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Analysis of the Characteristics of the Medical Industry and the Determinants of Investment: Focusing on South Korea–U.S. FDI*

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ABSTRACT

Purpose – This study analyzes the current status, background, and factors that affect the maintenance and success of the South Korea–U.S. medical foreign direct investment (FDI), which has been rapidly increasing since the COVID-19 pandemic.

Design/Methodology/Approach – This study was conducted from the perspective of the United States (U.S.), the host country of investment. A panel analysis was conducted with the 10-year data of economic and logistics factors of 30 major U.S. states. The independent variables were Gross domestic product (GDP), payroll, and employment rate, and logistics factors were the number of logistics bases and amount of investment. The dependent variable was the amount of South Korea–U.S. medical FDI.

Findings – The empirical analysis revealed that GDP, payroll, and number of airports had significant positive effects on FDI. The medical industry is a typical high value-added process industry, and the economic power of the host region and payroll to employ excellent workers were key variables. Air transport infrastructure was also a prominent factor due to the nature of pharmaceutical drugs.

Research Implications – The analysis results show the typical characteristics of the medical industry. The results and implications can guide future medical FDI in a more effective direction.

Keywords: foreign direct investment, logistics, medical FDI, penal analysis
JEL Classifications: F10, F20, I10

I. Introduction

With the growing interest in the medical industry since the coronavirus disease 2019 (COVID-19) outbreak, many countries, including South Korea, have put great effort into welfare policies to improve people's health and quality of life. One such effort is medical investment and attraction, which can be made through international trade. The medical industry is a high value-added, technology-intensive industry with a positive effect on both the home and host countries. As the medical industry is highly correlated with a country's national health, many nations do not have tight medical regulations to protect the domestic market. Therefore, this industry is receiving attention as a potential new growth engine in many countries, and is expecting increasing active imports and exports (Burns et al., 2016; Shah et al., 2022; Shenkar et al., 2021).

In particular, interest in medical needs is growing in South Korea due to Hallyu (Korean wave) and the best practices in medical administration displayed by South Korea in its handling of COVID-19. Specifically, while prior foreign direct investment (FDI) concentrated mainly on medical device manufacturing, the overseas expansion of medical services and medical institutions is becoming more active in recent times. In fact, South Korea, once a beneficiary of official development assistance (ODA), is now a donor that conducts ODA healthcare activities in Southeast Asia, South America, and Africa.

Medical sector FDI has been perceived as a new growth engine with high potential in South Korea over the past few years. Medical FDI, which began in earnest after 2000, continually increased from $119 (million) in 33 countries in 2013 to $1,326 (million) in 41 countries in 2022. In the United States (U.S.), it increased more than 10-fold, from $45 (million) in 2013 to $594 (million) in 2022 (The Export–Import Bank of Korea, 2022).

Numerous studies revealed the importance and growth of the medical industry. However, the most-studied factors of FDI inflow into the

researchers' own countries or investment policies, and research on FDI mostly analyzes investment in China and Southeast Asia (Aysan et al., 2020; Jang & Song, 2021; Lim, 2021). Accordingly, this study analyzes the determinants of FDI in the medical industry with a focus on the U.S., which is one of South Korea's biggest FDI markets and has high medical needs. To this end, 10-year panel data (2013-2022) on the economy, infrastructure, and research were collected from 30 major U.S. states. The medical industry is on the rise in FDI in most states of the U.S. Among them, 30 states that were large enough to have statistical validity were selected. Based on the collected data, a 10-year panel regression analysis was conducted, and the overall factors influencing Korea-US medical FDI were identified. In addition, to observe changes in influencing factors before and after COVID-19 regarding the rapid increase in the amount of medical FDI after COVID-19, a balanced panel was used to confirm the changes in effect factors before and after.

This study provides an accurate analysis by presenting a new method to analyze the increasing investment and interest in the medical industry and has academic implications for expansion into other industries. In addition, considering that the demand for medical FDI will increase, the results will offer practical and policy implications to the industry and the government to consider and encourage overseas investment in the medical industry.

II. Theoretical Background

1. Current State of South Korea–U.S. Medical FDI

COVID-19 highlighted the mutual cooperation of the global medical system, which led to the expansion of medical trade (Kim & Ahn, 2020). In particular, South Korea's medical FDI doubled since the COVID-19 outbreak, from $531 (million) to $1,041 (million), and South Korea-U.S. FDI nearly doubled, from $331 (million) to

$531 (million). This FDI is mainly in R&D and pharmaceutical manufacturing. Comparing the periods before and after COVID-19, the scope of investment increased even more. Moreover, the U.S., as South Korea's main target for FDI, accounts for half of South Korea's total medical FDI, with expectations of a continual increase. This reality makes analyzing the factors of South Korea–U.S. medical FDI an important topic for research.

Table 1. Status of South Korea–U.S. Medical FDI

(Unit: $ Million)

Category	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Medical device manufacturing	4	9	40	29	56	52	31	28	18	146
Medical device sales	2	4	2	5	12	11	8	10	9	10
Pharmaceutical manufacturing	5	7	43	34	31	72	271	200	170	140
Pharmaceutical sales	1	0	5	18	12	14	20	22	33	26
R&D	12	57	42	102	32	169	301	195	445	262
Hospitals	21	9	28	13	22	13	15	36	16	10
South Korea-U.S. FDI	45	86	160	201	165	331	646	491	691	594
South Korea-global FDI	118	229	374	354	545	531	1,014	1,119	1,244	1,326

Source: The Export–Import Bank of Korea (2022).

2. Supply Chain and Medical Supply Chain

Supply chain management is a macroscopic concept of logistics and begins with physical distribution focused on the flow of products within the relationship between firms and consumers (Ballou et al., 2000). Supply chain management is defined differently depending on the research purpose and can be examined from two aspects. First, it can be explained based on physical flows such as inventory management, demand forecasting, and logistics. Lewis and Naim (1995) defined supply chain management as controlling physical and information flow from producers of raw materials to end users. Second, it can be defined with a focus on its strategic dimension. Ross (1998) saw supply chain management as a strategic tool to improve competitiveness and profitability by combining all resources and competencies in the supply chain into one connected system.

As supply chain management can be defined differently based on the research approach, it can be classified into various categories. First, it can be classified based on the role of the firms participating in the supply chain. Gupta (1997) classified supply chains into supplier-led, distribution-oriented, and production-oriented supply chains. The characteristics of each type

are described as follows. In a supplier-led supply chain, the focus is on making plans regarding raw materials as the purchase of raw materials required for manufacturing accounts for a large part of product value; in a distribution-oriented supply chain, the emphasis is on forecasting consumer demands and making timely deliveries to retailers through distribution processes; in a production-oriented supply chain, the focus is on controlling the flow of the necessary raw materials. Bensaou and Venkatraman (1996) classified supply chains according to transactional relationships such as market transactional relationships, supplier-dominated relationships, buyer-dominated relationships, and strategic partnerships. Additionally, Fisher (1997) classified supply chains based on product characteristics. Although there are many different types of supply chains, a common aspect is that their success depends on the continuous participation of executives, effective strategies, and organizational culture and change (Handfield & Nichols, 1999).

Medical supply chain management can be referred to as the management of devices and supplies in hospitals and related medical institutions by extending supply chain management to the service sector. Specifically, medical supply chain management is integrating and managing related activities so that not only material flow but also service flow can be provided to patients, who can be considered end users, in a timely manner. There are mainly three issues related to medical supply chain management: scheduling, resource allocation, and service quality issues. For example, issues related to making appointments with doctors can be an example of scheduling issues (Lamiri et al., 2008), and those in the transportation of drugs or medical devices can be an example of resource allocation issues (Majzoubi et al., 2012).

Medical supply chain management and general supply chain management differ. As medical supplies, including medicine, directly or indirectly affect patients' lives, they cannot be back-ordered. Moreover, as there could be an emergency at any time, more effort is put into transport policies regarding inventory. In other words, it is necessary to supply an accurate number of medical supplies in a timely manner as they are related to the health of patients. Similar to general supply chain management, medical supply chain management must be managed so that there is a smooth flow of resources and information in the entire medical supply chain.

3. FDI and Medical FDI

Monopolistic advantage theory, internalization theory, and eclectic theory are just a few theoretical concepts applied to FDI. Monopolistic advantage theory, established by Kindleberger (1969), emphasizes the cost, technology, and management ability advantages that offset the entry barriers that firms expanding overseas may face. Internalization theory, systematized by Buckley and Casson (1976), argues that local market risks must be overcome by internalizing external market functions to overcome challenges such as those regarding workers, raw material procurement, and technological barriers, in the local market. Moreover, Morck and Yeung (1992) supported internalization theory by revealing that the FDI of U.S. firms that owned intangible assets such as technology, marketing, and management ownership, brought surplus earnings to corporate shareholders.

However, these two theories, when applied to FDI, may be somewhat lacking in terms of explaining various local risk factors. Dunning's (1980) eclectic theory overcomes these limitations. Dunning (1980) argued that it is important to secure a favorable location where costs can be reduced and regulations can be avoided by adding location-specific advantages to firm-specific and internalization advantages.

As mentioned earlier, FDI generally aims, among other goals, to increase exports, reduce costs, and avoid trade regulations (Ding & Choi, 2021; Liu et al. 2022; Yoon, 2022). In most cases, medical FDI is affected by the export expansion strategies of leading countries in healthcare and the host country's efforts to expand medical infrastructure, which is mostly led by a country's government. For example, Japan is looking to

attract patients, recruit excellent medical staff, and export specialized medical systems through the association Medical Excellence Japan. The United Kingdom (U.K.) established a public enterprise called Healthcare U.K. to support the overseas expansion of medical institutions and network formation. Southeast Asian countries are promoting long-term government-led plans to expand medical infrastructure, a typical example being the Healthcare Master Plan (2013-2020) in Vietnam.

III. Data and Research Model

1. Data Collection and Definition of Variables

Based on previous research, this study selected the economic and logistics factors of the U.S. as independent variables and the South Korea–U.S. medical FDI as the dependent variable. The panel model for each variable is as follows.

$$FDI_{it} = \beta_0 + \beta_1 log(GDP) + \beta_2 log(TEM) + \beta_3 log(AEM) + \beta_4 log(PAY)$$
$$+ \beta_5 log(APT) + \beta_6 log(SPT) + \beta_7 log(IIT) + \beta_8 log(HIT) + \mu_{it}$$

Table 2. Configuration and Definition of the Variables

	Variable		Unit	Source
Economic Variables	GDP	Log_GDP	$	US Department of Commerce
	Transportation Employment	Log_TEM	Number of persons	
	All Employment	Log_AEM	Number of persons	
	Payroll	Log_PAY	$	
Logistics Variables	Number of Airports	Log_APT	Number of airports	US Department of Transportation
	Number of Ports	Log_SPT	Number of ports	
	Infrastructure Investment	Log_IIT	$	
	Highway Investment	Log_HIT	$	
Dependent variable	Korea → USA Medical FDI		$	The Export–Import Bank of Korea

Source: The Export–Import Bank of Korea (2022), US Department of Commerce (2022) and US Department of Transportation (2022).

2. Economic Factors

Colovic and Mayrhofer (2011) and Ha and Woo (2022) argued that a region's economic power, land price, and the export performance of related industries are key factors of FDI that directly affect firm performance. In particular, GDP is a factor that represents the economic power of a region and is classified as an important variable in the attraction of firms, employees, and demand. In addition, employment costs for securing employees and labor costs are very important aspects. Accordingly, Lee (2014) and Ryoo (2011) mentioned the importance of securing high-quality human resources for FDI in the high-tech and medical industries, and presented employment

prospects and wage level as the key factors to consider for FDI. They found that these key variables had a significant positive effect on firm performance and FDI, which can be the dependent variable. Therefore, this study selected regional GDP, high-quality human resources, and payroll as economic factors that influence FDI in the medical industry and collected these data through the U.S. Department of Commerce.

3. Logistics Factors

Several studies highlighted the importance of logistics in the medical industry (He & Liu, 2015; Liao et al., 2020; Moons et al., 2019). They have also argued that there is a need for logistics optimization and emergency logistics measures. As the medical industry directly influences patients' lives, the importance of logistics in the medical industry is much higher than in any other industry, and the share of logistics costs for the industry is greater than that in other industries. This study selected, as logistics factors, number of logistics bases and investment status as the key independent variables by assuming that the status of logistics infrastructure and investment affect medical FDI. These data were collected through the U.S. Department of Transportation.

IV. Empirical Analysis

1. Model Selection and Descriptive Statistics

The samples used for analysis were panel data measured by state-year. In other words, as the data has both cross-sectional and time-series characteristics, there was a high possibility of violating the error term assumption in regression analysis. Therefore, a fixed effects model of the error-component model that can control the heterogeneity of error terms was used, for which the F-test, Breusch and Pagan LM-test (Lagrangian Multiplier), and Hausman test were conducted sequentially to reduce statistical errors.

Table 3. Model Fit Analysis

-	F-test	LM-test	Hausman test
	f-value (p-vlaue)	chibar2 (p-vlaue)	chi2 (p-vlaue)
Korea → USA Medical FDI	17.30*** (0.000)	364.42*** (1.000)	16.82** (0.000)

The F-value was 17.30, and the p-value rejected the null hypothesis at the 1% significance level. The null hypothesis of the F-test is that pooled ordinary least squares (OLS) are relatively more fit than the fixed effects model, and it is rejected at the 1% significance level, which indicates that the fixed effects model is more efficient than pooled OLS. From the Breusch and Pagan LM-test, chibar^2 was 364.42, and the null hypothesis was rejected at the 1% significance level. The null hypothesis of the LM-test is that pooled OLS is relatively more fit than the random effects model, and it is rejected at the 1% significance level, which indicates that the random effects model is more efficient than pooled OLS. The Hausman test was conducted to compare the efficiency between the fixed effects and random effects models. The chi^2 was 16.82, and the null hypothesis was rejected at the 5% significance level. The null hypothesis of the Hausman test is that the random effects model is relatively more fit than the fixed effects model, and it is rejected at the 5% significance level,

which indicates that the fixed effects model is more effective than the random effects model. Based on these three statistical test results, we used the fixed effects model. Moreover, as this is long-term data (10 years), the analysis was conducted with a one-way fixed effects model that can efficiently control the time effect.

Table 4. Descriptive Statistics

Variable	N	Mean	Std.Dev	Min	Median	Max
Korea → USA Medical FDI	300	.9766827	1.463274	0	0	5.572154
GDP	300	26.70252	.6605832	25.73083	26.53704	28.65778
TEM	300	11.77709	.6401364	10.77835	11.64428	13.52328
AEM	300	15.02233	.5932954	14.17761	14.87586	16.6852
PAY	300	7.920367	1.124968	5.15	7.25	12
APT	300	12.38	7.536018	2	9	35
SPT	300	4	3.536716	0	3	12
IIT	300	18.17829	.6500918	17.20116	17.98213	20.22629
HIT	300	15.63986	.6162652	14.49218	15.45269	17.11061

2. Panel Analysis

The results of the analysis are shown in Table 5 below. For economic factors, the employment rate was not significant, but GDP and payroll by state turned out to have a significant positive effect at the 1% significance level. Regarding logistics factors, the number of airports had a significant positive effect at the 1% significance level, whereas the number of ports had a negative effect at the 1% significance level.

The results of this empirical analysis reflect the characteristics of the medical industry, which is a high value-added industry. In fact, many studies and practical cases have analyzed the recruitment of excellent medical staff and the possibility of establishing medical devices and infrastructure as key factors for FDI in the medical industry. Economic power, employee supply, and demand capacity are the key investment factors to attract high value-added industries and employees in regions with expected investment (Burns et al., 2016; Shenkar et al., 2022; Zhao, 2001).

Moreover, medical devices, pharmaceutical drugs, and human resources are regarded as essential transport items, and most of them require air transport. In particular, in the case of pharmaceutical drugs, urgent transport is essential due to the nature of the products themselves, which can be sensitive to external conditions such as temperature and need to be handled well to ensure quality, in addition to the nature of the industry (Jung & Ji, 2011; Lee et al., 2015). While these industrial and product characteristics are positively related to the number of local airports, they are negatively related to ports and have no significant relationship with highway investment. However, due to the nature of the products that must be successfully transported in all cases, it is necessary to prepare various transport options in addition to air transport (Boysen et al., 2015; Özdamar et al., 2004).

Table 5. Empirical Analysis

Variable		Korea USA Medical FDI
GDP	Log_GDP	3.243***
		(4.51)
Transportation Employment	Log_TEM	-0.147
		(-0.34)
All Employment	Log_AEM	-1.191
		(-1.16)
Payroll	Log_PAY	0.326***
		(3.91)
Number of Airports	Log_APT	0.059***
		(3.38)
Number of Ports	Log_SPT	-0.126***
		(-5.54)
Infrastructure Investment	Log_IIT	-1.296
		(-2.05)
Highway Investment	Log_HIT	-0.317
		(-1.08)
N		300
R-sq		0.406

Table 6. Balanced Panel Analysis

Variable		Korea USA Medical FDI
COVID_dum	COVID_dum	1.145**
		(3.217)
GDP	Log_GDP	0.212**
		(3.48)
Transportation Employment	Log_TEM	-0.112
		(-0.65)
All Employment	Log_AEM	-1.459
		(-1.74)
Payroll	Log_PAY	0.248***
		(2.78)
Number of Air port	Log_APT	0.091***
		(1.28)
Number of Port	Log_SPT	-0.453*
		(-2.12)
Infrastructure Investment	Log_IIT	-0.783
		(-1.02)
Highway Investment	Log_HIT	-0.301
		(-1.74)
N		240
R-sq		0.513

The analysis in Table 5 covers the 10-year period from 2013 to 2022 in terms of the overall investment factors of medical FDI. However, considering the rapid increase in medical FDI after the COVID-19 pandemic, a balanced panel is used to examine how medical FDI changed after the COVID-19 pandemic. For the balanced panel analysis, a COVID-19 dummy variable was created and four years before and after COVID-19. This analysis aims to confirm which independent variables had more influence on the dependent variables after COVID-19.

The results of the balanced panel analysis are as follows. First, COVID-19 had a significant positive (+) effect on Korea-U.S. medical FDI at the 5% significance level. In other words, COVID-19 was a factor that increased FDI. In addition, some results do not differ significantly from the main analysis. However, the balanced panel analysis results show an increase in influence relative to before the pandemic. Therefore, the influential factors of GDP, payroll, and number of airports have a positive (+) effect at the significance levels of 5%, 1%, and 1%, respectively.

V. Conclusion

1. Summary of the Results

Prompted by the COVID-19 outbreak, the world is paying renewed and heightened attention to South Korea's medical industry. Since 2019, FDI in the medical industry has doubled and is expected to continuously rise. In particular, the U.S. is South Korea's biggest market, and accounts for 45% of South Korea's medical FDI as of 2022. As a continuous increase in investment is expected, the analysis of investment factors in this study is expected to provide research data to inform more efficient investments. The main results are as follows.

First, this study analyzed the current state and characteristics of medical FDI through current state analysis and a literature review. South Korea's medical sector's exports are rapidly increasing due to COVID-19, but medical FDI has a different investment intention than general FDI. While the motives of general FDI are the evasion of trade regulations, sales increase, and cost reduction, medical FDI is an industry with government-led investment attraction. Therefore, investments are expected to be made toward a direction different from the ongoing U.S. government trade regulations and efforts in supply chain integration.

Second, the results indicate the characteristics of the medical industry and products. The medical industry is a typical high value-added industry in which the economic power of a region has a great impact on attracting FDI to the industry. Moreover, the fact that payroll, which is an indicator of the ability to attract high-quality human resources, is a more important influencing variable than the quantity or existence of human resources, is an attribute unique to the medical industry. Furthermore, regions with smooth air transport specialized in the emergency transporting of medical devices or drugs are favorable in attracting the medical industry.

Finally, when investing in the medical industry, it would be favorable to consider various transport options for sustainable management and investment. The transport characteristics in industries that require timely transport such as fresh foods and the automobile industry are the diversity of transport routes and means that can have the products delivered at all times. As the medical industry is one in which the importance of transport is greater than any other industry, establishing various contingency plans can be a long-term driving force in addition to the significance shown in the empirical analysis.

2. Implications and Limitations

Although the U.S. is a large market for South Korea's medical investment, it is necessary to review investment in other regions as the demand for investment attraction is increasing as South Korea's medical industry continues to attract attention. In this context, the analysis and findings of this study can be a significant reference for

South Korea's medical FDI in that they can be used to analyze medical sector exports not only toward the U.S. but also toward other regions.

However, this study has its limitations in that it analyzed the factors using only panel data. Examining the optimal locations and transport routes for each method of transport could reveal overall solutions for the medical supply chain.

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The Influence of VR Tourism's Perceived Benefits on Value Experience and Intention to Visit: The Moderation Effect of Involvement

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ABSTRACT

Purpose – The current study focuses on the effects of different degrees of attention to information provided by VR tourism. The purpose of this study was to explore the impact of VR tourism on potential tourists' intention to visit, and provided an analysis of how information about a tourist destination moderates VR users' perceived value and intention to visit.

Design/Methodology/Approach – The study uses the SPSS 26.0 and AMOS 26.0 statistical packages to analyze a sample of 328 respondents are analyzed using structural equation modeling.

Findings – The results suggest that usefulness, ease of use, enjoyment, interactions among the perceived benefits of VR tourism has a positive effect on perceived value

except for Presence. Perceived value is positively correlated with intention to visit intention. Perception of value experience has a significant positive impact on the intention to visit a tourist destination. However, while the overall intention to visit is higher with high involvement, increasing experience with tourism has little influence on the intention to visit.

Research Implications – The study found that the perceived value of the VR experience has a direct and significant positive impact on the intention to visit, such that a good perception of value in the experience is a driving factor in users' visit a tourism destination. The implications of this study for future research are discussed.

Keywords: moderation effect, perceived benefits, value experience, virtual reality

JEL Classifications: I12, L93, M16, M31

I. Introduction

Technological progress often has direct and lasting impacts on the tourism industry. Virtual reality (VR) technology has made a major breakthrough and is one of the most important technologies (Gao & Jin, 2022; Tussyadiah et al., 2018). VR applications and head-mounted display (HMD) terminal provide users with abundant sensory stimulation, so users can explore virtual worlds and have new experiences without ever leaving home (Gao & Jin, 2022; Tussyadiah et al., 2018). VR can provide users with a complete virtual environment that is similar to a tourist destination, rich sensory information and interaction, and vivid images of the destination (Disztinger et al., 2017). Some research shows that the application of VR technology in the tourism industry provides an effective tool for potential tourists to plan visits to tourism destinations (Kim et al., 2020). The marketing of tourism products through VR can first be incorporated when people make their travel plans to guide tourists toward visiting the actual place (Spicer & Stratford, 2001).

VR tourism is a way for people to enjoy travel without leaving home and go to tourist attractions without time and space restrictions. With virtual reality devices, users can experience the virtual environment as if they were part of it. When the device perceives the user's reactions and actions, the virtual environment is modified in real time, which makes the user feel present, and generate the illusion of interacting with and being immersed in the virtual world (Wirth et al., 2007). VR can address the frustration of not being able to experience travel products before consumption. It breaks the boundary between the virtual world and reality, endows potential tourists with knowledge about what they will experience when they visit, and promotes a sense of existing in the potential destination. In VR, users not only have the freedom to control the information they receive but also to customize the information according to their own needs (Steuer, 1992). VR also reduces distance barriers between potential visitors and destinations by enhancing their knowledge of

destinations before they visit them so they know what to expect (Kim & Hall, 2019). VR enhances visitors' experience by facilitating interaction with the destination (Kang & Gretzel, 2012). Therefore, users not only enjoy the practical benefits of convenience and information brought about by the new technology but also enjoy the sensory experience benefits of the technology through entertainment and interaction. The benefits obtained by consumers in VR tourism can have a significant effect on whether tourists have positive experiences and come away from their visits with positive attitudes.

Moreover, currently research on VR has focused on the potential impact of using virtual technology on visitor experience, such as planning places and experiences, increasing accessibility, and enhancing entertainment (Guttentag, 2010; Healy et al., 2016; Hudson et al., 2019). However, based on the tourism destination marketing level, empirical studies on what influences the VR experience and the relationship between the perceived benefits of VR tourism and potential tourists' intention to visit are lacking. The ability to explain customer behavior is improved by taking situational variables into consideration. Tourism involvement plays an important role in determining users' attitudes and actions, so this study focuses on the effects of different degrees of attention to information provided by VR tourism. The purpose of this study is to explore the impact of VR tourism on potential tourists' intention to visit. This empirical study provides an analysis of how information about a tourist destination moderates VR users' perceived value and intention to visit, along with theoretical and practical implications.

The next section provides the study's theoretical background regarding virtual technology (VR) and tourism, the perceived benefits of tourism using VR technology, a review of the literature on tourists' intention to visit, and develops hypotheses based on the proposed research model. Then the third section explains the research methodology, including data collection and measures. The fourth section presents the results of the hypothetical

model and other models, while section Five discusses the results and theoretical and practical implications and provides some direction for future research.

II. Literature Review

1. Virtual Reality and Tourism

VR is a technology based on an interaction between a three-dimensional (3D) virtual space created in a computer and the user. Users can experience the virtual space through the senses, just as they would in the real space (Burdea & Coiffet, 2003; Vince, 2004). As an interface between humans and computers, VR can create the effect of interacting with the surrounding situation without having to experience the environment itself, which may be difficult to experience in daily life. Because of the different descriptions of the necessary features that constitute VR experience, the definitions put forward are different, so there are significant differences in the definitions of VR researchers. In this paper, the definition of VR is drawn from the definitions of Burdea and Coiffet (2003), Vince (2004). Virtual reality (VR) is defined as, The Virtual Environment (VE), a computer-generated 3D environment, is used for navigation and interaction to simulate one or more of the user's five senses in real time. Navigation refers to the ability to move around and explore in the VE, and interaction refers to the ability to select and move objects in the VE (Vince, 2004). VR real-time simulations let users experience an environment that is similar to reality while being free to cross the boundary between reality and imagination. VR technology, which centers on an HMD terminal device, is used in various fields to transport wearers into artificial worlds where they can interact with and experience digital content at various levels of immersion (Fox et al., 2009). Multiple digital technologies are applicable to the tourism industry, but VR is among the most promising (Lee & Kim, 2021), requiring discussion in academia.

The connection between VR and the travel industry is different from traditional sources of information offered by the media or social sources, which the consumer cannot test in advance. In such a complex decision-making process as that which takes place in choosing a tourist destination, VR can give potential tourists a rich sensory and visual information experience prior to making an actual visit (Berger et al., 2007). People who use this kind of technology will make more informed decisions because of the wealth of information they can access and will have more realistic expectations of their future journey. For example, Cheong (1995) studied a person who originally planned to travel to an island, but after gaining information through a VR experience, chose to visit another place he was interested in. With the wealth of information VR makes available, people make better-informed decisions, which may lead to more satisfying vacations (Cheong, 1995). Tourism content embodied in VR technology not only provides tourists with a deeper opportunity to explore destinations but can also be an effective marketing tool with which to experience representative tourism facilities in advance.

2. Perceived Benefit

Perceived benefit refers to when consumers recognize and evaluate a particular product or service (Zeithaml, 1988) by comparing the product or service's actual utility and benefits against their expectations (Kim et al., 2007). In the network environment, perceived benefits are often measured based on the theory of Delone and Mclean (2003), which is based on system, information, and service quality. In VR, perceived benefits can be treated as the utility that consumers feel after using VR. The perceived benefits of VR vary according to the purpose or object (Guttentag, 2010).

Davis et al. (1992) defines a new technology's and/or system's usefulness as the belief that using the technology or system will improve the user's business execution and improve results or performance. Perceived ease of use refers to

the degree to which users think they can easily exploit a particular technology and is closely related to whether they will continue to use it in the future. Enjoyment refers to the degree of happiness experienced when a user uses a product or service, regardless of whether it achieves the desired results (Davis et al., 1992). The information obtained through the use of VR tourism technology contributes to the usefulness of tourism information and tourism activities and can be a factor that arouses interest. In addition, understanding and learning is easier, and content is easier to interact with. Moreover, intrinsic motivations like enjoyment have a central impact on the acceptance of information technology (Ahn et al., 2007). In the Value-based Adoption Model (VAM), the elements of perceived benefits are limited to usefulness and enjoyment. However, in studies related to technology's basic services, a variety of factors for perceived benefits go beyond those two factors. Live broadcast commerce is a new mode of commercial transaction, and the ease of its use will affect consumers' usage intentions. Therefore, the components of perceived benefits of live broadcast commerce should include usefulness, ease and enjoyment, as shown in many studies (Choi & Lee, 2019; Disztinger et al., 2017; Lee & Kim, 2021).

VR is the most suitable technology for enabling users to have a sense of remote presence (Disztinger et al., 2017) and having a feeling of actually going to a place or being surrounded by an environment (Nilsson et al., 2016). The real world, however dangerous or remote, is simulated in real time, fully occupying the user's attention and consciousness and proving rich sensory information and interactions (Disztinger et al., 2017). VR technology can be seen as an excellent aid in helping tourists choose tourist attractions in a limited time.

Presence is defined as the mental state in which the user feels lost or immersed in the intermediary environment, that is, the degree to which the user feels physica "presence" in the virtual environment (Steuer, 1992). The degree of Presence is influenced by the stimulating experience of many perceptual elements in the content, and it has the ability to create and promote intimacy. The user's body is not in the place he or she is experiencing but in the virtual world (Sanchez-vives & Slater, 2005). In other words, the user shifts attention to the new environment, to the VR world. The user experiences stimuli or effects in a virtual environment and can convinced that he or she is in some other environment. In VR games, the higher the user's experience of Presence, the greater the enjoyment and reuse intention (Lee & Park, 2019). In the study of Lo & Cheng (2020), it is found that the stronger the sense of presence in VR technology will bring consumers more positive attitude towards consumption experience, thus bringing positive intention of action. Research verifies that the content of VR tourism has a substantial impact on the regional tourism industry's value experience and the tourism expectation effect.

In the virtual world, interactivity is based on VR, and users can change the form or content of the virtual environment to which they belong. Steuer (1992) regards information as the environment of media, that is, the form and content of VR, and defines Interactivity as the user's ability to control the shape and content of the virtual environment and to change it in real time. In the traditional media environment, people have little or no control over such information, but in using VR, users not only have the freedom to control the information they receive but can also customize information according to their needs. Generally speaking, the interaction in VR is that the more mutual the reactivity between the system and the user, the easier it is to obtain information and facilitate mutual communication (Ahn et al., 2019). For example, touch movements and body postures interact in the virtual world just as they do in real life, so in the VR system, users can interact with tourist attractions in a natural way and get feedback and sensory information from tourist areas and equipment. We contend that Presence and Interactivity are important elements in the perceived benefits of VR tourism.

III. Hypotheses Development

1. The Relationship between Perceived Benefits and Value Experience

Research confirms that the dimensions of perceived benefits–usefulness, ease of use, and enjoyment—all have significant positive (+) impacts on users' perceived value (Choi & Lee, 2019; Lee & Kim, 2021). The research on VR tourism divides perceived benefits into the sense of presence and enjoyment that these perceived benefits have significant positive influence on perceived value Kim et al. (2007). In the context of mobile technology, perceived usefulness and enjoyment are also seen as benefits and as having an effect on perceived value and intention (Kim et al., 2017; Lee & Kim, 2022). Research on smart home services of the Internet of Things divides perceived benefit into the dimensions of usefulness, enjoyment, and convenience and studies the relationship between perceived benefit and perceived value to find that perceived benefit has a significant impact on perceived value. From this perspective, it is possible to judge the interaction among sense of presence, usefulness, ease of use, and enjoyment of VR to establish the impact of VR tourism on customers' perceived value. Thus, we established the following research hypotheses:

H1: Presence among the perceived benefits of VR tourism has a positive effect on perceived value.
H2: Usefulness among the perceived benefits of VR tourism has a positive effect on perceived value.
H3: Ease of use among the perceived benefits of VR tourism has a positive effect on perceived value.
H4: Enjoyment among the perceived benefits of VR tourism has a positive effect on perceived value.
H5: The interactions among the perceived benefits of VR tourism have positive effects on perceived value.

2. Perceived Value and Intention to Visit

Value can be defined in terms of the concepts of attitude, belief, interest, and opinion, among other concepts. Holbrook (1994) defines perceived value as consumers' preference for products or services after they use them. Consumers attach importance to the experience of consumption, which can be regarded as a driving force behind differentiation and competitiveness. Therefore, perception of value directly affects the intention to engage in future actions (Zheng & Kim, 2022). The intention to visit refers to the likelihood that potential visitors will act in response to their evaluation of a particular destination. VR users can form a positive image of a tourist destination through a real-time experience with simulation.

In a broad sense, destination image is understood as the total impression of the knowledge, beliefs, and overall perceptual attributes associated with the tourist destination in the traveler's memory. (Wang & Hsu, 2010). Destination image can influence tourists' choice of destination before travel because they will evaluate their experience based on expectations and influence the continuation of this image when visiting tourists share their experience with friends, family and through online posts (Litvin et al., 2008). VR can maximize an experience and make it possible to gain unrestricted freedom of expression and experience, and compared with traditional marketing methods, can deliver more value and sense of presence. Most previous studies show that positive value from the computer media environment that provides indirect information and indirect experience is the main influencing factor in forming positive action intention (Agapito et al., 2013; Bai et al., 2008). Therefore, we set the following hypothesis:

H6: Perception of value experience has a significant positive impact on the intention to visit a tourist destination.

3. The Moderation Effect of Involvement

Involvement refers to the degree of a person's

attention to a particular thing. The higher the relevance, concern, and importance of a product or service to an individual, the higher the involvement. Krugman (1965) worked the characteristics of high investment and low investment and propose that investment is one of the most important variables to in studies of consumer behavior. Lee et al. (2019) Empirical studies on organic food that use involvement as a moderating variable show a positive effect on the intention to take action and interaction effects of service excellence value × involvement and functional value × involvement that show that the greater organic food consumers' involvement in the purchasing process, the greater the impact on their behavior. Research on tourists' perceptions of value, acceptance, and diffusion intention of mobile tourism information services shows that the relationship between tourists' perceptions of value and acceptance change with the level

of involvement such that the higher the level of involvement, the more positive the impact of experience value on acceptance (Hor, 2014). Accordingly, we set the following hypothesis:

H7: The impact of a VR experience on a potential visitor's intention to visit varies with the visitor's level of involvement.

The purpose of this study is to determine whether the perceived benefits of VR tourism have a positive impact on potential visitors' perceived value and the intention to visit the places they preview using VR tourism using research on the influence of perceived benefits on perceived value (Ahn et al., 2007; Kim et al., 2007; Kim et al., 2017; Lee et al., 2020; Um, 2013) and an advanced study on the influence of perceived value on intention to visit (Cronin, 2000; Holbrook, 1994; Litvin et al., 2008). The research model is shown in Fig. 1.

Fig. 1. Research Model
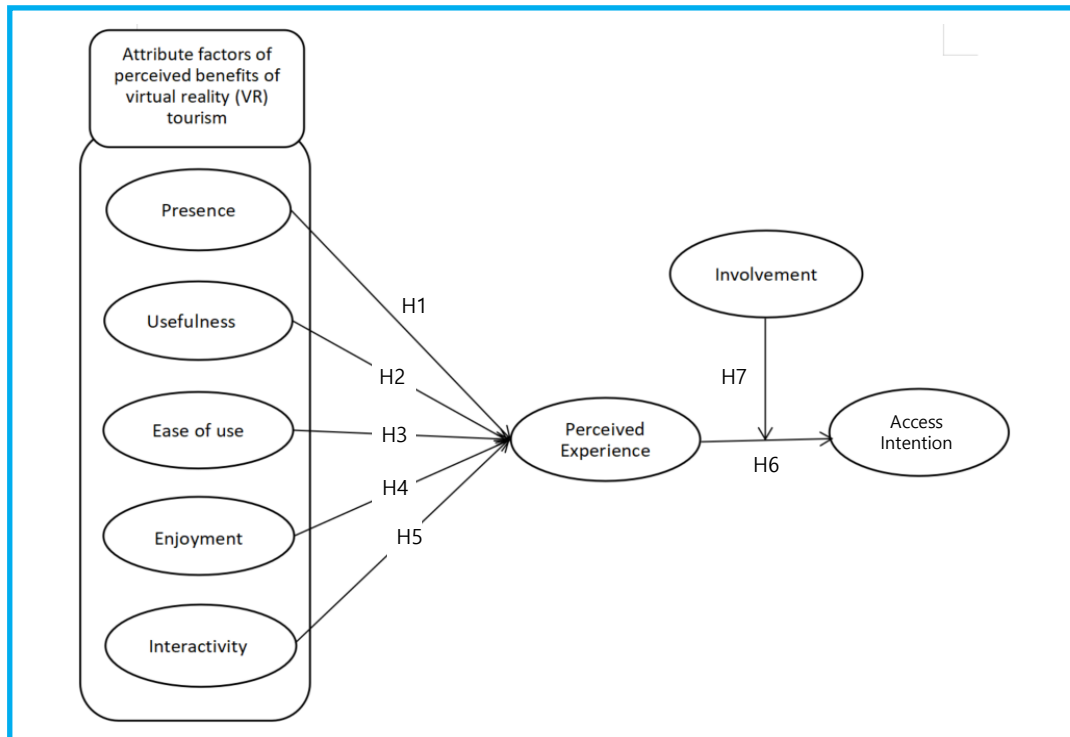
IV. Research method

1. Questionnaire and Pre-test

Based on the research of Kim et al. (2007), this study is extended according to the characteristics of VR tourism. A number of steps are used to select measurement items. The questionnaire consists of 32 items that measure 8 concepts. The four items measuring presence were based on previous studies (Lee et al., 2020). Four items to measure ease of use were drawn from previous studies (Agag & El-Masry, 2016; Ahn et al., 2007). Four Usefulness projects that measure usefulness come from previous studies (Moon & Kim, 2001). Four projects to measure Enjoyment are drawn from previous studies (Hosany & Witham, 2010; Kim et al., 2017). The four projects measuring Interaction employ previous studies (Liu, 2003; Steuer, 1992). Four items measuring Value experience were drawn from previous studies (Mathwick et al., 2001). The four items measuring Visit Intention are modified from previous studies (Bai et al., 2008; Oh, 2017). Four projects measuring Involvement come from previous studies (Zaichkowsky,1985). These items were measured on the Likert scale (1= completely imperceptible, 5= very perceptible).

To ensure the content-based validity of this study, questionnaires were distributed to 10 experts—three tourism managers and seven assistants and professors of tourism marketing from universities. We also conducted a pilot study with 30 participants who had experienced VR technology.

