ERIA Discussion Paper Series
No. 431

Prediction Errors of Macroeconomic Indicators and Economic Shocks for ASEAN Member States, 1990–2021*

Masahito AMBASHI
Associate Professor, Kyoto University, Research Fellow, ERIA, and Consulting Fellow, RIETI

Fusanori IWASAKI
Executive Assistant to the President, ERIA

Keita OIKAWA
Economist, ERIA

May 2022

Abstract: *In this study, economic shocks on six selected Association of Southeast Asian Nations (ASEAN) Member States (i.e. Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam) are analysed in three dimensions: global, domestic, and uncertainty. Annual actual and prediction values from 1990–2021 macroeconomic indicators – from international organisations such as the Asian Development Bank – were collected, and macroeconomic shocks were calculated based on prediction errors (i.e. actual values minus prediction values). The first finding is that if prediction errors of the real gross domestic product (GDP) growth rates are negative, on average, the countries were significantly subjected to negative economic shocks that were not anticipated. Second, according to a correlation analysis of the actual values and prediction errors of real GDP growth rates, economic fluctuations and shocks are highly synchronised within the countries as well as with the world, as previous literature has indicated. Finally, by conducting regression analyses regarding the prediction error of real GDP growth rates separately for each country, (i) variations of the global real GDP growth rate are positively associated with countries' economic shocks; (ii) the previous estimates have different quantitative significance amongst the countries; (iii) residual variations approximate country-specific, domestic shocks; and (iv) global and country-level uncertainty indices are correlated with negative economic shocks in some countries. Based on this dataset, the effect of the COVID-19 pandemic is also reviewed, and economic and historical backgrounds are examined that caused past economic shocks to these ASEAN Member States.*

JEL Classification: E32; F44; N15

Keywords: ASEAN-6 countries; Prediction error; Economic shock; Uncertainty; Business cycle synchronisation

* The authors wish to thank the Economic Research Institute for ASEAN and East Asia (ERIA) and the Research Institute of Economy, Trade and Industry (RIETI), which provided great support including the research fund. In addition, they would like to extend their gratitude to those who made invaluable comments at the CAPS Workshop at the Institute of Economic Research, Kyoto University, on 21 February 2022.

1. Introduction

Association of Southeast Asian Nations (ASEAN) Member States (AMS) have been frequently subjected to economic shocks and increased uncertainty due to various global business fluctuations, such as the 1997–1998 Asian financial crisis and the 2008–2009 global financial crisis. They have also suffered economic instability from within their domestic systems and institutions by failing to control economic recessions or due to overheating. Moreover, they have sometimes faced unanticipated exogenous shocks, such as natural disasters, political disturbances, and pandemics. In recent years, the COVID-19 pandemic has forced governments to implement several regulations that have decreased physical human contact to prevent infections. The negative economic effect of this pandemic has been so large in the ASEAN region that manufacturing operations and service industries ceased for a long period, causing serious disruptions of global supply chains involving AMS.

This study examines the effects of past economic shocks and increased uncertainty on six selected ASEAN countries – Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam – by examining global, domestic, and uncertainty shocks.[1] Both actual and prediction values of annual macroeconomic indicators from 1990 to 2021 were collected, such as real gross domestic product (GDP) growth rates, as well as prediction errors concerning actual and prediction values (i.e. the actual value minus the prediction value). Specifically, with respect to real GDP growth rates, correlation analyses of actual values and prediction errors within these AMS and with the world were conducted, as were regression analyses for individual countries. Based on these analyses, economic shocks that these AMS suffered so far are revealed.

Existing studies have analysed macroeconomic business synchronisation in East Asia and the ASEAN region, but this study makes a contribution to ASEAN economic literature by examining economic shocks using macroeconomic prediction data compiled by international organisations. From 1990 to today, AMS

[1] Brunei Darussalam, Cambodia, the Lao People's Democratic Republic, and Myanmar also belong to ASEAN. However, these four countries are excluded from the study, as they account for a small share of the ASEAN economy, and published data are likely to lose their quality – particularly those of the past.

have encountered various economic shocks, including local political disturbances (e.g. Indonesia in 2008) and natural disasters (e.g. Thailand in 2011) as well as global economic shocks that impacted the entire region. In other words, this study encompasses both a macroeconomic study using statistical and econometric analyses and a modern economic history study focused on the selected AMS.

Before moving to the study, prediction errors must be defined. When firms predict production aggregated in the economy, their prediction errors are likely to be related to the uncertainty of future business environments – or, their decisions on current investment activities. On the other hand, when international organisations predict annual real GDP growth rates, their prediction errors are likely to be proxy variables for (macro)economic shocks and various uncertainties. Thus, in this study, the latter measure was used, because historical backgrounds that influenced country- and regional-level macroeconomies are the focus. Specifically, this study used data compiled by the Asian Development Bank (ADB) and International Monetary Fund (IMF),[2] because ADB and IMF have continually issued macroeconomic predictions; ADB data are available from 1990. Second, their predictions seem more objective than those of official government institutions, which tend to establish optimistic economic predictions. Third, macroeconomic predictions made by ADB and IMF are frequently cited in mass media and referred to by professional investors, analysts, and economists.

This study finds that if prediction errors of real GDP growth rates for the selected AMS are negative on average, these countries have been subjected to unforeseen negative economic shocks, including through global business recessions, export variations, and idiosyncratic domestic downturns. Second, correlation analyses with respect to actual values and prediction errors of real GDP growth rates within the selected AMS and with the world demonstrate that these two correlation coefficients are significantly large in the total sample period, implying that countries' business cycles are highly synchronised with those of the region and globe, as many existing studies have already presented. However, there are significant differences in the degree of correlation and statistical significance across the periods and countries.

[2] World Bank data were also gathered, but they were used only as a reference.

Finally, ordinary least squares (OLS) regression analyses of the prediction errors of real GDP growth rates were conducted separately for each AMS. These indicate that (i) variations of the global real GDP growth rate are positively associated with economic shocks, although merchandise export growth rates have positive reactions in some countries; (ii) the estimates have different quantitative significance across countries; (iii) residual variations approximate country-specific, domestic shocks; and (iv) global and country-level uncertainty indices are associated with negative economic shocks in some countries. Based on the dataset, the effects of the recent COVID-19 pandemic were also reviewed, and economic and historical backgrounds were examined that caused past economic shocks to the selected AMS. This study thus derives useful implications for various types of economic shocks by observing detailed factors of past economic shocks, policy responses, and recovery paths.

It is organised as follows. Section 2 surveys existing studies on business cycles in East and South-East Asia as well as on economic shocks and uncertainty measurements. Section 3 details the dataset used in the analyses. Section 4 reviews major economic shocks to the selected AMS. Section 5 demonstrates the results of the statistical and econometric analyses. Section 6 details a tentative evaluation regarding the effect of the COVID-19 pandemic. Section 7 describes the history of each AMS behind the prediction errors of macroeconomic indicators. Section 8 concludes.