2. Sample Design and Data Collection

The questionnaire was sent to participants aged 18 and above attending the 2022 Asia VR/AR Expo in Guangzhou from Aug 10 to Aug 12. VR Experience Expo covers VR/AR hardware, VR/AR technology, VR/AR software, VR/AR entertainment, VR/AR education and more than ten other contents. VR entertainment: including VR tourism, VR theme parks, VR racing, VR dance, VR shooting games, etc. During the experience period, participants who had experienced VR travel, VR theme parks and other destinations (which exist in reality) were surveyed. In order to understand the intention of the experiencer to visit the tourist attraction, the questionnaire was set as "Have you visited the tourist attraction in VR tourism?" and tourists who have experienced the tourist attraction in VR tourism were excluded from the final analysis. We collected 386 questionnaires. After removing incomplete or unqualified questionnaires, 328 valid questionnaires were used for sample analysis.

The respondents were male (44.5%), female (55.5%), and aged between 20 and 30 (51.8%) and 31-40 (40.5%). Most respondents had a college or university degree (89.6%) and were employees of a company (89.6%). Their monthly income ranged from RMB 6000-8000 (26.5%) to RMB 8000-10,000 (22%) and above RMB 10,000 (30.2%).

V. Results

1. Validity and Reliability of the Measures

Confirmatory factor analysis (CFA) was used to test the econometric model's fit. Several indices were used to fit the model: the goodness-of-fit index (GFI) (0.882), the incremental fit index (IFI) (0.933), the Tucker–Lewis index (TLI) (0.922); and the comparative fit index (CFI) (0.932), where close to 1.00 indicates a good model fit. The root mean square error of approximation (RMSEA) was less than 0.08 (0.053), the normed chi square (chi-square/df) was below 3.00, chi square value (df) was 628.048 (329), and chi square/df was 1.909 (<3) (Anderson & Gerbing, 1988; Byrne, 2010; Hair et al., 2009). As Table 1 shows, all items have significant loads on their construction, with the lowest t-value at 11.177 (p < 0.001), indicating that the measured variables are sufficient in representing the structure (Hair et al., 2009). Cronbach's alpha was between 0.785 and 0.862, ensuring reliability. Most of the model fit indexes of CFA showed good fit. The CFA results meet the recommended goodness-of-fit level, which indicates that the measure model fits the sample data well (Byrne, 2010; Hair et al., 2009).

Table 1. Results of Confirmatory Factor Analysis (CFA) for the Measurement Model

	Factor (Cronbach's alpha)	Loading	T-value	AVE	CR
Presence (α=0.821)	I feel like I can touch the objects on the screen.	.717	-	.618	.866
	It was as if I were in reality.	.751	11.900***		
	It's like I'm looking at the location myself.	.749	11.879***		
	I seem to be able to look up anything in the destination directly.	.712	11.388***		
ease of use (α=0.821)	I am interested in a service function I can operate easily and is easy to use.	.739	-	.643	.878
	It is easy to collect relevant information about sightseeing places through VR tourism.	.659	11.068***		
	Virtual tour equipment is very convenient and simple to operate.	.728	12.198***		
	Virtual tour equipment's operating methods are easy to learn.	.741	12.393***		
Usefulness (α=0.817)	VR tourism can help me get travel information.	.789	-	.647	.819
	VR tourism can help me get more accurate information.	.683	11.938***		
	VR tourism can help me get the latest information.	.686	11.986***		
	VR tourism can help me make better decisions.	.751	13.139***		
Enjoyment (α=0.785)	VR tourism helps relieve stress.	.852	-	.649	.880
	VR tourism does not make me feel bored.	.701	13.672***		
	VR tourism makes me feel very happy.	.766	15.320***		
	I changed my mood when I visited a new place.	.809	16.400***		
Interaction (α=0.862)	My actions during use were natural.	.742	-	.619	.886
	It is easy to control during use.	.765	13.160***		
	It has a quick response during use.	.786	13.496***		
	I was free to choose what I wanted to see during use.	.726	12.482***		
Perceived value (α=0.821)	On the whole, it is satisfactory.	.705	-	.681	.895
	On the whole, it met my expectations.	.680	11.177***		
	If given the opportunity, I would not hesitate to participate in such a VR project.	.784	12.715***		
	It produced a positive attitude.	.796	12.873***		
Visit Intention (α=0.828)	I plan to visit the destinations featured in VR tourism.	.761	-	.613	.864
	I intend to visit the tourist attractions that appear in the VR tourism.	.718	12.293***		
	I would love to go to the tourist attractions that appeared in the VR tourism.	.723	12.391***		
	I am willing to pay for VR tourism attractions.	.687	12.873***		

Model fit: Chi-square (d.f)=628.048 (329), chi-square/df=1.909; GFI=.882, IFI=.933, TLI=.922, CFI=.932, RMR=.032, RMSEA=.053

Note: All items were measured on a 5-point Likert scale from 1=No feeling to 5=Feel strongly; ***$p<0.001$.

We used convergent and discriminant validity test construct validity (Bagozzi & Yi, 1988; Fornell & Larcker, 1981; Ping, 2004). Discriminant validity refers to the cross-construct correlation between measurements of causally correlated variables, which should be highly correlated, but the correlation levels should be lower than the intra-construct correlation (Fornell & Larcker, 1981; Ping, 2004). As Table 2 shows, discriminant validity is evident in our data because the AVE > 0.5 and the AVE squared is greater than the correlation coefficient between any pair of structures (Ping, 2004). Therefore, we identified a statistically acceptable model, and the overall metric model describes the relationships among the 7 constructs and 28 metrics that measure the corresponding underlying constructs.

Table 2. Construct Validity of the Measurement Model

	F1	F2	F3	F4	F5	F6	F7
F1: Presence	.618						
F2: Ease of use	.537***	.643					
F3: Usefulness	.493***	.600***	.647				
F4: Enjoyment	.453***	.518***	.403***	.649			
F5: Interaction	.510***	.658***	.531***	.430***	.619		
F6: Perceived value	.487***	.645***	.568***	.470***	.779***	.681	
F7: Intention to visit	.425***	.723***	.657***	.540***	.486***	.587***	.613
AVE	.786	.802	.804	.806	.787	.825	.783

Note: ***p<0.001.

2. Structural Parameter Estimates

We used structural equation modeling (SEM) to estimate the relationships between structures. Table 3 summarizes the estimation results and shows that the structure model is in good agreement with the measured data: chi-square value (df)=718.031 (334), chi-square/df=2.15, GFI=0.869, IFI=0.913, TLI=0.9014, CFI=0.912, and RMSEA=0.059. Most of the hypotheses were supported (Table 4). Enjoyment, interaction, usefulness, and ease of use, as proposed by H1–H5 are positively related to perceived value. All hypotheses are well supported except for HI. Perceived value is positively correlated with intention to visit intention (H6).

Finally, we examine the moderating effect of involvement on the relationship between perceived value and intention to visit (Table 4). The results show that involvement had a statistically significant moderating effect on this relationship (β = -0.164; sig = 0.002; p < 0.05). We used the simple slope method Aiken et al. (1991) propose to classify the independent variables and moderators as +/- one standard deviation from the mean. The results show that the lower the involvement, the greater the positive impact of a VR tourism experience on the intention to visit. However, while the overall intention to visit is higher with high involvement, increasing experience with tourism has little influence on the intention to visit. Therefore, it is likely that people who have a low level in involvement in tourism have significant potential to increase the demand for tourism.

Table 3. Structural Parameter Estimates

Hypothesized path	Standardized estimate	t-value	Result
H1: Presence → Perceived value	0.007	0.111	Rejected
H2: Ease of use → Perceived value	0.194	2.405*	Accepted
H3: Enjoyment → Perceived value	0.118	2.115*	Accepted
H4: Interaction → Perceived value	0.507	6.581***	Accepted
H5: Usefulness → Perceived value	0.184	2.836**	Accepted
H6: Perceived value →Intention to visit	0.661	9.611***	Accepted

Goodness-of-fit indices: Model fit: Chi-square (d.f)= 718.031 (334), CMIN/DF=2.15, GFI=.869, IFI=.913, CFI=.912, TLI=.901, RMSEA=.059

Note: $*p<0.05$, $**p<0.01$, $***p<0.001$.

Table 4. Moderating Effect of Involvement on the Relationship between Perceived Value and Intention to Visit

Independent variable	Beta	t	Sig	F	R2	Result
Perceived value	.197	3.859	.000	81.933	.426	Accepted
Involvement	.422	8.127	.000			
Perceived value × involvement	-.164	-3.153	.002			

Note: Dependent Variable (Intention to visit), $***p<0.001$, $**p<0.01$, $*p<0.05$.

VI. Discussion and Conclusions

The three purposes of this empirical study are to identify the impact of VR tourism's perceived benefits on potential tourists' intention to visit a tourism destination, the relationship between the perceived value of the VR experience and the intention to visit, and the moderating effect of tourism involvement on users' perceived value and intention to visit. This study provides new insights into the dimensions of visitors' experience, which affect their perceived value of the VR tourism experience and their intention to visit. The study's hypotheses are partially supported, as the research results show that the perceived benefits of ease of use, enjoyment, usefulness, and interaction have direct and significant impact on perception of value, a finding that is in line with Choi et al. (2019), Kim et al. (2007), Kim et al. (2017), Tussyadiah et al. (2018) and Um (2013).

We also found that the perceived value of the VR experience has a direct and significant positive impact on the intention to visit, such that a good perception of value in the experience is a driving factor in users' visit a tourism destination. This result is consistent with Holbrook (1994) and Kim et al. (2015). Thus, the more benefits a VR tourism user experiences, the more perceived value is likely and the more the person is encouraged to prefer the places they experience through VR experience when they choose a destination to visit. Finally, we found that involvement has a significant moderation effect on the relationship between users' perceived value and intention to visit. This result is consistent with prior research (Hor, 2014; Lee et al., 2019). In this study, groups that

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usually pay little attention to tourism information see a significant positive impact on the intention to visit after a VR tourism experience, while the experience has little influence on the intention to visit of those who are already interested in tourism. The reason may be that a VR experience will lead users who are already involved in tourism to make a comprehensive comparison of several sightseeing places and choose the most suitable place among them, so they don't immediately show higher intention to visit the sightseeing places they see during VR tourism. On the other hand, the curiosity and desire see new places may increase among those who are not usually much involved tourism increase when they experience VR tourism, and they are likely to consider the places they have experienced through VR first.

Our results are inconsistent with those of studies that show no positive relationship between perceived presence and perceived value (Lee & Kim, 2021; Tussyadiah et al., 2018). Perhaps this inconsistency is due to the focus of the VR technology at the VR/AR Expo Asia in Guangzhou on auditory and visual experience, while tactile and olfactory factors are important parts of enhancing the sense of presence. In addition, at present, most VR audio technologies still cannot achieve the audio effects that users expect, and it is difficult to maintain a consistent immersive experience between visual and auditory effects. What's more, 90 percent of our participants were between 20 and 40 years, and their average income was above average. People in this demographic group tend to be engaged in the intelligent Internet industry, no strangers to VR technology, and may deal with, pay attention to, or have experience with VR technology, so their requirements for the experience are high.

VR technology must (and undoubtedly will) continually improve the sense of reality as it relates to the five senses. With the widespread application of VR in various industries, the public is no longer unfamiliar with this technology, so they have high expectations for the wearing comfort, picture and sound quality of VR products. In particular, the current audio-processing method

in VR is not consistent with reality. For example, when the sound of a phone comes from one side of your head, you might just turn your head in the direction of the sound, not your body, separating the movements of your head and limbs in terms of time and direction. However, in the VR world, when one moves the body, the head and limbs move at the same time, and this inconsistency with reality may affect the precision of sound transmission and immersion in the experience. The importance of audio elements in creating realistic VE has also been demonstrated in the research. In addition, our research results suggest that interactivity is the most important aspect of users' perceived value of the VR experience, so special consideration should be given to the performance of ease of use, the simplicity of the menu function, and the overall ability to control the experience.

This information can help tourist attractions develop successful marketing strategies. Using VR technology will allow them to display a scenic spot at 360 degrees so consumers can feel the details of the attraction and its overall atmosphere, omit irritating communication with sales representatives, save time, and receive travel information quickly and efficiently, thus stimulating the development of tourism.

The research results show that people who are not particularly involved in tourism are a tourism consumption group with significant greater potential. The experience of VR technology can stimulate curiosity and excitement about the journey. Characteristics like age, occupation, and income will affect their choices, and VR tourism can expand those choice to include themes like adventure tours, experiential tourism, rural tourism, and cultural tourism.

Most of the participants in this study were between 20 and 40 years of age, and the sample was taken from a VR Expo. If the data were extracted from age groups and experience levels, different results could occur. Future research could compare the perceived benefits and value of VR tourism and their effects of intention to visit based on demographic characteristics like age and experience to expand our results.

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ABSTRACT

Purpose – This research aims to investigate the continuance intention of mobile payment services in Thailand based on the perceived innovativeness (PI) and task-technology fit (TTF) theories. The high attrition rate of mobile payment services in the market and lack of studies exploring the effect of personal attributes on continuance intention motivate the research.

Design/Methodology/Approach – 544 Thai mobile payment users were surveyed. Relationships between mobile technology skills, perceived usefulness of mobile payment services, perceived ease of use, PI, TTF, and continuance intention were analyzed using structural equation modeling (SEM).

Findings – The results indicate that perceived usefulness is the primary antecedent for TTF. Both TTF and PI were also found to have a significantly positive effect on the increase of continuance intention to use mobile payment services. Moreover, PI was found to have a strong negative moderating effect on the relationship between perceived task-technology fit and the continuance intention of using mobile payment services.

Research Implications – The findings provide important insights for mobile payment service providers on how to effectively target users and increase the intention to continue using mobile payment services.

Keywords: continuance intention, mobile payment, personal innovativeness, task-technology fit
JEL Classifications: M15, M31, O14, O33

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I. Introduction

The global mobile payments market is projected to grow almost four times over, from USD $1449.56 billion in 2020 to USD $5399.6 billion by 2026 (Mordor Intelligence, 2022). Lifestyle changes, the availability of high-speed internet, and e-commerce proliferation have contributed to the rapid growth rate of mobile payment adoption. This trend is visible around the world. More than half of adults in the US have used a mobile payment service since 2018 (PEW, 2019). About 87.3% of smartphone users in China use mobile payment services, and the adoption rate for mobile payment services in France, Brazil, Spain, and Germany hovers around 20% (Statista, 2022). Thailand is one of the fastest-growing mobile payment service markets in the world, with a projected mobile wallet penetration of 63% by 2025 (Statista Research Department, 2022a). In 2019, there were only around 5.3 billion mobile banking transactions in the country; in 2021, the number increased sharply to 16 billion transactions (Statista Research Department, 2022b).

The proliferation of mobile payment services has created a highly competitive environment among service providers. Many players, such as banks, e-commerce companies, and telecommunication companies, have entered the market to develop and provide different mobile payment services (Khando et al., 2022). This phenomenon has increased the number of choices for consumers. It has also provided them with additional value as many payment applications include promotions and/or special offers. With the increasing number of choices and the relatively low switching cost, payment providers have had difficulty retaining users. Only about 7.5% of users continue to use a payment service after one month (Kumar, 2022). For example, over 50 million users signed up for Apple Pay; however, they did not use it frequently in-store after the first transaction (Curry, 2023). When there is a mismatch between consumer needs and the benefits of a payment service, companies risk users losing interest and discontinuing the use of the mobile payment application (Franque et al., 2021; Kaewkitipong et al., 2022). This study, therefore, focuses on task-and-technology fit (TTF) and its influence on continuance intention to use mobile payment applications.

Prior literature has highlighted that TTF can explain technology adoption and continued use in several contexts. Specific to the context of mobile payment, prior studies (e.g., Franeque et al., 2022; Kaewkitipong et al., 2022; Rahi et al., 2021) have examined the effect of TTF on factors such as attitude and satisfaction, which were found to influence continuance intention to use mobile payment services. As TTF is a perception that could emerge both pre- and post-adoption, we speculate that it could also impact continuance intention directly. No study has examined the direct effect of TTF on the continuance intention to use mobile payment services. Only Yuan (2014) examined the relationship between TTF and continuance intention, but the study was in the context of mobile banking.

As mobile payment service providers face higher competition, they will introduce additional features to the services, which could make them more complex. Frequent service updates could affect user interest (Gong et al., 2021). For example, frequent updates could upset users that do not like change, and are already comfortable with an application's features. To this end, personal innovativeness has been found extremely relevant. Users with higher innovativeness can endure uncertainties and changes relatively more than those with lower innovativeness (Tan et al., 2017), and are more willing to adopt new technology (Simarmata & Hia, 2020). We therefore aim to investigate whether personal innovativeness affects intention to continue using mobile payment services.

Mobile payment services can also vary between countries. Differences in financial regulatory infrastructure and consumer behaviors create different segmentation needs of mobile payment services based on country (Gupta et al., 2021). The digital divide of mobile payment services is growing wider among countries. For instance,

the penetration rate of mobile payment services is 87.3% in China, 45.6% in South Korea, and 43.2% in the United States (Curry, 2023). However, the United Kingdom, Russia, and Spain all have a penetration rate under 25%. Therefore, it is imperative to conduct country-specific research on mobile payment services.

Thailand is one of the fastest growing mobile payment markets, ranking fourth worldwide with 9.7 billion real-time payment transactions in 2021 (ACI Worldwide, 2022). There are ample opportunities for mobile payment service providers in Thailand, and an increasing need among providers to retain users and compete within the market. Therefore, Thailand is considered a decent representative context for research on continuance intention to use mobile payment services.

In short, this study addresses the research gap on the continuance intention to use mobile payment services by investigating (1) the direct effect of TTF on continuance intention, which (2) factors may help increase perceived TTF, and (3) the role of personal innovativeness in increasing intention to continue using mobile payment services and in mediating the effect of TTF on continuance intention. The following research questions were asked.

"What is the role of TTF on the continuance intention to use mobile payment services and how can companies increase users' perception of TTF?"

"Does personal innovativeness influence the continuance intention to use mobile payment services?"

"Does personal innovativeness have a higher effect than TFF on the continuance intention to use mobile payment services?"

Understanding the correlation between these variables can provide insight on how to promote the continuous adoption of mobile payment services. The insights from this study can thus help mobile service providers improve customer loyalty, thereby resolving the current attrition issue.

The following section reviews previous research on mobile payment services. The methodology

employed in this study is then presented. This section is followed by the results and the theoretical/practical implications. The paper concludes with limitations and future research directions.

II. Literature Review and Hypothesis Development

1. Mobile Payment Services in Thailand

Mobile payment services (mobile wallet or mobile banking) allow financial transactions to be conducted on a smartphone (Zhou, 2013). In addition to using mobile payment services, financial transactions can also be conducted through SMS or NFC. Digital payment via mobile and other digital media is an important part of the fast-growing FinTech ecosystem (Gao & Jin, 2022). China is ranked first globally for its mobile payment penetration rate, which is currently at 87.3%.T USA is ranked third, while other developed countries, such as the UK, France, and Germany, have much lower adoption rates of less than 25% (Curry, 2023). As of 2018, the highest mobile payment usage rates occurred in the Asia Pacific region, most notably in Thailand and China, while North America, the Middle East, and Africa were ranked last (Best, 2022).

Mobile payment services in Thailand have grown exponentially, in part due to COVID-19 lock downs and social distancing policies implemented by the Thai government during the pandemic. According to the Bank of Thailand (BoT, 2021), demand for cash payments has declined, and will continue to decline; at the same time, mobile payments will continue to gain popularity. Digital payment transactions in Thailand rose above 80% in 2021 as COVID-19 persisted (Ongsakul, 2023). The increase in the number of mobile payment transactions conducted in Thailand during and after COVID-19 is also associated with the launch of "Pao Tang", a mobile payment app linked with several government financial aid schemes (Kaewkitipong et al., 2022). Two major financial

aid schemes that drove up the number of mobile payment transactions conducted in Thailand were "*Tiew Duay Kan*"(Let's Travel) and "*Kon-la-krueng*" (Let's Pay Half). Thai citizens that wanted to claim the benefits of these schemes needed to sign up with Pao Tang and pay for food, as well as services, via the app. The application had more than 40 million registered users in 2022 (Amphunan et al., 2022).

Apart from Pao Tang, there are several other mobile wallets available in Thailand, such as TrueMoney, LINE Pay, Air Pay, mPay, and GrabPay. Several local commercial banks also provide users with a mobile banking application, with which they can easily make mobile payment transactions by scanning a QR code. According to UnionPay (2018), using a QR code to pay for a transaction is one of the most popular payment methods in Thailand. Users simply scan a QR code provided by the merchant, indicate the amount of money they want to send, and then confirm the transaction. Money will then be transferred to the account associated with the QR code.

The growing number of mobile payment transactions has attracted service providers and led to competition. Consequently, mobile payment service providers feel increasing competition and have to focus on how to engage users such that they continue to use their services instead of switching to other payment services, which may offer additional benefits. According to Verani (2020), around 73% of those that download an application will stop using it after three months. Addressing such challenges, this research attempts to focus on how to help mobile service providers retain customers.

2. Task Technology Fit and Continuance Intention

Task-technology fit (TTF) is a dynamic concept originally proposed by Goodhue and Thompson (1995) in whicht tasks and technologies constantly evolve in response to environmental changes. It has been applied extensively in the past few decades in an effort to understand the relationship on how the newly-emerged technological features of an information system product fit user tasks and their behavioral intentions (Goodhue & Thompson, 1995; Khan et al., 2018; Li et al., 2019). The model suggests that user perceptions of technology do not necessarily lead to technological adoption. In other words, users do not make decisions to accept a technology exclusively based on their perceptions of the technology. Instead, they evaluate its fit as they perform their daily tasks (Franque et al., 2022). The ideal fit occurs when users feel that the adopted technology can help complete tasks successfully. A mismatch can occur when users feel that a technology does not sufficiently help complete a task. A mismatch can also occur when users feel that a technology is sufficient, but too complicated. Although the adopted technology performs the required task, the learning curve could be too steep. When users are in either under fit or overfat situations, a mismatch can occur between a mobile payment service and the task to be completed.

TTF has been widely used to understand and predict the behavioral intention to adopt mobile payment services; however, it has not been applied sufficiently to understand continuance intention (Franque et al., 2022). To the best of our knowledge, few studies have focused on the role of TTF in predicting continuance intention to use mobile payment services or similar online payment services. Franque et al. (2022) extended TTF using the expectation-confirmation model (ECM), and found individual performance and overall trust were positively associated with continuance intention to use mobile payment services. Yuan et al. (2014) integrated TTF with the technology acceptance model (TAM) and ECM to study continuance intention to use mobile banking, and found that satisfaction, perceived usefulness, perceived task-technology fit, and perceived risk were the main predictors of continuance intention. Rahi et al. (2021) integrated TTF with technology continuance theory (TCT) to study the continuance intention of those that used Internet banking; they found perceived usefulness, attitude, and satisfaction were the main predictors

of continuance intention. Kaewkitipong et al. (2022) found that TTF positively affected HCI experiences, which led to continuance intention to use mobile payment services.

These prior studies have shown that TTF is an important predictor of continuance intention to use mobile payment services. However, few investigated antecedents of perceived TTF. Purohit et al. (2022) also noted that studies on continuance intention of mobile payments should pay attention to the behavioral aspects of technology use, rather than just the task and technology aspects. This study, therefore, addresses this gap by adding behavioral aspects (perceived usefulness and perceived ease of use) and personal aspects (a user's skill and personal innovativeness) concerning the use of mobile payment services to the research model, and investigating the effects on TTF and continuance intention.

3. Impact of Mobile Technology Skills on the Perceived Task-Technology Fit for Mobile Payment Services

Previous studies have suggested that individuals are likely to accept and/or adopt a new technology based on their evaluation of a good task-technology fit (Afshan & Sharif, 2016). An ideal task-technology fit occurs when the adopted technology matches the tasks and user's ability to perform those tasks. When a technology does not match a user's skill to perform a task, users can perceive the difference between the ideal and mismatched conditions (Xu & Lu, 2022). Skill is usually studied under the term "effort expectancy" (user perception of having the skills or abilities to use a technology). Skill is also associated with self-efficacy. Individual with high self-efficacy can deal with complex tasks relatively better than those with low self-efficacy (Jung et al., 2022). A positive relationship between skill (effort expectancy) and TTF has been confirmed in several cases, such as cross-border mobile payment (Wu, et al., 2021), healthcare wearable devices (Wang et al., 2020), and augmented reality technology (Faqih & Jaradat, 2021). Mobile payment services inherit

locatable banking information systems, and require users to have the needed mobile technology skills to perform these services. For example, a user must know how to connect a smartphone to a wireless network, how to link a credit card to a mobile payment application, and how to use an app during a financial transaction. A user's ability to operate mobile technology is critical for the success of a mobile payment transaction. When users can perform mobile payment tasks with the acquired mobile technology skills, the perception of task-technology fit is fulfilled. Thus, we propose:

H1: Mobile technology skills have a positive impact on the perceived task-technology fit for mobile payment services.

4. Impact of Perceived Usefulness on the Perceived Task-Technology Fit for Mobile Payment Services

While task-technology fit focuses only on the match between task needs and the available functionality of the adopted technology to perform those tasks (Wu et al., 2021), it is also important to take into consideration perceived usefulness and ease of use as they have been found to have strong effects on user intention to adopt new technology (Siagian et al., 2022). Users are more likely to accept a new technology or an information system when they believe that using such technology or system will solve a problem (Permana & Setianto, 2019). In other words, when users feel or believe that the adopted technology has features or functionalities that will help complete a task at hand, they tend to have a stronger perception of the fit between task needs and the technological capabilities of an adopted system. For instance, Bere (2018) found that users with higher perceived usefulness of mobile instant messaging (MIM) tended to have a higher perceived task-technology fit. Previous studies have also explored task-technology fit in the context of mobile banking, and showed that perceived usefulness contributes to user acceptance of mobile banking and adoption

intention (Afshan & Sharif, 2016; Akturan & Tezcan, 2012). This relationship could also apply to mobile payment services. If users perceive that mobile payment services are useful for daily payment activities, they should perceive a higher fit with mobile payment services. Thus, we propose:

H2: Perceived usefulness has a positive impact on the perceived task-technology fit for mobile payment services.

5. Impact of Perceived Ease of Use on the Perceived Task-Technology Fit for Mobile Payment Services

Perceived ease of use (PEOU) is a personal belief that using an adopted information system will be effortless (Davis, 1989). PEOU can lead to positive user attitudes toward a new information system, and in turn, promote the adoption of various information systems, such as mobile hotel booking (Ozturk et al., 2016), mobile social software (Chinomona, 2013), and mobile healthcare systems (Hoque, 2016). Users generally put little effort into learning how to use these systems.

In the context of mobile payment services, financial transactions can be complex. To encourage users to conduct mobile transactions, ease of use may play an important role. If users perceive a mobile payment application is easy to use, they may perceive that the application is a good fit or a better match for their tasks. Mathiesona and Keil (1998) argued that PEOU was not just about interface design but also issues related to task-technology fit. Thus, we propose:

H3: Perceived ease of use has a positive impact on the perceived task-technology fit for mobile payment services.

6. Impact of Perceived Task-Technology Fit on the Continuance Intention of Mobile Payment Services

Behavioral intention is a good proxy for actual behavior (Lee & Kim, 2022); therefore, in this study, we investigate the intention of users to continue using mobile payment services, without having to observe or validate actual behavior. When users feel that the technology they have adopted can help complete tasks more successfully, they are more likely to continue use. For example, in the context of mobile banking, perceived task-technology fit has been shown to play an influential role on user intention to continue using mobile banking (Yuan et al., 2014). Since users expect to be able to conduct several financial transactions (e.g., pay their bills and buy food) via mobile payment applications, mobile payment services need to be designed to serve these needs. Users are more likely to continue using mobile payment services designed to fit their needs. On the other hand, a mismatch between what a user wants to do and the options offered through a mobile payment application could lead to dissatisfaction and the decision to discontinue use (Kaewkitipong et al., 2022). Thus, we propose:

H4: Perceived task-technology fit has a positive impact on the continuance intention of mobile payment services.

7. Impact of Personal Innovativeness on the Continuance Intention of Mobile Payment Services

Personal innovativeness is a strong determinant of innovation adoption behaviors (Agarwal & Prasad, 1998). According to Agarwal and Prasad (1998), personal innovativeness is the degree to which an individual is willing to try out any new information technology. In the context of mobile payments, Tan et al. (2014) found that personal innovativeness was a strong predictor of the behavioral intention to adopt Near-Field Communication (NFC) mobile payment in Malaysia. Patil et al. (2020) also confirmed this finding in the context of mobile payments in India. However, for continuance intention as a post-adoption behavior, it is also plausible that personal

innovativeness could lead to the intention to continue using a technology. Lu (2014) confirmed the relationship in the context of mobile commerce, and highlighted that personal innovativeness significantly influenced user continuance intention. Lin and Filieri (2015) also found that airline passengers that were more innovative tended to have higher continuance intention to use online check-in services.

In the context of mobile payment services, it is important that mobile payment service providers continue updating existing payment services with new services to meet the changing demands of users. Therefore, mobile payment users that are more innovative may remain with services longer than users with less innovativeness. Thus, we propose:

H5: Personal innovativeness has a positive impact on the continuance intention of mobile payment services.

8. Moderating Effect of Personal Innovativeness on the Relationship between Perceived Task-Technology Fit and the Continuance Intention of Mobile Payment Services

Mobile payment providers are offering new services to engage customers and increase the frequency and volume of transactions. These services include transferring money to friends or family, creating invoices, tracking invoices, sending money internationally, and splitting dining expenses. However, not all mobile payment applications have the needed functions to increase continuance intention. When the fit between users and an application is not ideal, users could feel disappointed and discontinue using a company's service (Xu & Lu, 2022). Improving the capabilities and user interface of an application could help increase the fit between mobile payment services and the tasks that they perform. However, the fine-tuning process takes time. Therefore, it is crucial to target users with a high level of perceived innovativeness. This user segment

is more likely to accept new mobile payment services and find ways to overcome any mismatch between task and technology (Patil et al., 2020). In other words, the direct impact of TTF on the continuance intention of mobile payment services can be reduced for users that are more innovative. Thus, we propose:

H6: Personal innovativeness has a negative moderating effect on the relationship between perceived task-technology fit and the continuance intention of mobile payment services.

III. Research Methodology

1. Research Method

This study used a survey to measure the influence of skills, perceived usefulness, and perceived ease of use on TTF in the context of mobile payment services, as well as the influence of personal innovativeness on the relationship between TTF and continuance intention to use mobile payment services. It collected data regarding the experience of Thai users with mobile payment services and their intentions to continue use. The survey method was considered cost-effective and reliable, and findings from this study are generalizable to the continued use of mobile payment services in Thailand and other emerging countries.

The survey questionnaire was developed and revised based on technology adoption and innovation diffusion theories. Three information systems professors were also solicited in a pilot study to help improve the design of the original survey instrument. These experts provided constructive feedback on how to improve the content's validity and reliability. After completing the pilot test, the researchers disseminated the survey via the researchers' personal social networks and popular financial product/service-related Facebook groups in Thailand. The survey

received 582 responses, of which 544 were valid and retained for analysis.

Partial least squares structural equation modeling (PLS-SEM) was adopted to examine the relationships between all constructs in the research model. The results of this analysis will provide insights into the relative value of these antecedents to promote the continuous use of mobile payment services based on the perceived innovativeness level of users in Thailand.

2. Measurement

We adopted the existing items from previous literature to measure this study's major constructs. The questions for the constructs were placed on a 7-point Likert scale, ranging from 1, "strongly disagree", to 7, "strongly agree." Table 1 lists the survey items used to measure constructs and sources, including loadings.

Table 1. Theoretical Construct Items

Construct	Questions	Source
Skill (SK)	• I am skillful at using mobile payment services. • I know how to use mobile payment services to get what I want. • I know more about using mobile payment services than most users.	Agarwal and Karahanna (2000)
Perceived Usefulness (PU)	• Using mobile payment services enhances my daily productivity. • I find mobile payment services useful in my daily activities. • Using mobile payment services enhance my effectiveness in daily activities.	Agarwal and Karahanna (2000), Flavián et al. (2020)
Perceived Ease of USE (PE)	• It is easy for me to become skillful in using mobile payment services • I find mobile payment services easy to use. • I find it easy to use mobile payment services to do what I want to do. • Learning to use mobile payment services is easy for me.	Davis (1989), Flavián et al. (2020)
Task-Technology Fit (TTF)	• In helping complete my mobile payment tasks, the functions of mobile payment apps are sufficient. • In helping complete my mobile payment tasks, the functions of mobile payment apps are appropriate. • In helping complete my mobile payment tasks, the functions of mobile payment apps meet my payment needs.	Zhou et al. (2010), Lin and Huang (2008)
Continuance Intention (CON)	• I intend to continue using mobile payment services. • I intend to continue using mobile payment services than pay using alternative means (credit card, cash) • If I could, I would like to continue using mobile payment services in the future	Wu et al. (2010)
Personal Innovativeness (PI)	• If I heard about a new information technology, I would look for ways to experiment with it. • Among my peers, I am usually the first to try out new information technologies. • I like to experiment with new information technologies.	Agarwal & Prasad (1998) Patil et al. (2020)

IV. Findings and Discussion

1. Demographic Analysis

An online survey was conducted to collect data from 544 mobile payment users in Thailand. 28.2% of the respondents were male, and 71.3% were female. More than 87% of surveyed users used mobile payment services for at least 6 months. Table 2 contains details on the respondents.

Table 2. Respondent Profiles

		Frequency	Percent (%)
Gender	Male	154	28.2
	Female	390	71.3
How long have you been using mobile payment services? (Years)	< 0.5	70	12.9
	0.5-1	98	18.0
	1-1.5	123	22.6
	1.5-2	85	15.6
	2-2.5	35	6.4
	2.5-3	48	8.8
	> 3	85	15.5

2. Validity and Reliability Testing

The validity and reliability of all items were inspected. We estimated each construct's average variance extracted (AVE) concerning internal consistency validity. All constructs had an AVE larger than the cut-off of 0.5 (Fornell & Larcker, 1981; Hulland, 1999), suggesting sufficient convergent validity (Table 3). We compared the construct's AVE square root and correlations with other constructs to check discriminant validity. We found that all AVE values were higher than the correlations, indicating sufficient discriminant validity (Table 4).

Table 3. Measurement Quality Indicators

Variables	Mean	Standard Deviation	AVE	Composite Reliability	Cronbach's Alpha	Communality
CON	5.4406	1.3606	0.8698	0.9525	0.9251	0.8698
PEOU	5.5667	1.2809	0.8901	0.9701	0.9588	0.8901
PI	4.5801	1.3691	0.8369	0.9390	0.9043	0.8369
PU	5.5765	1.2308	0.8080	0.9619	0.9523	0.8080
SK	5.1332	1.3327	0.8466	0.9430	0.9092	0.8466
TTF	5.1359	1.3155	0.8845	0.9583	0.9348	0.8845

Table 4. Discriminant Validity

	CON	PEOU	PI	PU	SK	TTF
CON	0.9326					
PEOU	0.6825	0.9435				
PI	0.4555	0.4866	0.9148			
PU	0.7916	0.7145	0.4538	0.8989		
SK	0.7275	0.7513	0.5408	0.6971	0.9201	
TTF	0.6919	0.6145	0.4048	0.6587	0.5905	0.9405

3. Structural Model and Hypothesis Testing

PLS-SEM was conducted to calculate the research model's estimated path coefficients, path significance, and R^2 values (Fig. 1). The model was evaluated using data from 544 mobile payment users in Thailand. The path analysis result shows that 53.7% (R^2) of the variation in continuance intention to adopt mobile payment services was explained by the model's PI and TTF constructs. In addition, 48.5% (R^2) of the variation in TTF was explained by the model's SK, PU, and PEOU constructs.

The Skill to use mobile payment services (SK) had a significant and positive effect on Thai user perceived task-technology fit (TTF) for mobile payment services ($\beta = 0.149$; t = 2.737). Thus, H1 is supported (Table 4). Perceived usefulness (PU) has a significant and positive effect on the TTF of Thai users for mobile payment services ($\beta = 0.400$; t =7.060). Thus, H2 is supported. Perceived ease of use (PE) affects Thai user TTF for mobile payment services ($\beta = 0.217$; t = 3.729). Thus, H3 is supported. TTF has a significantly positive effect on the continuance intention (CON) of Thai users for mobile payment services ($\beta = 0.937$; t =14.725). Thus, H4 is supported. Personal innovativeness significantly affects Thai user continuance intention to adopt mobile payment services ($\beta = 0.645$; t = 6.217). Thus, H5 is supported. Personal innovativeness has a significantly negative moderating effect on the relationship between TTF and CON ($\beta = -0.660$; t = 5.025). Thus, H6 is supported. In summary, all six hypotheses were supported (Table 5).

Fig. 1. Path Analysis Results
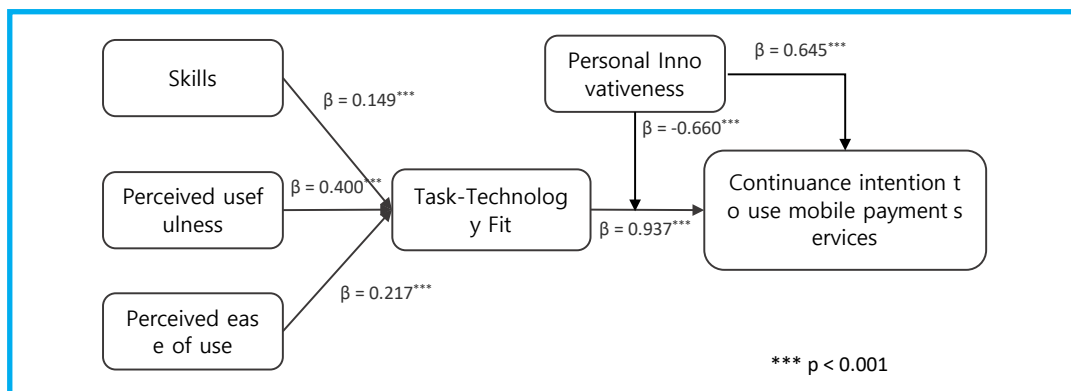
Note: ***p<0.001.

Table 5. Hypothesis Test Results

Hypothesized Paths	Path Coefficients	T-statistics
H1. SK → TTF	0.149	2.737***
H2. PU → TTF	0.400	7.060***
H3. PEOU → TTF	0.217	3.729***
H4. TTF → CON	0.937	14.725***
H5. PI → CON	0.645	6.217***
H6. PI*TTF → CON	-0.660	5.025***

Note: ***p<0.001.

4. Discussion

This study investigated factors that can positively influence perceived TTF and the relationship between TFF and user continuance intention to use mobile payment services in Thailand. In addition, the study aimed to explore whether personal innovativeness would directly affect continuance intention and/or mediate the relationship between task-technology fit and continuance intention. Consistent with previous research findings on mobile banking (e.g., Akturan & Tezcan, 2012; Hanafizadeh et al., 2014), the present study found that user mobile technology skills, perceived usefulness, perceived ease of use, and perceived innovativeness influence TTF, and in turn, predict the continuance intention to adopt mobile payment services.

Prior studies (e.g. Chen et al., 2019; Kaewkitipong et al., 2022) indicated that when mobile phone users had the necessary technology skills, they were less likely to feel anxiety in a situation wherein they needed to use a mobile payment service. The findings from this study also show that users that are more skillful with mobile technologies were more likely to perceive mobile payment services as a good fit for their financial needs. The skill set required for using mobile technology is increasingly important in a digital era where almost all daily activities can be conducted using mobile applications, and mobile service providers are constantly introducing new features that may increase the complexity of applications. Without appropriate skills, users could perceive a payment service as too complex or too difficult to use, and thus decide not to use it.

Perceived usefulness was found to be positively associated with TTF in this study. Our findings show that mobile payment users that perceived that mobile payment services were useful tended to perceive a higher fit between the mobile payment services and financial tasks. While previous studies on the continuance intention of mobile payment services (e.g. Chen & Li, 2017; Franque et al., 2021) found perceived usefulness directly affected continuance intention, our study shows that it also influenced user perceptions of the TTF of mobile payment services.

Perceived ease of use was another factor significantly influencing user perceptions of TTF in the context of mobile payment services. Our findings reveal that users that perceived mobile payment services as easy to use appeared to perceive a higher fit for their tasks. It is possible that when users felt fewer struggles in using mobile payment services, they then perceived that the technology fit their tasks well. Prior studies (e.g. Phoung et al., 2020; Yaun et al., 2014) have found that PEOU affected continuance intention via other factors, such as satisfaction or perceived usefulness. Our study adds that PEOU also has a direct effect on perceived TTF, which in turn

influences mobile payment user continuance intention.

Perceived ease of use and skill have a marginally positive effect on the increase of perceived TTF for mobile payment services, while perceived usefulness has a stronger effect. These findings indicate that users care more about the functionalities of a mobile payment service than its user-friendliness.

Once users perceive a good fit between a mobile payment service and financial needs, they seem to have a higher intention to continue using a service. This is consistent with previous research on mobile banking applications (Yuan, 2014). Prior studies on mobile payment services (e.g. Franque et al., 2022; Kaewkitipong et al., 2022; Rahi et al., 2021) have also investigated the role of TTF on the continuance intention of users for mobile payment services. However, none of these studies tested the direct effect of TTF on continuance intention. They only found that TTF played a role in increasing continuance intention via other factors, such as satisfaction or attitude. Therefore, our findings add to the existing literature, highlighting that TTF also has a direct effect on continuance intention.

Lastly, our study considers personal innovativeness an essential antecedent and moderator to predict user intentions to continue using mobile payment services in daily life. Our findings indicate that individuals are likely to continue using mobile payment services due to the technology's high level of innovativeness. This is in line with Lu's finding (2014) that personal innovativeness strongly affects intention to continue using mobile commerce. However, our study adds that TTF appears to have higher influence on continuance intention than personal innovativeness. Furthermore, our study shows that personal innovativeness can reduce the impact of TTF on continuance intention. In other words, users with strong personal innovativeness are more likely to continue using mobile payment services; they tend to be able to overcome the discrepancy between task and technology, and continue use. This type of user is generally more tolerant when faced with a technological problem, regardless of the TTF.

5. Theoretical and Practical Implications

The findings of the present research contribute to existing literature on the role of TTF on the continuance intention to use mobile payment services. Extending previous studies that looked at TTF as factors influencing satisfaction and/or attitude, which in turn influenced continuance intention, our study examined and confirmed the direct effect of TTF on continuance intention. Furthermore, the present study provides empirical evidence for the moderating role of perceived innovativeness in the relationship between TTF and continuance intention. When introducing new mobile payment services or upgrading previous features, users will need time to adapt and integrate the new technology into their lives. Users are more likely to experience a perceived mismatch between intended tasks and a new technology when trying to overcome a learning curve. Therefore, users that were more innovative were found to be more likely to continue using mobile payment services.

To improve perceived TTF, mobile service providers can create and distribute short informative videos that explain the functionality of an application, how it is used, and its benefits. This would help to improve the experience of users and highlight the advantages of the application. In addition, service providers can organize training sessions to help users acquire the right skills to perform tasks in their application. These sessions could improve the perceived ease of use of the payment service among its users (Franque et al., 2021), and increase the degree of perceived TTF, thereby improving the utilization levels of the adopted technology (McGill & Klobas, 2009). Lastly, service providers can target innovative users first, as they are most likely to continue using mobile payment services. Prior research (Lu et al., 2017; Park et al., 2019) has proven that social influence affects continuance intention, so innovative users may also influence peers to continue using a specific mobile payment service.

V. Conclusion

Mobile payment services have become an important part of daily life. The sharp increase in the number of digital payments worldwide can (in part) be attributed to the COVID-19 pandemic (World Bank, 2022). This increase has led to higher competition among mobile payment service providers. Another distinct challenge for mobile payment service providers is the high churn rate of mobile payment service users. Service providers need to find innovative ways to retain customers. Our study aimed to provide insight into this challenge by investigating factors influencing continuance intention to use mobile payment services in Thailand.

While there are several existing studies examine continuance intention to use mobile payment services, most (e.g., Yuan et al., 2014; Chen & Li 2017; Phoung et al., 2020; Franque et al., 2021) focus on technology related factors, such as information quality, system quality, service quality, perceived ease of use, and perceived usefulness. These studies neglect personal attributes such as skill and personal innovativeness. In addition, we were unable to identify prior research on mobile payment services that investigated the direct impact of TTF on continuance intention; thus, our study sought to fill this gap. We additionally explored factors influencing TTF. Our findings show that when technologically literate consumers believe that a new mobile payment service is useful and easy-to-use, they are likely to continue using the service. TTF appears to have a stronger influence on continuance intention than personal innovativeness. Additionally, users with a high level of personal innovativeness seem to be able to overcome the mismatch between tasks and mobile payment services, and show higher intention to continue using the services.

This research highlights the direct impact that TTF has on consumer continuance intention to use mobile payment services. It also provides evidence of which factors may lead to higher TTF. The research suggests that mobile payment service providers may benefit from targeting innovative users, and educating users that lack mobile skills.

Lastly, this research is not without limitation. The findings of this study are based on data collected in Thailand, and therefore may not apply to other markets. Mobile payment service providers will need to take into consideration their specific context and its impact on adoption rates, as well as consumer continuance intention. Mobile payment services require a supportive ecosystem, wherein mobile payment service providers, merchants, banks, and consumers all play important roles. Thus, in places where merchants do not want to accept mobile payments, or laws forbid this form of transaction, the personal attributes of users, namely skill and personal innovativeness, may not be applicable. In addition, mobile payment services can be varied in terms of complexity, and this could affect the required skills users need, as well as the perception of an application's ease of use and its usefulness. Future research may want to look at specific mobile payment services and examine whether different characteristics mediate the effect of perceived usefulness and ease of use on continuance intention. Consumer trust may also be an important area for investigation as mobile payment services involve financial transactions, and thus need high levels of security. The potential for gamification features may also prove to be a fruitful area of research, as innovative users may enjoy this type of feature.

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Analysis of the Impact of CPTPP Membership on the Korean Economy*

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ABSTRACT

Purpose – As of 2022, Korea's dependence on trade was 75%. Korea must join the Comprehensive Progressive Trans-Pacific Partnership (CPTPP) in order to keep pace with US-led trade standards in the future. This paper empirically investigated the impacts of Korea's participation in the CPTPP on the economy.

Design/Methodology/Approach – Using the World Input-Output Database and regression analysis, Korea's CPTPP membership expands trade with 11 countries, including Japan, contributing greatly to the growth of the Korean economy.

Findings – Our main findings can be summarized as follows. In 2022, exports and imports to Japan were $30.6 billion and $54.7 billion, respectively. If Korea joins the CPTPP, the economic effect will increase GDP by about 1.7% every year, and is expected to be more than $40.3 billion in 2025. The CPTPP has a great impact on the Korean economy by expanding trade with 11 countries, including Japan. Although Korea already has FTAs with 9 TPP member countries, it has been found that Korea's GDP expands through additional tariff and non-tariff trade expansion by joining the CPTPP.

Research Implications – Existing studies focus on the benefits of Korea on joining the CPTPP. This paper attempts to firstly evaluate the impact of joining the TPP on the Korean economy via analysis of the World Input-Output Database (WIOD).

I. Introduction

President Yoon Seok-yeol, who took office in 2022, is also making great efforts to expand trading countries, such as by visiting the UAE. Korea should join the CPTPP and continue its trade expansion policy. In 2022, the UK, China, Taiwan, and Ecuador applied to join the CPTPP. If Korea joins the CPTPP, it will have the effect of concluding FTAs with Japan and Mexico, which have not concluded FTAs. Korea has already signed FTAs with 9 out of the 11 CPTPP member countries. Joining the CPTPP expands trade, including non-tariff barriers and intellectual property rights, with countries that have already signed FTAs . It has been analyzed that the effect of concluding FTAs with Japan and Mexico would increase Korea's GDP by 1.7%. U.S. President Joseph Biden was elected in November of 2020. He declared the U.S. would rejoin the Trans-Pacific Partnership (TPP) from which President Trump had withdrawn. However, it is difficult to join the TPP due to labor issues in the states of Pennsylvania, Wisconsin, and Michigan. As of 2022, the rate of trade dependency of Korea is 75%, which is the second largest in the world. Korea should join the CPTPP to keep pace with trade standards led by the U.S. The CPTPP has a great impact on the Korean economy by expanding trade with 11 countries, including Japan. Although Korea already has FTAs with 9 TPP member countries, Korea's GDP will expand through additional tariff and non-tariff trade expansion by joining the CPTPP. Trade must be expanded by joining multinational trade associations such as CPTPP and RECP. South Korea's trade deficit in 2022 was $47.4 billion due to external influences. The continuation of the Russia-Ukraine war, a 100-400% increase in oil and gas prices, China's COVID-19 policy, and a hike in the US interest rate accelerated Korea's trade deficit. South Korea's trade dependence on China is 33%. As exports from China decreased and imports increased, the trade deficit widened. Korea should lower its dependence on China to 15% and diversify exporting countries. Joining the CPTTP helps reduce dependence on China.

President Moon signed the Regional Comprehensive Economic Partnership (RCEP) in November of 2020. The TPP will take effect when more than 50% of member countries sign. Korea should join the TPP and RCEP simultaneously. Biden claims that the U.S. should lead a world trade standard. Therefore, Korea should join the U.S.-led TPP, while also joining the China-led RCEP. The U.S. will lead global trade standards after joining the TPP. Korea's security and national defense depends on the U.S. As of 2022, China (including Hong Kong) covers 33% of Korea's trade, followed by the U.S. at 14%. However, it is assumed that the U.S. is more important than China when considering national security.

On December 8, 2020, President Moon said that Korea is considering becoming a member of the major Asia-Pacific free trade agreement known as the Comprehensive Progressive Agreement Trans-Pacific Partnership (CPTPP), as part of efforts to diversify exports. He stressed the need to build up the strength of the country's trade in preparation for the post-coronavirus era. "Diversifying the market is a task that Korea should achieve," he said, "the ROK will continue to review joining the CPTPP". He was referring to the CPTPP, a free trade agreement (FTA) involving 11 nations. It is a renegotiated version of the Trans-Pacific Partnership (TPP) led by the Obama administration, but abandoned by President Trump 2017. The U.S. may join the CPTPP under Biden's leadership. This was the first time that President Moon talked in public about the possibility of South Korea joining the CPTTP. In November of 2020, Korea signed another large FTA called RCEP.

According to the official homepage of the Korean government, the size of the external economy of the Republic of Korea (ROK) accounts for more than 82% of the GDP of the ROK. It also insists that the ROK should join the TPP to prevent Korean products from losing price competitiveness due to high tariffs. As of March of 2014, the ROK signed FTAs with 47 economies, including Chile, Singapore, the EFTA, ASEAN, India, the EU, Peru, the USA, Turkey, and Canada. The joining

of the TPP in 2021 is one of the biggest economic issues in the ROK. The ROK initially reserved membership in the TPP due to the Korea-China FTA and the Korea-Japan FTA. However, the ROK decided to join the TPP as it was known that it would be signed in 2021, and the USA has called for Korea's participation in economic blockage to constrain China. The 12 countries, including the ROK, joined the TPP, and it received much attention, accounting for 39% of the world's economy. Under these circumstances, FTAs with Korea and its neighboring countries is becoming more complicated. Regarding FTAs among Korea, China, and Japan, a single economic bloc has been officially initiated for a long period. The ROK is promoting bilateral FTAs with Korea-China or Korea-Japan separately from the Korea-China-Japan FTA. However, it is not easy to draft the Korea-Japan FTA due to complicated cultural issues stemming from Japanese colonialism and other issues. Therefore, it can be said that the TPP is the easier way to establish an FTA between Korea and Japan. The purpose of this study was to determine the concept and background of the TPP, Korea's economic effect through industry-related analysis, and impacts of the TPP entry on Korea.

The TPP stands for the Trans-Pacific Partnership for the purpose of the economic integration of the Asian and Pacific regions, starting from a multilateral FTA with New Zealand, Singapore, Chile, and Brunei on June, 2005. In the initial stage of the TPP, not much attention was given due to its small economic presence. However, the TPP was carried out with the active participation of President Obama. One of the reasons for Korea to join the TPP is to enter the regional supply system. If Korea fails to enter the Asia-Pacific supply system, it will lose much of the market share to Japan. Meanwhile, tariffs on electronic products, cars, and trucks imported from Japan are 8% and 10%, respectively. Until now, high tariffs have protected the domestic automobile industry by increasing the price of Japanese cars. However, it is worrisome that Japanese cars may be very competitive.

The economy and company growth in Korea have been highly affected by infant industry protection. Infant industry protection means that a domestic industry should be protected until it has grown to a certain level of competitiveness. In other words, this principle means that domestic companies should be shielded until they can compete with foreign companies. Germany, Korea, and Japan achieved economic growth through this principle. In the era of openness, Korean companies must compete with global companies to survive. Although importing Japanese cars is a concern when the TPP is implemented, it also has the advantage of increasing exports to other TPP member countries.

II. Previous Research

Lee (2014) argued that the parts and material industry in Korea would suffer a trade deficit of $35.4 million US dollars when the Korea-Japan FTA was signed. The researcher also suggested that it would be necessary to take measures for the preparation of the widening trade deficit and the deepening trade imbalance between Korea and Japan. Different research reported that the Korea's participation in the TPP was necessary from the standpoint of Korea; furthermore, it would positively impact Northeast Asian countries (Sung, 2014). He also said that when the TPP was implemented, there would be a change in the dynamic economic effects in Korea, China, and Japan by –0.1~4%, -0.1%~-0.06%, and 0.5~0.6%, respectively. Han (2013) mentioned that the TPP, starting from the four countries, expanded to a huge trade agreement with the participation of the USA and Japan. The paper anticipated that the content of the TPP (led by the USA) would be drafted based on FTAs the USA previously signed. For example, the e-commerce part, in which the USA hold advantage, would be one of main points. It also reported that if Korea participates in the TPP, it would be important to actively propose content favorable to Korea in the FTA with the USA, and negotiate for Korea to take a lead in the e-commerce area. Lee and Hong (2013) indicated

that the USA continuously controls economic integration and trade rights through the TPP, and Korea was considering joining the TPP. It also reported that China was in strong favor with a Asean+3 agreement, negotiating with the Asean+6 countries, and Korea's participation in the TPP has a substantial impact on East-Asian economic integration and trade rights, which was based on the analysis of trade reports between Korea and 22 countries from 1990 to 2011.

Kim (2013) indicated that Korea's real GDP would increase by 2.5~2.6% when joining the TPP, and it would decrease by 0.11~0.19% if not joining the TPP. Petri and Plummer (2012), using a GTAP 8 model or

a CGE model for analysis, reported that the overall welfare level of the USA would increase to 15-30 billon USD until 2025, when the TPP is signed.

III. Empirical Framework and Hypothesis

The international input-output table shows that when two countries trade, they are connected. This table shows that the global economy is highly interconnected across country and industry, and the tables are compiled by classifying industries in 40 countries into 35 sectors.

Fig. 1. Outline of a World Input-Output Table (WIOT)

			Use by country-industries						Final use by countries			Total use
			Country 1			...	Country M			Country 1	...	Country M	
			Industry 1	...	Industry N	...	Industry 1	...	Industry N			...	
Supply from country-industries	Country 1	Industry 1											
		...											
		Industry N											
	......												
	Country M	Industry 1											
		...											
		Industry N											
Value added by labour and capital													
Gross output													

Source: University of Groningen (n.d.).

This is an explanation of the international input/output table for Korea and the U.K. Through trade, the C14 industry, Korea's electrical and electronics industry, and the U.K.'s C14 industry, bring a total ripple effect of $323 million. Korea's electrical and electronics industry has a ripple effect of a total of $1.07 billion through trade with the U.K. Finance, automotive, and metals are heavily traded industries with the U.K. Using the international input-output table, the international production inducement effect, added value inducement effect, and employment inducement effect of a specific

domestic industry can be derived, and the method is as follows (Timmer et al., 2016).

Suppose S is an industry, F is a factor of production, and N is a country. When a country's industry is represented as a market for one factor of production, it can be expressed as SN. Each country's industry produces goods by inputting domestic raw materials and production factors imported from abroad as intermediate goods. These outputs are used for final demand domestically and abroad, and are also used as intermediate goods for production. Final demand

Table 1. World Input-Output Table

(Unit: US$, Millions)

Intercountry Input-Output Table for 2016			Machinery, Nec	Electrical and Optical Equipment	Transport Equipment	TOTAL
40 countries, in current prices			GBR c13	GBR c14	GBR c15	
Electrical and Optical Equipment	KOR	c14	104	323	158	1,071
Water Transport	KOR	c24	7	14	19	897
Financial Intermediation	KOR	c28	2	3	5	882
Transport Equipment	KOR	c15	5	0	163	309
Basic Metals and Fabricated Metal	KOR	c12	40	15	53	254

Source: University of Groningen (n.d.).

consists of household consumption, government spending, and investment. Intermediate and final goods can be divided by origin and destination, taking into account trade between countries. In the case of a specific product, let s be the country of origin, s be the source industry (input industry), and t be the destination industry (output industry). Suppose that the quantity of any one product is equal to the sum of both domestic and foreign products, and that both are liquidated.

$$y_i(s) = \Sigma_i f_{ij}(s) + \Sigma_j \Sigma_t m_{ij}(s,t) \qquad (1)$$

Global final demand is the sum of all countries' demands, where is the total output of industry i in country i, is the sum of all goods for final use in country j, and mij is the total value of goods used as intermediate goods for industry i in country j. If this good is used domestically, $i=j$, and if it is used abroad, $i \neq j$. We use the world input-output structure to formulate the matrix under the condition that SN (country/industry) goods are liquidated. First, if y is the production dimension vector $(SN \times 1)$, it is the sum of all outputs of the corresponding industry in each country. f is a one-dimensional vector $(SN \times 1)$, which is the sum of all final demand for production by country and industry in each country. Global final demand is the sum of demand in each country.

We can refer to Global Intermediate Input Coefficient Matrix A as having $(SN \times SN)$ dimensions. The production factor formula represents a part of the goods produced in country i, industry s, in order to be input as intermediate goods to industry t, country j. Matrix Equation A shows the combination of various intermediate goods for each country and industry, and is as follows.

$$A \equiv \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1N} \\ A_{21} & A_{22} & \cdots & A_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ A_{N1} & A_{N2} & \cdots & A_{NN} \end{bmatrix}$$

The $S \times S$ matrix summarizes production factors. The diagonal matrix refers to domestic intermediate input factors, and the outside of the diagonal matrix refers to foreign intermediate input factors. Matrix A summarizes all intermediate goods by country-industry. We can use Matrix A to organize the country-industry market as follows under the condition that it is cleared.

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix} \equiv \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1N} \\ A_{21} & A_{22} & \cdots & A_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ A_{N1} & A_{N2} & \cdots & A_{NN} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_N \end{bmatrix} + \begin{bmatrix} \Sigma_j f_{1j} \\ \Sigma_j f_{2j} \\ \vdots \\ \Sigma_j f_{Nj} \end{bmatrix}$$

yi shows the total output of industry *S* in country *i*. is the supply from country *j* for production in country *i*. The simple expression of the above expression becomes Equation (2) as follows.

$$Y = AY^{-1}f \tag{2}$$

The above equation is called the input-output equation. If the inverse matrix is obtained from the input calculation formula, Equation (3) is obtained. This inverse matrix is used to find the production inducement, which is also called the Leontief production function.

$$Y = (I-A)^{-1}f \tag{3}$$

I is a ($SN \times SN$) identity matrix. $(I-A)^{-1}$ refers to the Leontief inverse matrix. In the factor market, the horizontal *m* and vertical *n* indicate that one factor of production is input at every stage of each output. The Input Matrix A of intermediate goods changes when the movement of intermediate goods from one country to another occurs.

So far, we have explained how to calculate the production inducement coefficient and the value-added inducement coefficient in the international input output table. In this paper, the 2016 data of the International Input-Output Analysis (WIOD) published by the EU was used. As mentioned before, WIOD, published by the European Union, analyzed which industries of each country are affected by trade, contains data on about 40 countries by classifying them into 35 industries. In other words, the international input-output analysis table lists 35 industries horizontally and 35 vertically, and then analyzes the ripple effect of one industry on all industries in other countries.

IV. Empirical Method and Data

The percent changes from 2019 to 2020 in Korea Exports to the USA, Japan, and China are described in Table 3. Korea's exports to the USA, Japan, and China in May of 2020 decreased by 29%, 29.7%, and 2.4%, respectively, compared to the same period in the prior year due to COVID-19. Korea's imports from the USA, Japan, and China decreased by 22%, 1.6%, and 9%, respectively, compared to the same period in the previous year. The exports and imports in Korea in January of 2021 significantly increased with the deployment of the COVID-19 vaccination. Exports and imports to the USA, Japan, and China increased by 46/9%, 8/25% and 22/14%, respectively, compared to the same period in 2019.

Table 4 shows a descriptive statistical analysis of Korea's total exports, total imports, and ordinary income. From 1981 to 2020, the export volume to Korea has increased significantly. Korea ranks second in the world with a trade dependence of 65%. The Korean economy is heavily dependent on exports and imports. In detail, Korea's exports increased about 2.5 times from $212.5 billion USD in 1981 to $542.2 billion USD in 2019. Meanwhile, imports increased 1.8 times from $261.3 to $485.1 billion USD in the same period. It is important for Korea to increase exports without any natural resources. Korea's current account deficits were $20.6 and $8.4 billion USD in 1996 and 1997, respectively. In 1997, Korea went bankrupt and received an IMF bailout due to low exports and high imports. Korea endured a financial crisis with a current account deficit of $13.2 billion USD in 2008 due to Lehman Brothers' bankruptcy. U.S. quantitative erasing overcame Korea's financial crisis, and Korea had a trade surplus with a steady increase in exports after 2008. Korea's total exports and imports in 2019 were $542.2 and $485.1 billion USD, respectively, with a current balance of $76.8 billion USD. Korea's total exports in 2019 fell by 10.3% from $604.8 billion USD in 2018. The current balance in 2019 was $76.8 billion USD, a 30% fall due to a decrease in total exports as compared to the $110.0 billion USD in 2018. The U.S.-China trade war in 2019 largely decreased Korea's exports and current balance. If Korea's total exports increase by $1,000 USD, the current balance increases an average of $126 USD. This indicates that Korea is the biggest victim of the US-China trade war. As export growth leads to a trade surplus, Korea should make efforts to expand

Table 2. Percent Change from 2019 to 2020 in Korean Exports to the USA, Japan, and China

Year/Month	Exports by Country			Imports by Country		
(1000$)	U.S.A	Japan	China	U.S.A	Japan	China
2020/01	-7.55%		-11.02%	5.47%	-21.90%	-8.81%
2020/02	8.99%	-1.35%	-7.42%	24.35%	-0.92%	-15.65%
2020/03	15.23%	9.88%	-6.98%	6.96%	1.74%	1.71%
2020/04	-14.31%	-12.85%	-18.33%	-9.74%	-13.91%	-1.71%
2020/05	-29.40%	-29.70%	-2.46%	-22.14%	-16.44%	-9.55%
2020/06	-8.22%	-17.99%	9.79%	-1.61%	-7.92%	3.07%
2020/07	7.95%	-21.48%	2.46%	-17.43%	-8.11%	-2.24%
2020/08	-0.55%	-21.44%	-3.10%	-10.85%	-8.96%	-0.67%
2020/09	22.98%	-6.67%	7.26%	-2.26%	1.30%	11.80%
2020/10	3.22%	-18.85%	-5.84%	-12.12%	4.62%	4.39%
2020/11	6.80%	-11.96%	1.17%	-20.59%	15.07%	14.72%
2020/12	11.62%	1.33%	3.27%	-16.36%	20.04%	20.58%
2021/01	46.53%	-8.32%	22.24%	-9.99%	24.65%	14.04%
2021/02	7.82%	-3.27%	26.92%	5.73%	8.87%	62.32%
2021/03	9.23%	-2.58%	26.03%	15.72%	10.75%	21.48%

Source: Bank of Korea (2022).

exports. Korea's total exports to China were $136.2 billion USD in 2019, which was a reduction of 15.9% from $162.1 billion USD in 2018. Meanwhile, Korea's exports to the U.S. increased by 0.8% from $72.7 billion USD in 2018 to $73.3 billion USD in 2019. The difference in exports to the U.S and China may be due to the US-China trade war. GDPs in 2020 were $22 trillion USD in the U.S, $16 trillion USD in China, $5 trillion USD in Japan, and $2 trillion USD in Korea. As of

2018, total exports in Japan and Korea were $743.1 and $628.4 billion USD, respectively. Korea's dependence on exports of 65% is higher than Japan at 25%. Therefore, Korea will surpass Japan's total exports within a few years. As of 2019, Korea's total exports per capita were already twice those of Japan. Since the Korea-Chile FTA in 2004, Korea signed FTAs with several countries, including the USA, EU, Australia, and Canada, and has become the country with the most FTAs.

Table 3. Descriptive Statistics for Korea's Total Exports, Total Imports, and Total Balance

(Unit: $ Thousands)

Total Exports		Total Imports		Trade Balance	
Mean	252224871.6	Mean	230744402.1	Mean	21480469.43
Standard Error	32,968,611	Standard Error	29,008,841	Standard Error	5,168,239
Median	156,454,836	Median	151,232,627	Median	11,065,434
Standard Deviation	208,511,803	Standard Deviation	183,468,017	tandard Deviation	32,686,814
Kurtosis	-1.379991065	Kurtosis	-1.424020543	Kurtosis	0.863021797
Skewness	0.515492529	Skewness	0.475042714	Skewness	1.235174205
Range	605,012,743	Range	501,263,666	Range	130,710,763

Correlation analysis was performed on Korea's total exports, total imports, and ordinary income from 1980 to 2020 (Table 5). The correlation between total exports and total imports is 0.9942, which is very high. It can be seen that the increase in Korea's exports directly led to the increase in imports. The correlation between total exports and ordinary income is high at 0.7985. As exports increase, Korea's ordinary income increases.

Table 4. Analysis of the Correlation between Korea's Exports and Imports from 1980 to 2020

	Total Exports	Total Imports	Trade Balance
Total Exports	1		
Total Revenue	0.9942	1	
Trade Balance	0.7985	0.729385747	1

Fig. 2. Regression Analysis of Korean Exports and Trade Balance
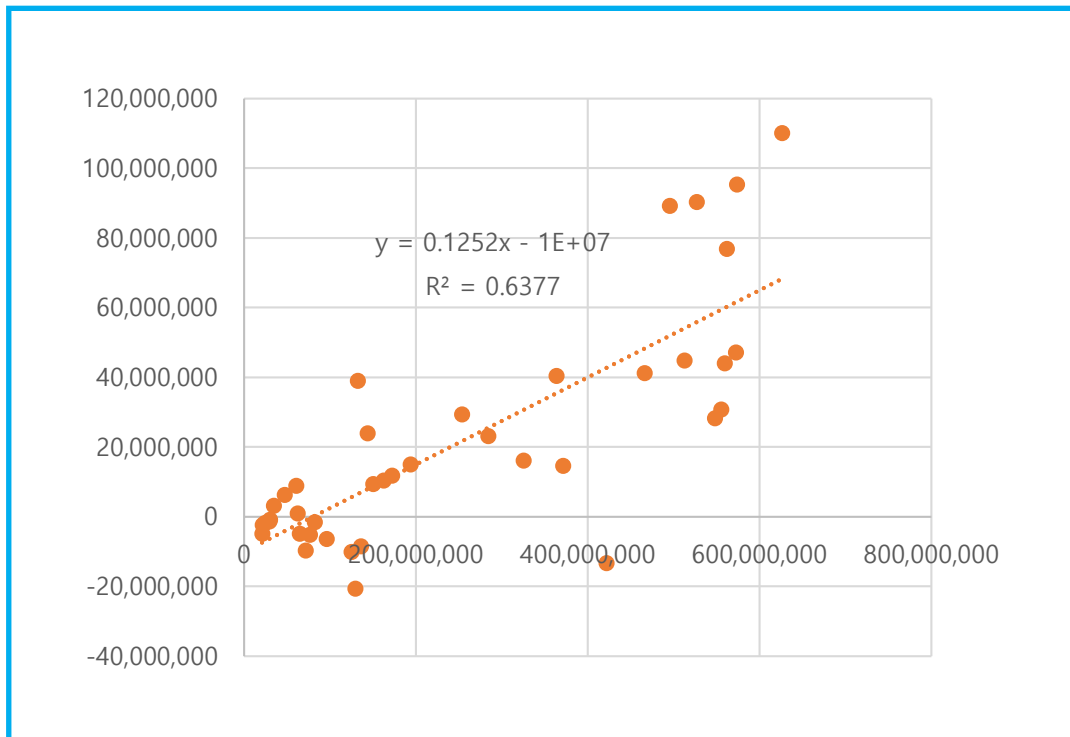
Note: The X axis is exports to Korea. The Y-axis is Korea's trade balance. As Korea's total exports increase, the trade balance also increases. If Korea's total exports increase by $1,000, Korea's trade balance increases by $125. Korea ranks second in the world with a trade dependence of 75%. This shows that Korea needs to join the CPTTP.
Source: Authors' calculation using Bank of Korea (2022).

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Regression analysis was performed on the relationship between Korean exports and the trade balance (Fig. 2). The slope is 0.125. As exports increase, ordinary income also increases. The coefficient of the determination is 0.6377. In other words, this regression graph can explain 63% of Korea's exports and trade balance. Since Korea is highly dependent on trade, an export-oriented economic policy is desirable. Korea's accession to the CPTTP will increase Korea's exports. Trade dependence is calculated by (exports + imports)/ GDP. Korea is a country that lives on trade. Germany ranks first in the world at 80%. In 2022,

Korea's trade deficit rose to $47.5 billion when energy prices increased by 100%. Korea already has FTAs with 11 countries that have joined the CPTPP. If Korea joins the TPP, Korea's trade will further increase by more than 5% due to the elimination of tariff and non-tariff barriers. The trade expansion between Korea and Japan has the greatest impact. South Korea has become a developed country from an emerging country, but is very vulnerable to a global financial crisis due to its high dependence on trade. The following is the Foreign Trade Dependency Degree, an indicator of trade dependence.

$$Foreign\ Trade\ Dependence\ Degree = \frac{export + import}{GDP}$$

South Korea ranks second in the world at 75%.

An analysis of the CPTPP was performed centered on Korea-Japan trade, as it was similar to the nature of the Korea-Japan FTA (Table 6). As of 2019, exports to Japan amounted to $28.4 billion USD, and imports were $47.5 billion USD, with a trade deficit of $19.1 billion USD.

However, it has been fortunate that Korea's trade deficit with Japan has decreased little by little every year since the trade deficit of $36.1 billion USD in 2010. Korea produces intermediate goods with materials, parts, and equipment imported from Japan. Semiconductor parts and materials are representative of this. Using parts imported

Table 5. Korean Exports to and Imports from Japan

Item	Export Amount ($ 1,000)	Import Amount ($1,000)	Trade Balance ($ 1,000)
2011	39,679,706	68,320,171	-28,640,465
2012	38,796,057	64,363,080	-25,567,023
2013	34,662,290	60,029,355	-25,367,065
2014	32,183,788	53,768,313	-21,584,525
2015	25,576,507	45,853,834	-20,277,327
2016	24,355,036	47,466,592	-23,111,556
2017	26,816,141	55,124,725	-28,308,584
2018	30,528,580	54,603,749	-24,075,169
2019	28,420,213	47,580,853	-19,160,640
2020	25,092,517	46,024,958	-20,932,441
2021	30,061,806	54,6421165	-24,580,359
2022	30,630,511	54,707,489	-24,076,978

Source: Bank of Korea (2022).

from Japan, Korea manufactures intermediate goods such as semiconductors and machinery equipment, and exports them to countries such as China. For this reason, increasing imports from Japan is a bad thing. However, it is necessary to reduce the dependence on imports from Japan and diversify Korea's dependence on imports. In 2019, Korea had again saw issues arising from Japan's colonization of Korea. It was not possible for Korea to import semiconductor materials, such as etching gas, from Japan with a 95% dependence on imports. A similar pattern was found in 2020;

both exports and imports dropped, showing a trade deficit of $20.9 billion USD. The export volume of Korea's small and medium-sized businesses was $102.6 billion USD in 2012. The regional portions of Korea's export volume were 63.2, 10.9, 12.4, and 8.5 billion USD in Asia, North America, Europe, and the Middle-East, respectively. The exports of small and medium-sized businesses to Japan amounted to $11.4 billion USD in 2012, which decreased by 0.5% compared to the export volume in 2011. If Korea participates in the TPP, Korean-Japanese trade will exceed the current level.

V. Empirical Results

Table 6. CPTPP Member States

Economy	Population (10,000s)	GDP ($100 million)	GDP per capita (USD)
Japan	12,790	58,970	46,108
Canada	3,444	17,811	51,716
Australia	2,248	14,905	66,289
New Zealand	441	1618	36,688
Chile	1,725	2509	14,552
Mexico	11,373	15,830	10,184
Peru	3,001	1785	5,948
Brunei	39	164	41,662
Malaysia	2896	2879	9941
Singapore	531	2656	50000
Vietnam	8932	1227	1374

Note: Population, GDP, and GDP per capita.
Source: IMF (2022) and Bank of Korea (2022).

Table 7 details CPTPP member countries, populations, and GDPs. After the U.S. withdrew, it was signed by Japan. In 2022, Britain, China, and Taiwan also applied for membership. Korea's accession to the CPTPP will expand trade and contribute greatly to Korea's economic growth. In particular, Korea has not signed FTAs with Mexico or Japan out existing memebers. Joining with allow

trade with the two to increase significantly. The authors analyzed that joining the CPTPP would increase Korea's GDP by 1.7% in the long run. The International Economic Research Institute analyzed that the Korean economic growth rate would rise by 0.35%. Korea has already signed FTAs with nine CPTPP countries. When Korea joins the CPTPP, trade with countries that have already concluded FTAs, such as non-tariff barriers and intellectual property rights, expands, further increasing Korea's trade volume. This also has the effect of concluding an FTA with Japan and Mexico, and increases Korea's GDP in the long run.

Table 8 shows statistics on exports, imports, and the current balance of South Korea with Japan for 30 years from 1990 to 2019. Korea's exports to and imports from Japan averaged $22.1 and $41.2 billion USD, respectively, with a current account deficit of $9.0 billion USD, which has continued for decades. As the size of the economy continues to increase, imports and exports also increase.

Table 7. Descriptive Statistics for Korea's Exports to and Imports from Japan

Exports ($ 1,000)		Imports ($ 1,000)		Trade Balance ($ 1,000)	
Mean	22,153,723.13	Mean	41,222,094.93	Mean	-9,068,371.8
Standard Error	1498922.158	Standard Error	2923937.529	Standard Error	1584491.426
Median	21736088	Median	45999148.5	Median	-19718983.5
Standard Deviation	8209934.777	Standard Deviation	16015065.42	Standard Deviation	8678616.962
Sample Variance	6.7403E+13	Sample Variance	2.56482E+14	Sample Variance	7.53184E+13
kurtosis	-0.679526556	kurtosis	-1.385600334	kurtosis	-1.07343826
Skewness	0.472795331	Skewness	-0.002240623	Skewness	-0.0102586
Range	28115288	Range	51479762	Range	31517014
Minimum	11564418	Minimum	16840409	Minimum	-36119836
Maximum	39679706	Maximum	68320171	Maximum	-4602822
Sum	664611694	Sum	1236662848	Sum	-572051154
Count	30	Count	30	Count	30
Confidence Level (95.0%)	3065640.028	Confidence Level (95.0%)	5980123.707	Confidence Level (95.0%)	3240648.832

According to correlation analysis (Table 9), if Korean exports to Japan increase by 1, imports also increase by 0.98. The current account is reduced by -0.92. In other words, this shows that as Korea's exports to Japan increase, imports increase, and the current account deficit continues to increase. Korea imports machinery, parts, and materials from Japan. They are processed and exported to China. It is necessary to foster Korea's materials and machinery parts industry.

Table 8. Correlation between Korea's Exports to and Imports from Japan

	Exports	Imports	Trade Balance
Export	1		
Imports	0.98244019	1	
Trade Balance	-0.9246388	-0.9794596	1

The regression analysis of Korean exports to and imports from Japan is shown in Fig. 3. The x-axis is exports, and the Y-axis is imports. As exports increase, imports increase at a slope of 1.85. As trade between Korea and Japan increases, both exports and imports increase simultaneously. If exports increase by one unit ($1,000), imports increase by $1,843. When exports from Korea to Japan increase, imports of machinery and parts increase 1.8 times. Korea purchases production equipment and semiconductor materials from Japan, and Korea has been running a trade deficit with Japan for more than 20 years. If trade with Japan expands through the CPTPP, Korea's average tariff of 12% on goods imported from Japan will disappear. In the early stage of the TPP, Korea's trade deficit will increase due to zero tariffs, but competitiveness will improve due to lower import prices. In conclusion, it will help the Korean economy. Japan already has many duty-free tariffs on Korean goods. Korea will also be rid of tariffs on Japanese imports. In the long run, the unit cost of production for Korean companies will be lowered, which will give Korea a more competitive edge.