2. Related Literature

2.1. Business Cycle Synchronisation in East and South-East Asia

Many studies have examined business cycles in East and South-East Asia. These studies mostly analysed business cycle synchronisation in East Asia – including South-East Asia – mainly from the viewpoint of trade and financial connectivity, given the fact that regional economic integration has advanced since the 1990s.[3] Meanwhile, research focussed on the ASEAN region has often been limited to Indonesia, Malaysia, the Philippines, Singapore, and Thailand.

Existing studies have demonstrated that trade integration is the most critical factor for business cycle synchronisation in East Asia, although they do often include different countries or regions. Jiang, Li, and Zhang (2019) revealed that – considering the development of regional supply chains in East Asia since the latter half of the 1990s – bilateral trade intensity (i.e. a value-added base) within East Asia has had a significant impact on business cycle synchronisation, while the impact of trade with partners outside of the region was not robust. Allegret and Essaadi (2011) indicated that an increase in bilateral trade in the region enhanced the degree of long-term – but not short-term – synchronisation, based on the time-varying coherence function. Using a simulation analysis of the dynamic general equilibrium model, Takeuchi (2011) confirmed business cycle synchronisation promoted by the expansion of product fragmentations between East Asian developing countries and major developed countries such as Japan and the United States (US). Despite a positive association between trade integration and business cycles with respect to East Asia, including the all current AMS, Nguyen, Hoang, and Nguyen (2020) demonstrated that the difference in trade structures across countries generated a negative impact on business cycle synchronisation.

In addition, Gong and Kim (2013) presented a positive impact of regional trade integration on the co-movement of business cycles, while Rena, Cheng, and

[3] In South-East Asia, the establishment of the ASEAN Free Trade Area (AFTA) was agreed to in 1992, and it was almost completed in 2010. As for East Asian economic integration, negotiations of the ASEAN+1 free trade agreements (i.e. with Australia and New Zealand, China, India, Japan, and the Republic of Korea) began in the 2000s and have already entered into force. Furthermore, the Regional Comprehensive Economic Partnership agreement was concluded amongst AMS, Australia, China, Japan, Republic of Korea, and New Zealand in 2020.

Chia (2012) found that intra-industry trade – rather than inter-industry trade – is responsible for business cycle synchronisation. Similarly, other studies have argued that the impact of intra-industry trade on East Asian business cycle synchronisation is relatively large due to the development of regional supply chains, such as those involving electrical and electronic equipment (Shin and Wang, 2003; Cortinhas, 2007; Rena, 2007; Li, 2017; Sng, Dou, and Rena, 2017). In contrast to these studies, however, Xie, Cheng, and Chia (2013) extended their distinctive view that trade specialisation actually negatively affects business cycle synchronisation.

Next, some studies have explored the effect of financial integration, but there has not been any consensus as to whether the effect is positive or negative. Rena (2007) and Nguyen, Hoang, and Nguyen (2020) asserted that the advancement of financial integration – as well as trade integration – is associated with business cycle synchronisation in East Asia. Xie, Cheng, and Chia (2013) showed that particularly after the Asian financial crisis, financial integration was promoted, positively affecting business cycle synchronisation in a direct manner.[4] Kim and Kim (2013) pointed to international capital flow encouraged by capital market liberalisation as a cause of positive correlation of business cycle synchronisation amongst Asia–Pacific countries. However, Gong and Kim (2013) demonstrated that while financial linkages with regions outside of East Asia are a substantial factor for business cycle synchronisation in East Asia, financial integration within the region negatively affects this synchronisation. By conducting a dynamic panel general moment of method, Pontines and Parulian (2010) discovered that strengthened financial integration has a negative impact on business cycle synchronisation in Asia–Pacific countries while bilateral trade enhances it. Sethapramote (2015) also mentioned that whereas trade integration is the main reason for business cycle synchronisation in the ASEAN region, financial integration is the only reason for synchronisation between ASEAN and the US.

Other studies highlighted other factors for business cycle synchronisation. Selover (1999) revealed that commodity prices, war, and political disturbances weaken synchronisation in ASEAN by using a bilateral vector autoregression (VAR) model. According to Moneta and Rüffer (2009), while much of business

[4] The impact is small for countries with large volatilities of exchange rates, however.

cycle synchronisation in East Asia is attributed to export synchronisation, common external factors – such as oil and commodity prices and the US dollar–Japanese yen exchange rate – are also critical factors. He and Liao (2012) indicated that developing countries in Asia have individual strong business cycles and that supply shocks via vertical trade integration and productivity improvements are the main reasons for business cycle synchronisation in these countries. Finally, Park (2013) argued that while the monetary aggregate is the most significant factor for macroeconomic variations in East Asia, supply shocks – such as changes in oil prices and productivity – have an effect on real GDP variations in individual countries.

2.2. Prediction Errors, Uncertainty, and Economic Shocks

Generally, economic predictions – particularly mid- and long-term – often entail an element of uncertainty. Bloom (2014) pointed to natural disasters, war, terrorist attacks, and unforeseen political shocks as reasons for generating uncertainty that can be regarded as 'natural experiments'. Moreover, public health problems – such as the COVID-19 pandemic – are also responsible for uncertainty. Besides such exogenous shocks, endogenous factors – such as burst bubbles and financial crises – could also cause uncertainty. It has been empirically observed that macroeconomic uncertainty is likely to rise when economic shocks or recessions occur; this tends to be higher in developing countries than in developed countries (Bloom, 2014).

Some methods are designed to measure uncertainty: (i) GDP growth rates, inflation rates, and volatility of economic indicators (e.g. stock prices); (ii) the degree of prediction variation (i.e. standard error) of economic indicators reported by economic institutions or other professionals; (iii) residuals in macroeconomic indicators that cannot be explained by econometric methods; (iv) errors that are measured by differences between prediction values and *ex post* ones (or actual values); (v) point predictions that include subjective probability distributions gathered from individual consumers and firms; and (vi) composite indicators that are compiled from the frequency of various words associated with uncertainty in newspapers and other resources. This subsection briefly reviews literature on the

fourth and sixth methods to measure economic shocks and uncertainty, which were used for this study.

With respect to *ex post* prediction errors of economic indicators, existing studies used data on predictions of production or business confidence made by firms (Bachmann, Elstner, and Sims, 2013; Arslan et al., 2015; Morikawa, 2016). These studies carefully defined standard deviations of prediction errors between present and former business confidence or average absolute values of prediction errors across firms as degrees of aggregate uncertainty that are specific to firms. Morikawa (2019) exploited a standard deviation and an average value of the absolute difference between the actual value of production in the present month and the prediction value in the previous month, based on monthly firm-base survey data.