Fig. 3. Regression Analysis of Korea Exports to and Imports from Japan
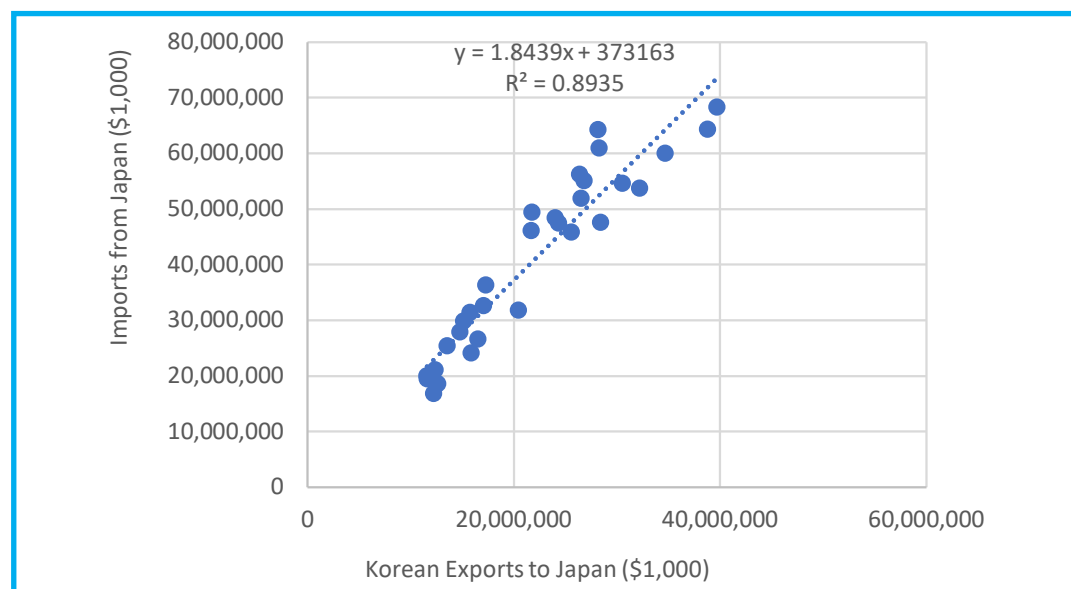
Note: The x-axis is Korea's exports to Japan. The y-axis is imports from Japan to Korea. For every 1 unit increase in Korea's exports to Japan, imports from Japan increase by 1.8 units. If Korean exports to Japan increase by $1,000, imports from Japan increase by $1,843.
Source: Authors' calculation using Bank of Korea (2022).

The Institute for International Economic Policy predicted that Korea's economic growth rate would be around 0.35% if Korea joined the CPTTP.

The institute claims that the U.K., China, Taiwan, and Ecuador applied in 2022, and that Korea should also join. It argued that Korean agricultural products would be hit the hardest. The authors projected an increase of 1.7%. Trade with Japan is increasing, and although there are already FTAs with TPP member countries, trade is increasing as non-tariff barriers and other factors are removed. Table 9 shows GDP due to the natural economic growth rate in 2022, the amount of GDP that has increased every year, the amount of GDP increase in the case of an economic growth rate of 1.7%, and the trend of GDP increase in the case of a 2.6% growth rate. GDP includes consumption, investment, and net exports. When joining the CPTTP, Korea's GDP increases more significantly due to the increase in trade. If Korea joins the CPTPP, the economic effect is expected to increase by about 1.7% per annum on the current basis, resulting in a GDP of more than $ 40.3 billion in 2025. It is estimated to reach $3.2778 trillion by 2030.

As of 2022, the average tariff rate of Korea is 12.1%, while that of Japanese products is almost 0%. Currently, there are no tariffs on 3,640 items in Japan. There are about 3,150 of these products, and 490 agricultural and marine products. Japan's high-tariff agricultural and marine products are not significantly related to Korea, such as rice (778%), dairy products (360%), and sugar (328%). As mentioned earlier, Korea has almost the same characteristics as the Korea-Japan FTA if it joins the CPTPP, so it does not affect exports from Korea to Japan. The reason for this is that Japan does not have tariffs on industrial products. Japan's average tariff rate is 5.3%, but most are agricultural products. However, it is expected that the tariffs on machinery parts, automobile parts, and precision equipment, which imposes tariffs on imported goods from Japan, will increase significantly.

Table 9. Forecasts of Total Domestic Production after Joining the CPTPP

(Unit: Nominal, $100 Million)

Year	Gross Domestic Product (Not CPTPP)	Gross Domestic Product (Amount increased)	After Joining CPTPP (Assuming 1.7%)
2022	20939.3146	1,253.96	21274.08378
2023	22273.14894	1,333.83	22629.24292
2024	23691.94852	1,418.80	24070.72569
2025	25201.12565	1,509.18	25604.03092
2026	26806.43735	1,605.31	27235.00769
2027	28514.00741	1,707.57	28969.87768
2028	30330.34968	1,816.34	30815.25889
2030	32262.39295	1,932.04	32778.19088
2031	34317.50739	2,055.11	34866.16164
2032	36503.53261	2,186.03	37087.13614
2033	38828.80763	2,325.28	39449.58671

Source: Authors' calculation using Bank of Korea (2022).

Table 10. Korea-Japan World Input-Output Database

Intercountry Input-Output			A01	A02	A03	
43 Countries (current prices)			Crop and Animal Production, Hunting and Related Service Activities	Forestry and Logging	Fishing and Aquaculture	
(industry-by-industry)			JPN	JPN	JPN	TOTAL
(millions of US$)			c1	c2	c3	
	TOTAL					30,635
Manufacture of Basic Metals	KOR	R15	0	0	0	6,187
Manufacture of Coke and Refined Petroleum Products	KOR	R10	81	10	70	5,519
Manufacture of Chemicals and Chemical Products	KOR	R11	86	1	3	3,461
Manufacture of Computer, Electronic, and Optical Products	KOR	R17	1	0	1	3,088
Manufacture of Fabricated Metal Products, except Machinery and Equipment	KOR	R16	1	0	1	2,134
Other Professional, Scientific, and Technical Activities; Veterinary Activities	KOR	R49	0	0	1	2,086
Manufacture of Electrical Equipment	KOR	R18	0	0	1	1,587
Manufacture of Machinery and Equipment	KOR	R19	0	0	0	738
Manufacture of Rubber and Plastic Products	KOR	R13	5	1	1	697
Manufacture of Textiles, Apparel, and Leather Products	KOR	R6	5	1	6	687
Manufacture of Motor Vehicles, Trailers, and Semi-Trailers	KOR	R20	0	0	0	650
Manufacture of Other Transport Equipment	KOR	R21	0	0	4	552
Retail Trade, except of Motor Vehicles and Motorcycles	KOR	R30	2	0	1	486
Wholesale Trade, except of Motor Vehicles and Motorcycles	KOR	R29	2	0	1	381

Source: University of Groningen (n.d.).

In 2022, South Korea's total exports to Japan were $30.6 billion, imports were $54.7 billion, and there was a deficit of $24 billion. There was a deficit of $24.5 billion in 2021. South Korea has a total trade deficit of $47.4 billion due to a 100% increase in energy prices in 2022. The trade deficit with Japan accounts for 51% of the total deficit. However, semiconductor machinery and equipment from Japan are used to manufacture export goods in Korea. Semiconductor etching gas and equipment intermediates imported from Japan are used for semiconductor exports in Korea. As a result of trade between Korea and Japan, it can be seen that machines imported from Japan were used for export in Korea's semiconductors, petrochemicals, machinery, and automobiles. The world input-output table explains which industries in Korea have a ripple effect from an item imported from Japan. Korea-Japan industry-related analysis results obtained by Korea-Japan trade are presented in Table 10. As of 2014, Japan and Korea have had a ripple effect of US $30.6 billion in imports and exports between them in the analysis of inputs between countries. Given that these statistics are in 2016, the impact will be greater after the CPTPP is concluded. In 2019, Korea exported to Japan a total with $28.4 billion USD, with total imports of $47.5 billion USD. The trade between the two countries has resulted in a total ripple effect of $306 billion. Petri and Plummer (2012) analyzed the effect of the TPP on the USA and Asian Pacific countries. The analysis of world input and output shows the analysis of the ripple effect of 56 items between the two countries. The trade wholesale sector in Korea has shown a ripple effect totaling $3 billion in Japan. The industry-related analysis is the same, with the sum of the length and the length being $30.6 billion because they affect each other. The ripple effects of the two countries at the time of CPTPP entry will be far greater than in 2020. With current trends, Japanese products imported into Korea will increase significantly. The international input calculation result table announced in 2016 has noted several items of interest. As of 2014, the biggest impact of export-import trade between Korea and Japan

was the impact of the metal industry's $6.1 billion, followed by manufacture of coke and refined petroleum products at $5.5 billion, chemicals and chemical products at $3.4 billion, and electricity and optics at $3.0 billion. Chemistry came in fifth with a $ 2.1 billion spillover effect. If Korea's CPTPP admission is officially approved, these industries will see the biggest ripple effect as the expansion of Korea-Japan exchanges widens.

VI. Conclusions

The U.K., China and Taiwan applied to the CPTPP in 2022. Korea is considering membership in the CPTPP. CPTPP members, except for Japan, Mexico, and Korea have already joined the FTA. Korea's accession to the CPTPP will increase Korea's GDP by 1.7%. This study used WIOD and analyzed the impact of each industry on Korea. Korea must overcome its economic crisis by expanding trade by joining the RCEP and CPTPP. As Korea has few resources available, trade expansion is the only way to survive. The President of Korea proclaimed participation in the CPTTP on December 8th, 2020. As of May of 2020, Korea's exports decreased by 24% from the same period in the year prior due to COVID-19. Compared to the same period in 2018 without the US-China trade war, it fell by 31%. Korea should foster the fourth industrial revolution, including an online industry, Korea-Quarantine, and Intellectual Technology (IT) intensively, responding to the COVID-19 crisis. Korea should become a stronger country than Japan through export growth and pro-business policies. If the government implements a trade expansion policy, Korea's economy will make further progress. According to an inter-industry analysis, Korea and Japan earned more than $30.6 billion USD in mutual benefit in 2014. Korean-Japanese trade will bring more than 40 billion US dollars in 2020. This study indicates how much Korea will benefit, and which industries will obtain an advantage by joining the CPTTP. Korea's GDP in 2025 is expected to be more than $40.3 billion. It is expected to bring in $76.7 billion

in 2033. The most vulnerable sectors in Korea after joining CPTPP were analyzed to be machinery, electrical and electronics, chemical industry, steel, construction, and transportation equipment. The conclusion is that Korea should be able to export more of the competitiveness of electronics, automobile, chemical, and metal when Korean companies participate in the CPTPP. At the same time, we must consider the position of vulnerable industries in competition with Japan. Korea's exports should be increased, imports should be deferred slightly, or other means should be taken to protect and nurture companies. The government should actively participate in CPTPP negotiations in this practical way. Korea has also entered the CPTPP market with CPTPP membership, so it should be confirmed as soon as possible. After that, it must proceed with practical negotiations for national interests. The CPTPP is a high-intensity regional block convention that eliminates all future tariffs. As seen in the international input and output analysis, Korea and Japan have a ripple effect of US $30.6 billion in imports and exports with each other. In the near future, the total ripple effect is expected to exceed $52 billion due to trade between Korea and Japan. As a result of this study, it was found that the expansion of trade and the CPTPP subsidy create significant economic growth and a ripple effect for both Korea and member countries, including Japan. For this reason, the expansion of government trade, including the CPTPP, is desirable.

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The Effect of Periodic Auditor Designation on Audit Quality:
Focusing on the Amount of Conservatism

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ABSTRACT

Purpose – This purpose of this study is to verify how the periodic auditor designation system, which was implemented in Korea in 2019, affects audit quality using the amount of conservatism.
Design/Methodology/Approach – To establish hypotheses, previous studies were reviewed, and 1,031 samples were selected from KOSPI-listed companies in Korea for 2019 and 2020. The dependent variable was the amount of conservatism; the impact of periodic auditors, Big 4 auditors, debt ratios, total assets, ROA, loss, and audit complexity were empirically analyzed.
Findings – The study found significant differences in audit quality among other variables, and confirmed a statistically significant difference in audit quality based on periodic auditor designation between the Big 4 and Non-Big 4 accounting firms. The study concluded that periodic auditor designation is effective in suppressing opportunistic behavior and enhancing the reliability of financial reporting, ultimately strengthening conservatism.
Research Implications – This study is meaningful in that it targets empirical data from 2019 and 2020 using the amount of conservatism on the effect of periodic auditor designation on audit quality. Since this system was first implemented in Korea in 2019, there are not many related data, so there are limitations in the analysis of related studies.

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I. Introduction

Since 2019, Korea has introduced and implemented a periodic auditor designation system. The periodic auditor designation system is a system in which a company appoints an external auditor to the same accounting firm for 6 years, and then for the next 3 years the auditor is designated by the Securities and Futures Commission. A periodic audit designation system was introduced for listed corporations and large unlisted companies without ownership or separation of management. In the meantime, there have been concerns that if a company voluntarily appoints an accounting firm for a long period, it could lead to insolvent audits, and a stalemate could form between the company and the auditor.

Therefore, the purpose of this study is to verify how the newly implemented periodic auditor designation system in Korea affects audit quality and conservatism. The reliability of financial statements can be improved if an independent third-party auditor audits the financial statements to remove the information risk that exists (Wang & Ki, 2011). In this process, the reliability of financial statements is closely related to audit quality. Even if the financial statements are externally audited, if the audit quality is not high, there is a possibility that irregularities or distortions included in the financial statements may not be removed. Even after the introduction of an external audit system, questions about the reliability and audit quality of financial statements sometimes arise. In recent cases of accounting fraud, including the Daewoo Shipbuilding & Marine Engineering scandal[1], serious problems have arisen in the reliability and audit quality of financial statements, even if they have been audited externally (Bae et al., 2022; Choi & Choi, 2008; DeAngelo, 1981; Farmer et al., 1987; Lee et al., 2010).

The distortion of financial statements causes serious problems in capital markets. Accordingly, financial authorities are introducing and implementing various systems to improve the audit quality of accounting information in the capital market (Wu & Jin, 2022). Among these, auditor independence is a very important factor in improving audit quality, so the auditor designation system, which has the advantage of increasing auditor independence, is being implemented. The auditor designation system is a system in which the Korean Securities and Futures Commission designates auditors for companies that require fair auditing, rather than having companies appoint them. The auditor designation system was introduced in 1989 and was revised several times to protect stakeholders by improving the quality of external audits and maintaining the independence of auditors. However the auditor designation system has since been expanded and applied in accordance with the External Audit Act revised in 2014[2].

Companies that fall within the reasoning for the designation of auditors will be designated as auditors by the Securities and Futures Commission. In a situation in which auditors appointed by free appointment provide audit services and receive audit fees from audited companies, it is difficult to objectively and fairly present audit opinions by maintaining independence in relation to audited companies. On the other hand, a designated auditor can fairly and objectively audit a company's financial statements while maintaining independence from audit risk.

This study verifies the effect of periodic auditor designation on audit quality. To examine the effect of periodic auditor designation on audit quality, companies designated as regular auditors were selected among listed companies in 2019 and 2020, and empirical analysis was conducted using the amount of conservatism to

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1. Deloitte Anjin LLC, which audited Daewoo Shipbuilding & Marine Engineering's financial statements from 2010 to 2015, presented an appropriate opinion even though Daewoo Shipbuilding & Marine Engineering had fraudulent accounting of 5.5 trillion won over 5 years.
2. Reasons for designation of auditors (Article 11 of the New External Audit Act, Article 14 of the Enforcement Decree of the same Act)

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alleviate the problem of the measurement error of discretionary accruals widely used in analysis. In addition, a study by Kim (2012) demonstrated that "audit quality works effectively to suppress managers' opportunistic behaviors and contributes to enhancing the reliability of financial reporting, thereby strengthening conservatism." Therefore, this study attempts to confirm whether the newly introduced periodic auditor also shows a difference in the amount of conservatism.

For analysis, the companies in Korea's KOSPI market were selected as periodic audit companies that have been using the same audit accounting firm for six years and had changed in 2019, and samples that have undergone the selection process in 2020 in the same way were used.

In this study, companies that were externally audited by the same external auditor from 2013 to 2018, with the external auditor changing in 2019, and companies that were externally audited by the same external auditor from 2014 to 2019, with the auditor changing in 2020, were periodically reviewed. This is the first study using empirical data processed as periodic audit companies, thus making it different from previous studies.

II. Literature Review

1. Periodic Auditor Designation

Korea introduced and implemented the periodic auditor designation system in 2019. The periodic auditor designation system is a system in which an auditor is designated by the Securities and Futures Commission under the Financial Services Commission for the next three years if a company voluntarily appoints an external auditor for six years. The periodic auditor designation system revised the New External Audit Act to secure the independence of auditors and improve audit quality, thereby introducing a periodic designation system for listed corporations and large unlisted companies that are not separated in ownership and management. In the meantime, there have been concerns that if a company appoints an accounting

firm autonomously for a long time, it could lead to a poor audit and create a deadlock between the company and the auditor. The periodic auditor designation system was implemented to solve these problems and improve the transparency and quality of audits. Due to the periodic auditor designation system, there is a high possibility that the independence of auditors will be secured, and it is expected to increase accounting transparency.

Lee and Chung (2019) examined whether audit quality decreased based on the continuous audit period of 6 years in relation to the periodic designated audit system that limits the continuous audit period to 6 years to enhance the independence of auditors. As a result of empirical analysis, it was reported that there was an inverse U-shaped nonlinear relationship between the continuous audit period and audit quality, and in the period when the impact of the continuous audit period on audit quality changed after 6 years, or the second audit contract period. Meanwhile, the Financial Supervisory Service reports the current status of companies subject to external audit and the results of auditor designation to the Securities and Futures Commission every year, and announces the content.

As of the end of 2018, the number of companies subject to external audit was 31,473, up 2,210 (7.6%) from the previous year (29,263), and the growth rate has been higher than 7% in the preceding five years, except in 2015, when the judgment criteria (total assets) of external audit companies were raised. The Financial Supervisory Service announced the designation ratio of external auditors in 2017 and 2018. The number of companies designated by the Securities and Futures Commission as auditors continues to increase due to the addition of reasons for designation following the revision of the External Audit Act. As for the status of auditor designation in 2018, 699 companies were designated as auditors in 2018, an increase of 153 companies (28.0%) from the previous year (546 companies), and 217 companies were scheduled to be listed, 146 companies of those as a result of supervision. Of the total external audit target companies, the

ratio of designated companies is 2.2%, and the ratio of designated corporations is 12.7%.

2. Previous Studies

2.1. Previous Study on the Audit Quality

DeAngelo (1981) defined audit quality as the combined probability of an auditor discovering fraud and errors in the audited entity's financial statements and the probability of reporting those errors. Since audit quality cannot be directly observed, previous studies use a proxy value for audit quality.

The periodic designated audit system is based on the relationship between the continuous audit period and audit quality, and an entity is forced to undergo a designated audit for three years after six years of free acceptance, limiting the continuous audit period by the same auditor to six years. This is due to concerns that the longer an audit period continues, the more damaging it is to the independence of the auditor. Research on the audit period and quality is divided into positive views claiming the auditor's learning effect, and negative views claiming that the longer the audit period, the more damaging to auditor independence. At the beginning of an audit, the ability to detect irregularities and errors may be low due to the lack of corporate-specific information, but the opinion is that the quality of the audit increases due to the learning effect as the audit period continues. Lim (2006) presented results showing that the longer the duration of an audit, the less discretionary the accruals were, and Lee et al. (2010) reported that the (-) relationship between the duration of an audit and discretionary accruals was stronger in non-Big 4 auditors than in Big 4 auditors. These studies suggest that the longer the audit period, the more effective the learning effect is on audit quality.

On a negative note, DeAngelo (1981) argued that, for auditors, continuing audit companies provide permanent pensions, thereby increasing an auditor's economic dependence, and undermining independence. In addition, Famer et al. (1987) argued that the longer an audit period, the more the bond between the auditor and the audited company can form, which can undermine the independence of the auditor; additionally, expert doubts decrease as the auditor becomes lazy (Choi & Choi, 2008). This means that the longer the continuous audit period of a full-time auditor, the higher the audit risk, and efforts to improve audit quality are made.

In Korea, empirical results showing that the quality of accounting information improves simply by being part of the Big 4 were inconsistent. This is a measurement error caused by the measurement of discretionary accruals used as the quality of accounting information, which was also pointed out in a previous study by Goh et al. (2009).

Previous studies have presented conflicting research results between audit period and audit independence. The longer a continuous audit period, the more an auditor's ability improves due to the learning effect, but there is a possibility that auditor independence may be damaged due to ties to the companies being audited.

2.2. Previous Study on the Conservatism

Empirical research on conservatism began with Basu (1997). Basu (1997) explored the phenomenon of conservatism in U.S. companies from 1963 to 1990, using the relationship between profit and stock return, relationship between cash flow and stock price return, persistence of unexpected profits, and the profit response coefficient (ERCs) of unfavorable and favorable factors. The research results verified the hypothesis that conservative accounting treatment exists by comparing the size of the regression coefficient for favorable and unfavorable factors and R^2 when the research model equation was applied to each sample after dividing the entire sample into unfavorable and favorable factors.

Paek and Lee (2004) verified the impact of conservatism on profit sustainability and the evaluation of stock market participants in 468 companies (3,579 companies-years) from 1990 and 2001. According to the results, profits from conservative accounting were less sustainable, and the stock price multiple for profits from

conservative accounting was smaller.

As conservative measures, the Q score correction value of Penman and Zhang (2002), the ratio of non-operating accruals of Givoly and Hayn (2000) divided by operating cash flow, Basu's (1997) net profit-to-stock return measure, Feltham and Ohlson (1995), and Zhang (2000) were used.

Krishnan (2005), following the Enron case, found that former Andersen clients that replaced auditors with other Big 4 auditors increased levels of conservatism in 2002 as compared to 2001. Chung and Kallapur (2003) presented results that firms audited by Big 6 auditors showed stronger conservatism than firms that did not using the profit-stock return model of Basu (1997). Francis and Wang (2008) found that a positive correlation existed between conservatism and Big 4 auditors in countries with a high level of investor protection in an international comparative study.

Paek and Yoo (2005) presented a clear difference in the level of conservatism between the Big 4 and Non-Big 4 in conservatism measured by the gap between the book and market values and non-operating accruals, but did not show a clear difference when using the Basu (1997) model. In addition, Kang (2006) presented empirical results that Big 4 auditors were more conservative because they had a higher risk-aversion tendency to audit risk in conservatism measured by discretionary accruals, but Basu's (1997) research results using profit-stock returns did not provide significant results. Choi and Ahn (2007) empirically analyzed auditor risk-aversion as an important determinant of conservative accounting, and suggested that the higher the auditor's risk-aversion, the stronger the conservatism. Lee et al. (2011) confirmed that the larger the size of the main auditor and the higher the audit ratio of the main auditor, the more conservatively the consolidated financial statements are accounted.

Kim et al. (2011) empirically analyzed the market anomaly of accruals due to audit quality and conservatism. Auditors with high audit quality were more prudent than auditors that did not audit financial statements, so the accounting information calculated at this time is information with conservatism relatively applied. Therefore, audit quality and conservatism in accounting will have a greater impact on accruals among earnings components. Therefore, in order to examine the information effect of audit quality and application of conservatism, the combined information effect of earnings sustainability was examined using accruals, and market efficiency verification for this information was performed. As a result of the analysis, the market was analyzed to have overestimated the information effect of profit sustainability according to the application of audit quality and conservatism. In other words, the result was that the difference in earnings continuity due to audit quality and conservatism was not fully reflected in stock price determination, suggesting that market participants are functionally fixated on the size of profit. Therefore, a market anomaly appeared in which the simple investor hypothesis was established for the combined information effect of the audit quality difference and conservatism accounting treatment.

Kim (2012) empirically analyzed the effect of the quality of internal control and audit quality on conservatism using data from 2005 to 2008 with 4,520 samples. Audit quality was verified on whether it affected the reinforcement of conservatism, and audit quality was demonstrated to work effectively to suppress opportunistic manager behaviors and contribute to enhancing the reliability of financial reporting.

III. Research Model and Samples Selection

1. Establishment of Hypotheses

Korea introduced the periodic auditor designation system in 2019, and is currently implementing it. This is a system in which a company voluntarily appoints an external auditor for six years, and the auditor for following next three years is designated by the Securities and Futures Commission under the Financial Services Commission. Studies on audit period and audit

quality are divided into positive and negative views. One positive view is that the ability to detect irregularities and errors may be low due to a lack of company-specific information in the early stage of the audit, but as the audit period is extended, the audit quality increases due to a learning effect. One negative view is that the audit period continues. As a result, it is argued that auditor independence is undermined by increasing the auditor's economic dependence (Choi & Choi, 2008; Farmer et al., 1987).

Therefore, this study selected companies that appointed a periodic auditor among actual listed companies in 2019 to examine the effect of periodic auditor appointments on audit quality, and used a compensation conservatism measure to alleviate measurement error issues proposed by Goh et al. (2009). Kim (2012) empirically demonstrated that compensation conservatism enhances audit quality by effectively suppressing opportunistic managerial behaviors and contributing to the improvement of financial reporting reliability. Therefore, in this study, a difference in the amount of conservatism depending on whether the newly introduced periodically designated auditor is present is thought to exist, and the following hypothesis was established to confirm this.

H1: There will be a difference in the audit quality of companies subject to periodic auditor designation.

In addition, the following hypothesis was established to further examine the relationship between external auditor Big 4 status, which is a substitute for traditional audit quality.

H2: There will be a difference between the Big 4 and Non-Big 4 in the audit quality of companies subject to periodic auditor designation.

2. Research Model

To test Hypothesis 1, Research Model 1 uses the amount of conservatism as a dependent variable.

In addition, to test Hypothesis 2, Research Model 2 is to be analyzed by classifying Big 4 and Non-Big 4 entities. To calculate the amount of conservatism, we intend to use the model that defined conservatism by comparing the size of stock prices and net assets in a study by Feltham and Ohlson (1995) in measuring conservatism propensity. Equation (1) is an equation for calculating the amount of conservatism. Previous studies in Korea (Kim, 2016; Park, 2020) were also used based on the fact that the stock price level becomes higher than net assets as a result of conservative accounting due to the understatement of net profit and net assets.

$$CA_t = 1-(BV_t / MV_t) \tag{1}$$

BV_t: Net assets at the end of t.
MV_t : Market value at the end of t.

Equation (2) is a research model with the amount of conservatism as the dependent variable to analyze H1. As independent variables of the research model, a regression model is set up and analyzed with the existence of periodic auditors, variables related to audit quality, and control variables related to auditors.

$$CA = \alpha + \beta_1 PA + \beta_2 Big4 + \beta_3 DR + \beta_4 TA + \beta_5 ROA + \beta_6 Loss + \beta_7 COM + \varepsilon \tag{2}$$

Equation (3) is the research model that analyzes Hypothesis 2 by classifying the Big 4 and Non-Big 4, with the amount of conservatism as the dependent variable. A regression model was established with the presence or absence of a periodic auditor as the independent variable, as well as the relevant variables of audit quality and control variables related to auditors, to conduct analysis.

$$CA = \alpha + \beta_1 PA + \beta_2 DR + \beta_3 TA + \beta_4 ROA + \beta_5 Loss + \beta_6 COM + \varepsilon \tag{3}$$

Dependent variables are the quality of accrual and the amount of conservatism.
CA represents conservatism amounts (Feltham

& Ohlson, 1995; Kim, 2016; Park, 2020).

The independent and control variables are listed below.

PA is the periodic auditor designation dummy; 1 if a periodic audit, and otherwise 0.

Big 4 is a dummy variable that is 1 if the designated auditor is in the Big 4, and 0 otherwise.

DR is the Debt Ratio, calculated by total liabilities divided by total assets.

TA is the the natural logarithm of total assets.

ROA is the Return on Assets, which is calculated by dividing net income by total assets.

Loss is a dummy variable that equals 1 if the company had a net loss in the previous year, and is 0 otherwise.

COM represents Audit Complexity, which is calculated by dividing the sum of accounts receivable and inventory by total assets.

The reasons for selecting control variables for audit quality are as follows.

The *Big 4* control variable was used when the auditor was a Big 4 accounting firm, as it would affect audit quality. Although there is a negative (-) relationship between discretionary accruals (*DA*) and *Big 4* (Becker et al., 1998), audit quality increases as audit time increases. However, there was no difference for those non-Big 4, a difference depending on the size of the company to be audited was confirmed (Choi & Hong, 2021; Kwon, 2019). However, studies in Korea show inconsistent results.

The risk of bankruptcy is high when the debt ratio (*DR*) is high, and if a company goes bankrupt, the possibility of a lawsuit against the auditor increases. In other words, a company with a high debt ratio can be regarded as a company with a high audit risk, so audit quality should be improved (Bae et al., 2022; Mun, 2017; Shon et al., 2006).

The following is the value obtained by taking the natural logarithm of total assets as the control variable *TA*. Audit fees are significantly higher for firms with larger assets. As this can also affect audit risk, audit quality should be increased.

Next is *ROA* (return on assets), which is a control variable. The higher the *ROA*, the higher the audit fee. This can also affect audit risk. In addition, it was found that the audit risk increased as audit time increased (Kwon, 2019).

Loss is a control dummy variable of the net loss for the current period. In the case of a net loss in the previous year, audit fees are significantly higher for companies, and audit risks increase. In addition, audit risk was found to increase as the audit time increased (Kwon, 2019).

Finally, control variable *COM* is the audit complexity rate. This is the value obtained by dividing the sum of trade receivables and inventories by total assets. If the ratio of trade receivables and inventories among assets is high, audit input time increases. Trade receivables and inventories are variables that represent audit risk as a means of earnings management (Choi & Paek, 1998). Audit risk was found to increase as audit time increased (Kwon, 2019).

3. Sample Selection

As Korea introduced and implemented the periodic auditor designation system in 2019, this study selects a sample of securities companies listed on the Korea Exchange in 2019 that satisfy the following requirements. Previous research by Lee and Chung (2019) on the subject of periodic audits, or empirical studies using samples before this system was implemented, show differences from this study in the study period.

(a) Corporation with the settlement of accounts made at the end of December

(b) Non-financial business

(c) Companies that can obtain financial data from Kis-Value

(d) Since the government does not publicly disclose companies designated as periodic auditors, in this study, companies using the same auditing and accounting firm for six years from 2013 to 2018 were changed to another auditing and accounting firm in 2019 as periodic auditor designation are eligible. Those that had the same auditing firm for six years from 2014 to 2019 but changed to a different audit firm in 2020 are eligible.

Table 1 shows the selection process of samples used in this study. In order to secure temporal homogeneity, it was limited to corporations with the settlement of accounts at the end of December. Financial data for financial statement analysis were extracted from Kis-Value. In addition, a total of 1,031 samples were selected as periodically designated auditing companies the using same auditing accounting firm for 6 years, and have changed in 2019 and 2020. Of these, 406 companies had not changed auditors, 134 companies were selected as periodic audit companies in 2019, and companies whose auditors had changed within 5 years were excluded from this study as they had been changed for other reasons.

Table 1. Selection Process of Samples

Selection Process	N
KOSPI Targets (2019-2020)	1,588
(-) Financial companies that are not settlement companies at the end of December	(184)
(-) Companies that have changed auditing and accounting firms for other reasons	(373)
Selected Samples	1,031

IV. Analysis Results

1. Descriptive Statistics and Correlation Analysis

Table 2 details the descriptive statistics of the variables used in this study.

This shows the conservatism amount (*CA*) of the dependent variable, the number of samples of independent and control variables, averages, medians, standard deviations, minimum values, and maximum values. Conservatism, the dependent variable, has an average value of -0.288, a median value of -0.121, and a minimum value ranging from -6.398 to a maximum value of 1.203. Since *PA* is a dummy variable depending on whether a periodic auditor was designated, the average value is 0.245, the median value is 0.000, and the minimum value is 0. The maximum value is 1. The *Big 4* variable indicates whether the external auditor belongs to the Big 4 accounting firms, while the *Loss* variable is a dummy variable indicating whether the company is a loss-making enterprise.

Table 2. Descriptive Statistics

	N	Average	Median	S. D.	Min	Max
CA	1,031	-0.288	-0.121	0.886	-6.398	1.203
PA	1,031	0.249	0.000	0.433	0.000	1.000
Big 4	1,031	0.597	1.000	0.491	0.000	1.000
DR	1,031	0.956	0.653	1.742	-21.928	28.177
TA	1,031	27.099	26.804	1.510	24.199	33.068
ROA	1,031	0.013	0.019	0.081	-0.386	0.292
Loss	1,031	0.268	0.000	0.443	0.000	1.000
COM	1,031	0.204	0.195	0.138	0.000	0.717

Note: CA: conservatism amount, PA: periodic auditor, Big 4: Big 4 auditor, DR: debt ratio, TA: total assets, ROA: return on assets, Loss: net loss, COM: audit complexity.

Table 3 shows the analysis results of Pearson's correlation analysis between each variable. As a result of analyzing the correlation between the dependent variable *CA*, the independent variable *PA* and control variables in the correlation between variables *PA*, *DR*, and *TA* were found to have statistically significant values. Variables of *CA*, *Big 4*, *TA*, and *Loss* were found to have statistically significant values in the correlation between the independent variable *PA* and the control variables.

Table 3. Correlation Matrix (Pearson)

	CA	PA	Big 4	DR	TA	ROA	Loss	COM
CA	1							
PA	-0.107**	1						
Big 4	-0.052	0.280***	1					
DR	0.120***	0.034	0.012	1				
TA	-0.103***	-0.086**	-0.471***	0.031	1			
ROA	-0.015	-0.054	-0.080**	-0.243***	0.083**	1		
Loss	0.019	0.072*	0.128***	0.183***	-0.147***	-0.563***	1	
COM	0.044	-0.031	0.040	0.045	-0.229***	-0.020	-0.024	1

Notes: 1. Refer to Table 2 for other variable definitions.
      2. *$p<0.05$, **$p<0.01$, ***$p<0.001$.

2. Results of Regression Analysis

Table 4 uses the amount of conservatism (CA) to perform a regression analysis on the effect of audit quality depending on whether a periodically designated auditor exists. In Study Model 1 (Model 1), the amount of conservatism was used as the dependent variable, and as a result of analysis using the existence of periodic designated auditors and control variables, a statistically significant result was obtained at the $P<0.001$ level. Looking at this in detail, the regression coefficient was -0.096, which was significant at the $P<0.01$ level, with or without a periodic designated auditor, and the regression coefficient was 0.104, which was significant at $P<0.001$, with or without a Big 4 external auditor. These analysis results show that the amount of conservatism of companies designated as periodic auditors is statistically significantly smaller than the amount of conservatism of companies that do not designate periodic auditors at the 1% significance level. In conclusion, Hypothesis 1, "There will be a difference in the audit quality of companies subject to periodic auditor designation." was adopted. In other words, if the amount of conservatism is defined as a substitute for audit quality, this shows that the introduction of periodic auditor designation has a positive effect on improving audit quality.

Looking at the control variables in addition to hypothesis testing, total assets (*TA*) and debt ratio (*DR*) were found to be statistically significant at the $P<0.001$ level. After periodic auditor designation, whether the designated auditor was Big 4 was also found to be statistically significant at the $P<0.005$ level with a regression coefficient of 0.104. These analysis results can be interpreted as having an effect on audit quality, as the risk of audit failure may increase when total

Table 4. Results of Regression Analysis (Model 1)

Variable	Model 1	
	β	t-stat.
Int.		3.901***
PA	-0.096	-3.016**
Big 4	0.104	2.881**
DR	0.134	4.227***
TA	-0.166	-4.617***
ROA	0.018	0.477
Loss	0.001	0.022
COM	0.001	0.035
F	7.487***	
adj. R^2	0.042	
N	1031	

Notes: 1. t: t-statistics.
      2. β: beta coefficient.
      3. *$p<0.05$, **$p<0.01$, ***$p<0.001$.
      4. Refer to Table 2 for other variable definitions.

assets (*TA*) and debt ratio (*DR*) are high, as in previous research. In addition, Big 4, the variable representing cases in which the designated auditor corresponds to the Big 4 and non-Big 4, also means that the amount of conservatism is statistically significant under the 5% significance level. In other words, with the introduction of the periodic auditor designation system, the amount of conservatism was found to be statistically significantly smaller when the designated auditor was non-Big 4, which shows that audit quality is high. For these results, Hypothesis 2 was established, and additional analysis was conducted, so we will analyze these again together with the results of Hypothesis 2.

However, the control variables return on assets (*ROA*), net loss (*Loss*), and audit complexity (*COM*) were found to be statistically insignificant.

Unlike previous research, there may be several reasons for the statistically insignificant results, but *ROA* and net loss (*Loss*) have a statistically significant correlation coefficient of -0.563 at the 1% significance level. It has one value (refer to Table 3. Correlation Matrix) and can be estimated from the results shown.

Summarizing the above-mentioned content, this study used the auditor designation according to the introduction of the periodic auditor designation system, and the amount of conservatism defined as a substitute for audit quality was the dependent variable. In addition, as a result of analyzing several factors that can affect the dependent variable as control variables, it was clearly confirmed that there was a significant difference in the periodic auditor designation (PA) variable under the periodic auditor designation

system. In other words, it was confirmed that the periodic auditor designation has a difference in audit quality. Therefore, this study proves that the periodic auditor designation system works effectively to suppress the opportunistic behavior of managers by raising audit quality, and enhances the reliability of financial reporting.