However, it should be noted that since this study used prediction values of time-series macroeconomic indicators published by a few international organisations, it was difficult to keep sufficient samples to calculate a standard deviation, unlike the above studies that used cross-sectional firm survey data. For this reason, a prediction error was simply interpreted (i.e. the actual value minus the prediction value of the macroeconomic indicator) as an unforeseen economic shock. Especially when the error is negative, it is a negative economic shock – or uncertainty in the relevant country.[5] If the existing studies are followed, the prediction error may well be interpreted as uncertainty. However, it is difficult to explicitly disintegrate the prediction error into the factors of (negative) economic shocks and increased uncertainty from that information. Since annual macroeconomic data were used rather than monthly, firm-level microeconomic data to measure prediction errors, it is appropriate to interpret an error as an economic shock. So, hereafter, 'economic shock' is used, but this cannot always eliminate the factor of uncertainty.

Lastly, regarding a direct measurement of uncertainty, Baker, Bloom, and Davis (2016) conducted seminal research employing newspapers. They formulated

[5] Many existing studies have already shown that macroeconomic growth predictions published by governments and international organisations tend to exhibit upward-biased (i.e. optimistic) prediction values (Ashiya, 2007; Frankel, 2011; Merola and Perez, 2013; Morikawa, 2020; Pain et al., 2014; Timmermann, 2007). This study also tried to confirm whether prediction values of macroeconomic indicators, such as the real GDP growth rate of the selected AMS, have upward biases.

a policy uncertainty index by calculating the frequency of words, such as 'uncertainty (uncertain)' and 'economy (economic)', related to policy uncertainty, appearing in US newspapers. Similarly, they constructed another uncertainty measure that relied on text published by the US Federal Reserve Board's Beige Book and The Economist Intelligence Unit. In this study, the latter uncertainty measure was used to explain economic shocks that the selected AMS received, because its information is widely available and includes these countries.

3. Dataset

This section describes the dataset used in this study. The main macroeconomic indicators were collected from the statistical tables from the *Asian Development Outlook* from 1989 to 2022.[6] These reports, made public annually between March and April, demonstrate annual prediction values of that publication year and the next year, as well as annual actual values of the past 5 years.[7] While ADB also publishes the *Asian Development Outlook Update* every September to October since 2000 – a revised version of each year's *Asian Development Outlook* – these updated datasets were not used because they do not include sufficient samples for this analysis. It should also be noted that ADB (1999) did not report statistical tables, including the prediction of macroeconomic indicators, due to the difficulty in exhibiting point forecasts in the middle of the Asian financial crisis. Therefore, the 2000 prediction values from ADB (1999) are treated as missing values; these are extrapolated from the IMF dataset, if appropriate.

Three annual macroeconomic indicators based on ADB (1989−2022) were employed: (i) real GDP growth rates, (ii) inflation rates, and (iii) merchandise export growth rates, all of which were calculated in the percentage growth rate relative to the previous year. As for supplemental explanations, the GDP of each AMS was valued at market prices. The inflation rate was the averaged value of the Consumer Price Index across the year.[8] Merchandise exports evaluated in $ million

[6] ADB, *Asian Development Outlook*, Manila (33 years: 1989−2022).
[7] ADB (2020) exhibited prediction values of macroeconomic indicators both in 2020 and 2021.
[8] Although the reference year of the Consumer Price Index in Indonesia changed from 2012 to 2018, and the series may have some disruption from 2019 due to these changes, all series were used without any modification, anticipating that the analysis was not heavily affected.

were obtained from the balance-of-payments accounts of each AMS economy, and export data were based on free on board.[9]

While using datasets compiled by ADB to conduct the statistical and econometric analyses, prediction values of macroeconomic indicators published by other international organisations were referenced. For instance, the IMF World Economic Outlook Database was referenced to collect data on real GDP growth rates (i.e. a fixed-price base) and inflation rates of the AMS.[10] The World Economic Outlook Database is published twice a year, April and September−October, and the analysis employed only April data to be consistent with ADB data. IMF (1999), published in April 1999, is the oldest available dataset with respect to the selected AMS; 1-year-later prediction values are available from 2000 to 2022. Specifically, IMF (1999) was used to complement the missing prediction value of the 2000 real GDP growth rate in ADB (1999) for part of the analyses.

In addition, *Global Economic Prospects* by the World Bank is another reference that collected prediction values of the real GDP growth rate (i.e. fixed-price base) in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam from 2008 to 2022.[11] Although *Global Economic Prospects* has been published twice a year since 2010, the versions published in December or January were used to make use of as many samples as possible.

To examine the world-wide economic shocks that hit the six AMS, data on global real GDP growth rates (i.e. fixed-price base, without exchange rate adjustment) synthesised from 195 countries' GDP data were collected from IMF (1999−2022).[12] Its dataset on actual and prediction values are available from 1990 and 2000, respectively.

Importantly, past actual values of macroeconomic indicators were determined (i.e. real GDP growth rates, inflation rates, and merchandise export growth rates). With respect to the system of national accounts, the basis of the time series is

[9] For further information, see the 'Statistical Notes and Tables' of *Asian Development Outlook* of each year.

[10] IMF, World Economic Outlook Database, Washington, DC, (23 years: 1999−2022), https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending (accessed 16 May 2022).

[11] World Bank, *Global Economic Prospects*, Washington, DC, (25 years: 2007−2022).

[12] The World Bank also publishes global real GDP growth rates. However, since more samples are available from IMF, this study used these.

periodically modified; thus, actual values are frequently revised from those of the past. There is a serious concern that actual values of macroeconomic indicators from the present viewpoint may diverge from economic outlooks formulated by relevant international organisations or economists of that time. That is, immediate past values – such as those of the last year – could drastically change in the next year due to additional data becoming available for the system of national accounts. Considering these difficulties, 3-year lagged actual values of macroeconomic indicators from the report publication year were used, implying that, for example, the actual value of 2000 refers to that documented in the dataset of the 2003 report (e.g. *Asian Development Outlook 2003*). Unfortunately, since it is impossible to obtain 2020 and 2021 actual values of indicators by the abovementioned methodology, those listed in the 2022 report were used.

To facilitate the analyses, ADB (1989−2022) were used for data on the actual values of real GDP growth rates and inflation rates, as these cover the longest time span from 1990 to 2021. Indeed, when the actual values of these two indicators are compared between ADB (1989−2022) and IMF (1999−2022), they do not critically differ between the two datasets. If ADB (1999) is only used, the actual 1996 values are missing. To address this problem, actual values of real GDP growth rates and inflation rates were extrapolated from IMF (1999), and merchandise export growth rates from ADB (1998). In addition, the actual value of the global real GDP growth rates from 1990 to 1995 were extrapolated by referring to the statistical table offered by IMF (1999).

Table 1 represents the actual values, prediction values, and prediction errors of real GDP growth rates for the six selected AMS and the world. It also consolidates the average growth rates, standard deviations, and coefficients of variation (i.e. standard deviation divided by sample mean) in the 1990s, 2000s, and 2010s.