In the above analysis results (see Table 4), the variable *Big 4,* as to whether the designated auditor is Big 4, after the periodic auditor designation, showed a statistically significant difference at the P<0.05 level. In order to examine these results in more detail, the amount of conservatism (*CA*) was used as the dependent variable in the same way as the previous analysis method, and the samples were analyzed by dividing them according to whether the designated auditor after periodic auditor designation was Big 4. After removing control variable *Big 4* from the regression equation, regression analysis was performed on the effect of audit quality by dividing the samples into Big 4 and non-Big 4 auditors after periodic auditor designation. The results of this analysis are shown in Table 5. Looking at the results, if the designated auditor after the periodic auditor designation is Big 4, the periodic auditor designation (*PA*) is statistically insignificant. However, it was found to be statistically significant at the P<0.001 level when the designated auditor after the periodic auditor designation was non-Big 4. All accounting firms belonging to the Big 4 are large accounting firms, and have a separate quality control office independent from the audit team that directly conducts accounting audits. On the other hand, most accounting firms that do not belong to the Big 4 are small in size and do not have a separate quality control office, and the teams that conduct audits use relatively easy methods such as peer review, which makes a difference in audit quality. However, considering that *1 - (BVt/ MVt)* was used in a study by Feltham and Ohlson (1995) to measure the amount of conservatism, large accounting firms belonging to the Big 4 are well equipped with various systems. For example, if there are various accounting methods that can be selected, such as the fair value evaluation method

of tangible assets, it can be interpreted as a result of using them well. These details can be confirmed in more detail by additionally examining control variables other than the variable of interest. When the designated auditor after the periodic auditor designation system is Big 4, only the control variable Total Assets (*TA*) was found to be statistically significant, and debt ratio (*DR*), return on assets (*ROA*), net loss (*Loss*), audit complexity (*COM*) were found not to be statistically significant. Unlike previous studies, the reason for this result is that, as explained above, there are various accounting methods that companies can choose, such as a fair value evaluation of tangible assets. In this case, it is believed that this occurred because the accounting method was selected in the direction of reducing the difference between the book and market values.

On the other hand, when the designated auditor after the periodic auditor designation system is non-Big 4, the regression model is statistically significant at the P<0.001 level, and not only the periodic auditor designation (*PA*) but also the debt ratio (*DR*) and total assets (*TA*) were found to be statistically significant at the P<0.001 level. As explained above, this result may also be the reason why non-Big 4 are not building various systems like the Big 4. In the case of non-Big 4, it may have occurred because the accounting method was not selected in the direction of reducing the difference between the book and market values in selecting various accounting methods. As in the previous analysis, it was found that the control variables *ROA*, net loss (*Loss*), and audit complexity (*COM*) were not statistically significant.

Summarizing the above results, it was confirmed that if the amount of conservatism is suitable as a proxy for evaluating audit quality, audit quality is not affected, even if the auditor changes under the periodic auditor designation system when the designated auditor is Big 4. However, if the designated auditor is non-Big 4, it can be interpreted that if the auditor is changed and designated according to the periodic auditor designation system, appropriate audit fees and audit hours are invested, affecting audit quality.

Table 5. Results of Regression Analysis (Model 2)

Variable	Model 2 (Big4)		Model 2 (Non-Big4)	
	β	t-stat.	β	t-stat.
Int.		1.792		5.080***
PA	0.004	0.087	-0.178	-3.840***
DR	0.065	1.586	0.217	4.477***
TA	-0.099	-2.346*	-0.253	-5.345***
ROA	0.031	0.617	-0.009	-0.163
Loss	-0.017	-0.342	0.001	0.014
COM	0.034	0.797	-0.036	-0.771
F	1.759		11.339***	
adj. R^2	0.007		0.130	
N	615		416	

Notes: 1. t: t-statistics.
     2. β: beta coefficient.
     3. *$p<0.05$, **$p<0.01$, ***$p<0.001$.
     4. Refer to Table 2 for other variable definitions.

V. Conclusion

Korea introduced and implemented the periodic auditor designation system in 2019. The periodic auditor designation system is a system in which an auditor is designated by the Securities and Futures Commission under the Financial Services Commission for three years if a company voluntarily appoints an external auditor for six years. The periodic auditor designation system revised the New External Audit Act to secure the independence of auditors and improve audit quality, and it introduced a periodic designation system for sovereign listed corporations and large unlisted companies that do not separate ownership and management.

This study verified the effect of periodic auditor designation on audit quality. In order to review the impact of periodic auditor designation on audit quality, periodic auditor designation companies were selected from listed companies in 2019

and 2020, as well as to alleviate the problem of measurement error of discretionary accruals, which is frequently used in analysis. To do this, we conducted an empirical analysis using the amount of conservatism, as used in a study by Feltham and Ohlson (1995). It was confirmed that audit quality, due to the periodic designation of an auditor, contributes to suppressing the opportunistic behaviors of managers and enhances the reliability of financial reporting, thereby strengthening conservatism.

For the analysis, companies on the Korean KOSPI market were selected as periodic designated auditors for companies that had been using the same auditing and accounting firm for 6 years, and had changed in 2019 and 2020. A total of 1,031 final samples were selected through an additional sample selection process and were used for analysis.

In the study using the periodic designation of auditors in Hypothesis 1, in the regression

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equation using the amount of conservatism as the dependent variable, a statistically significant difference was confirmed in the periodic auditor designation variable (*PA*) under the periodic auditor designation system. In the regression equation testing Hypothesis 1, in order to further analyze the conclusion that the variable (*Big 4*) was statistically significant under the 5% significance level, additional analysis was conducted excluding the corresponding control variable. As a result, in the case of accounting firms with designated auditors that were non-Big 4, a statistically significant difference in audit quality according to periodic auditor designation was confirmed. Through this, this study demonstrated that the auditor designation system, following the introduction of the periodic auditor designation system, effectively works to improve audit quality, suppress the opportunistic behaviors of managers, and enhances the reliability of financial reporting. However, when using the amount of conservatism used in the study by Feltham and Ohlson (1995), if a company has multiple accounting methods available, the amount of conservatism decreases, even if a method that reduces the difference between the book and market values is selected. It was suggested in the research results that problems may occur.

This study is meaningful in that it targets data from 2019 and 2020 as empirical data using the amount of conservatism on the effect of periodic auditor designation on audit quality. Since this system was first implemented in Korea in 2019, there are not many related data, there are limitations in the analysis of related studies. In addition, it was found that the amount of conservatism used in Feltham and Ohlson's (1995) study could affect the amount of conservatism; for example, if a firm chooses a fair value valuation model for tangible assets. However, there is a limitation in that additional analysis was not possible due to difficulties in collecting data.

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When Expatriates Feel Betrayed: Perceived Psychological Contract Violation and Its Consequences and Potential Moderators

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ABSTRACT

Purpose – Given the fact that a majority of multinational enterprises (MNEs) are still heavily reliant on expatriates for critical functions abroad, expatriate management is crucial to MNEs in today's global business environment. In this context, increasing attention has been devoted to the psychological contract as a useful explanatory tool for understanding expatriate management. In spite of a growing recognition of its importance in expatriate management, the psychological contract has not yet been sufficiently studied in the multi-layered context of expatriation. Therefore, this paper aims to explore expatriate psychological contracts in the multi-contextual nature of expatriation.

Design/Methodology/Approach – Drawing upon social exchange theory and equity theory, this paper develops a conceptual framework for the relationship between perceived psychological contract violations and work-related outcomes and proposes the contextual moderators of this relationship at the individual, organizational, and national levels, respectively.

Findings – Four research propositions are developed around the proposed conceptual model, such that expatriates that perceive a violation of the psychological contract have significantly lower job satisfaction and commitment to the MNE. Moreover, the moderating effects of individual (e.g., cultural intelligence), organizational (e.g., the extent of cross-cultural training), and national (e.g., cultural distance) factors on the relationship between perceived psychological contract violations and expatriate attitudinal outcomes are suggested.

Research Implications – This paper can vastly increase the current understanding of psychological contracts by broadening its application beyond the domestic employee-employer relationship. It also provides relevant insight into expatriate management.

Keywords: expatriate attitudes, expatriate employment relationship, multicontextuality, potential moderators,
psychological contract violations
JEL Classifications: M10, M12, M54

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I. Introduction

Over the past few decades, globalization has changed the business landscape significantly. As goods, labor, capital, and even knowledge move freely and cheaply across national borders, organizations have greater opportunities than ever before to expand operations into global markets. Consequently, an increasing number of multinational enterprises (MNEs) have begun to appear in global markets and have played a prominent role in the global economy.

The global market research agency Finaccord (2017) found that there were a total of 12,230 MNEs with annual revenues of at least $200 million in 2017, and this is expected to reach about 14,000 by 2021. Moreover, according to a new OECD report (OECD, 2018), MNEs account for almost one-third (33 percent) of global gross output.

With the growth of global operations, the use of expatriates has become common practice among MNEs. In a recent study, Finaccord (2018) revealed that there were roughly 66.2 million expatriates working worldwide in 2017, and this population was projected to climb to 87.5 million by 2021. Taken together, the use of expatriates in MNEs will continue to grow in response to increasing pressure for international involvement (Shen & Edwards, 2004).

In this regard, an emerging stream of expatriate research has studied the psychological contract as an explanatory framework to understand expatriate management (Aldossari & Robertson, 2016, 2018; Bolino et al., 2017; De Ruiter et al., 2018; McNulty, 2013; Pate & Scullion, 2018; Sherman & Morley, 2018).

Beyond the formal and legal contract of employment, each and every employee has an informal and unofficial contract in mind with his or her organization. This ambiguous, imprecise, and elusive contract in the employment relationship is often called the psychological contract (Robinson & Rousseau, 1994).

Although the psychological contract encompasses the formal requirements or promises of employment that the formal contract also specifies, such as salaries, commissions, bonuses, and benefits, it covers a much wider scope of employment promises than the formal contract.

Furthermore, the formal contract exists in a physical state, and thereby is relatively apparent and objective. As a consequence, there is generally limited room for interpretation regarding the content and the state of the formally documented contract. On the other hand, the psychological contract is fundamentally perceptual and subjective (Rousseau, 1995). Hence, it is much more open to interpretation. In other words, each individual may have different views of the psychological contract.

A psychological contract refers to an individual's internalization or interpretation of what his or her organization has promised to offer in return for the employment (Lester et al., 2002).

Just as employees evaluate the formal contract, they also determine whether the psychological contract is fulfilled (Rousseau, 2001). In this sense, the psychological contract violation refers to any sort of discrepancy between perceived and actually received inducements in exchange for the employee's contributions to his or her organization (Rousseau, 1989).

Not surprisingly, a plethora of studies have found that a perceived psychological contract violation is inversely related to various work-related outcomes (job satisfaction, organizational commitment, trust, and organizational citizenship behaviors) and conducive to counterproductive work behaviors (turnover intentions and actual turnover) (Saleem et al., 2021; Turnley & Feldman, 1999; Yang et al., 2020).

As noted above, the psychological contract is highly subjective and idiosyncratic (Guzzo et al., 1994). Although individuals may work in the same organization and perform the same job, no employee has the same psychological contract with the organization, evaluates the contract in the same way, or is equally influenced by it. This implies that the psychological contract is context-dependent (Shaffakat et al., 2022). Similarly, Guest (2004) highlighted the role of context in

the formation and the effect of a psychological contract.

In this regard, the context of expatriation is considerably different from those in the domestic or local employment relationship. Specifically, expatriation is a multi-faceted and multi-layered phenomenon that involves mainly three-level contexts: the individual- (e.g., the expatriate's abilities, skills, and personality traits), the organizational- (parent company policies,subsidiary practices, and parent company-subsidiary relationships), and the country-level (host country's environments and cultural differences between home and host countries) contexts.

For example, host country cultures provide a further layer of intricacy to already complex psychological contracts. More particularly, the international assignment is carried out in the host country and hence is invariably influenced by the cultural context of the host country (Kim et al., 2022). In fact, a wide array of studies have postulated that host country cultures have considerable influence on expatriation (Claus et al., 2011). Given the fact that the psychological contract cannot completely be free from the surrounding context, the host country's cultural context as well as individual- and organizational-level contexts must be taken into consideration when it comes to understanding expatriate psychological contracts.

In brief, vis-à-vis the domestic counterpart, the expatriate employment relationship is influenced by a myriad of contexts.

Considering that psychological contracts vary widely depending on context, the effect of expatriate psychological contracts may differ significantly from those of the domestic employment relationship (Perera et al., 2017). Nevertheless, there has been relatively sparse research on the effects of perceived psychological contract violation in the context of expatriation. The aim of this conceptual paper is to propose the effects of perceived psychological contract violation on expatriate attitudes.

Further, only a handful of studies have studied the potential moderators in the relationship between perceived psychological contract violation and employment outcomes (Lin et al., 2022; Robinson, 1996), and even fewer such studies have been done to date in the expatriation context. Given the multi-contextual nature of expatriate employment relationship, another aim of this paper is to suggest individual, organizational, and national factors that moderate the relationship between perceived psychological contract violation and expatriate attitudinal outcomes.

In sum, grounded in social exchange theory and equity theory, this attempts to answer the following research questions.

(a) What impact does perceived psychological contract violation have on expatriate attitudes?

(b) How do individual, organizational, and national factors influence the effects of perceived psychological contract violation on expatriate attitudes?

II. Literature Review

The conceptual basis of the psychological contract is largely grounded in studies of motivation. This is because the psychological contract often acts as a significant motivator in the employment relationship. More particularly, employees are motivated and engaged at work when they receive promised rewards in accordance with the psychological contract. In brief, the psychological contract is the cornerstone of employee motivation.

Most contemporary theories of motivation contend that although people may have similar needs, they prioritize these needs differently and have different ways of satisfying needs. Moreover, the same motivator may be effective at different times.

Likewise, an increasing number of studies have begun to place emphasis on individual differences in motivation. As a consequence, several distinct theories of motivation have been proposed, claiming that motivation is a highly individual and subjective psychological process.

One such motivation theory is social exchange theory (Blau, 2017; Gouldner, 1960). Social exchange theory builds on the initial assumption that all humans view their own needs and desires as paramount. Accordingly, social relationships that people make can be seen as a result of the pursuit of self-interest. In other words, people are motivated to create and maintain a certain interpersonal relationship in the pursuit of maximizing personal benefits while minimizing personal costs (Le et al., 2018; Stafford & Kuiper, 2021).

Further, in many cases, personal benefits are best maximized when people behave reciprocally (Blau, 2017; Donaldson & O'toole, 2007). This indicates that social relationships are reciprocal in nature based on bilateral exchanges (Fiske, 1992). Therefore, people behave according to beliefs that the other in the social relationship will reciprocate. These beliefs, known as "reciprocity" in the parlance of social exchange theory (Gouldner, 1960), help to forge mutually beneficial relationships (Jones & Vaughan,1990). Compensation and benefits are positive reciprocity examples that employers may provide in returns for employee efforts in the employment relationship. In summary, the desire for reciprocity forms the basis of social relationships (Bannya et al., 2022; Cropanzano & Mitchell, 2005; Fiske, 1992).

In addition to reciprocity, equity theory brings the concept of equity into social relationships (Adams, 1963). According to equity theory perspective, people do not simply make rational calculations of potential benefits and costs derived from social relationships, but they do seek to achieve a balance between these. Similarly, several studies have argued that reciprocity connotes a fair exchange (Blau, 2017; Larson, 1998).

In practice, however, not every social relationship is reciprocal. Further, the balance of exchanges in social relationships is not always equal. As a result, social relationships that maintain reciprocal exchanges are likely to remain strong. On the contrary, social relationships that fail to achieve an equitable balance in exchanges are unlikely to be maintained. The reason is that the balance between

benefits and costs of social relationships is broken (Cropanzano & Mitchell, 2005).

The standards that people use to evaluate benefits and costs of the social relationship vary considerably from person to person. In other words, the social relationship is evaluated using a subjective cost-benefit analysis (Bental & Kragl, 2021; Loewenstein et al., 1989).

Even though both social exchange theory and equity theory have been criticized for limited applicability to the diverse pattern of social relationships, they have been increasingly used to understand modern employment relationships (Lambe et al., 2001). Many recent studies have adopted social exchange theory and equity theory as a theoretical basis for understanding the important role of the psychological contract in the employment relationship (Coyle-Shapiro & Conway, 2005; Turnley et al., 2003).

As a perceived exchange of agreement between the employee and the employer, the psychological contract underlies the employment relationship (Morrison & Robinson, 1997).

Moreover, employees evaluate the psychological contract to see if their employers have successfully conveyed promises. More particularly, employees calculate the discrepancy between what they believe they were promised and were actually given. When employees perceive that they have received less than they have been promised, a perceived violation of the psychological contract occurs.

The psychological contract mostly remains implicit, but becomes explicit when it is violated. In fact, extensive empirical studies have demonstrated that a perceived psychological contract violation can profoundly damage the employment relationship, exerting negative effects on employee attitudes (Robinson, 1996; Turnley & Feldman, 1999). Zhao and colleagues (2007) found that employee perceptions of psychological contract violation lead to an immense loss of trust.

To conclude, the significance of psychological contract violation, as the key antecedent of individual and organizational outcomes, deserves more attention in the literature.

III. Theoretical Framework and Propositions

While the psychological contract serves a variety of functions, one fundamental function of the psychological contract is to increase the predictability, stability, and security of future exchanges among the parties involved; thus, it reduces uncertainty within the employment relationship (Shore & Tetrick, 1994). While these perceived promises are not legally enforceable, employee perceptions regarding the terms of the exchange make them more informed, and foster confidence regarding the employment relationship.

The greater the uncertainty, the greater must be the level of confidence. This is because uncertainty increases the likelihood of inequitable exchanges in the employment relationship. That is, the norm of reciprocity is likely to be broken in times of uncertainty. In this vein, the expatriation is inherently packed with uncertainties and risks for both the expatriate and the MNE (Kim & Von Glinow, 2017).

During the process of expatriation, expatriates face multifold problems in both their professional and personal lives. Concretely, when it comes to carrying out the international assignment in a foreign subsidiary, expatriates often experience miscommunication, misunderstanding, and even conflict, primarily due to culture, language, and work practices that are different from those of the home country (Von Glinow et al., 2004). Along with these challenges in the workplace, expatriates also experience major life upheavals in all aspects of daily life, including housing, spousal career, and children's education (Tanure et al., 2009).

To the MNE, using expatriates overseas requires some uncertainty. When managing employees abroad, the MNE inevitably has much greater uncertainty than at home, largely due to the different contexts (Shapiro et al., 2007). For example, different cultural contexts often hinder effective communication, produce numerous misunderstandings, and eventually increase the level of uncertainty (Johanson & Vahlne, 2009).

Additionally, expatriation typically entails massive investments and costs throughout the process. However, despite these substantial investments, most MNEs earn only modest or meager returns on international assignments (Collings et al., 2007; Meyskens et al., 2009). This fact significantly amplifies the uncertainty associated with the expatriation.

Further, employees selected for international assignments are generally either high performers or high potential. In this sense, the loss of such talent as a result of expatriate failure can cause severe damage to the competitiveness of the MNE.

Taken together, it is clear that expatriation is a process that involves great uncertainty for both the expatriate and the MNE. Given the considerable amount of uncertainty, expatriates are more inclined to depend upon the psychological contract (McNulty, 2013). This is because it provides predictability, and thereby boosts confidence regarding future returns.

Concurrently, however, the uncertainty emanating from expatriation often makes it difficult for the MNE to meet all promises perceived by the expatriate. This fact may, in part, account for the frequent occurrence of perceived violations in the psychological contract during expatriation (Coyle-Shapiro & Kessler, 2002).

1. The Effects of Psychological Contract Violation on Expatriate Attitudes

From a social exchange perspective, a perceived violation in the psychological contract occurs when the norm of reciprocity is broken in the employment relationship (Gouldner, 1960). Therefore, the breaking of the norm of reciprocity can cause adverse consequences, such as negative employee attitudes.

Among various employee attitudes, job satisfaction, and organizational commitment are of major interest to expatriation management (Rynes et al., 2002; Saari & Judge, 2004).

Above all, one of the most widely studied attitudinal outcomes in expatriate literature is job satisfaction (Hess & Jepsen, 2009). Job satisfaction

can be defined as a pleasurable condition that comes from an employee's positive evaluation of his or her job (Locke, 1984). Similarly, how the expatriate evaluates various facets of the international assignment determines his or her level of job satisfaction.

In this regard, the job satisfaction of expatriates is closely related to perceived psychological contract violations, in that both are built around the compound evaluation of expatriates (Gakovic & Tetrick, 2003; Suazo, 2009).

Indeed, prior research has revealed that employees appear to hold higher job satisfaction when the psychological contract is fulfilled (Sheehan et al., 2019; Tekleab & Taylor, 2003). Conversely, the perceptions of psychological contract violation reduce the job satisfaction of expatriates (Tekleab & Taylor, 2003). According to equity theory, if expatriates perceive exchanges with the MNE as inequitable, a psychological contract violation occurs (Taylor & Tekleab, 2004). In the face of such a situation, expatriates are likely to adopt negative attitudes in order to restore equity. In other words, expatriates attempt to regain the perceived give-and-take balance by lowering job satisfaction to a level commensurate with the effort put forth.

Organizational commitment is another commonly used attitudinal outcome in expatriate research. Organizational commitment describes employee attachment to the organization (Allen & Meyer, 1996).

In this vein, there is a general belief that employees satisfied with their jobs are more prone to feel connected to the organization. This means that employees with high job satisfaction have a strong desire to be part of their organizations (Kim et al., 2021). In fact, a positive relationship between job satisfaction and organizational commitment has been consistently found in studies (Meyer et al., 1989).

Moreover, according to previous findings, the effect of perceived psychological contract violations on organizational commitment is similar to those on job satisfaction, in that it decreases employee commitment to the organization (Lester et al., 2002).

As such, it can be expected that a perceived violation of the psychological contract has detrimental effects on the organizational commitment of expatriates. Given the perceived psychological contract violation as an imbalance of social exchanges, expatriates decrease psychological investment by reducing commitment to the MNE, which promotes more balanced exchanges (Coyle-Shapiro & Kessler, 2000).

Additionally, the negative effects of perceived psychological contract violation on both job satisfaction and organizational commitment become more apparent in the context of expatriation. This is because uncertainty is prevalent in the expatriation context; in turn, the role of the psychological contract is emphasized.

In conclusion, a perceived psychological contract violation leads to low levels of expatriate job satisfaction and organizational commitment. Based on the above, the following hypothesis is suggested.

P1: A perceived psychological contract violation negatively relates to (i) job satisfaction and (ii) organizational commitment.

2. The Moderating Role of Individual Factors (Cultural Intelligence) between Perceived Violations in the Psychological Contract and Expatriate Attitudes

In light of the personal nature of the psychological contract, previous research has revealed that the psychological contract tends to be largely influenced by the individual situation of the employee. Indeed, numerous recent studies have examined the possible moderation effects of individual variables on the relationship between perceived psychological contract violation and employee attitudes, including personality (Tallman & Bruning, 2008), individual characteristics (age, gender, emotional intelligence, and literacy level) (Schalk, 2004),

and job-related attributes (employment status, organizational trust, and career orientation) (Kickul & Lester, 2001).

Specifically, Schalk (2004) found that older employees were less likely than their younger counterparts to be affected by perceived psychological contract violations. Ng and Feldman (2009) found similar results wherein older employees exhibited higher levels of acceptance toward perceived violations in the psychological contract, and thereby were less inclined to adapt attitudes accordingly.

Additionally, another stream of research has investigated the influence of personality on perceived violations in the psychological contract (Jafri, 2014; Raja et al., 2004; Zhao & Chen, 2008). More particularly, Jafri (2014) found that both agreeable and conscientious employees were less likely to perceive violation in their psychological contracts.

These findings can also be applied to the various types of employment relationships, such as the expatriate employment relationship. In fact, Lub and colleagues (2016) argued that different demographic characteristics cause expatriates to respond differently to the psychological contract.

With this in mind, this paper advances the argument that the usefulness of a perceived psychological contract violation in predicting expatriate attitudes is contingent upon the expatriate's level of cultural intelligence.

Working abroad mostly means working in another culture. In other words, expatriates encounter new and unfamiliar cultural values, norms, and practices during international assignments, albeit to different extents. In this regard, cultural intelligence has been increasingly recognized as an important individual competency that facilitates cultural understanding. According to the definition provided by Earley and Ang (2003), cultural intelligence is a set of cross-cultural capabilities to function effectively in multicultural settings.

As proposed above, the failure of the MNE to fulfill its reciprocal obligations implied in the psychological contract may jeopardize expatriate attitudes, in line with the norm of reciprocity. Yet, the negative effects of perceived psychological contract violation on expatriate attitudes become weaker as expatriates possess higher levels of cultural intelligence. This is because culturally intelligent expatriates are likely to have a better understanding of cultures, and thereby have a more realistic approach to exchanges occurring in different cultural settings. As such, the psychological contracts of culturally intelligent expatriates are less easily violated.

More particularly, those who are richly endowed with cultural intelligence would be well aware of the fact that the MNE may not be able to reciprocate adequately in a timely manner when operating indifferent countries. They also understand that the norm of reciprocity is easily breakable in the expatriate employment relationship, primarily because of the high degree of uncertainty, which results mainly from the different cultures (Stahl, 2001).

In a similar vein, Kim et al. (2008) insisted that it was easier to understand unfamiliar cultures for expatriates with higher cultural intelligence. One plausible explanation was that culturally intelligent expatriates were more likely to be able to gain pertinent information about the host country, recognize subtle cultural differences, and interact with people from other cultures (Brislin et al., 2006).

Taken together, cultural intelligence may positively influence how expatriates construe the psychological contract in the culturally diverse contexts of expatriation. For example, when a perceived psychological contract violation occurs, culturally intelligent expatriates understand that the violation is a part of expatriation; as a result, they are better equipped to bounce back.

Therefore, although expatriates are expected to reciprocate perceptions of the psychological contract violation by lowering job satisfaction, those with higher cultural intelligence are more likely to be resilient, and hence their job satisfaction is presumably less changeable. To wit, the perceived psychological contract violation becomes less important in determining the job

satisfaction of culturally intelligent expatriates.

In addition, when expatriates perceive that the psychological contract is violated, they are generally inclined to adapt attitudes by reducing commitment to the MNE. However, it is not wholly applicable to culturally competent expatriates. That is, even though they may also feel detached and less committed to the MNE at some point, expatriates with higher cultural intelligence are less likely than those with lower cultural intelligence to be influenced by the perceived violation in the psychological contract.

Indeed, multiple studies have found that highly resilient employees display greater job satisfaction and organizational commitment than those of others in a case of adversity (Luthans et al., 2005). Based on the above, the study developed the hypothesis below.

P2: Expatriate cultural intelligence moderates the relationship between perceived psychological contract violation and both (i) job satisfaction and (ii) organizational commitment, such that the negative relationship diminishes when an expatriate possesses higher levels of cultural intelligence.

3. The Moderating Role of Organizational Factor (Extent of Cross-Cultural Training) between Perceived Violations in the Psychological Contract and Expatriate Attitudes

In addition to the individual factor, the psychological contract is subject to organizational influences. In other words, the psychological contract varies dramatically depending on organizational circumstances (Robinson et al., 1994).

In fact, a plethora of studies have contended that organizational influences play a prominent role, particularly in shaping the psychological contract, including organizational structures, management policies and procedures, and employment regulations (Arunachalam, 2021; Rousseau, 1995, 2001).

For example, Rousseau (1995) posited that the content of the psychological contract was heavily driven by organizational factors, such as human resource management practices. In particular, he elaborated that human resource management practices send a clear message as to what the organization expects from employees and in return, what employees can expect from the organization. In a similar vein, Westwood and coauthors (2001) insisted that formal communication helps employees understand the terms of employment.

Further, some studies have argued for training and development programs as one form of human resource management practice to help employees make experiences in the new work environment more predictable, and hence determine the state of the psychological contract (Waiganjo & Muceke, 2012).

Taken together, training and development programs not only give employees an accurate picture of their roles and job requirements, they also increase confidence regarding future exchanges. Consequently, this contributes to the building of a more realistic and deliverable psychological contract.

With the increased recognition of the importance of culture in expatriation, much attention has been directed toward cultural education in recent years. As a consequence, a number of MNEs have endeavored to develop cross-cultural training programs for expatriates. Concretely, according to a Brookfield survey (Brookfield Global Relocation Services, 2015), the vast majority of MNEs (83%) offered cultural training for at least some international assignments.

Unexpected, unusual, or unintended situations that disturb the employment relationship frequently occur during expatriation, largely due to different cultures. This implies that even though an MNE wants to deliver on perceived promises, it is difficult due to external reasons during expatriation.

In this vein, cross-cultural training helps

expatriates better cope with unexpected and negative events that cause perceived violations of the psychological contract in a new culture (Earley, 1987). In particular, cross-cultural training reduces conflicts in the expatriate employment relationship by educating expatriates about possible conditions that might actually limit future exchanges.

Accordingly, it can be argued that extensive cross-cultural training programs contribute to cultivating a positive psychological contract, and thereby placate negative expatriate reactions to the perceived psychological contract violation.

Specifically, expatriates become capable of benefiting from realistic previews of expatriation through comprehensive cross-cultural training, which in turn increase the accuracy of expatriate perceptions regarding the employment relationship in different cultures. In other words, cultural understanding converts itself into the ability of expatriates to better adapt to the new employment relationship in an expatriation context. Further, properly trained expatriates are better prepared for perceived violations in the psychological contract.

To wit, extensive and comprehensive cross-cultural training is expected to reduce the effects of perceived psychological contract violation on expatriate attitudes (reduced job satisfaction and lowered organizational commitment) by forming accurate perceptions about expatriation.

In support of the expectations, previous findings revealed that training had a positive influence on the job satisfaction and organizational commitment of employees (Bulut & Culha, 2010; Schmidt, 2007). Based on the above, the hypothesis below was developed.

P3: Cross-cultural training moderates the relationship between perceived psychological contract violations and both (i) job satisfaction and (ii) organizational commitment, such that the negative relationship diminishes when cross-cultural training was provided the expatriate to a larger extent than a lesser extent.

4. The Moderating Role of National Factor (Cultural Distance between Home and Host Countries) between Perceived Violations in the Psychological Contract and Expatriate Attitudes

The psychological contract is inherently dynamic and context-bound; thus, it constantly changes depending upon the circumstances. In particular, prior research has emphasized the significant influence of social context on psychological contract, such as a country's political, economic, and social situations, the demographic composition, stages of industrial development, societal norms, and employment and labor law (Bendix, 2010; Linde, 2015).

Notwithstanding the dynamic nature of the psychological contract, previous studies on psychological contracts of expatriates have adopted constructs largely applicable to the domestic employment relationship. This results in the neglect of a culture that exerts considerable influence in the expatriation context.

In essence, expatriation involves business operations across national boundaries. In this sense, cultural distance has long been recognized as an indispensable part of expatriation. Cultural distance is commonly defined as the extent of cultural differences between two countries (Kogut & Singh, 1988; Shenkar, 2001). This implies that greater differences in cultural values and norms create a greater cultural distance between the two countries (Jun & Kim, 2022; Kim et al., 2022).

In this vein, unexpected occurrences arising from cultural differences are fairly common when operating in a culturally distant country (Dowling & Welch, 2004). More specifically, a variety of unforeseen circumstances may interfere with delivering on the perceived promises often occur during expatriation, particularly when there is a greater cultural distance. That is, when operating in culturally distant countries, there are additional difficulties for MNEs to identify in orde to fulfill the psychological contracts of expatriates.

In summary, a greater cultural distance results

in a high degree of perceived uncertainty for expatriates (Shenkar, 2001). Evans and Mavondo (2002) found empirical evidence that expatriates that perceived greater cultural differences in the host country were more likely to experience higher levels of uncertainty during the expatriation period.

Therefore, considering that the psychological contract serves a key role in reducing uncertainty and increasing predictability about future exchanges in the employment relationship, expatriates are expected to depend more on the psychological contract in culturally distant destinations.

In support of this expectation, a great deal of research has shown that greater uncertainty leads to a greater reliance on the existing employment relationship (Ito & Brotheridge, 2001). In other words, under conditions of great uncertainty, employees appear to continue the exchange relationship with the same organization in order to alleviate the perils of uncertainty. This is because, in many instances the existing employment relationship seems to better ensure the reciprocal norm of social exchange than possible alternatives elsewhere.

Similarly, given the uncertainty associated with expatriation, expatriates strive to maintain the current expatriate employment relationship and place high value on the existing psychological contract.

Therefore, the prevalent uncertainty inherent to expatriation makes the psychological contract more influential (McNulty, 2013; Shore & Tetrick, 1994). In this sense, the increasing significance of the psychological contract may elicit more severe reactions to perceived violations in the psychological contract.

Moreover, expatriates tend to rely extensively on perceived organizational support because the line between professional and personal lives is often blurred during expatriation. In turn, MNEs exercise profound influence over expatriate lives, both on and off the job.

Specifically, many aspects of personal lives, which are not usually present in domestic settings, such as housing, spouse vocational assistance, and child education assistance, can be part of the psychological contracts of expatriates, especially when considerable cultural differences exist (Perera et al., 2017; Suutari et al., 2012).

This broader range of promises increases the likelihood of expatriates perceiving violations in the psychological contract during expatriation. It also increases the intensity of response to the perceived psychological contract violation (Guzzo et al., 1994; Rousseau, 1995).

Indeed, perceived violations of the psychological contract usually occur during unpredictable situations. Further, previous studies have found that uncertainty originating from organizational changes heightens employee reactions to perceived psychological contract violations (Lo & Aryee, 2003; Zhao et al., 2007).

Taken together, it is anticipated that expatriates sent to culturally distant countries react more intensely to perceived psychological contract violations, whereas expatriates assigned to culturally close countries are less vulnerable to the effects of perceived psychological contract violations.

In other words, a smaller cultural distance between the home and host countries mitigates the damaging effects of perceived psychological contract violations on expatriate attitudes (decreased job satisfaction and reduced organizational commitment). In support, previous studies have postulated an association between the unfamiliar cultures of the host country and negative expatriate attitudes (Selmer, 2004). Based on the discussion above, this study proposes the hypothesis below.

P4: Cultural distance between the home and host countries moderates the relationship between perceived psychological contract violations and both (i) job satisfaction and (ii) organizational commitment, such that the negative relationship diminishes when the cultural distance between home and host countries is smaller than larger.

Fig.1 shows the proposed conceptual model.

Fig. 1. Conceptual Model
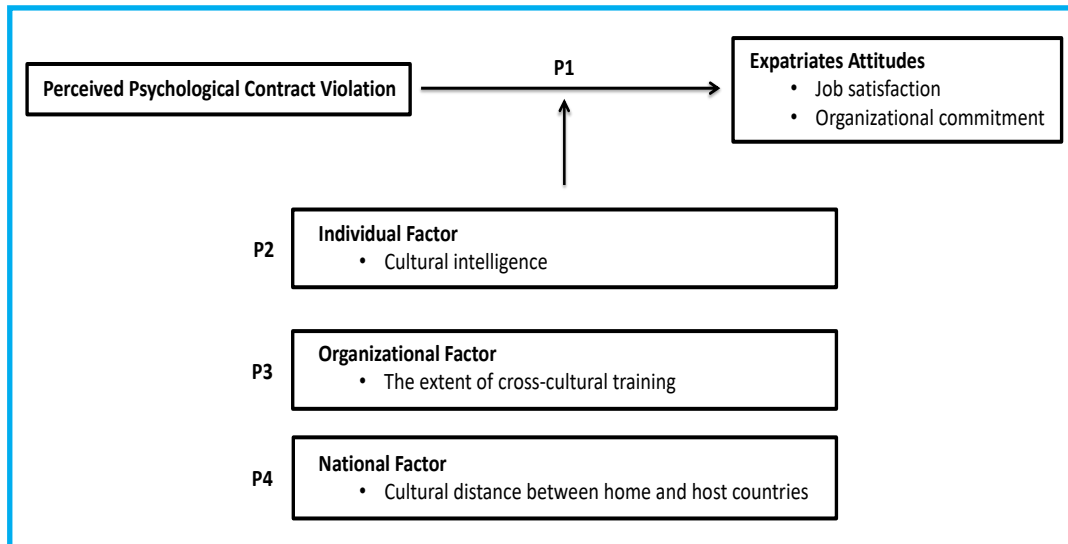
IV. Conclusion

As a business becomes dependent on knowledge and intellectual capabilities, human resource management is undoubtedly a key driver of organizational success. In the same vein, the importance of managing human resources for the MNE cannot be overstated. Since a large number of MNEs depend on expatriates to run global operations despite the relatively high costs, it is essential for MNEs to develop a better understanding of expatriate management.

In this regard, the psychological contract has received recent attention as an underlying mechanism for managing expatriates. However, existing psychological contract studies have paid little heed to the unique context of expatriate employment relationships (Ng & Feldman, 2009; Lub et al., 2016), which are different from domestic employment relationships.

Expatriates are often exposed to more complex environments than domestic counterparts, such as different cultures. Moreover, expatriate contracts usually involve multiple parties and are directed by various interests (Kraimer & Wayne, 2004). Therefore, the current understanding of psychological contracts in the expatriation context is not well understood. This could potentially hinder the ability to manage expatriates on international assignments.

In this vein, the primary purpose of this manuscript is two-fold. First, this paper attempts to study the effects of perceived psychological contract violations on expatriate attitudes (job satisfaction and organizational commitment). Second, this paper aims to explore the moderating effects of individual, organizational, and national factors on the relationship between perceived psychological contract violation and expatriate attitudes.

Using social exchange theory and equity theory, this paper developed four testable propositions. More elaborately, the first proposition concerns perceptions that the MNE failed to fulfill promises, and how this is related to a decrease in the job satisfaction and organizational commitment of expatriates.

This is in line with both social exchange theory and equity theory, as regulated by the norm of reciprocity (Blau, 1964). The main thrust of both theories is that people act on the expectation of reciprocal returns, which are comparable to the

cost or effort of that action. Therefore, for example, employees give loyalty to the organization because they expect the organization to reciprocate with comparable rewards. These expectations of reciprocal and equitable exchanges provide a basis for the employment relationship, and are essential for understanding psychological contracts (Blau, 1964; Kelley & Thibaut, 1978).

However, both reciprocity and equity are not always guaranteed in practice, and are occasionally broken. In this regard, perceived inequity and lack of reciprocity lead to serious negative consequences in the employment relationship. More particularly, when employees perceive that the relationship with the organization is not reciprocal and thereby is inequitable, they use negative strategies, such as worsening attitudes, in their attempts to restore equity.

Similarly, the first proposition proposes that when expatriates perceived psychological contract violations, they react to this violation with negative attitudes (a decrease in both job satisfaction and organizational commitment). In this way, expatriates are able to correct the perceived imbalance in the expatriate employment relationship (Coyle-Shapiro & Kessler, 2000).

Moreover, several factors are related to expatriate reactions to perceived psychological contract violations. Specifically, the second proposition suggests that perceived psychological contract violations hardly matter among expatriates with high cultural intelligence. This implies that culturally intelligent expatriates are more aware of the significant impact of culture during expatriation; in turn, they are capable of responding adequately to perceived violations of the psychological contract.

The third proposition is that extensive cross-cultural training attenuates the damaging effects of perceived psychological contract violations on expatriate attitudes. This is because intensive cross-cultural training helps expatriates establish a precise understanding of the international assignment, and develop a realistic psychological contract with the MNE. As such, expatriates that received cross-cultural training to a large extent

are likely to better anticipate and proactively prepare for any perceived psychological contract violations, and thereby react less intensely to it.

The fourth proposition suggests that perceived psychological contract violations inflict severe damage on expatriate attitudes when the cultural distance between the home and host countries is greater. In other words, a small cultural distance between two countries contributes to expatriate tolerance, and hence alleviates the negative effects of perceived psychological contract violations on their attitudes.

This paper contributes to existing literature on the psychological contract in at least three important ways. First, whereas previous psychological contract research has focused predominantly on the domestic employment relationship, the present paper extends its applications to various employment relationships. In particular, this study delves into how perceptions of a psychological contract violation affect attitudinal outcomes in the expatriation context.

Second, there has been a lack of effort to investigate contextual variables that might influence and shape perceptions of the psychological contract (Kickul et al., 2004). By exploring the role of individual, organizational, and national factors as potential moderators in the relationship between perceived psychological contract violation and expatriate attitudes, this paper proposes various contexts which must be taken into account.

In summary, this conceptual paper contributes to a clearer understanding of expatriate management by answering essential questions on what impact perceived psychological contract violations have on expatriate attitudes and how individual, organizational, and national factors influence the effects of perceived psychological contract violations.

Last, but not least, using social exchange theory and equity theory as theoretical frameworks, this paper extends the applicability of both theories beyond the domestic employment relationship.

Furthermore, this study provides several critical implications for expatriate management practices. Concretely, to some extent, MNEs should consider selecting candidates that achieve a score of

moderate to high on cultural intelligence. This is because they are more likely to understand what might happen during expatriation, and hence better deal with the perceived psychological contract violations than those with low scores on cultural intelligence.

Moreover, cross-cultural training is often the first point of interaction between the expatriate and the MNE. Thus, the initial impression during cross-cultural training forms the foundation of the psychological contract. This suggests that MNEs need to be active in identifying individual characteristics, as well as in developing and implementing adequate cross-cultural training programs for expatriates (Turnley & Feldman, 1999).

More particularly, in situations in which candidates are newcomers and thus lack working experience in the field of expatriation, or in which cultural distance between the home and host countries is greater, it is worthwhile for MNEs to provide both informative and consultative cross-cultural training programs that provide a more in-depth understanding of the complex nature of the expatriation, develop mutual perceptions of exchanges, and curtail the negative effects of perceived violations in the psychological contract (Puck et al., 2008; Waxin & Panaccio, 2005).

Although this study yields valuable information regarding the effects of perceived psychological contract violations and potential moderators (individual, organizational, and national-level variables) of expatriate attitudes (job satisfaction and organizational commitment), there are several limitations that create opportunities for future research.

Firstly, the reciprocal nature of the psychological contract implies that there are two perspectives to the psychological contract: the employee and the employer (Dabos & Rousseau, 2004; Tekleab & Taylor, 2003). Therefore, to fully understand the psychological contract, which consists of the perceptions of both parties to the employment relationship (Guest & Conway, 2002; Wu et al., 2021), studies should explore the psychological contract from the perspectives of both the employee and the employer (Lester et al., 2002; Tekleab & Taylor, 2003). Indeed, Chen et al. (2008) examined reactions to psychological contract breaches from these two separate perspectives. Nonetheless, most previous research has focused on the employee's perspective, and paid scant attention to understanding the employer's view of the psychological contract (Guest, 2004; Tekleab & Taylor, 2003). In line with these previous studies, this research studies perceived psychological contract violations from an expatriate perspective.

However, there may be perceptual discrepancies in terms of psychological contract violations between the employee and the employer, as psychological contracts represent how people interpret promises (Rousseau & Wade-Benzoin, 1995). Accordingly, re-examining psychological contract violations with the perspective of both the expatriate and the MNE can greatly extend the existing understanding of the psychological contracts of expatriates.

Secondly, whereas attitudinal outcomes examined in this research (job satisfaction and organizational commitment) are critical in expatriation, future studies can delve into other attitudinal variables, as well as behavioral outcomes, of perceived psychological contract violations (cultural adaptation, job performance, and turnover intention).

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The Journal of Global
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An Empirical Study on Vietnam's Trade Facilitation in the Digital Economy*

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ABSTRACT

Purpose – Vietnam is among the fastest growing digital economies in the Southeast Asian region, and has made enormous efforts to adopt digital measures to facilitate trade. The paper aims to assess Vietnam's performance of digital trade facilitation and estimate the impact of digital trade facilitation on Vietnam's exports to the Association of Southeast Asian Nations (ASEAN).

Design/Methodology/Approach – Vietnam's implementation of digital trade facilitation is assessed through a constructed framework based on two groups of indicators, including Information Availability and Formalities Automation extracted from the OECD Trade Facilitation database. Further, a gravity model was adopted to estimate the impact of digital trade facilitation on Vietnam's exports.

Findings – The results show that Vietnam performs a slightly better than the average level of ASEAN countries. However, Vietnam's implementation of digital trade facilitation tends to be improving at a slower rate than other ASEAN countries' implementations, as well as the country's overall implementation of other trade facilitation. The paper is among leading studies to quantify the impact of digital trade facilitation on Vietnam's exports to ASEAN countries, and finds that if Vietnam and ASEAN countries increase trade facilitation through Information Availability measures by 1%, Vietnam's exports will increase more than proportionately by 1.29% and 1.01%, respectively. Meanwhile, the digitalization of trade formalities so far has had no effect on Vietnam's exports to this region.

Research Implications – Vietnam should place priority on enhancing automation in trade-related administrative procedures, especially in customs procedures. Furthermore, it should pay more attention to promote the electronic publication of trade-related information, enhance the transparency of government policymaking, and increase the quality of enquiry points.

Keywords: ASEAN, digital economy, digital trade facilitation, exports, vietnam
JEL Classifications: F13, F14, F17, O53

I. Inrtoduction

Along with the development of Industrial Revolution 4.0, a digital transformation has evolved with intelligent data processing in all economic sectors. Digital transformation also acts as an important catalyst to enable countries around the world to integrate more efficiently. When trade barriers have been gradually reduced and eliminated as a result of global integration efforts, the extent of benefits from trade depends largely on the implementation of trade facilitation measures (Herzer, 2013; Márquez-Ramos et al., 2012; Ramanayake & Lee, 2015). Previous studies widely acknowledged that trade facilitation increases trade flows and lowers goods prices by reducing trade costs and removing trade barriers (Amoako-Tuffour et al., 2016; Dollar & Kraay, 2004; Márquez-Ramos et al., 2012; Wilson et al., 2003). Trade facilitation contributes to increasing both imports and exports (Ramanayake & Lee, 2015), ensuring higher predictability in trading processes (Dreger & Herzer, 2013), thereby increasing national competitiveness. By reducing transaction costs, trade facilitation also strengthens participation in the global value chains. Given the benefits of trade facilitation in the context of Industrial Revolution 4.0, the rapid development of the digital economy, and the COVID-19 pandemic, taking advantage of digital measures to facilitate trade has therefore become more important than ever before, helping countries accelerate trade and recover effectively after the pandemic.

Vietnam's Internet economy has experienced high growth over the last decade. The country's digital economy in 2019 was valued at around USD $13 billion, reached USD $18 billion in 2021, and is predicted to achieve USD $47 billion in 2025 (Google et al., 2021). The digital economy has created numerous opportunities for Vietnam to take advantage of technological achievements to accelerate economic growth, promote the process of industrialization and modernization, and narrow the development gap with the rest of the world (Pham, 2020; Tran, 2020; Yu & Luu, 2020).

Specifically, as trade is an important driver for Vietnam's economic growth, the country has made great efforts to adopt digital measures to facilitate trade aimed at increasing the efficiency of trade activities, promoting trade value and deepening international economic integration.

Vietnam has implemented trade facilitation in various aspects, including the simplification and harmonization of border procedures, adoption of modern information and communication technology (ICT) in trade, and cooperation in trade facilitation. However, Vietnam's implementation of trade facilitation in general, and of cross-border paperless trading systems in particular, is still below the world average (ESCAP, 2021; Ministry of Finance, 2022; Ministry of Industry and Trade, 2022), and the country has been faced with persistent problems in burdensome administrative procedures, complicated customs procedures, and corruption (Hammar, 2009; Vu & Tang, 2022; Yu & Luu, 2020). Given the substantial benefits of implementing trade facilitation measures and the rapid development of the digital economy, the issue of digital trade facilitation has received increasing attention recently in Vietnam.

However, extant literature shows that while many prior studies have been occupied with analyzing Vietnam's trade liberalization, very few have tackled the topic of digital trade facilitation. Some typical studies that directly analyzed and assessed the current state and impact of trade facilitation in Vietnam were conducted by Hammar (2009), Huy et al. (2021), Mai & Ngoc (2019), Vu et al. (2021), Vu & Tang (2022), and Yu & Luu (2020). There are other studies investigating Vietnam's trade facilitation in the broader context of ASEAN, Asia, and the Pacific, region such as Duval (2008), ESCAP (2019a, 2020b, 2021), Fry (2011), Layton (2007), and Otsuki (2011). In the above-mentioned studies, the topic of digital trade facilitation in Vietnam was nearly unresolved, though Vu Thanh Huong and her co-researchers are work in the field. Vu et al. (2021) adopted a framework initiated by the United Nations to analyze and assess Vietnam's readiness for digital trade facilitation. The results

show that even though the country's readiness has gradually improved, its performance has been low. The authors pointed out that Vietnam should focus on promoting electronic payment systems and speeding up digital transformation in both governmental agencies and businesses.

The review of past literature reveals two important research gaps. In fact, the topic of how Vietnam performs trade facilitation in the digital economy has been less noticed in prior studies. Most previous studies fail to discuss Vietnam's performance in digital trade facilitation by specific indicators, neglect comparing Vietnam's digital trade facilitation with the country's overall trade facilitation, and ignore describing Vietnam's digital trade facilitation in the context of ASEAN's implementation. In addition, to the knowledge of this study, there are virtually no studies conducted to quantify the impact of digital trade facilitation on Vietnam's trade flows. The contributions and value of this paper are to develop a framework consisting of 34 indicators to analyze trade facilitation in the digital economy, and based on this framework, to assess Vietnam's implementation in comparison with that of other ASEAN countries. The detailed analysis and comparison of Vietnam's implementation by 34 indicators are also provided in the paper. Additionally, by adopting a gravity model, the paper leads the estimation of the effect of digital trade facilitation on Vietnam's exports to ASEAN countries. Combining the analysis of Vietnam's implementation and estimation results, the paper proposes policy implications for Vietnam to promote digital trade facilitation, focusing on two aspects: Information Availability and Formalities - Automation.

The paper reviews the concept of the digital economy and trade facilitation in Section 2, and describes methodology in Section 3. Section 4 presents and assesses how Vietnam has performed trade facilitation in the digital economy, and estimates its impacts on Vietnam's exports to ASEAN before proposing some implications in Section 5.

II. Theoretical Framework

1. Concept of the Digital Economy

The digital economy concept has evolved with various perspectives since it was first initiated in the late 1990s. Kling and Lamp (1999) defined the digital economy as the use of information to interact and communicate in a globalized and high-tech economy. According to UNCTAD (2017), the digital economy is the result of the development and adoption of new technologies and innovations, including advanced robotics, Artificial Intelligence, the Internet of Things, cloud computing, big data analysis, three-dimensional printing, and electronic payments. In Vietnam, the digital economy is understood as economic activities conducted based on a digital platform, and new business models are developed using digital technology and data (Ministry of Science and Technology of Vietnam, 2019).

As stated by Alina (2016), the digital economy is made up of infrastructure, supporting infrastructure, Internet application, economic activities, business mediation activities, and e-commerce. In a study by Bukht and Heeks (2017), the digital economy was explained in different scopes. In a narrow understanding, this includes the information and communication technology (ICT) sector. In a broader scope, it expands to include various digital services and platform economy services, such as Facebook and Google. In the broadest scope, it encompasses traditional industries whose activities are performed using digital technologies. The World Bank (2020) proposed a relatively comprehensive definition, by which the digital economy is made up of five main pillars, including digital infrastructure, digital platforms, digital financial services, digital entrepreneurship, and digital skills. The first pillar of digital infrastructure refers to the coverage of the Internet, the percentage of social network users, and the average Internet connection speed. The second pillar is digital platforms such as E-commerce platforms, social networking platforms, and ride-hailing platforms.

Digital financial services related to payments, money transfers, lending, insurance, and investment services with information technology applications is the third pillar. The fourth pillar is digital startups, which refers to the development of the startup ecosystem and the state's interest, investment, and support in science, technology, engineering, and mathematics. In the final pillar, digital skills are understood as the application of software and Information Technology (IT) systems as part of the working process.

In light of the above definitions, the digital economy in the paper is understood as an economic system using digital information and knowledge as key factors of production, Internet and information networks as operating spaces, and telecommunications and information technology as instruments to improve labor productivity and optimize economic activities.

2. Trade Facilitation in the Digital Economy

There is no standard definition of trade facilitation. In a narrow sense, trade facilitation merely deals with the logistics of moving goods across ports or border customs. According to the World Trade Organization (WTO) (2015), trade facilitation is understood as the simplification and harmonization of international trade procedures, including activities, practices, and procedures related to the collection, presentation, communication, and processing of data and other information necessary for the movement of goods in international trade. Under this WTO definition, trade facilitation is mainly related to border administrative procedures that are also the focus of trade negotiations in the WTO and various regional trade agreements. Therefore, the WTO (2015) defined trade facilitation in a relatively narrow sense. In a similar vein, Woo and Wilson (2000) defined trade facilitation as streamlining regulatory environments, deepening the harmonization of standards, and conforming to international regulations.

The definitions used by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) and the Organization for Economic Co-operation and Development (OECD) reflect a broader approach wherein trade facilitation is defined as international trade procedures, and information and payments flow along the entire supply chain. As stated by UN/CEFACT, trade facilitation includes several measures behind-the-border, such as product standards and conformity assessment measures, business facilitation, e-commerce, trade finance, and logistics. This definition shifts the focus of trade facilitation from at-the-border efforts to behind-the-border domestic policies and institutional structures. According to the OECD, trade facilitation is referred to as policies and measures aimed at easing trade costs by improving efficiency at each stage of the international trade chain (ADB & ESCAP, 2013).

Based on a past literature review on the concept of the digital economy and trade facilitation, this paper argues that trade facilitation in the digital economy can be understood as the application of digital technology, digital information and knowledge, and ITC to simplify, modernize, and harmonize trade procedures to reduce trade costs and time along the entire international trade chain.

III. Methodology and Data

1. Framework for the Assessment of Trade Facilitation in the Digital Economy

The paper adopted a framework proposed by the World Bank (2020) to analyze Vietnam's digital economy based on five main pillars: (i) digital infrastructure, (ii) digital platforms, (iii) digital financial services, (iv) digital entrepreneurship, and (v) digital skills. These five main pillars provide the background to identify the motivation and ability of Vietnam's implementation of digital trade facilitation.

The OECD (2013, 2015, 2018) has developed a set of trade facilitation indicators comprising 11 groups of indicators from (a) to (k) with 155

indicators (Table 1). Based on this set, the paper selected indicators directly reflecting the application of digital technology, digital information and knowledge, and ICT to simplify, modernize, and harmonize trade procedures. These selected indicators constitute a framework for assessing trade facilitation in the digital economy, which were then used to analyze the case of Vietnam. The value of each indicator is scored with 0, 1, or 2, of which 0 corresponds to not implemented, and 2 corresponds to the best performance.

Table 1. OECD Trade Facilitation Groups of Indicators

Groups of Indicators	Number of Indicators	Description
(a) Information Availability	21	Enquiry points; publication of trade information
(b) Involvement of the Trade Community	8	Structures for consultations; established guidelines for consultations; publications of drafts; existence of notice-and-comment framework
(c) Advance Rulings	11	Prior statements by the administration to requesting traders concerning the classification, origin, and valuation method applied to specific goods at the time of import; the rules and process applied to such statements
(d) Appeal Procedures	13	The possibility and modalities to appeal administrative decisions by border agencies
(e) Fees and Charges	14	Disciplines on the fees and charges imposed on imports and exports; penalties
(f) Formalities - Documents	9	Acceptance of copies, simplification of trade documents; harmonization in accordance with international standards
(g) Formalities - Automation	13	Electronic exchange of data; use of automated risk management; automated border procedures; electronic payments
(h) Formalities - Procedures	35	Streamlining of border controls; single submission points for all required documentation; post-clearance audits; authorized operators
(i) Internal Cooperation	11	Control delegation to Customs authorities; cooperation between various border agencies of the country
(j) External Cooperation	11	Cooperation with neighboring and other countries
(k) Governance and Impartiality	9	Customs structures and functions; accountability; ethics policy

Source: OECD (2015).

Specifically, two out of the 11 groups of indicators, including "Information Availability" (IA) and "Formalities - Automation" (FA), were selected as they are most directly related to digitization of trade facilitation activities (Table 2). The former consists of 21 indicators ranging from IA1 to IA21, focusing on the digitization of trade information, publication, and updating of trade-related information such as laws, regulations, and procedures on websites, and the establishment of digital Q&A enquiry points toward improving the transparency of the policy making process and access to trade information. The latter, which is made up of 14 indicators from FA1 to FA14, refers to digitalizing trade procedures and processes, such as customs clearance, automatic customs declaration, digital signatures, digital payment procedures, and telecommunications and IT quality.

Table 2. Framework for Assessing Trade Facilitation in the Digital Economy

Groups of Indicators	Indicator
Information Availability (IA)	IA1. Establishment of a national customs website
	IA2. Possibility to provide online feedback to customs
	IA3. Publication of rate of duties
	IA4. Establishment of enquiry points
	IA5. Adjustment of enquiry point operating hours to commercial needs
	IA6. Timeliness of enquiry points
	IA7. Information on import and export procedures
	IA8. Required documentation easily accessible for download
	IA9. Information about procedures published in advance of entry into force
	IA10. Average time between publication end entry into force
	IA11. Publication of agreements with any country or countries relating to the above issues
	IA12. Publication of information on procedural rules for appeal
	IA13. Publication of decisions and examples of customs classification
	IA14. Publication of necessary information on advance rulings
	IA15. Penalty provisions for breaches of import and export formalities published
	IA16. Applicable legislation published on Internet
	IA17. Publication of judicial decisions on customs matters
	IA18. Dedicated interactive page for professional users/companies
	IA19. User manuals available online
	IA20. Quality/User friendliness of the research/help function of the customs website
	IA21. Transparency of government policymaking
Formalities Automation (FA)	FA1. Percent of import declarations cleared electronically
	FA2. Percent of export declarations cleared electronically
	FA3. Percent of import and export procedures that allow for electronic processing
	FA4. Pre-arrival processing supported by possibility to lodge documents in advance in electronic format
	FA5. Import and export procedures allow for the electronic payment of duties, taxes, fees, and charges collected upon importation and exportation
	FA6. Electronic payment system integrated with automated declaration/cargo processing systems
	FA7. Risk management applied and operating in an automated environment
	FA8. Single window supported by information technology
	FA9. IT systems capable of accepting and exchanging data electronically
	FA10. Automated processing system include functions allowing the release of goods subject to conditions
	FA11. Digital certificates and signatures in place
	FA12. Automated processing for customs declarations available full-time (24/7)
	FA13. Quality of telecommunications and IT

Source: OECD (2015).

Overall, the studied framework includes two groups of indicators, namely IA and FA, with 34 indicators to analyze and evaluate Vietnam's performance of trade facilitation measures in the digital economy. Data for each indicator were taken from the OECD Trade Facilitation Database for two years: 2017 and 2019. These indicators put an emphasis on the digitization, automation, and application of information technology in trade procedures and processes. The paper also compared Vietnam's performance with other ASEAN nation performance. Based on the assessment of Vietnam's digital trade facilitation implementation, the paper provided some policy implications for Vietnam's government to further promote the process of trade facilitation in the digital economy.

2. Assessing the Impact of Digital Trade Facilitation on Vietnam's Exports to ASEAN: Gravity Model Approach

The paper used a gravity model to assess the impact of trade facilitation in the digital economy on Vietnam's exports to ASEAN countries. This model was first developed by Tinbergen (1962) and Pöyhönen (1963), based on Newton's law of gravity, to measure factors affecting bilateral trade. Initially, the basic gravity model explains bilateral trade based on the size of the two economies and the distance between. Later, many scholars applied and continued to develop this model by adding more variables, such as Bhattacharya and Bhattacharyay (2007), Cassing et al. (2010), Cui and Dao (2019), Cui and Do (2019), Kalirajan (1999, 2000), Mai and Ngoc (2019), Moinuddin (2013), Srinivasan and Canonero (1993), Urata and Okabe (2010), Vu (2018), and Vu and Tang (2022). Generally, variables such as GNP, GDP, and population are used to represent the size of economies. The commonly used variables for trade barriers or stimulators include tariff, non-tariff measures, distance, transportation costs, exchange rate, and dummy variables related to language, border, culture, historical relationship, and FTAs.

Based on empirical studies and research

objectives, in addition to traditional variables such as GDP and distance, the paper added other variables that represent trade facilitation in the digital economy to estimate the impact of the facilitation measures on Vietnam's exports to ASEAN countries.

$$Ln\ EX_{ijt} = \alpha_0 + \alpha 1 Ln\ GDP_{it} + \alpha_2 Ln\ GDP_{jt} + \\ \alpha_3 Ln\ D_{ij} + \alpha_4 Ln\ FA_{it} + \alpha_5 Ln\ FA_{jt} + \\ \alpha_6 Ln\ IA_{it} + \alpha_7 Ln\ IA_{jt} + \alpha_8 Ln\ TF_{it} + \\ \alpha_9 Ln\ TF_{jt} + \varepsilon_{ij}$$

In which:
i: Vietnam
j: ASEAN nations
EX_{ijt}: Export turnover of country i to country j in year t
GDP_{it}, GDP_{jt}: Gross domestic product of country i and country j at year t
D_{it}: Distance between capitals of two countries i and j
FA_{it}, FA_{jt}: Formalities - Automation (FA) indicator of country i and country j in year t
IA_{it}, IA_{jt}: Information Availability (IA) indicator of country i and country j in year t
TF_{it}, TF_{jt}: Average Trade Facilitation index of country i and country j in year t

The size of the economy expressed in terms of GDP, GNP, or population is correlated with trade. The larger the size of the economy, the larger the volume of expected goods to be exchanged (Krugman et al., 2022). At the same time, numerous experimental studies such as Anderson et al. (1993), Anderson and Wincoop (2003), Bhattacharya and Bhattacharyay (2007), and Vu and Tang (2022) also showed that the size of the economy is directly proportional to trade. Therefore, coefficients α_1 and α_2 are expected to have a positive sign.

On the other hand, distance variable D_{ij} represents a factor that creates barriers to trade. The greater the distance, the higher the trade cost. This result is shown in many studies, such as Baldwin (1993), Cui and Dao (2019), Nguyen (2011), and Vu and Tang (2022). Therefore,

distance variable D_{ij} is expected to be negatively correlated with export turnover.

FA_{it} and FA_{jt} represent the Formalities - Automation indicator, IA_{it} and IA_{jt} refer to the Information Availability indicator, and FA_{it} and FA_{jt} show the Average Trade Facilitation indicator. The FA_{it}, FA_{jt}, IA_{it}, and IA_{jt} variables are calculated as the simple average value of all indicators in the group. TF_{it} and TF_{jt} are the simple average of the other nine groups of indicators, except for (a) and (g), in Table 1. The value of each indicator ranges from 0 to 2, of which 2 corresponds to the best performance. As the objective of trade facilitation is to promote trade, all variables are expected to be positively correlated with the dependent variable. This positive relationship is also supported in Mai and Ngoc (2019), Wilson et al. (2003), and Yadav (2014).

In summary, this paper adopted the 5-pillar framework of the digital economy proposed by the World Bank (2020) to identify the motivation and ability of Vietnam's implementation of digital trade facilitation. After, by combining the developed framework and the gravity model, the paper assessed Vietnam's performance of trade facilitation measures in the digital economy as compared with those of nine other countries in ASEAN, and estimated the impact of digital trade facilitation on Vietnam's exports to ASEAN. Based on the above analysis and assessment, the paper provided policy implications for Vietnam's government to further promote the process of trade facilitation in the digital economy.

3. Data

The data to analyze Vietnam's development of the digital economy were collected for the period from 2016 to 2020 from multiple sources, mainly from the World Bank's World Development Indicators database and We Are Social's Digital Reports.

Table 3. Summary of Variables and Data Sources of the Gravity Model

Variable Code	Explanation	Expected Sign	Data Source
EXijt	Country i's export turnover with country j		Trade Map (Unit: Million dollars)
GDPit	Gross domestic product of country i in year t	+	WB Development Indicators (Unit: Million dollars)
GDPjt	Gross domestic product of country j in year t	+	WB Development Indicators (Unit: Million dollars)
Dij	Distance between country i and country j	-	CEPII database (Unit: Km)
FAit	Formalities - Automation indicator of country i in year t	+	OECD Trade Facilitation Indicators
FAjt	Formalities - Automation indicator of country j in year t	+	
IAit	Information Availability indicator of country i in year t	+	
IAjt	Information Availability indicator of country j in year t	+	OECD Trade Facilitation Indicators
TFit	Average Trade Facilitation Index of country i in year t	+	
TFjt	Average Trade Facilitation Index of country j in year t	+	

Note: i, Vietnam; j, ASEAN.
Source: Author's compilation.

To estimate the impact of digital trade facilitation on Vietnam's trade flows, the paper constructed panel data of Vietnam with nine ASEAN countries for 99 groups of products classified by the World Customs Organization in the Harmonized System (HS), from HS 01 to HS 99, in the two years of 2017 and 2019. Data on Vietnam's export turnover to nine ASEAN countries were collected from the Trade Map database of the International Trade Center, and GDP Fig. s were extracted from the World Development Indicators database of the World Bank. The distance data between Vietnam and ASEAN countries were taken from database of the Centre d'Études Prospectives et d'Informations Internationales (CEPII), and calculated based on the distance between the capitals of the two countries. The values of FA, IA, and other trade facilitation indicators were derived from the OECD Trade Facilitation database (Table 3 and Table A). Stata 14 software was used to estimate the impact of digital trade facilitation on Vietnam's exports to ASEAN.

IV. Results and Discussion

1. The Development of the Digital Economy in Vietnam

Digital infrastructure in Vietnam has grown strongly in both quantity and quality. In the period from 2016 to 2020, the coverage of 3G and 4G networks and the mobile subscription rate were at high levels (Table 4). Mobile broadband connections, smartphone penetration, and the speed of fixed Internet connections have significantly increased. However, social network penetration rate attained only 67%, and the average speed of fixed Internet connections was not high at only 43.26 MBPS in 2020, ranking 60th out of 174 countries. Another challenge for Vietnam was the inequitable development of digital infrastructure between regions, as digital infrastructure is underdeveloped in remote and rural areas (Nguyen, 2020).

Table 4. Vietnam's Digital Infrastructure Development from 2016 to 2020

Digital Infrastructure Indicators	2016	2017	2018	2019	2020
At Least 3G Coverage (percent of population)	77	90	91	95	95
Mobile Broadband Penetration (percent of population)	39	47	64	76	70
Internet users (million)	47.3	50.05	64	64	68.17
Average Speed of Fixed Internet Connection (MBPS)		6.27	24.77	27.18	43.26
Mobile Subscription (percent of total population)	152	131	153	148	150
Smartphone Penetration Rate (percent of adult population)	55	72	72	72	93
Social Media Penetration (percent of total population)	37	48	57	64	67

Source: We Are Social (2016, 2017, 2018, 2019, 2020) and World Bank (2022).

Digital platforms in Vietnam are strongly growing, and are characterized by high competition. The most common business-to-consumer (B2C) and business-to-business (B2B) e-commerce platforms in Vietnam now are Shopee, Tiki, Lazada, and Sendo. Up through 2020, fashion and beauty products were the main commodities traded on the e-commerce platforms, followed by electronics, furniture, home appliances, food, toys, and video games. For social platforms, Facebook was used most in Vietnam, followed by YouTube and Zalo (Nguyen, 2020). The key problem in this pillar is limited access to digital e-commerce platforms in remote areas, and the uptake of digital platforms focused on simpler business functions, such as business administration and payment (We

are social, 2020; World Bank, 2021).

Vietnam has great potential to develop digital financial services due to the strong growth of online shopping and increasing application of new technology in banking services. The State Bank of Vietnam has established a Fintech Steering Committee, thereby helping the size of Vietnam's fintech startups triple in the period from 2017 to 2020 with the most substantial growth recorded in peer-to-peer (P2P) lending and blockchain space. The revenue from digital financial services is projected to increase from USD $0.5 billion in 2019 to USD $3.8 billion in 2025, with an average growth rate of 38% per year. However, Vietnam has been faced with various challenges in developing digital financial services. From 2016 to 2020, the proportion of the adult population with a bank account in Vietnam was the lowest in Southeast Asia, and the percentage of cash transactions in the country was high at 70% (Table 5). The number of bank branches and Automated Teller Machines (ATMs) is limited, and ATMs and point-of-sale (POS) terminals are mainly concentrated in urban areas. Despite significant development, Vietnam's fintech sector is still in an infant stage compared to neighboring countries. Another limitation is that the Vietnamese still have low knowledge of digital financial services, leading to low accessibility (Nguyen, 2020).

Table 5. Vietnam's Digital Financial Services Development from 2016 to 2020

Digital Financial Services Indicators	2016	2017	2018	2019	2020
Bank Account Penetration (percent of population over 15)			31.0	31.0	30.0
Credit Card Penetration (percent of population over 15)			2.0	4.1	4.1
Mobile Money Account Penetration (percent of population over 15)			0.5	3.5	3.5
Commercial Bank Branches per 100,000 Adults		3.5	3.9	3.9	
ATMs per 100,000 Adults	24.2	24.6	25.3	25.9	
Product or Service Online Purchase Penetration (percent of Internet users)	37.0	39.0	47.0	77.0	75.0

Source: We Are Social (2016, 2017, 2018, 2019, 2020) and World Bank (2022).

The digital entrepreneurship ecosystem in Vietnam is nascent but dynamic. Vietnam has made significant investments in science, technology, engineering, math, digital education, and entrepreneurship. A wide range of funds and agencies to support digital entrepreneurship have been set up, including the National Technology Innovation Fund, the National Agency for Technology Development, Entrepreneurship and Commercialization Development, and Vietnam Silicon Valley. So far, Vietnam owns the third most active startup ecosystem in ASEAN after Singapore and Indonesia (Bao Linh, 2022). However, Vietnam falls short in protecting privacy, and is less capable of protecting firms against unfair competition from dominant players in the market (World Bank, 2021).

Vietnam has faced a shortage of labor equipped with necessary digital skills. A large number of businesses have not regularly used ICT software and systems as an integral part of working processes. Only 40% of businesses have adequate ICT skills to maintain and fully use their digital systems. In 2020, Vietnam was estimated to lack 500,000 data scientists, and the skill shortage is projected to reach 1 million ICT workers by 2023 (World Bank, 2021).

An analysis of the five main pillars of the digital economy in Vietnam shows that there is uneven development between the pillars. The first

two pillars have shown significant growth, while the latter three have faced significant limitations. The strong development of digital structure and platforms has created a fundamental background for Vietnam to electronically facilitate trade, but weakness in digital skills, the entrepreneurship ecosystem, and financial services have challenged the further implementation of trade facilitation.

2. Vietnam's Implementation of Trade Facilitation in the Digital Economy

Along with the process of digitizing the economy, Vietnam has conducted a wide variety of trade facilitation measures. Among 11 groups of trade facilitation indicators, Vietnam performed best in Advanced Rulings for both years with 1.875 points in 2017, and 2 points in 2019, whereas External Border Agency Co-operation achieved the lowest scores in these 2 years (Fig. 1). The ranks of the two groups of digital indicators were at a moderate level, in which Information Availability (IA) was 5th, and Formalities - Automation (FA) were in 8th.

There was moderate improvement in the overall performance of trade facilitation from 1.36 points in 2017 to 1.49 points in 2019 (Fig. 1). The Formalities - Documents group achieved the biggest improvement by 0.5140 points, followed by Appeal Procedure, Fees, and Charges, and Involvement of the Trade Community. On the contrary, the two groups of factors directly related to digital trade facilitation, including Formalities - Automation (FA) and Information Availability (IA), received the lowest improvement. There was no change in the score of Formalities - Automation (FA), and performance worsened for Information Availability (IA) from 2017 to 2019.

Fig. 1. Vietnam's Trade Facilitation Implementation in 2017 and 2019
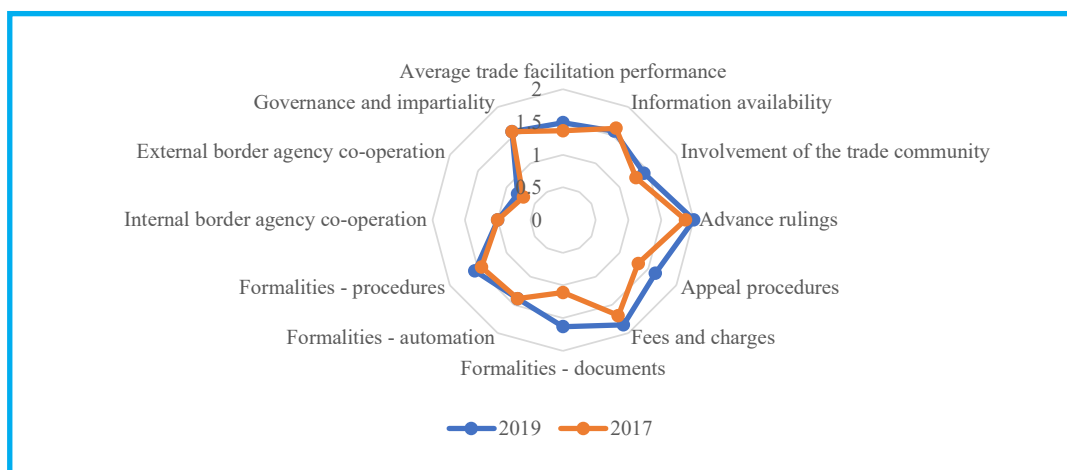
Source: OECD (2022).

More specifically, there was a decrease in Information Availability (IA) from 1.62 points in 2017 to 1.57 points in 2019 (Fig. 2). This decrease was attributed to the drop in the performance of IA9 (information about procedures published in advance of entry into force) from 2 points in 2017 to 1 point in 2019. In 2019, there was an interval between the publication of some new or amended trade related laws and regulations, and their entry into force (Global Express Association, 2020), while there was no interval in 2017. In addition, Vietnam has not conducted three indicators,

namely IA5 (adjustment of enquiry point operating hours to commercial needs), IA17 (publication of judicial decisions on customs matters), and IA18 (dedicated interactive page for professional users), with scores of 0 in both years. In fact, the operating

hours of the enquiry points were not adaptable to commercial needs, and it was hard to receive answers for enquires submitted online. Further, no judicial decision on customs matters was published, and interactive pages to provide specific

Fig. 2. Vietnam's Performance in the Information Availability Indicator in 2017 and 2019
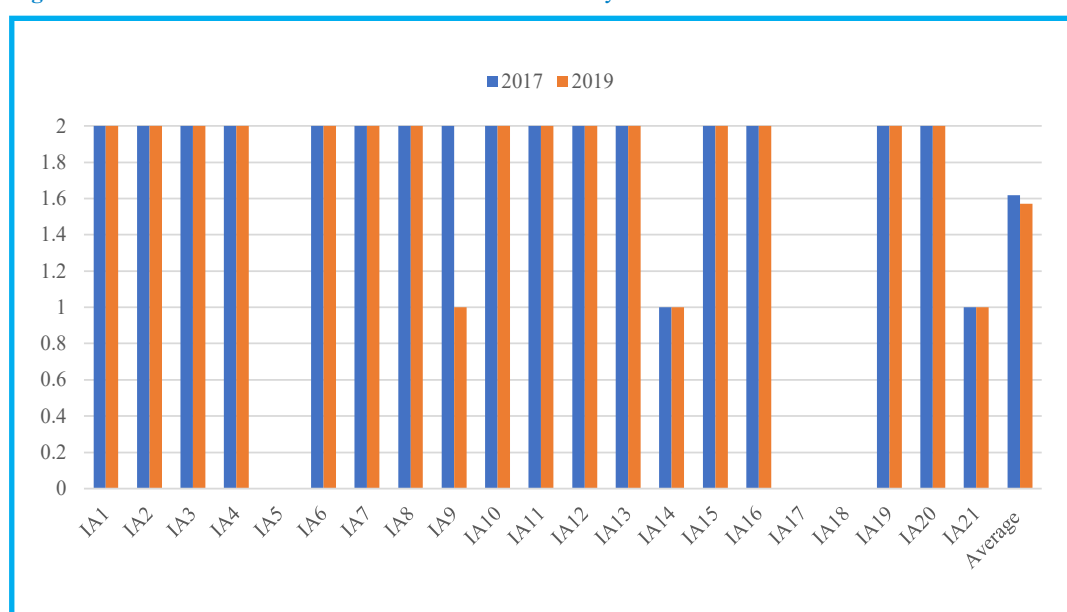
Note: See Table 2 for the code of each indicator.
Source: OECD (2022).

information and tools for electronic interface and downloadable forms were not provided.

Over the period of 2017 to 2019, there was no change in the performance index of Formality - Automation (FA), whose average score stayed at 1.385, indicating that Vietnam's efforts in promoting electronic exchange of data and automated border procedures were not enough (Fig. 3). Scores of 0 were recorded for FA10 (automated processing system includes functions allowing for the release of goods subject to conditions) and FA13 (quality of telecommunications and IT). In Vietnam, the release of goods subject to conditions has not yet been separated from the final determination and payment of customs duties,

taxes, fees and charges, which cannot be operated in the automated declaration processing. In addition, Vietnam's quality of telecommunication and IT was assessed as low quality. The IT infrastructure of many customs departments was not adequate to operate electronic public customs services, especially those in remote and rural areas. The Internet connection was unstable, resulting in the slow exchange of information. On the contrary, Vietnam performed well in many indicators, such as implementing electronic declarations of traded goods (FA2, FA3, and FA12), risk management in automated environment (FA7), single window (FA8), and electronic data exchange (FA9).