Table 1: Actual Values, Prediction Values, and Prediction Errs of Real GDP Growth Rates and World Uncertainty Index (%)

	Real GDP growth rate																					WUI	
	Indonesia			Malaysia			Philippines			Singapore			Thailand			Viet Nam			World				
	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	L	FD
1990	7,1	4,8	2,3	9,7	6,0	3,7	2,7	5,4	-2,7	8,3	6,0	2,3	10,0	7,5	2,5	5,1	6,5	-1,4	2,6	n.a.	n.a.	123,3	n.a.
1991	6,9	6,5	0,4	8,7	7,5	1,2	-0,5	6,2	-6,7	6,7	7,7	-1,0	8,1	9,2	-1,1	6,0	8,1	-2,1	1,8	n.a.	n.a.	80,6	-42,8
1992	6,5	6,6	-0,1	7,8	8,7	-0,9	0,3	4,1	-3,8	6,0	6,5	-0,5	7,9	8,0	-0,1	8,6	4,9	3,7	2,7	n.a.	n.a.	101,8	21,3
1993	7,3	7,0	0,3	8,3	8,0	0,3	2,1	4,3	-2,2	10,1	7,0	3,1	8,3	8,1	0,2	8,1	4,5	3,6	2,7	n.a.	n.a.	129,6	27,8
1994	7,5	6,7	0,8	9,1	7,8	1,3	4,4	4,5	-0,1	10,5	6,0	4,5	8,9	8,5	0,4	8,8	8,2	0,6	4,0	n.a.	n.a.	101,3	-28,3
1995	8,2	7,0	1,2	9,5	8,4	1,1	4,8	5,5	-0,7	8,7	6,0	2,7	8,8	8,5	0,3	9,5	10,0	-0,5	3,7	n.a.	n.a.	101,8	0,5
1996	8,0	7,1	0,9	8,6	8,0	0,6	5,9	5,5	0,4	7,5	8,5	-1,0	5,5	8,0	-2,5	9,3	9,0	0,3	4,3	n.a.	n.a.	102,3	0,5
1997	4,7	7,7	-3,0	7,5	8,0	-0,5	5,2	5,7	-0,5	8,0	7,5	0,5	-1,8	8,0	-9,8	8,2	9,9	-1,7	4,1	n.a.	n.a.	87,3	-15,0
1998	-13,1	7,9	-21,0	-7,4	8,5	-15,9	-0,6	6,5	-7,1	0,1	8,0	-7,9	-10,8	6,6	-17,4	4,4	9,3	-4,9	2,8	n.a.	n.a.	118,2	31,0
1999	0,9	1,0	-0,1	6,1	4,5	1,6	3,4	4,0	-0,6	6,9	4,5	2,4	4,4	1,0	3,4	4,7	6,5	-1,8	3,6	n.a.	n.a.	94,3	-23,9
2000	4,8	2,5	2,3	8,3	2,0	6,3	4,4	3,0	1,4	9,4	4,2	5,2	4,6	3,0	1,6	6,1	4,5	1,6	4,7	3,4	1,3	92,7	-1,6
2001	3,5	5,0	-1,5	0,3	6,1	-5,8	3,0	4,3	-1,3	-1,9	6,2	-8,1	2,1	4,6	-2,5	5,8	6,0	-0,2	2,5	3,9	-1,4	210,3	117,5
2002	4,3	4,5	-0,2	4,1	6,0	-1,9	4,3	4,2	0,1	3,2	6,0	-2,8	5,3	4,5	0,8	6,4	6,9	-0,5	3,0	3,9	-0,9	206,3	-4,0
2003	5,0	3,6	1,4	5,4	5,8	-0,4	4,5	4,5	0,0	2,9	6,5	-3,6	7,0	3,0	4,0	7,3	6,8	0,5	4,0	4,0	0,0	240,3	34,0
2004	5,0	4,0	1,0	7,2	5,1	2,1	6,2	4,5	1,7	8,8	4,2	4,6	6,3	5,5	0,8	7,8	7,1	0,7	5,3	4,1	1,2	134,2	-106,0
2005	5,7	4,5	1,2	5,0	5,6	-0,6	4,9	5,0	-0,1	7,3	4,8	2,5	4,5	6,2	-1,7	8,4	7,6	0,8	4,4	4,9	-0,5	139,4	5,2
2006	5,5	6,0	-0,5	5,8	5,3	0,5	5,4	5,0	0,4	8,4	4,5	3,9	5,2	5,8	-0,6	8,2	7,6	0,6	5,1	5,6	-0,5	101,7	-37,7
2007	6,3	6,0	0,3	6,2	5,8	0,4	7,1	5,3	1,8	8,2	4,6	3,6	4,9	5,5	-0,6	8,5	8,0	0,5	5,2	5,7	-0,5	168,8	67,1
2008	6,0	6,3	-0,3	4,7	5,7	-1,0	3,7	5,7	-2,0	1,5	5,5	-4,0	2,5	5,0	-2,5	6,3	8,5	-2,2	2,9	4,9	-2,0	146,2	-22,6
2009	4,6	6,2	-1,6	-1,6	5,9	-7,5	1,1	6,2	-5,1	-1,0	5,8	-6,8	-2,3	5,2	-7,5	5,3	8,1	-2,8	-0,6	3,8	-4,4	185,6	39,3
2010	6,2	5,0	1,2	7,2	4,4	2,8	7,6	3,5	4,1	14,8	3,5	11,3	7,8	3,0	4,8	6,8	6,5	0,3	5,2	1,9	3,3	189,3	3,7
2011	6,5	6,0	0,5	5,1	5,0	0,1	3,6	4,6	-1,0	6,0	5,0	1,0	0,1	4,5	-4,4	5,9	6,8	-0,9	3,9	4,3	-0,4	168,0	-21,3
2012	6,0	6,7	-0,7	5,6	5,3	0,3	6,8	5,3	1,5	3,4	4,8	-1,4	6,5	4,8	1,7	5,2	6,7	-1,5	3,4	4,5	-1,1	300,4	132,4
2013	5,6	6,7	-1,1	4,7	5,0	-0,3	7,1	5,0	2,1	4,7	4,5	0,2	2,7	5,5	-2,8	5,4	6,2	-0,8	3,3	4,1	-0,8	200,0	-100,4
2014	5,0	6,6	-1,6	6,0	5,5	0,5	6,2	5,9	0,3	3,6	3,7	-0,1	0,9	5,0	-4,1	6,0	5,6	0,4	3,5	4,0	-0,5	177,7	-22,3
2015	4,9	6,0	-1,1	5,0	5,0	0,0	6,1	6,7	-0,6	2,2	4,1	-1,9	3,0	4,5	-1,5	6,7	5,8	0,9	3,5	3,9	-0,4	237,5	59,8
2016	5,0	6,0	-1,0	4,2	5,0	-0,8	6,9	6,3	0,6	2,8	3,4	-0,6	3,4	4,1	-0,7	6,2	6,2	0,0	3,4	3,8	-0,4	258,9	21,4
2017	5,1	5,5	-0,4	5,7	4,4	1,3	6,7	6,1	0,6	4,3	2,2	2,1	4,1	3,5	0,6	6,8	6,5	0,3	3,9	3,5	0,3	227,9	-31,0
2018	5,2	5,3	-0,1	4,8	4,6	0,2	6,3	6,6	-0,3	3,5	2,3	1,2	4,2	3,6	0,6	7,1	6,7	0,4	3,6	3,6	-0,1	236,1	8,2
2019	5,0	5,3	-0,3	4,4	5,0	-0,6	6,1	6,9	-0,8	1,1	2,9	-1,8	2,2	4,1	-1,9	7,0	6,8	0,2	2,9	3,9	-1,1	406,5	170,4
2020	-2,1	5,3	-7,4	-5,6	4,7	-10,3	-9,6	6,4	-16,0	-4,1	2,6	-6,7	-6,2	3,7	-9,9	2,9	6,7	-3,8	-3,1	3,6	-6,7	336,0	-70,4
2021	3,7	5,0	-1,3	3,1	5,5	-2,4	5,6	6,5	-0,9	7,6	2,0	5,6	1,6	2,5	-0,9	2,6	6,8	-4,2	6,1	5,8	0,3	178,2	-157,9

Table 1 Continued: Actual Values, Prediction Values, and Prediction Errs of Real GDP Growth Rates and World Uncertainty Index

	Real GDP growth rate																				WUI	
	Indonesia			Malaysia			Philippines			Singapore			Thailand			Viet Nam			World				
	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	A	P	E	L	FD
1990s	4,40	6,23	-1,83	6,79	7,54	-0,75	2,77	5,17	-2,40	7,28	6,77	0,51	4,93	7,34	-2,41	7,27	7,69	-0,42	3,22	n.a.	n.a.	104,1	-3,2
	6,18	1,92	6,52	4,83	1,24	5,19	2,27	0,84	2,56	2,75	1,14	3,32	6,16	2,21	6,05	1,90	1,89	2,49	0,79			14,75	24,76
	1,40	0,31		0,71	0,16		0,82	0,16		0,38	0,17		1,25	0,30		0,26	0,25		0,24			0,14	
2000s	5,07	4,86	0,21	4,54	5,33	-0,79	4,46	4,77	-0,31	4,68	5,23	-0,55	4,01	4,83	-0,82	7,01	7,11	-0,10	3,65	4,40	-0,76	162,6	9,1
	0,80	1,21	1,21	2,87	1,15	3,65	1,58	0,84	1,98	4,04	0,83	4,78	2,54	1,04	2,92	1,11	1,11	1,32	1,72	0,75	1,56	45,80	57,80
	0,16	0,25		0,63	0,22		0,36	0,18		0,86	0,16		0,63	0,21		0,16	0,16		0,47	0,17		0,28	
2010s	5,45	5,91	-0,46	5,27	4,92	0,35	6,34	5,69	0,65	4,64	3,64	1,00	3,49	4,26	-0,77	6,31	6,38	-0,07	3,65	3,76	-0,12	240,2	22,1
	0,56	0,59	0,79	0,84	0,34	0,99	1,02	1,03	1,49	3,62	0,93	3,66	2,22	0,72	2,67	0,64	0,40	0,71	0,60	0,69	1,22	67,18	76,03
	0,10	0,10		0,16	0,07		0,16	0,18		0,78	0,26		0,64	0,17		0,10	0,06		0,16	0,18		0,28	
Total	4,71	5,63	-0,92	5,11	5,88	-0,77	4,12	5,29	-1,17	5,30	5,03	0,27	3,74	5,33	-1,59	6,61	7,04	-0,43	3,38	4,14	-0,69	174,5	1,8
	3,74	1,43	4,00	3,85	1,49	4,02	3,29	1,00	3,55	4,00	1,71	4,19	4,38	2,01	4,37	1,67	1,35	1,87	1,68	0,84	1,90	76,78	65,33
	0,79	0,25		0,75	0,25		0,80	0,19		0,75	0,34		1,17	0,38		0,25	0,19		0,50	0,20		0,44	

A = actual value, ASEAN = Association of Southeast Asian Nations, E = prediction error (A – P), FD = first difference of uncertainty level, GDP = gross domestic product, L = uncertainty level, P = prediction value, WUI = World Uncertainty Index.

Notes:

1. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (i.e. standard deviation/simple mean).
2. The prediction values of the 2000 real GDP growth rates for the six ASEAN Member States are extrapolated from IMF (1999).

Sources: ADB (1989−2022), IMF (1999), Economic Policy Uncertainty, https://www.policyuncertainty.com/index.html（accessed 16 May 2022）.

As seen in Baker, Bloom, and Davis (2016), the World Uncertainty Index is reported by the Economic Policy Uncertainty Project. For this study, the Economic Policy Uncertainty Index, composed of the frequency of words related to uncertainty appearing in newspapers, was not used. Instead, the World Uncertainty Index, also created by the Economic Policy Uncertainty Project, was used.[13] The Economic Policy Uncertainty Index is available only from 1997, while the World Uncertainty Index is available from 1990 – and in some countries from the 1950s – consistent with this analysis that begins in 1990.

The World Uncertainty Index is based on individual country-level uncertainty indices that are calculated on a quarterly basis by counting the frequency of the word 'uncertainty' and closely relevant words appearing in country reports of The Economist Intelligence Unit. Data on the six AMS country-level uncertainty indices are available from at least 1990. All indices were magnified 100-fold, and the World Uncertainty Index (i.e. weighted average of countries' GDPs) were downsized by 100 to read numerical values. The numerical expansion and contraction did not affect the statistical analyses, excluding numerical scales. Furthermore, since the dataset has an annual base, the series of the annual uncertainty indices simply average the quarterly World Uncertainty Index and country-level uncertainty indices.

4. Major Economic Shocks to South-East Asia

Before showing analytical results of the statistical analyses, Section 4 reviews major, negative economic shocks that hit the six selected AMS in the past. It is important to note that there were two common negative economic shocks: the 1997−1998 Asian financial crisis and the 2008−2009 global financial crisis. Section 4 depends on Institute of Developing Economies (1990−2021).[14]

[13] See Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html（accessed 16 May2022）

[14] Institute of Developing Economies, *Yearbook of Asian Affairs*, Chiba (30 years: 1990−2020).

4.1. Asian Financial Crisis

The Asian financial crisis initially broke out due to the significant depreciation of the Thai baht in July 1997. Thailand and other countries had pegged their currencies to the US dollar (i.e. exchange rates between the currencies and the US dollar were fixed). When corporate investors – such as US hedge funds – executed short sales of various currencies in Asia, a financial crisis was triggered, stemming from Thailand. Fragile Asian financial systems – due to insufficient management and monitoring of financial risks as well as inadequate regulations to guarantee financial soundness and transparency – were impacted by frantic bubbles and a lowered quality of bank lending. Because of increased bad debts and bankrupt financial institutions and firms, a serious economic recession thus occurred in Asia.