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Fig. 3. Vietnam's Performance in the Formalities - Automation Indicator in 2017 and 2019
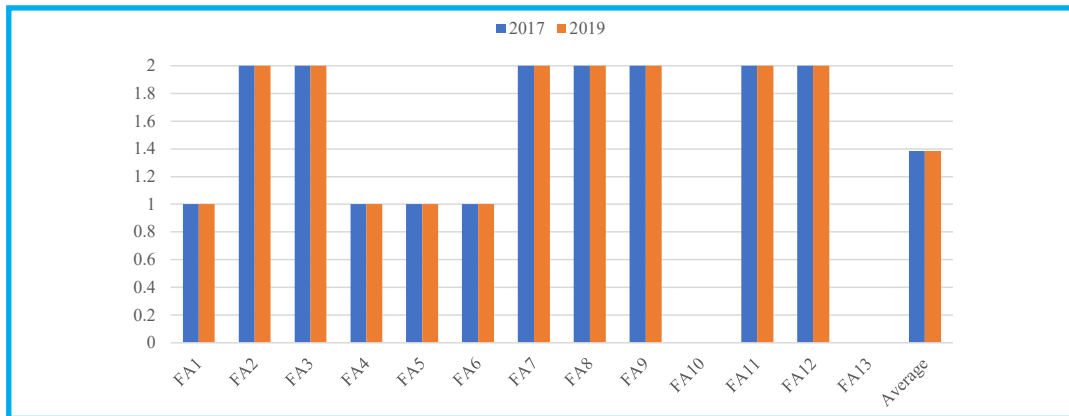
Note: See Table 2 for the code of each indicator.
Source: OECD (2022).

3. Comparison of Vietnam's and Other ASEAN Nations' Implementation of Trade Facilitation in the Digital Economy

Fig. 4 and 5 show Vietnam's level of trade facilitation implementation in comparison with other ASEAN countries' implementations in 2017 and 2019. Overall, Vietnam performed well in facilitating trade with average scores higher than those of ASEAN countries, and ranked 2nd in the region after Singapore (Fig. 5). Vietnam also performed better than the average of ASEAN in digital trade facilitation. In 2019, Vietnam achieved 1.57 points in Information Availability (IA), as compared to the ASEAN countries' average level of 1.33 points. The corresponding Fig. s for Formalities - Automation (FA) were 1.39 points and 1.16 points. In this year, Vietnam ranked 2nd and 4th in the implementation of IA and FA in ASEAN, respectively.

Fig. 4. ASEAN's Trade Facilitation Implementation in 2017
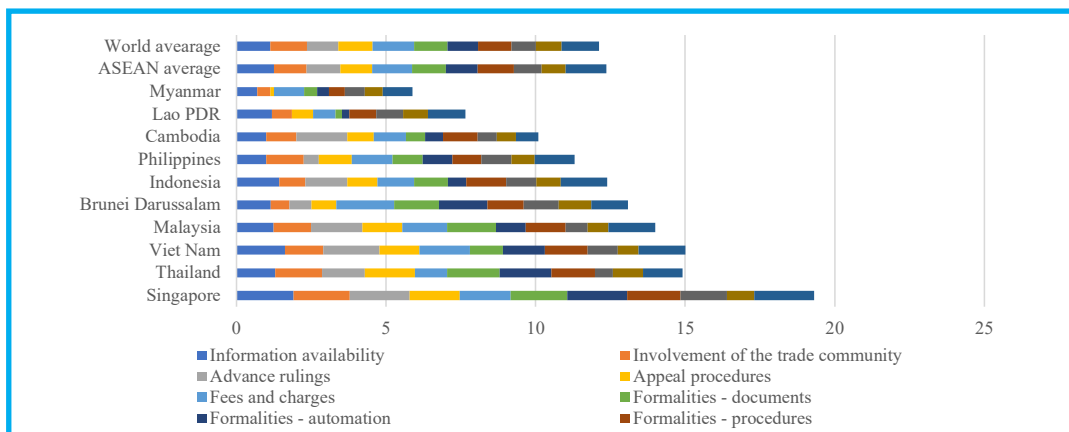

Source: OECD (2022).

Fig. 5. ASEAN Trade Facilitation Implementation in 2019
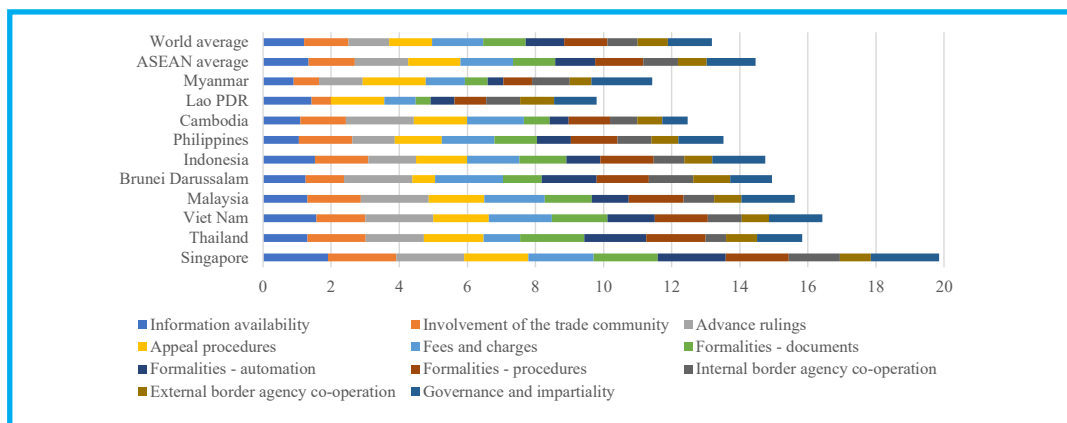
Source: OECD (2022).

Table 6. A Comparison of Information Availability Implementation Scores among the Top 5 ASEAN Countries in 2017 and 2019

Indicator	Vietnam		Thailand		Singapore		Indonesia		Malaysia	
	2017	2019	2017	2019	2017	2019	2017	2019	2017	2019
IA1	2	2	2	2	2	2	2	2	2	2
IA2	2	2	2	2	2	2	2	2	2	2
IA3	2	2	2	2	2	2	2	2	2	2
IA4	2	2	2	2	2	2	2	2	2	2
IA5	0	0	0	0	2	2	2	2	0	0
IA6	2	2	0	0	2	2	2	2	0	0
IA7	2	2	2	2	2	2	2	2	1	1
IA8	2	2	2	2	2	2	2	2	2	2
IA9	2	1	2	2	2	2	1	1	2	2
IA10	2	2	-	-	0	0	2	2	-	-
IA11	2	2	1	1	2	2	1	1	0	1
IA12	2	2	2	2	2	2	1	1	2	2
IA13	2	2	2	2	2	2	2	2	2	2
IA14	1	1	1	1	2	2	0	0	0	0
IA15	2	2	0	0	2	2	2	2	1	1
IA16	2	2	1	1	2	2	1	1	1	1
IA17	0	0	0	0	2	2	0	0	0	0
IA18	0	0	0	0	2	2	0	0	0	0
IA19	2	2	2	2	2	2	2	2	2	2
IA20	2	2	2	2	2	2	1	2	2	2
IA21	1	1	1	1	2	2	1	2	2	2
Average IA	1.62	1.57	1.30	1.30	1.91	1.91	1.43	1.52	1.25	1.30
Average TF	1.36	1.49	1.38	1.44	1.75	1.80	1.13	1.34	1.27	1.42

Source: OECD (2022).

Despite the encouraging performance, a closer analysis showed that Vietnam's implementation of digital trade facilitation tended to improve slower than other ASEAN nations' digital facilitation implementation, as well as the country's overall implementation of trade facilitation. Within Vietnam, the country's performance in IA was better, while the implementation of FA was worse than its overall implementation of trade facilitation in 2019 (Tables 6 and 7).

For IA, Vietnam attained scores of 1.62 in 2017, and 1.57 in 2019 (Table 5). This is the only group of indicators in which Vietnam faced a reduction in implementation scores over the period of 2017 to 2019. Vietnam was behind only Singapore in this group in both years, but the gap between the two countries increased from 0.29 to 0.34 (Table 5). Meanwhile, the gap between Vietnam and the other nine ASEAN countries, on average, reduced from 0.36 in 2017 to 0.24 in 2019. In short, the implementation gap between Vietnam and the best performing country in ASEAN increased, and the gap between Vietnam and other ASEAN countries decreased.

Like most other ASEAN countries with 0 points in both years, Vietnam performed worst in IA5 (adjustment of enquiry point operating hours to commercial needs), IA17 (publication of judicial decisions on customs matters), and IA18 (dedicated interactive page for professional users/companies). Vietnam achieved 1 point in IA 14 (publication of necessary information on advance rulings) and IA21 (transparency of government policymaking) (Table 6).

For FA, Vietnam had no improvement as its score remained the same at 1.38 over the period from 2017 to 2019 (Table 7). As a consequence, in 2019, Vietnam's implementation score of FA was lower than its average trade facilitation implementation score of 1.49. Among ASEAN countries, Vietnam was in 4th after Singapore, Thailand, and Brunei in both 2017 and 2019 for FA performance (Table 6). Even though the implementation gap between Vietnam and Singapore stayed the same at a high level of 0.61 points in both years, the other ASEAN countries closed the gap with Vietnam as it shrank from 0.33 in 2017 to 0.23 in 2019.

Table 7. A Comparison of Formalities: Automation Implementation Scores among the top 5 ASEAN Countries in 2017 and 2019

Indicator	Vietnam		Thailand		Brunei		Singapore		Malaysia	
	2017	2019	2017	2019	2017	2019	2017	2019	2017	2019
FA1	1	1	1	1	2	2	2	2	0	0
FA2	2	2	2	-	2	2	2	2	-	-
FA3	2	2	-	-	2	2	2	2	-	-
FA4	1	1	2	1	1	1	2	2	1	1
FA5	1	1	1	2	2	2	2	2	1	1
FA6	1	1	1	2	1	1	2	2	1	2
FA7	2	2	2	2	1	1	2	2	1	1
FA8	2	2	2	2	2	2	2	2	2	2
FA9	2	2	2	2	2	2	2	2	1	1
FA10	0	0	2	2	2	2	2	2	0	0
FA11	2	2	2	2	2	2	2	2	2	2
FA12	2	2	2	2	0	0	2	2	2	2
FA13	0	0	2	2	2	2	2	2	0	0
Average FA	1.39	1.39	1.75	1.82	1.62	1.62	2.00	2.00	1.00	1.09
Average TF	1.36	1.49	1.38	1.44	1.75	1.80	1.13	1.34	1.27	1.42

Source: OECD (2022).

In 2019, Vietnam's performance was worse than Singapore, Thailand, and Brunei in FA5 (import and export procedures allow for the electronic payment of duties, taxes, fees and charges), FA10 (automated processing system include functions allowing for the release of goods subject to conditions) and FA13 (quality of telecommunications and IT) (Table 4). In Vietnam, businesses cannot pay duties and taxes together electronically with import and export procedures, and the electronic payment system is in the process of being integrated with the automatic goods declaration/handling system. The quality of telecommunications and IT in Vietnam also fell behind Singapore, Thailand, and Brunei. These weaknesses raise the need for Vietnam to streamline the customs and payment process into a national Single Window to facilitate businesses and improve IT infrastructure and service quality.

4. Impact of Trade Facilitation in the Digital Economy on Vietnam's Exports to ASEAN

The correlation between the independent variables was checked to detect any multicollinearity problem. The results showed that independent variables have low correlation, with correlation coefficients ranging from 0 to 0.6 (Table B). After conducting the Breusch - Pagan Lagrange Multiplier test and the Breusch-Pagan-Godfrey Test, the results show that the Random Effects Model (REM) is suitable, but there is a heteroscedasticity problem. Therefore, the model was re-estimated using REM with robust standard errors. Estimation results after resolving the defect show that all coefficients have expected values, and the model is useful and explains more than 70% of the changes in Vietnam's exports to ASEAN countries (Table 8).

Table 8. Estimation Results

Variables	Coefficient	t-stat	p-value
C	3.54230	6.34	0.047***
$lnGDP_{it}$	0,52060	0.85	0.290
$lnGDP_{jt}$	0.92790	4.72	0.000***
lnD_{ij}	-1.40790	-2.11	0.049**
$lnFA_{it}$	0.865032	0.54	0.342
$lnFA_{jt}$	0.962309	-1.27	0.229
$lnIA_{it}$	1.29659	2.05	0.042**
$lnIA_{jt}$	1.01345	3.61	0.023**
$lnTF_{it}$	2.67329	3.25	0.002***
$lnTF_{jt}$	2.13829	2.32	0.047***
R-squared	0.70440	F-stat	203.676
Adjusted R-square	0.68120		

Note: ***, **, * are statistically significant at the 1%, 5%, and 10% levels, respectively.
Source: Eviews results.

The estimated coefficient of GDP_{it} and $GDP_{jt,}$ representing the economic sizes of Vietnam and other ASEAN countries, are positive, but only the coefficient of GDP_{jt} is statistically significant. This estimated result implies that when the GDPs of ASEAN countries increase by 1%, Vietnam's

exports to ASEAN countries increase less than proportionately by 0.923%.

Distance *(D_{ij})* negatively affects Vietnam's exports with an estimated coefficient of -1.4079. This indicates that an increase in the distance between Vietnam and other ASEAN countries by 1% will result in a reduction of Vietnam's exports more than proportionately by 1.41%.

The ccoefficients of both Information Availability (IA_{it} and IA_{jt}) and Trade Facilitation (TF_{it} and TFA_{jt}) for Vietnam and other ASEAN nations are statistically significant, positive, and consistent with expectation. The magnitudes of all coefficients are more than proportionate implying that trade facilitation in general, and digital trade facilitation through publishing information electronically, in particular have contributed considerably to promoting Vietnam's exports to ASEAN countries. An increase of Information Availability of Vietnam and ASEAN partners by 1% will result in a 1.29% and 1.01% increase in Vietnam's exports, respectively. These results indicate the important role of publishing information online to increase trade flows. However, the improvement in Information Availability expands Vietnam's exports to a lesser degree than improvement in other trade facilitation measures. If Vietnam's and other ASEAN countries' overall trade facilitation increases by 1%, then Vietnam's exports will grow strongly by more than 2%.

On the contrary, the coefficient for Formalities - Automation (FA_{it} and FA_{jt}) of both Vietnam and ASEAN countries are insignificant, suggesting that there is not enough statistical evidence to conclude an impact of digital trade facilitation through the implementation of the electronic exchange of data, use of automated risk management, border procedures, and electronic payments on Vietnam's exports. This result reveal that the effort of ASEAN in general and Vietnam in particular in implementing Formalities - Automation is not sufficient, and therefore more attention to such an effort must be given in the future when digital transformation is increasingly expanded at the global scale.

V. Conclusions and Implications

Vietnam has made great efforts to conduct digital transformation in multi-faceted dimensions, from developing digital infrastructure, platforms, and financial services to enhancing digital entrepreneurship ecosystem and skills. While Vietnam has implemented the first two pillars relatively well, weak performances in the latter three pillars have challenged the promotion of digital trade facilitation.

By adopting a framework consisting of 34 indicators extracted from the OECD Trade Facilitation database, the paper notes that Vietnam has implemented different digital trade facilitation measures focusing on improving the availability of electronic information and digitalizing trade procedures and processes. Generally, Vietnam performed a little bit better than the average ASEAN level in digital trade facilitation. However, its implementation of digital facilitation was at a relatively low level in comparison with the implementation of other overall trade facilitation measures; in particular, Information Availability (IA) landed 5th and Formalities - Automation (FA) placed 8th among 11 trade facilitation groups. Moreover, the improvement in Vietnam's performance of digital trade facilitation tended to be slower than other ASEAN countries' performances and the country's overall implementation of other trade facilitation. There was no increase in the implementation of FA, and there was a decline in the performance of IA from 2017 to 2019; accordingly, these two groups received the lowest improvement over the two years.

The results of the gravity model show that, beside economic size, distance, and overall trade facilitation measures, the implementation of IA of both Vietnam and other ASEAN countries affects considerably and positively Vietnam's exports to ASEAN. Its exports will increase more than proportionately by 1.29% and 1.01% if the IA level of Vietnam and other ASEAN countries improves by 1%. Meanwhile, the digitalization of trade formalities so far has had no effect on Vietnam's exports to the region.

Based on the above findings, the paper proposes implications for the Vietnamese government to further promote trade facilitation measures in the digital economy, and accordingly, strengthen exports to ASEAN. First, as the performance of FA is low and makes no contribution to increase Vietnam's exports. The Vietnamese government must place priority on enhancing automation in trade-related administrative procedures, especially customs procedures. Vietnam has implemented quite well certain measures, such as conducting a National Single Window (NSW) and connecting to the ASEAN Single Window (ASW). Therefore, it is now important to bring more trade administrative procedures into the NSW, promote the exchange of trade documents through ASW, and integrate the electronic payment system with the automatic goods declaration into the NSW to facilitate such procedures in businesses. In addition, improving IT infrastructure and service quality, and building an IT system to serve the implementation of the NSW and ASW in the direction of integrating different trade-related systems of individual ministries into NSW for better coordination between state agencies in managing trade is vital. Second, as Vietnam's IA index decreased in 2019, the Vietnamese government must improve the electronic publication of trade-related information, enhance the transparency of government policymaking, and increase the quality of enquiry points and interactive pages for companies. These can be done by developing a portal for trade facilitation in both Vietnamese and English to provide systematic and up-to-date information for businesses. In the portal, it is of great importance to promptly publish judicial decisions on customs issues and information on advance rulings, and add a separate interactive information page for users, as well as an electronic enquiry point with a 24/7 switchboard. Thirdly, the Vietnamese government should take into consideration how to improve digital-related knowledge and skills for both governmental officers and businesses, and utilize business associations as a bridge to organize dialogue between the government and businesses about digital trade facilitation. Finally, speeding up the digital transformation in financial services is of great importance to create favorable conditions for businesses in trading activities.

This paper contributes to existing literature by developing a framework to analyze trade facilitation in the digital economy, and adopting this framework to highlight Vietnam's performance in trade facilitation in comparison with that of ASEAN. This paper is among the first to quantify the impact of digital trade facilitation on Vietnam's exports relative to ASEAN countries. However, it still has limitations and can be improved in the future. The paper tries to assess the impact of digital trade facilitation on Vietnam's exports to ASEAN countries using two groups of indicators. Prospective studies can concentrate on separating the impact of individual digital trade facilitation indicators to provide better and more insightful recommendations for Vietnam. Future studies can adopt the proposed framework and expand the scope of study to Vietnam's overall exports, rather than be limited to ASEAN countries.

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Does U.S. Economic Policy Uncertainty Influence Chinese Domestic Inflation?: Evidence from China's 31 Provinces

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ABSTRACT

Purpose – This paper empirically analyzed how China's domestic inflation responds to foreign uncertainties, especially U.S. economic policy uncertainties. This paper helps to fill the gap in the research on the impact of one country's economic uncertainty on the others economy.

Design/Methodology/Approach – In this paper, we were first to collect disaggregated data on China's 31 provinces from Q1 2001 to Q4 2021, adopting the nonlinear autoregressive distributed lag (NARDL) approach, to study the impact of U.S. economic policy uncertainty (EPU) on Chinese inflation. Given that the economic structures of China's 31 provinces are different, such as the level of economic development, industrial structure, economic scale, population scale, and so on, this paper uses China's regional data for the first time. We employ the nonlinear autoregressive distributed lag (NARDL) approach proposed by Shin et al. (2014), which has recently attracted attention.

Findings – The main findings are as follows. First, the impact of U.S. EPU on inflation in China's provinces is prominently presented by the short-run (26 provinces) versus the long-run (19 provinces). Second, an increase (decrease) in U.S. EPU causes a decrease (increase) in Chinese inflation in the long-run. Third, short-run asymmetry in U.S. EPU was demonstrated in 20 provinces, and long-run asymmetry was demonstrated in 17 provinces. Moreover, the characteristics of asymmetry develop from short-run to long-run in 15 provinces.

Research Implications – The estimation result of the NARDL model shows that the long- and short-run asymmetric effects of the U.S. EPU on domestic inflation are not exactly the same in terms of China's 31 provinces. This paper also suggests that province-specific phenomena should not be ignored when the Chinese government formulates policies to deal with foreign uncertainty.

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I. Introduction

As global uncertainties expand, many economists want to analyze how U.S. interest rate hikes affect inflation in emerging markets and developing countries as Arteta et al. (2022). Therefore, we are also going to analyze the impact of U.S. economic policy uncertainties, such as interest rate hikes, on EMDE domestic inflation. There are various studies on China (for example, Lee and Yang (2022), Liu and Jo (2021), and Wang and Jin (2023)). In addition, there are many domestic and foreign studies on inflation (Imran et al., 2021; Kang, 2022; Lim, 2021). However, there are few studies on foreign and macro variables, especially economic policy uncertainty index in the United States, on inflation in each region of China. In this paper, we use the U.S. Economic Policy Uncertainty Index (hereafter EPU) as an explanatory variable, and select the consumer price index of Chinese provinces as the target.

Inflation refers to an economic state in which overall prices of goods and services in a country continue to rise. At the same time, this leads to a decline in the currency value of the country, and a weakening of purchasing power. The main causes of inflation include an increase in the money supply in circulation, and the specific causes vary from school to school. In addition, domestic inflation is caused not only by the expansion of the currency but also by the expansion of demand, such as consumer, investment, and fiscal expenditures.

Significant research tends to overlook the global factors of inflation. In particular, there are few papers dealing with the impact of economic policy uncertainty in one country on the provincial economies of another country. This paper empirically analyzed how China's domestic inflation responds to foreign uncertainties, especially U.S. economic policy uncertainties. Given that the economic structures of China's 31 provinces[1] are different, such as the level of economic development, industrial structure, economic scale, population scale, and so on, this paper uses China's regional data for the first time. We employ the nonlinear autoregressive distributed lag (hereafter NARDL) approach proposed by Shin et al. (2014), which has recently attracted attention.

Leduc and Liu (2012, 2013) argued that an uncertainty shock was like an aggregate demand shock, as it depressed economic activity and lowered inflation. U.S. EPU and Chinese aggregate demand show opposite trends, generally (Fig. 1). That is, when U.S. EPU increases (decreases), Chinese demand decreases (increases). Moreover, the correlation analysis in Table 1 reveals that the correlation coefficient between U.S. EPU and the Chinese aggregate demand growth rate is -0.69, implying a high negative correlation. This paper can therefore reasonably propose the hypothesis that an increase (decrease) in U.S. EPU can decrease (increase) China's aggregate demand by influencing inflation.

The remaining sections of this paper are as follows. Section 2 provides a literature review. Section 3 describes the model and methodology. Section 4 shows the results of the empirical analysis, and the last section concludes. Finally, the appendix presents the sources of the data, definitions of variables, and notes.

II. Literature Review

Numerous scholars have studied the impact of EPU on the economy from different perspectives, and have drawn considerable theoretical and empirical conclusions. In research on the impact of uncertainty on the stock market, for example, Arouri et al. (2016), Chen et al. (2017), and Phan et al. (2018) assessed the effect of EPU on stock returns. Arouri et al. (2016) and Chen et al. (2017)

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1. China's 31 provinces: Anhui, Beijing, Chongqing, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Henan, Hubei, Hunan, Inner-Mongolia, Jiangsu, Jiangxi, Jilin, Liaoning, Ningxia, Qinghai, Shaanxi, Shandong, Shanghai, Shanxi, Sichuan, Tianjin, Tibet, Xinjiang, Yunnan, and Zhejiang.

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pointed out that an increase in EPU reduced stock returns, and Phan et al. (2018) showed that EPU had an asymmetric effect on stock excess returns. Tsai (2017) and Zhang et al. (2019) discussed the impact of EPU in different countries on the global stock market, including China and the United States. Tsai (2017) demonstrated that the contagion risk effect of Chinese EPU on global stock market investments was greater than the impact of U.S. EPU, while Zhang et al.'s (2019) empirical results exposed that U.S. EPU had greater impact on global stock markets than that of China. Ko and Lee (2015) and Segal et al. (2015), respectively, revealed that the effect of EPU on stock prices was negative, and good uncertainty made stock prices increase, while bad certainty made stock prices decrease. Liu and Zhang (2015) showed that higher EPU led to increased stock market volatility. Brogaard and Detzel (2015) indicated that EPU was an important economic risk factor for stocks.

In addition, some scholars have studied the impact of EPU on financial markets. For instance, Li and Zhong (2020) demonstrated that volatility in Chinese financial markets was mainly impacted by Chinese EPU, and that U.S. uncertainty was an important exogenous cause of Chinese financial market volatility. Bordo et al. (2016), Nguyen et al. (2020), and Ashraf and Shen (2019) investigated the relationship between EPU and bank credit, and reached a consistent conclusion. Bordo et al. (2016) and Nguyen et al. (2020) showed that higher EPU had a negative effect on bank credit. Ashraf and Shen (2019) indicated that EPU had a significant positive effect on the interest rate of bank gross credit. Bahmani-Oskooee and Nayeri (2018) and Wen et al. (2019) concluded that EPU had long-run asymmetric effects on money demand and inflation, respectively.

There is also a body of authors that have studied the effects of EPU on macroeconomic variables such as output, investment, unemployment rate, and so on, and produced robust empirical results. Specifically, Segal et al. (2015) suggested that good EPU had a positive effect on consumption, output, and investment, and conversely, bad uncertainty had a negative effect. The results of the empirical studies of Bhagat et al. (2013), Colombo (2013), Foerster (2014), Istiak and Serletis (2018), and Karnizova and Li (2014) uncovered a significant negative relationship between EPU and output. Studies including Bhagat et al. (2013), Kang et al. (2014), and Wang et al. (2014) showed that the impact of EPU on investment was also negative, and Kang et al. (2014) and Wang et al.'s (2014) studies were based at the firm level. Bahmani-Oskooee and Nayeri (2019) noted that EPU had asymmetric effect on investment in the short- and long-runs. In addition, Caggiano et al. (2017), Foerster (2014), and Leduc and Liu (2016) indicated that an increase in EPU made the unemployment rate increase, and Caggiano et al. (2020) revealed that the effect of EPU in the United States on the Canadian unemployment rate was asymmetric. Leduc and Liu (2012, 2013, 2016) found that higher uncertainty was an aggregate demand shock, as it made unemployment higher and inflation lower.

III. Model and Methodology

Generally, monetary factors, output, and exchange rate, among others, have a relatively large impact on inflation.[2] In this paper, foreign economic policy uncertainty is also regarded as a factor affecting inflation. Therefore, we consider a regression on inflation as shown in Equation (1) below.

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2. Adu and Marbuah (2011), Alexander et al. (2015), Chaudhary and Li (2018), Domaç and Elbirt (1998), and Laryea and Sumaila (2001) emphasized that money supply had a significant impact on inflation in the long-run, and Domaç and Elbirt (1998), Iya and Aminu (2014), and Moser (1995) pointed out that there was a positive correlation between money supply and inflation. Alexander et al. (2015) and Chaudhary and Li (2018) indicated that output had a significant positive impact on inflation in the long-run, but Domaç and Elbirt (1998) suggested that the two were negatively related in the long-run. Domaç and Elbirt (1998), Khan and Gill (2010), Lim and Papi (1997), and Moser (1995) showed that the exchange rate had a positive effect on inflation, while Iya and Aminu (2014) concluded that exchange rate negatively affected inflation.

$$\pi_t = \beta_0 + \beta_1 y\_gw_t + \beta_2 m\_gw_t + \beta_3 q_t + \beta_4 epu_t + \mu_t \tag{1}$$

Where π is CPI inflation for each of China's 31 provinces; y_gw represents real gross provincial product growth rate for each of China's 31 provinces; m_gw refers to the growth rate of the money supply (M_2); q means the log of real effective exchange rate of RMB against USD; and epu is the log of the U.S. Economic Policy Uncertainty Index.

Equation (1), however, can only investigate the long-run relationship between the variables. In order to research the short-run relationship between U.S. EPU and Chinese inflation, we rewrite Equation (1) in error correction form, as shown in Equation (2).

$$\Delta\pi_t = \alpha_0 + \sum_{k=1}^{n1} \alpha_{1k}\Delta\pi_{t-k} + \sum_{k=0}^{n2} \alpha_{2k}\Delta y\_gw_{t-k} + \sum_{k=0}^{n3} \alpha_{3k}\Delta m\_gw_{t-k}$$

$$+ \sum_{k=0}^{n4} \alpha_{4k}\Delta q_{t-k} + \sum_{k=0}^{n5} \alpha_{5k}\Delta epu_{t-k} + \beta_0\pi_{t-1} + \beta_1 y\_gw_{t-1}$$

$$+ \beta_2 m\_gw_{t-1} + \beta_3 q_{t-1} + \beta_4 epu_{t-1} + \varepsilon_t \tag{2}$$

Hence, Equation (2) is the autoregressive distributed lag (ARDL) model. The coefficients of the first-order difference variables refer to the short-run relationship, and the long-run relationship is represented by the estimated coefficient β_0-β_4. However, Equation (1) can be rewritten as Equation (2) only if the variables are mutually cointegrated. The F-Bounds test is a simple method for estimating cointegration relationships. The null hypothesis is $\beta_0=\beta_1=\beta_2=\beta_3=\beta_4=0$. That is, there is no level relationship between the dependent variable and the regressors. If the F-statistic is greater than the upper critical value (F > I(1)), then we reject the null hypothesis, implying that the variables are mutually cointegrated; if the F-statistic is less than the lower critical value (F < I(0)), or between the I(0) and I(1) critical values, then the null hypothesis cannot be rejected. Another way of estimating the cointegration relationship is the T-Bounds test. The T-Bounds test in particular is a parameter significance test on the lagged value

of the dependent variable. If a cointegration relationship indeed exists, the coefficient on the error correction term (ec_{t-1}) is negative and highly significant. One point to emphasize here is that both the F- and T-Bounds tests allow the data to be pure I(0) or I(1) processes, or a combination of both, which is one of the strengths of the method.

In the linear ARDL approach (Equation (2)), we assume that U.S. EPU affects Chinese inflation symmetrically. However, it seems that this is not the case in reality. Next, we build a Nonlinear ARDL to check. The Nonlinear ARDL approach is able to estimate the cointegration relationship as well as capture short- and long-run asymmetries simultaneously. In this paper, the nonlinear approach clearly distinguishes the response of Chinese inflation to increases and decreases in U.S. EPU. Firstly, the independent variable epu is decomposed into positive (pos) and negative (neg) partial sums.

$$pos_t = \sum_{j=1}^{t} \Delta epu_j^+ = \sum_{j=1}^{t} \max(\Delta epu_j, 0),$$

$$neg_t = \sum_{j=1}^{t} \Delta epu_j^- = \sum_{j=1}^{t} min(\Delta epu_j, 0) \tag{3}$$

Replacing *epu* in Equation (2) with *pos* and *neg* in Equation (3), we rewrite the equation as follows.

$$\Delta \pi_t = \alpha_0 + \sum_{k=1}^{n1} \alpha_{1k} \Delta \pi_{t-k} + \sum_{k=0}^{n2} \Delta \alpha_{2k} \, y\_gw_{t-k} + \sum_{k=0}^{n3} \alpha_{3k} \Delta m\_gw_{t-k}$$
$$+ \sum_{k=0}^{n4} \alpha_{4k} \Delta q_{t-k} + \sum_{k=0}^{n5} \alpha_{5k} \Delta pos_{t-k} + \sum_{k=0}^{n6} \alpha_{6k} \alpha_{6k} \Delta neg_{t-k}$$
$$+ \beta_0 \pi_{t-1} + \beta_1 y\_gw_{t-1} + \beta_2 m\_gw_{t-1} + \beta_3 q_{t-1} + \beta_4 pos_{t-1}$$
$$+ \beta_5 neg_{t-1} + \varepsilon_t \tag{4}$$

Thus, we call Equation (4), including both *pos* and *neg,* a Nonlinear ARDL approach, as compared to the linear ARDL model (Equation (2)). Next, we check whether the impact of the increases (*pos*) and decreases (*neg*) attached to U.S. EPU on Chinese inflation is asymmetrical via a Wald-test. We take the null hypothesis: $\sum \alpha_{5k} = \sum \alpha_{6k}$ (-$\beta_4/\beta_0 = -\beta_5/\beta_0$). That is, if the null hypothesis is rejected, then there is asymmetry in the short-run (long-run), and if it is not rejected, then there is no evidence of asymmetry.

IV. Data and Empirical Results

1. Data Sources and Definition

All data are quarterly, seasonally adjusted, and span from Q1 2001 to Q4 2021.

Sources include (a) Economic Policy Uncertainty, the (b) National Bureau of Statistics of China, (c) People's Bank of China, and (d) Federal Reserve Bank of St. Louis.

Variables are listed below.:

π: CPI inflation for each of China's 31 provinces, expressed as a first-order difference process on the natural logarithm of the consumer price index (CPI) (National Bureau of Statistics of China, n.d.)

y_gw: Real gross provincial product growth rate for each of China's 31 provinces (National Bureau of Statistics of China).

m_gw: Growth rate of money supply (M_2) (People's Bank of China, n.d.)

q: Real effective exchange rate of RMB/USD. It is defined as *q= Ei·CPI*/CPI*, where *Ei* is the bilateral nominal exchange rate of the Chinese yuan per U.S. dollar; and *CPI* and *CPI** represent the consumer price indices in China and the U.S., respectively. Thus, *q* rises (falls), implying RMB depreciation (appreciation) and USD appreciation (depreciation). (National Bureau of Statistics of China, n.d.; Federal Reserve Bank of St. Louis, n.d.)

epu: U.S. Economic Policy Uncertainty Index.

This is an index of search results from 10 large newspapers (USA Today, the Miami Herald, Chicago Tribune, Washington Post, Los Angeles Times, Boston Globe, San Francisco Chronicle, Dallas Morning News, Houston Chronicle, and the Wall Street Journal). To summarize, it is an index obtained by selecting 10 large U.S. newspapers and filtering articles related to economic uncertainty policies by searching keywords such as 'uncertainty' or 'uncertain', 'economic' or 'economy', and 'congress', 'legislation', 'white house', 'regulation', 'federal reserve', or 'deficit', and then performing statistical and standardized processing (Economic Policy Uncertainty, n.d.).

Fig. 1. Trends of U.S. EPU and Chinese Aggregate Demand Growth
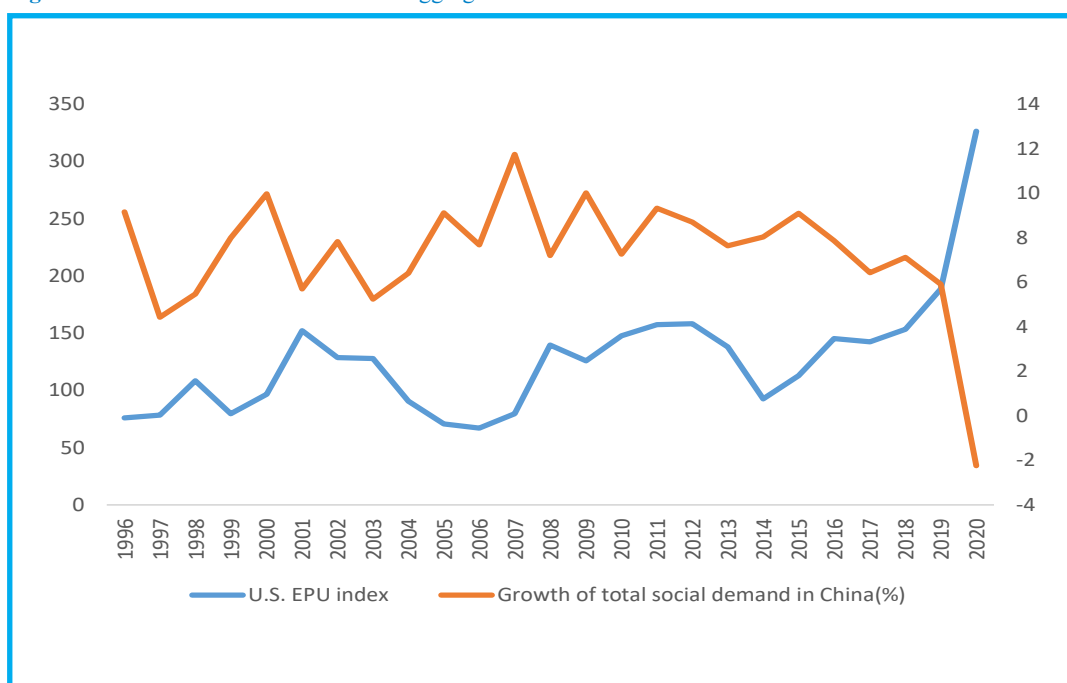
Sources: Economic Policy Uncertainty (n.d.) and National Bureau of Statistics of China (n.d.).

Table 1. Correlation Analysis

	Demand_gw	EPU
Demand_gw	1	
EPU	-0.69	1

2. Empirical Results

This section starts by checking the unit root of the data via Augmented Dickey Fuller (ADF),

as the techniques for testing cointegration only allow variables to be pure I(0), pure I(1), or a combination. The estimates show that there is strong evidence for the non-I(2) process for the data in this paper, which is valid for testing the cointegration relationship.[3] Ensuring that errors do not have any serial correlation up to the maximum lag order, we chose a maximum lag length of $p = 8$. The optimal lag order was selected according to Akaike Information Criterion (AIC).

For convenience, we first discuss the empirical results for one province, Anhui (first column, Table 2), and then summarize the estimated results for all 31. In terms of short-run results (Panel A), $\Delta(y\_gw)$ and $\Delta(m\_gw)$ do not have a significant impact on the inflation rate contemporaneously. In contrast, changes in the real effective exchange rate have a large negative impact on the inflation rate since $\Delta(q)$ holds a significant negative coefficient at the 5% level. For example, for every one percent rise in the exchange rate, inflation falls by 26.83 percent contemporaneously. Contrary to what most references have concluded, this result can probably be explained by the "RMB value paradox": While RMB appreciation should theoretically lead to lower domestic prices, in recent years, domestic prices have risen sharply over several periods, highlighting the coexistence of the "internal devaluation and external appreciation" of the RMB in China. The short-run results also show that the coefficient of $\Delta(pos)$ is insignificant, implying that an increase in U.S. EPU has no effect on inflation. A decrease in EPU can cause an increase in inflation, such that a one percent reduction in U.S. EPU leads to a 3.09 percent increase in inflation significantly at the 5% level in Anhui Province. We should keep in mind that the interest point of our paper is the asymmetry of U.S. EPU. We can observe that the magnitudes of the coefficients of Δpos and Δneg are not equal at the corresponding lag order, implying that the effects are asymmetric. To verify our observations, we calculate the short-run Wald statistic (Wald-S). The calculated Wald-S

statistic in Panel C also supports our conclusion since it holds a statistical value of (8.92), which effectively rejects the null hypothesis of symmetry at the 5% level.