The financial crisis spread to Indonesia, the Republic of Korea, Malaysia, the Philippines, and Singapore, so a serious and wider economic crisis began by 1998. According to Table 1, the 1997 to 1998 actual real GDP growth rates of the six selected AMS indicate this rapid decline in the macroeconomic environment: Indonesia (4.7% to −13.1%); Malaysia (7.5% to −7.4%); the Philippines (5.2% to −0.6%); Singapore (8.0% to 0.1%); Thailand (−1.8% to −10.8%); and Viet Nam (8.2% to 4.4%). Similarly, global real GDP growth rates decreased from 4.1% in 1997 to 2.8% in 1998.

The negative economic shocks caused by the Asian financial crisis can also be assessed by observing the prediction errors of the real GDP growth rates. The prediction errors in 1997 and 1998, with respect to the six AMS, were calculated as follows: Indonesia (−3.0% point to −21.0% point); Malaysia (−0.5% point to −15.9% points); the Philippines (−0.5% point to −7.1% points); Singapore (−0.5% point to −7.9% points); Thailand (−9.8% points to −17.4% points); and Viet Nam (1.7% points to −4.9% points). As negative prediction errors significantly expanded in 1998, negative economic shocks from 1997 to 1998 were not arguably expected at all when the predictions were announced in April 1997.

Regarding the economic and political impacts of the Asian financial crisis, Indonesia was particularly stuck in a vicious cycle of economic deterioration and political destabilisation, as economic bankruptcy resulted in the collapse of the

political system that President Mohammed Suharto had established. Moreover, Malaysia and Thailand also became politically unstable in 1998. Although Philippine and Singaporean politics were not directly affected by the Asian financial crisis, their real GDP growth rates in 1998 slowed down drastically. Although Viet Nam also witnessed decreasing economic growth, it was lightly affected because its degree of economic openness was still low. After 1999, economies in ASEAN began to recover, led by exports to the US and trade within Asia.

4.2. Global Financial Crisis

The global financial crisis was caused by the Lehman Shock in the US in September 2008. The ASEAN economy had smoothly grown since 2002−2003, but it started to decelerate after the 4th quarter of 2008. GDP growth rates of the six AMS in 2008 and 2009 are shown in Table 1 as follows: Indonesia (6.0% to 4.6%); Malaysia (4.7% to −1.6%); the Philippines (3.7% to 1.1%); Singapore (1.5% to −1.0%); Thailand (2.5% to −2.3%); and Viet Nam (6.3% to 5.3%). The global real GDP growth rates also decreased from 2.9% in 2008 to −0.6% in 2009. Likewise, prediction errors of real GDP growth rates were calculated as follows: Indonesia (−0.3% point to −1.6% points); Malaysia (−1.0% point to −7.5% points); the Philippines (−2.0% points to −5.1% points); Singapore (−4.0% points to −6.8% points); Thailand (−2.5% points to −7.5% points); and Viet Nam (−2.2% points to −2.8% points). Negative prediction errors expanded in 2009, and unforeseen negative economic shocks became more profound. However, Indonesia, Malaysia, and Viet Nam experienced steady growth through 2008.

The negative impacts of the global financial crisis on the six AMS were not as serious as those on other countries outside of the region. However, as Malaysia, Singapore, and Thailand registered negative GDP growth rates and the Philippines stagnated at only 1% growth in 2009, these countries did not entirely avoid the negative effects of the global financial crisis. Indonesia and Viet Nam, which had larger shares of domestic markets and lower GDP per capita, were minimally impacted by the global recession, but Malaysia, Singapore, and Thailand, which highly depended on exports, saw serious impacts. Indeed, Malaysia, Singapore, and Thailand recognised the serious threat to their economies; therefore, they

implemented extensive large-scale fiscal and monetary policies. By the end of 2009, the six AMS entered a moderate economic recovery process, which was enhanced by economic stimulus packages as well as the global economic recovery.

5. Analytical Results

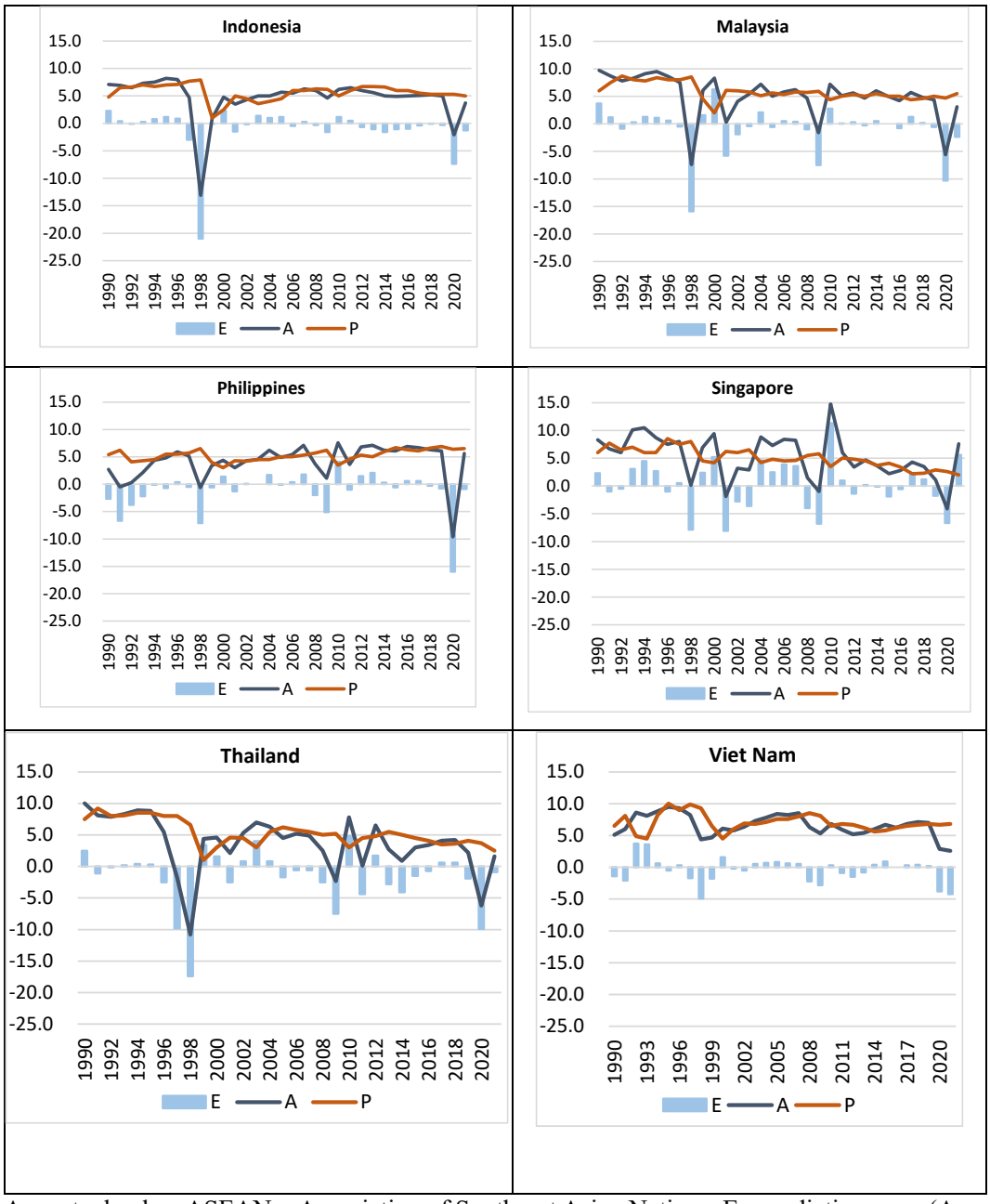
Section 5 details (i) an overview of real GDP growth rates and prediction errors across the six selected AMS; (ii) correlation analyses of these two series from 1990 to 2021 within the six AMS and with the world; and (iii) regression analyses of the prediction errors in each country.

5.1. Actual Values and Prediction Errors of Real GDP Growth Rates

In Table 1, the shaded cells signify negative prediction errors, wherein actual values fall below prediction values. This implies that past prediction values overestimated macroeconomic environments that were hit by unforeseen negative economic shocks. Among the sample period of 1990−2021 (i.e. 32 years), overestimations can be observed in Indonesia (19 years), Malaysia (14 years), the Philippines (19 years), Singapore (15 years), Thailand (19 years), and Viet Nam (15 years).[15] Specifically, it appears that the predictions of Indonesia, the Philippines, and Thailand tended to heavily overestimate the macroeconomic environments. The Philippines recorded negative prediction errors mostly in the 1990s, while Indonesia and Thailand saw them mostly after 2005. Recent overestimations are more conspicuous in Indonesia and Thailand than in the other countries. Particularly, while Indonesia has highly appreciated with its recent stable, remarkable economic growth, its prediction errors are negative in 10 consecutive years from 2012 to 2021. Moreover, while having a lower frequency of negative prediction values, Malaysia, Singapore, and Viet Nam also recorded them in around half of the total sample years (Figure 1).

[15] Examining the standard deviations and coefficients of variation, they are larger for the actual values than for the prediction values with respect to all countries, which means that the actual real GDP growth rates fluctuated more than their predictions.

Figure 1: Actual Values, Prediction Values, and Prediction Errors of the Real GDP Growth Rate in Selected ASEAN Member States



A = actual value, ASEAN = Association of Southeast Asian Nations, E= prediction error (A − P), GDP = gross domestic product, P = prediction value.
Sources: ADB (1989–2022), IMF (1999).

Taking the simple average over these three values across 32 years (i.e. 1990−2021), prediction errors are negative in the six AMS, which supports the findings of existing studies that prediction values have upward, optimistic biases.[16] However, the average prediction error for Singapore is positive in 1990s; that for Indonesia is almost zero in 2000s; those for Malaysia, the Philippines, and Singapore are positive; and that for Viet Nam is almost zero in 2010s. Notably, recording a negative prediction error (i.e. −0.50% point) and a small standard deviation (i.e. 1.87) despite a high average real GDP growth rate (i.e. 6.61%) for 32 years suggests that Viet Nam has seen relatively stable economic growth since the 2010s.

In addition, Singapore continued its solid growth before the COVID-19 pandemic, exhibiting the smallest prediction error (i.e. 0.11% point). In sharp contrast, Thailand shows sizable, negative prediction errors in the 1990s (i.e. −2.41% point), 2000s (i.e. −1.09% point), and 2010s (i.e. −0.77% point), and the average prediction error for 32 years is −1.69% point, while its standard deviation is the largest at 4.40. Thailand could not exploit its growth potential sufficiently despite its long-time centrality of manufacturing and export bases in South-East Asia.

5.2. Correlation Analyses between the Six ASEAN Member States and the World

Table 2 calculates the Pearson (i.e. centred) correlation coefficients with respect to the six AMS and global real GDP growth rates in the 1990s, 2000s, 2010s, and total period (i.e. 1990−2021). Obviously, significantly positive correlations exist between all of them for the total period, excluding the relationship between Indonesia and the world. Although this analysis is very primitive, the finding is almost consistent with existing studies that observed business cycle synchronisation within South-East Asian countries.

[16] The average prediction error of the global real GDP growth rate is also negative. One possible reason for upward biases in ADB (1989−2022) is that its prediction values are frequently made in reference to upward-biased economic outlooks that individual governments published.

Table 2: Correlation Coefficients of Real GDP Growth Rates

	Malaysia	Philippines	Singapore	Thailand	Viet Nam	World
Indonesia	0.984 ***	0.471	0.884 ***	0.897 ***	0.650 **	0.131
	0.510	0.564 *	0.539	0.246	0.668 **	0.453
	0.433	-0.287	0.647 **	0.233	-0.428	0.570 *
	0.819 ***	0.471 ***	0.479 ***	0.793 ***	0.537 ***	0.294
Malaysia		0.493	0.896 ***	0.901 ***	0.549	0.142
		0.813 ***	0.878 ***	0.825 ***	0.605 *	0.906 ***
		0.274	0.796 ***	0.520	0.036	0.829 ***
		0.534 ***	0.766 ***	0.867 ***	0.613 ***	0.552 ***
Philippines			0.603 *	0.230	0.562 *	0.893 ***
			0.814 ***	0.813 ***	0.866 ***	0.929 ***
			0.244	0.724 **	0.062	0.160
			0.446 **	0.421 **	0.402 **	0.814 ***
Singapore				0.801 ***	0.575 *	0.285
				0.654 **	0.725 **	0.853 ***
				0.535	0.078	0.953 ***
				0.640 ***	0.481 ***	0.683 ***
Thailand					0.409	-0.109
					0.671 **	0.883 ***
					0.104	0.525
					0.528 ***	0.411 **
Viet Nam						0.509
						0.795 ***
						0.201
						0.400 **

GDP = gross domestic product.

Notes:

1. The values in the correlation table are the Pearson correlation coefficients. The first, second, third, and fourth rows represent the correlation coefficients of the 1990s, 2000s, 2010s, and the total period, respectively.
2. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors.