Next, we turn our attention to the long-run results (Panel B). Each one percent increase in real GDP effectively predicts a 0.26 percent increase in inflation at the 5 percent level in Anhui Province. As with the short run, the supply of money still has no effect on inflation. For the exchange rate (e), there is also no long-run impact on inflation. Of most interest in this paper, we find that an increase (decrease) in U.S. EPU causes a decrease (increase) in Anhui provincial inflation. For instance, a one percent increase in EPU causes a 2.6 percent decrease in inflation; a one percent decrease in EPU causes a 2.76 percent increase in inflation. Obviously, the coefficients of pos and neg are not equal, so we asses that the impact of EPU is asymmetric. The Wald-L statistic (Panel C) ensures the reliability of our observations, since the value of Wald-L (16.14) effectively rejects the null hypothesis of symmetry at the 5% level. However, are the above long-run results indeed meaningful? Both the F-statistic and the T-statistic (ec_{t-1}) in Panel C support a cointegration relationship between the variables. Specifically, the value of the F-statistic (6.05) is greater than the upper critical value (3.38) at the 5% level, which means that the null hypothesis of no levels of relationship is rejected, implying the existence of a long-run relationship. The value for ec_{t-1} is negative and highly significant, again ensuring that the variables are mutually cointegrated.

In addition, we also report additional diagnostic statistics presented in Panel C. LM refers to the Lagrange Multiplier statistic of testing serial correlation, and the test result fails to reject the null hypothesis of no serial correlation. RESET denotes the regression specification error test proposed by Ramsey. The CUSUM (CU) and CUSUM of Squares (CUS) were applied to check the structural stability of the model. At least one

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3. Interested readers can contact the authors for more details on testing unit roots.

should effectively prove the structural stability of the model. Finally, the R^2 value refers to an estimate of the adjusted goodness of fit of the model.

We now summarize the estimated results for the 31 provinces. Firstly, when discussing the short-run results, we found that at least one of the coefficients of $\Delta(pos)$ and $\Delta(neg)$ was significant above the 10% level in 26 provinces, except for Hebei, Henan, Hubei, Inner-Mongolia, and Shanxi. This implies that U.S. Economic Policy uncertainty plays an important role in influencing inflation in Chinese provinces. Meanwhile, short-run asymmetries of U.S. EPU appear in 20 provinces: Anhui, Beijing, Fujian, Gansu, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Jiangsu, Jiangxi, Liaoning, Ningxia, Qinghai, Shandong, Tianjin, Tibet, Xinjiang, Yunnan, and Zhejiang. The coefficient of variable y_gw was shown to be negative and highly valid in 11 provinces. This means that the growth of output causes a decrease in inflation, which may be explained by rapid economic growth in these provinces in the short-run causing supply to exceed demand, which leads to a decrease in prices. While the increase in money supply has a positive short-run impact on inflation in 11 provinces, the increase in the real effective exchange rate causes a significant decrease in inflation in 24 provinces. This empirical result can be explained by the "RMB Value Paradox" that has emerged in recent years, as mentioned in the previous paragraphs.

Let us then turn to the long-run results for the 31 provinces. There is strong evidence that the long-run results are meaningful for all provinces, as the F-statistic and the T-statistic (ec_{t-1}) in Panel C have at least one supporting cointegration relationship. We observed that the coefficients of at least one of *pos* and *neg* were significant in 19 provinces: Anhui, Chongqing, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Heilongjiang, Hunan, Jiangxi, Jilin, Ningxia, Shandong, Shanghai, Sichuan, Tianjin, Tibet, Yunnan, and Zhejiang. Moreover, all *pos* and *neg* coefficients had negative values, implying that an increase (decrease) in U.S. EPU causes a decrease (increase) in inflation in these provinces. However, this result suggests that the long-run impact of U.S. economic policy uncertainty on inflation in Chinese provinces is relatively weak, as it has a short-run impact on inflation in 26 provinces. In terms of the long-run asymmetry of U.S. EPU, the symmetry hypothesis was rejected above the 10% level in 17 provinces: Anhui, Fujian, Gansu, Guangdong, Guangxi, Guizhou, Hainan, Hebei, Heilongjiang, Jiangsu, Jiangxi, Liaoning, Ningxia, Qinghai, Sichuan, Yunnan, and Zhejiang. Moreover, the short-run asymmetry in most provinces lasts into the long-run, except for the provinces of Beijing, Shandong, Tianjin, Tibet, and Xinjiang. An increase in variable y_gw causes an increase in inflation in 8 provinces, still causing a decrease in inflation in 6 provinces, the same as the short-run. However, unlike in the short-run, the real effective exchange rate (e) has very little effect. It was only negatively associated with inflation in three provinces, and was positively associated with inflation in four.

Table 2. Estimated Coefficients of the Inflation Model via Nonlinear ARDL Approach

	i = Anhui	i = Beijing	i = Chongqing	i = Fujian	i = Gansu	i = Guangdong	i = Guangxi
Panel A: Short-Eun Results							
$\Delta(y\_gw)$	0.01(0.55)	-0.02(-2.01)**	-0.02(-1.33)	-0.02(-1.19)	-0.04(-3.39)**	-0.02(-0.91)	-0.04(-2)**
$\Delta(y\_gw(-1))$	-0.19(-3.4)**	-0.04(-1.53)	-0.02(-1.69)	-0.02(-0.83)	-0.04(-1.53)	-0.15(-3.01)**	-0.07(-1.82)*
$\Delta(y\_gw(-2))$	-0.21(-4.39)**	-0.04(-1.72)*		-0.06(-3.24)**	-0.05(-1.97)*	-0.17(-3.71)**	-0.1(-2.63)**
$\Delta(y\_gw(-3))$	-0.18(-4.15)**	-0.05(-2.69)**		-0.02(-1.51)	-0.04(-2.27)**	-0.16(-4.08)**	-0.11(-3.27)**
$\Delta(y\_gw(-4))$	-0.17(-4.37)**	-0.05(-3.37)**		-0.04(-3.16)**	-0.05(-2.61)**	-0.11(-3.15)**	-0.15(-5.35)**
$\Delta(y\_gw(-5))$	-0.08(-2.35)**	-0.03(-2.46)**			-0.06(-3.47)**	-0.12(-4.06)**	-0.19(-6.71)**

Δ(y_gw(-6))	-0.01(-0.2)				-0.04(-3.65)**	-0.09(-3.7)**	-0.15(-6.2)**
Δ(y_gw(-7))	0.02(0.87)					-0.06(-3.24)**	-0.07(-4.2)**
Δ(m_gw)	0.19(1.66)	-0.01(-0.18)	-0.22(-2.23)**	0.06(1.76)*	0.09(1.16)	-0.05(-0.7)	0(0.04)
Δ(m_gw(-1))	0.15(1.13)				-0.05(-0.74)	-0.08(-1.03)	-0.09(-0.71)
Δ(m_gw(-2))	0.13(0.99)				-0.2(-3.02)**	0.09(1.29)	0.14(1.27)
Δ(m_gw(-3))	0.16(1.18)				-0.1(-1.56)	-0.08(-1.16)	0.03(0.28)
Δ(m_gw(-4))	0.24(1.97)*				-0.12(-1.72)*		-0.28(-2.67)**
Δ(m_gw(-5))	0.16(1.56)						-0.08(-0.78)
Δ(m_gw(-6))	0.04(0.38)						-0.03(-0.28)
Δ(m_gw(-7))	0.37(2.83)**						0.13(1.36)
Δ(q)	-26.81(-3.06)**	-6.26(-1.08)	-16.28(-1.86)*	-14.86(-3.04)**	-22.99(-4.56)**	-1.63(-0.27)	-8.55(-1.21)
Δ(q(-1))	4.63(0.55)	-13.34(-2.31)**				-6.89(-1.2)	-19.38(-2.21)**
Δ(q(-2))	-11.7(-1.44)						-33.2(-3.76)**
Δ(q(-3))	-1.29(-0.15)						-9.78(-0.96)
Δ(q(-4))	-9.45(-1.13)						17.16(1.93)*
Δ(q(-5))	3.39(0.43)						
Δ(q(-6))	-8.22(-1.03)						
Δ(pos)	-1.78(-1.72)	-0.77(-1.13)	1.21(1.18)	0.38(0.7)	0.41(0.7)	0.13(0.22)	-0.71(-0.82)
Δ(pos(-1))	-0.36(-0.34)	-1.44(-2.17)**	1.64(1.44)	-1.85(-3.2)**	-1.02(-1.69)	-1.28(-2.09)**	
Δ(pos(-2))	1.14(1)	0.29(0.38)			-0.49(-0.82)		
Δ(pos(-3))	0.71(0.61)	1.21(1.59)			1.03(1.78)*		
Δ(pos(-4))	1.83(1.57)	1.12(1.61)			-0.83(-1.54)		
Δ(pos(-5))	2.07(1.71)						
Δ(neg)	-3.09(-2.35)**	0.47(0.7)	-0.04(-0.04)	-0.86(-2.75)**	0.29(0.46)	-1.13(-2.77)**	-1.85(-1.9)*
Δ(neg(-1))	-1.79(-1.48)		1.07(1.11)				0.11(0.14)
Δ(neg(-2))	-1.92(-1.59)		2(2.21)**				-0.64(-0.88)
Δ(neg(-3))	-0.68(-0.58)						-1.49(-1.91)*
Δ(neg(-4))	-2.41(-1.82)*						-1.94(-2.23)**
Δ(neg(-5))	-3.57(-2.81)**						-2.48(-3.01)**
Δ(neg(-6))	-1.31(-1.63)						-2.95(-3.47)**
Δ(neg(-7))							-1(-1.16)

Panel B: Long-Run Results

y_gw	0.26(2.54)**	0.17(1.19)	-0.04(-0.7)	0.08(1.73)*	-0.03(-0.42)	0.31(2.69)**	-0.03(-0.42)
m_gw	-0.12(-0.75)	-0.02(-0.18)	0.16(1)	0.13(1.67)	0.52(3.99)**	0.13(1.42)	0.42(3.72)**
q	-5.84(-1.42)	-8.79(-1.62)	1.53(0.3)	0.66(0.27)	8.34(1.57)	-2.26(-0.75)	9.03(3.48)**
pos	-2.6(-3.08)**	-1.99(-1.51)	-2.4(-2.05)**	-1.46(-2.54)**	-0.32(-0.38)	-1.35(-2.03)**	-2.13(-3.47)**
neg	-2.76(-3.26)**	-2.18(-1.45)	-2.92(-2.03)**	-1.95(-2.77)**	-1.48(-1.39)	-2.28(-2.53)**	-3.68(-4.18)**
c	12.9(1.1)	21.37(1.43)	-5.9(-0.38)	-4.11(-0.55)	-30.02(-1.87)*	-0.9(-0.1)	-33.59(-3.84)**

Panel C: Diagnostic Statistics

F-statistic	6.05**	2.78*	6.17**	8.05**	6.67**	13.57**	11.62**
ec_{t-1}	-0.81(-7.22)**	-0.26(-4.65)**	-0.38(-6.88)**	-0.44(-7.88)**	-0.37(-7.26)**	-0.5(-7.44)**	-0.85(-9.85)**
LM	1.25	1.67	0.36	2.22	0.4	0.98	0.39
RESET	3.95	3.90	2.34	1.35	9.24	0.17	1.05
CU/CUS	s/s	s/s	s/us	s/s	s/us	s/s	s/s
R^2	0.79	0.63	0.47	0.74	0.76	0.78	0.85
Wald-L	16.14**	2.05	1.11	5.95**	10.77**	13.57**	48.53**
Wald-S	8.92**	6.65**	7.14E-07	7.06**	7.24**	0.14	21.18**

	i = Guizhou	i = Hainan	i = Hebei	i = Heilongjiang	i = Hena	i = Hubei	i= Hunan
Panel A: Short-Run Results							
$\Delta(y\_gw)$	-0.02(-0.88)	0.03(1.27)	-0.04(-1.82)*	-0.01(-1.33)	0.01(0.57)	-0.01(-0.99)	0.01(0.52)
$\Delta(y\_gw(-1))$	-0.1(-2.15)**	-0.19(-3.14)**	0.06(1.72)*	0.03(2.39)**			
$\Delta(y\_gw(-2))$	-0.1(-2.38)**	-0.16(-2.83)**	-0.02(-0.5)	0.04(2.8)**			
$\Delta(y\_gw(-3))$	-0.11(-2.72)**	-0.19(-3.46)**	0.03(0.98)	0.02(2.02)**			
$\Delta(y\_gw(-4))$	-0.12(-3.87)**	-0.11(-2.47)**	-0.02(-0.95)	0.01(1.34)			
$\Delta(y\_gw(-5))$	-0.12(-4.13)**	-0.16(-4.15)**	0.01(0.46)				
$\Delta(y\_gw(-6))$	-0.1(-4.15)**	-0.06(-2)**	-0.03(-1.1)				
$\Delta(y\_gw(-7))$	-0.05(-2.66)**	-0.11(-3.77**)	-0.03(-1.47)				
$\Delta(m\_gw)$	0.24(2.67)**	0.27(2.13)**	0.07(0.75)	0.31(5.18)**	0.1(2.23)**	0.06(1.37)	0.05(1.2)
$\Delta(m\_gw(-1))$	0.09(0.87)	-0.22(-1.85)*	-0.04(-0.37)				
$\Delta(m\_gw(-2))$	0.07(0.84)	0.09(0.73)	-0.24(-2.08)**				
$\Delta(m\_gw(-3))$	0.36(4.13)**	-0.19(-1.67)	0.02(0.15)				
$\Delta(m\_gw(-4))$	0.24(2.17)**	0.26(1.92)*	-0.07(-0.68)				
$\Delta(m\_gw(-5))$	0.09(1.04)		-0.06(-0.61)				
$\Delta(m\_gw(-6))$	0.14(1.94)*		-0.3(-3.1)**				
$\Delta(m\_gw(-7))$	0.16(1.88)*		0.19(1.91)*				
$\Delta(q)$	-7.47(-1.28)	-4.62(-0.58)	-12.88(-1.7*1)	-20.41(-3.04)**	-19.58(-3.08)**	-15.57(-2.62)**	-16.96(-2.68)**
$\Delta(q(-1))$	-8.27(-1.36)		-10.17(-1.29)				
$\Delta(q(-2))$	-13.91(-2.22)**						
$\Delta(q(-3))$	-21.34(-3.35)**						
$\Delta(q(-4))$	-5.32(-0.73)						
$\Delta(q(-5))$	3.9(0.6)						
$\Delta(q(-6))$	-6.88(-1.02)						
$\Delta(q(-7))$	-12(-1.78)*						
$\Delta(pos)$	-0.87(-2.69)**	0.93(0.96)	-0.48(-1.07)	-2.03(-2.38)**	-0.45(-1.38)	-0.57(-1.67)	-0.52(-1.81)*

	i = inner	i = Jiangsu	i = Jiangxi	i = Jilin	i = Liaoning	i = Ningxia	i = Qinghai
$\Delta(pos(-1))$		-2.09(-2.1)**		-1.36(-1.77)*			
$\Delta(pos(-2))$				-1.8(-2.21)**			
$\Delta(pos(-3))$				-1.66(-1.99)**			
$\Delta(pos(-4))$				-0.95(-1.25)			
$\Delta(pos(-5))$				-0.2(-0.27)			
$\Delta(pos(-6))$				0.4(0.52)			
$\Delta(pos(-7))$				-1.6(-2.06)**			
$\Delta(neg)$	1.22(1.96)*	-1.45(-1.39)	0.77(0.82)	0.75(0.99)	-0.62(-1.54)	-0.66(-1.46)	-0.63(-1.72)*
$\Delta(neg(-1))$	1.54(2.28)**	3.24(3)**	-0.89(-0.97)				
$\Delta(neg(-2))$	1.6(2.58)**	-0.11(-0.11)	0.47(0.52)				
$\Delta(neg(-3))$		1.75(1.96)*	0.92(1.01)				
$\Delta(neg(-4))$		2.23(2.7)**	-0.82(-0.81)				
$\Delta(neg(-5))$			-1.29(-1.4)				

Panel B: Long-Run Results

	i = inner	i = Jiangsu	i = Jiangxi	i = Jilin	i = Liaoning	i = Ningxia	i = Qinghai
y_gw	0.05(0.93)	0.37(2.74)**	-0.11(-0.79)	-0.06(-1.75)*	0.02(0.57)	0.01(0.66)	0.02(0.53)
m_gw	0.15(2.71)**	0.24(1.43)	0.39(1.62)	0.6(4.1)**	0.19(2.29)**	0.11(1.37)	0.1(1.19)
q	-1.61(-1.21)	8.6(1.53)	8.42(1.17)	2.82(0.86)	0.47(0.18)	-0.75(-0.31)	0.58(0.23)
pos	-0.76(-2.85)**	-1.94(-1.98)**	-1.12(-0.92)	-1.02(-1.09)	-0.84(-1.31)	-1.06(-1.54)	-1.02(-1.7)*
neg	-0.99(-2.94)**	-3.49(-2.38)**	-2.06(-1.18)	-2.26(-1.88)*	-1.17(-1.46)	-1.23(-1.36)	-1.22(-1.61)
c	3.1(0.74)	-30.84(-1.7)	-27.54(-1.2)	-16.06(-1.48)	-2.87(-0.36)	1.97(0.26)	-1.5(-0.19)

Panel C: Diagnostic Statistics

	i = inner	i = Jiangsu	i = Jiangxi	i = Jilin	i = Liaoning	i = Ningxia	i = Qinghai
F-statistic	8.62**	5.39**	3.44*	8.15**	5.79**	4.39**	5.28**
ec_{t-1}	-1.14(-8.41)**	-0.46(-6.56)**	-0.43(-5.27)**	-0.52(-8.03)**	-0.53(-6.66)**	-0.53(-5.82)**	-0.51(-6.36)**
LM	2.57	0.87	0.09	0.35	2.61	2.59	0.49
RESET	1.67	0.64	2.01	1.45	4.15	1.55	3.16
CU/CUS	s/s	s/us	s/s	s/s	s/s	s/us	s/s
R^2	0.85	0.7	0.69	0.68	0.64	0.64	0.57
Wald-L	6.46**	15.16**	5.9**	17.09**	0.89	0.05	0.72
Wald-S	12.05**	16.6**	4.04**	16.38**	1.5	0.31	0.57

	i = inner	i = Jiangsu	i = Jiangxi	i = Jilin	i = Liaoning	i = Ningxia	i = Qinghai
Panel A: Short-Run Results							
$\Delta(y\_gw)$	0(-0.26)	-0.05(-1.72)	-0.03(-2.07)**	-0.03(-3.14)**	0(-0.15)	-0.07(-3.64)**	-0.03(-2.15)**
$\Delta(y\_gw(-1))$		-0.16(-2.58)**		0.03(2.45)**	-0.06(-2.93)**	0.12(2.31)**	0.02(0.74)
$\Delta(y\_gw(-2))$		-0.13(-2.34)**		0.01(1.23)	-0.05(-2.85)**	0.13(2.93)**	0.06(2.95)**
$\Delta(y\_gw(-3))$		-0.07(-1.29)		0.02(2.13)**	-0.03(-2)*	0.13(3.33)**	0.05(3.7)**
$\Delta(y\_gw(-4))$		-0.08(-1.85)*			-0.03(-2.35)**	0.08(2.75)**	

Δ(y_gw(-5))		-0.16(-4.69)**			-0.02(-2.16)**	0.02(0.87)	
Δ(y_gw(-6))		-0.1(-2.97)**			-0.01(-0.87)		
Δ(y_gw(-7))		-0.03(-1.14)					
Δ(m_gw)	0.04(1.29)	0(-0.03)	0.06(0.77)	0.25(2.94)**	0.61(3.84)**	-0.06(-0.45)	0.11(1.37)
Δ(m_gw(-1))		-0.23(-1.87)*	-0.14(-1.52)	-0.17(-2.1)**	0.02(0.13)	-0.47(-2.72)**	0.06(0.77)
Δ(m_gw(-2))		-0.04(-0.3)			0.15(1.12)	-0.48(-2.69)**	-0.12(-1.5)
Δ(m_gw(-3))		0.11(1)			0.17(1.32)	-0.46(-2.93)**	
Δ(m_gw(-4))		-0.03(-0.32)			0.32(2.34)**	-0.44(-3.09)**	
Δ(m_gw(-5))		-0.05(-0.51)			-0.18(-1.51)	-0.31(-2.43)**	
Δ(m_gw(-6))		0(-0.05)			0.04(0.29)	-0.17(-1.32)	
Δ(m_gw(-7))		0.2(2.38)**			0.32(2.92)**		
Δ(q)	-15.59(-3.01)**	-6.41(-1.15)	-12.51(-1.87)*	-19.4(-2.88)**	-27.95(-2.79)**	-15.02(-1.84)*	-13.88(-2.38)**
Δ(q(-1))		-3.06(-0.48)	4.69(0.67)	-10.31(-1.39)	15.97(1.32)	-22.83(-2.46)**	
Δ(q(-2))		-8.71(-1.49)	-8.65(-1.34)		19.18(1.71)	-9.81(-1.13)	
Δ(q(-3))		-4.28(-0.73)			15.53(1.3)	-13.76(-1.59)	
Δ(q(-4))		-2.74(-0.45)			23.88(1.71)	-16.73(-1.95)*	
Δ(q(-5))		9.64(1.55)			30.5(2.21)**	-19.7(-2.07)**	
Δ(q(-6))		-10.54(-1.6)			26.69(2.5)**	-9.7(-1.1)	
Δ(q(-7))					19.03(1.7)	-21.03(-2.22)**	
Δ(pos)	-0.37(-1.49)	-0.96(-1.37)	-0.94(-2.89)**	-0.66(-1.98)**	-2.74(-2.15)**	0.44(0.44)	-0.29(-1.09)
Δ(pos(-1))		-0.9(-1.19)			-1.23(-1.12)	0.2(0.21)	
Δ(pos(-2))		0.51(0.67)			-0.85(-0.73)	0.15(0.15)	
Δ(pos(-3))		-0.14(-0.18)			-3.94(-2.73)**	1.17(1.09)	
Δ(pos(-4))		-0.25(-0.33)			-0.01(-0.01)	2.18(1.97)*	
Δ(pos(-5))		-0.29(-0.44)			-1.38(-0.97)	1.67(1.33)	
Δ(pos(-6))		-1.22(-1.93)*			3.55(2.31)**		
Δ(pos(-7))		-1.44(-2.39)**			1.23(0.96)		
Δ(neg)	-0.41(-1.3)	-1.54(-2.33)**	0.26(0.36)	-0.91(-2.04)**	-0.38(-0.34)	1.97(1.52)	0.6(1.01)
Δ(neg(-1))			0.81(1.18)		1.88(1.59)	2.65(2.14)**	1.04(1.82)*
Δ(neg(-2))			1.72(2.52)**		0.45(0.41)	2.62(2.06)**	
Δ(neg(-3))			1.08(1.66)		3.27(2.85)**	2.34(1.93)*	
Δ(neg(-4))			0.88(1.31)		-1.87(-1.59)	2.39(1.69)	
Δ(neg(-5))						2.24(1.66)	
Δ(neg(-6))						1.86(1.62)	
Δ(neg(-7))						1.77(1.61)	

Panel B: Long-Run Results

y_gw	0(-0.26)	0.07(0.6)	-0.05(-1.94)*	-0.05(-2.74)**	2.03(0.14)	-0.2(-3.24)**	-0.09(-1.25)
m_gw	0.12(1.28)	0.18(1.77)*	0.34(3.54)**	0.29(3.71)**	8.38(0.14)	0.55(4.02)**	0.57(4.83)**

q	-1.94(-0.61)	3.35(0.94)	2.62(1.08)	-1.66(-0.89)	-65.94(-0.13)	9.15(3.25)**	-2.81(-0.85)
pos	-1(-1.36)	-0.39(-0.67)	-1.38(-2.55)**	-0.88(-1.8)*	-62.29(-0.14)	-0.39(-0.86)	-0.68(-1)
neg	-1.12(-1.18)	-1.13(-1.51)	-2.27(-2.88)**	-1.22(-1.84)*	-88.51(-0.14)	-1.18(-1.88)*	-1.2(-1.36)
c	4.89(0.51)	-11.96(-1.2)	-11.46(-1.44)	1.38(0.23)	-38.29(-0.12)	-28.7(-3.17)**	1.39(0.13)

Panel C: Diagnostic Statistics

F-statistic	3.44*	4.09**	6.56**	6.95**	3.67*	5.17**	4.9**
ec_{t-1}	-0.37(-5.13)**	-0.71(-5.88)**	-0.68(-7.16)**	-0.74(-7.35)**	-0.04(-5.65)**	-1.06(-6.68)**	-0.43(-6.17)**
LM	0.09	1.63	2.35	0.56	0.25	0.01	0.002
$RESET$	1.19	0.40	2.12	2.41	1.03	3.23	2.25
CU/CUS	s/s	s/s	s/s	s/s	s/us	s/s	s/s
R^2	0.60	0.79	0.62	0.64	0.69	0.77	0.76
$Wald$-L	0.07	11.05**	6.04**	2.56	16.01**	13.44**	4.42**
$Wald$-S	0.13	7.77**	3.46*	2.26	4.04**	9.54**	6.76**

	i = Shaanxi	i = Shandong	i = Shanghai	i = Shanxi	i = Sichuan	i = Tianjin	i = Tibet
Panel A: Short-Run Results							
$\Delta(y\_gw)$	-0.02(-1.06)	0.04(1.59)	0(-0.47)	-0.02(-1.14)	-0.12(-4.98)**	0.03(2.11)**	-0.08(-5.64)**
$\Delta(y\_gw(-1))$	-0.07(-2.35)**	0.41(6.18)**	-0.04(-2.06)**		-0.26(-6.15)**	0.06(3.76)**	-0.02(-1.28)
$\Delta(y\_gw(-2))$	-0.09(-3.06)**	0.3(5.55)**	-0.02(-1.27)		-0.26(-6.01)**	0.04(2.6)**	
$\Delta(y\_gw(-3))$	-0.08(-3.17)**	0.29(6.67)**	-0.02(-1.58)		-0.18(-4.5)**	0.05(3)**	
$\Delta(y\_gw(-4))$	-0.06(-2.89)**	0.27(5.88)**	-0.02(-1.79)*		-0.14(-3.95)**	0.05(4.21)**	
$\Delta(y\_gw(-5))$	-0.04(-2.02)**	0.21(5.21)**	-0.03(-2.71)**		-0.11(-4.07)**		
$\Delta(y\_gw(-6))$	-0.05(-3.07)**	0.07(2.3)**	-0.02(-2.03)**		-0.07(-4.39)**		
$\Delta(m\_gw)$	0.07(1.64)	0.03(0.34)	0.03(0.53)	0.11(1.92)*	0.14(1.61)	0.04(0.42)	0.12(3.54)**
$\Delta(m\_gw(-1))$		-0.39(-3.52)**	-0.08(-1.62)		-0.18(-2.22)**	-0.22(-2.3)**	
$\Delta(m\_gw(-2))$		-0.61(-4.58)**	0.08(1.81)*		0.06(0.68)	-0.08(-0.81)	
$\Delta(m\_gw(-3))$		-0.29(-3.05)**	0.03(0.66)		0.16(1.71)	-0.25(-3.24)**	
$\Delta(m\_gw(-4))$		-0.22(-2.05)**	-0.1(-2.17)**			-0.12(-1.31)	
$\Delta(m\_gw(-5))$		-0.3(-3.27)**				-0.08(-0.83)	
$\Delta(m\_gw(-6))$		-0.61(-5.28)**				-0.14(-1.45)	
$\Delta(q)$	-18.49(-2.92)**	-23.21(-3.37)**	-8.15(-2.31)**	-19.61(-2.54)**	-19.17(-2.94)**	-27.35(-4.01)**	-21.17(-4.8)**
$\Delta(q(-1))$		-13.59(-1.89)*		-0.0004(-4.82E-05)	-14.16(-2)**	5.75(0.81)	
$\Delta(q(-2))$		-16.41(-2.5)**		-12.89(-1.54)	-19.18(-2.87**)	-10.45(-1.44)	
$\Delta(q(-3))$		-10.38(-1.49)			-20.53(-2.85)**	-6.34(-0.85)	
$\Delta(q(-4))$		-15.19(-2.1)**				6.08(0.82)	
$\Delta(q(-5))$		-10.63(-1.49)				8.25(1.09)	
$\Delta(pos)$	1.23(1.8)*	-1.54(-1.75)*	-0.33(-2)**	-0.6(-1.45)	0.38(0.48)	0.79(1.08)	-0.54(-2.41)**

Δ(pos(-1))	-1.25(-1.76)*	2.65(2.57)**			0.12(0.15)	0.93(1.05)	
Δ(pos(-2))		3.31(3.23)**			0.02(0.03)	0.27(0.32)	
Δ(pos(-3))		3.78(3.43)**			-1.32(-1.54)	1.47(1.63)	
Δ(pos(-4))		3.47(3.57)**			0.15(0.17)	0.06(0.07)	
Δ(pos(-5))		3.76(3.78)**			1.33(1.6)	0.98(1.14)	
Δ(pos(-6))		2.05(2.66)**			3.02(3.53)**	2.66(3.19)**	
Δ(pos(-7))		1.91(2.32)**			2.15(2.66)**		
Δ(neg)	-0.21(-0.52)	-2.11(-2.18)**	0.05(0.13)	-0.92(-1.64)	-0.54(-0.66)	-1.73(-1.95)*	0.93(1.89)*
Δ(neg(-1))		0.74(0.84)			2.03(2.41)**	0.29(0.36)	1.51(3.02)**
Δ(neg(-2))		-0.25(-0.28)			1.11(1.18)	-0.6(-0.67)	0.77(1.61)
Δ(neg(-3))		-0.18(-0.19)			1.08(1.28)	-2.35(-2.49)**	0.99(2.14)**
Δ(neg(-4))		0.05(0.05)			-1.29(-1.37)	-0.72(-0.71)	
Δ(neg(-5))		-2.26(-2.52)**			-0.87(-0.81)	-0.74(-0.9)	
Δ(neg(-6))					-1.56(-1.71)	-2.05(-2.63)**	
Δ(neg(-7))					-1.31(-1.4)		

Panel B: Long-Run Results

y_gw	0.16(3.19)**	-0.52(-5.55)**	0.07(1.37)	-0.03(-1.16)	0.03(1.19)	-0.17(-2.4)**	-0.03(-0.63)
m_gw	0.13(1.71)*	0.33(3.49)**	0.17(3.02)**	0.21(1.96)*	0.17(4.55)**	0.49(2.23)**	0.19(3.71)**
q	0.90(0.36)	7.67(3.11)**	-6.66(-3.13)**	3.59(1.04)	2.30(2.32)**	-5.23(-1.45)	-4.5(-2.82)**
pos	0.18(0.31)	-5.58(-4.79)**	-0.71(-2)**	-1.12(-1.34)	-0.74(-2.98)**	-3.73(-2.58)**	-0.86(-2.5)**
neg	-0.36(-0.51)	-5.62(-4.54)**	-0.94(-2.06)**	-1.71(-1.52)	-1.15(-3.6)**	-4.08(-2.45)**	-1.08(-2.43)**
c	-5.58(-0.75)	-20.79(-2.69)**	15.03(2.49)**	-12.03(-1.15)	-8.02(-2.59)**	5.02(0.46)	11.01(2.18)**

Panel C: Diagnostic Statistics

F-statistic	5.03**	10.08**	7.27**	3.64*	14.11**	6.3**	8.43**
ec_{t-1}	-0.58(-6.25)**	-0.83(-9.23)**	-0.47(-7.54)**	-0.54(-5.3)**	-1.74(-10.89)**	-0.47(-7.23)**	-0.63(-8.06)**
LM	0.53	0.01	1.28	2.04	0.49	0.88	0.03
RESET	9.55	1.95	1.78	3.3	5.66	0.25	0.22
CU/CUS	s/s	s/s	s/s	s/s	s/us	s/s	s/s
R^2	0.60	0.75	0.83	0.49	0.81	0.77	0.68
Wald-L	2.42	0.02	1.79	0.68	16.6**	0.09	0.27
Wald-S	6.91E-05	32.43**	1.05	2.44	2.04	15.67**	5.54**

	i = Xinjian	i = Yunnan	i = Zhejiang

Panel A: Short-Run Results

Δ(y_gw)	0.01(0.67)	-0.02(-1.48)	-0.06(-2.23)**
Δ(y_gw(-1))	-0.04(-2.09)**	-0.1(-3.67)**	-0.21(-3.91)**

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$\Delta(y\_gw(-2))$	-0.05(-2.9)**	-0.08(-3.34)**	-0.22(-4.49)**
$\Delta(y\_gw(-3))$	-0.03(-2.16)**	-0.06(-2.9)**	-0.21(-4.74)**
$\Delta(y\_gw(-4))$	-0.03(-2.01)**	-0.09(-5.59)**	-0.24(-5.57)**
$\Delta(y\_gw(-5))$	-0.04(-2.96)**	-0.08(-4.47)**	-0.21(-5.69)**
$\Delta(y\_gw(-6))$	-0.03(-3.33)**	-0.02(-1.06)	-0.13(-5.84)**
$\Delta(m\_gw)$	0.19(4.18)**	0.15(3.06)**	0.04(0.38)
$\Delta(m\_gw(-1))$			0.06(0.74)
$\Delta(m\_gw(-2))$			-0.15(-1.85)*
$\Delta(m\_gw(-3))$			-0.21(-2.65)**
$\Delta(m\_gw(-4))$			-0.23(-2.76)**
$\Delta(q)$	-13.28(-2.13)**	-18.27(-2.95)**	-6.05(-0.99)
$\Delta(q(-1))$	-10.76(-1.69)	-3.80(-0.56)	-2.49(-0.42)
$\Delta(q(-2))$		-7.27(-1.16)	-16.85(-2.95)**
$\Delta(q(-3))$			5.78(1.01)
$\Delta(pos)$	0.81(1.15)	-0.21(-0.28)	-0.09(-0.13)
$\Delta(pos(-1))$	-2.30(-3.09)**	-1.07(-1.33)	-0.87(-1.19)
$\Delta(pos(-2))$		1.24(1.6)	-0.57(-0.75)
$\Delta(pos(-3))$		-0.76(-0.94)	1.73(1.92)*
$\Delta(pos(-4))$		-0.04(-0.06)	0.76(0.9)
$\Delta(pos(-5))$		2.61(3.54)**	1.92(2.53)**
$\Delta(pos(-6))$			0.91(1.46)
$\Delta(neg)$	0.18(0.26)	-0.69(-0.82)	-0.16(-0.24)
$\Delta(neg(-1))$	1.93(2.93)**	2.21(2.63)**	0.22(0.34)
$\Delta(neg(-2))$	0.93(1.48)	-2.48(-3.19)**	0.55(0.74)
$\Delta(neg(-3))$		-0.21(-0.24)	-1.27(-1.97)*
$\Delta(neg(-4))$		-0.17(-0.2)	1.1(1.57)
$\Delta(neg(-5))$		-1.66(-2.12)**	

Panel B: Long-Run Results

y_gw	0.08(1.93)*	0.12(2.97)**	0.19(3.88)**
m_gw	0.34(5.39)**	0.22(2.99)**	0.1(2.07)**
q	-5.64(-2.68)**	-0.8(-0.41)	-2.1(-1.31)
pos	0.19(0.37)	-1.82(-3.96)**	-0.4(-1.31)
neg	-0.06(-0.09)	-2.29(-4.09)**	-0.87(-2.26)**
c	10.96(1.74)*	-2.45(-0.41)	1.99(0.44)

Panel C: Diagnostic Statistics

F-statistic	6.54**	9.83**	9.87**
ec_{t-1}	-0.57(-7.16)**	-0.7(-8.87)**	-1.04(-8.99)**

LM	1.33	0.78	2.26
RESET	1.78	1.84	1.32
CU/CUS	s/us	s/s	s/us
R^2	0.70	0.80	0.81
Wald-L	0.46	5.19**	21.3**
Wald-S	9.62**	7.47**	6.38**

Note: * and ** denote critical values significant at the 10% and 5% levels, respectively. The values in parentheses are the absolute value of t-statistics. The F-statistic for the 5% (10%) critical value with k = 5 is 3.58 (3.00). The t-statistic of the error-correction term (ect-1) for the 5% (10%) critical value is -4.19 (-3.86). These come from Pesaran et al. (2001, Table C2.iii). Both the LM and RESET tests follow a Chi-square distribution with degrees of freedom of one. The critical value is 3.84 (2.71) at the 5% (10%) level. Both the Wald-S and Wald-L tests also follow the Chi-square distribution with degrees of freedom of one.

V. Conclusion

The empirical analysis of this paper identified that the impact of global factors on domestic inflation regionally is asymmetric. It examines the impact of foreign economic policy uncertainty (specifically U.S. EPU) on inflation in China's 31 provinces using quarterly data from Q1 2001 to Q4 2021. We performed a nonlinear autoregressive distributed lag (Nonlinear ARDL) approach that simultaneously estimated cointegration and long- and short-run asymmetries.

Regarding the heterogeneity of China's 31 provinces, we postulate that U.S. EPU has asymmetric impacts on domestic inflation in each province. In the NARDL model, the asymmetric effects of POS and NEG variables on inflation in various provinces imply that changes in the positive and negative directions of U.S. EPU are important and cannot be ignored. There is strong evidence that U.S. EPU fluctuates Chinese inflation at the provincial level in the short-run (26 provinces) more than in the long-run (19 provinces). In addition, both the increase and decrease in EPU are negatively correlated with inflation in 19 provinces in the long-run, which verifies our hypothesis that uncertainty in U.S. economic policy acts like an aggregate demand shock in China, as an increase (decrease) in U.S.

EPU decreases (increases) China's provincial inflation. We also find that short-run asymmetry was supported in 20 provinces, while long-run asymmetry was supported in 17 provinces. Furthermore, the short-run asymmetry lasts into the long-run in 15 provinces. This result implies a province-specific phenomenon in China. Inflation in some provinces is asymmetrically affected by U.S. EPU in the short- and long-runs, while some provinces are barely affected either in the short- or long-runs.

This paper contributes to filling a gap in research on the asymmetric impact of foreign economic policy uncertainty (specifically U.S. EPU) on inflation domestically (e.g. China) at the provincial level, as the empirical results of previous studies may have masked the asymmetry of uncertainty. We found that U.S. EPU has a significant impact on inflation in Chinese provinces, both in the short- and long-runs, so the Chinese government needs to consider U.S. EPU as a factor affecting inflation in China. Our findings also suggest that province-specific phenomenon should not be ignored when the Chinese government formulates policies to deal with foreign uncertainty.

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