Albeit the limitation of small samples, what follows reviews correlation coefficients in the individual periods. First, in the 1990s, there is no statistically significant correlation between the countries (excluding the Philippines) and the world. Meanwhile, after the 2000s, significantly positive correlations exist in relation to the world: Malaysia and Singapore in the 2000s and 2010s; and Thailand, the Philippines, and Viet Nam in the 2000s. As suggested by previous literature, this seems to reflect that trade and financial integration with the global economy have advanced since the 2000s in East Asia. Second, the correlation is weaker amongst the six AMS in the 2010s than in the 2000s. For example, the correlation coefficients for Malaysia−Thailand and Singapore−Thailand in the 2010s are not significant. The 2010s is exactly the time when ASEAN economic integration first

occurred, but at the same time, autonomous business cycles may have been reinforced within each country in that period. Viet Nam does not exhibit significant correlation with the other AMS and the world in the 2010s, although it realised relatively high growth. Third, Indonesia tended to be influenced by its large domestic demand, so its correlation coefficient with the world in the total period is small (0.294) and statistically insignificant (10.2%).

Next, Table 3 shows the correlation coefficients of prediction errors of real GDP growth rates with respect to the six AMS and the world. It also examines the relationship between prediction errors and the World Uncertainty Index. Since prediction values of global real GDP growth rates are available only from 2000, the correlation coefficients regarding the prediction errors of those indicators in the 1990s are missing, and those in the total period were calculated based on 2000−2021.

Table 3: Correlation Coefficients of Prediction Errors of Real GDP Growth Rates and the World Uncertainty Index

	Malaysia	Philippines	Singapore	Thailand	Viet Nam	World	WUI
Indonesia	0.986 ***	0.581 *	0.855 ***	0.898 ***	0.599 *	n.a.	-0.218
	0.868 ***	0.692 **	0.688 **	0.744 **	0.732 **	0.819 ***	-0.340
	0.609 *	0.310	0.752 **	0.524	-0.059	0.706 **	-0.104
	0.862 ***	0.535 ***	0.526 ***	0.832 ***	0.572 ***	0.815 ***	-0.070
Malaysia		0.589 *	0.869 ***	0.880 ***	0.489	n.a.	-0.244
		0.812 ***	0.853 ***	0.711 **	0.745 **	0.873 ***	-0.634 **
		0.665 **	0.891 ***	0.667 **	0.191	0.886 ***	-0.425
		0.673 ***	0.736 ***	0.811 ***	0.591 ***	0.869 ***	-0.237
Philippines			0.699 **	0.438	0.359	n.a.	-0.074
			0.785 ***	0.805 ***	0.885 ***	0.932 ***	-0.330
			0.739 **	0.673 **	-0.177	0.684 **	-0.276
			0.593 ***	0.597 ***	0.481 ***	0.885 ***	-0.119
Singapore				0.823 ***	0.542	n.a.	0.575
				0.454	0.733 **	0.746 **	-0.752 **
				0.653 **	0.160	0.973 ***	-0.435
				0.600 ***	0.392 **	0.797 ***	-0.336 *
Thailand					0.558 *	n.a.	-0.037
					0.748 **	0.859 ***	0.024
					0.085	0.693 **	0.117
					0.555 ***	0.851 ***	-0.010
Viet Nam						n.a.	0.222
						0.915 ***	-0.338
						0.328	-0.017
						0.631 ***	-0.103
World							n.a.
							-0.370
							-0.403
							-0.392 *

GDP = gross domestic product, WUI = World Uncertainty Index.

Notes:

1. The values in the correlation table are the Pearson correlation coefficients. The first, second, third, and fourth rows represent the correlation coefficients of the 1990s, 2000s, 2010s, and the total period, respectively. The total period of the matrix relating to 'World' ranges from 2000 to 2021.
2. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors.

The correlation coefficients of prediction errors with respect to the six AMS and the world in the total period are all highly statistically significant; all have 1% significance, excluding only the correlation between Singapore and Viet Nam.[17] For this reason, economic shocks that the six AMS faced seem to have been synchronised with the growth rates themselves. The second finding is that the correlation coefficients regarding Indonesia become weaker over the 1990s to the 2000s and 2010s. Particularly in the 2010s, they are significantly correlated with those only for Malaysia and Singapore. With respect to Viet Nam, while there is positive correlation with the other AMS prediction errors in the 2000s, the correlation coefficients in the 2010s are not statistically significant; in addition, those with the world are not significant, either. Therefore, it is likely that Indonesia and Viet Nam have not been exposed to economic shocks common within the ASEAN region by leveraging autonomous domestic demand.

In contrast, the correlation coefficients of the prediction errors between Malaysia and Singapore remain at very high levels – possibly due to the economic and geographical proximity of the two countries. Furthermore, Singapore has large correlation coefficients with those of the other countries, excluding Thailand in the 2000s and Vietnam in the 1990s and 2010s. This finding suggests that economic shocks and increased uncertainty may have transmitted through Singapore –the centre of trade and finance in South-East Asia – to the other countries in the region.

Finally, the correlation coefficients concerning the World Uncertainty Index are significantly negative only with respect to Malaysia in the 2000s and Singapore in the 2000s and the total period. This implies that world uncertainty could have

[17] Moreover, the correlation coefficients in the 2000s and 2010s, excluding Indonesia and Viet Nam in the 2010s, are strongly significant.

affected the real domestic economies of these countries through, for example, financial systems and stock prices.

5.3 Regression Analysis of Prediction Error

To probe the factors for generating prediction errors of real GDP growth rates, OLS regression analyses were undertaken to regress the prediction errors (*cgdp*) of the following macroeconomic indicators: global real GDP growth rates (*ggdp*), merchandise export growth rates (*exm*), World Uncertainty Index (*wui*), and country-level uncertainty indices (*clui*). Note that these independent variables, except *clui,* are related to factors accounting for global economic fluctuations. Although such macroeconomic indicators as domestic consumption and investment should be added to the independent variables to explain domestic variations, these are not consistently available from ADB (1989−2022).[18]

Data on *cgdp* and *exm* were obtained from ADB (1989−2022). As noted, data of 2000 *exm* are missing and cannot be obtained, unlike *cgdp* by extrapolation from IMF (1999). The data on *cgdp* and *exm* are disrupted in 2000; thus, they cover 1990−1999 and 2001−2021. Data on *ggdp*, which range from 2000 to 2021, were obtained from IMF (1999−2022). Since *ggdp* and *exm* may be mutually correlated in general – and this correlation may cause serious multicollinearity – regression analyses were also conducted that added one of the two as independent variables. When only *exm* was employed as an independent variable, the sample covers 31 years (1990−2021, excluding 2000). In regression analyses, heteroskedasticity- and autocorrelation-consistent (HAC) standard errors were applied (Newey and West, 1987) by considering serial autocorrelation between the error terms.[19]

Table 4 presents the estimation results for the six AMS separately. Using Indonesia as an example, Estimation (1) includes both *ggdp* and *exm* as independent variables, but they do not generate serious multicollinearity, considering their variance inflation factors (VIFs), 1.312 for *ggdp* and 1.473 for *exm*. These VIF

[18] ADB published data on the ratio of domestic investment to GDP until 2011. However, these data cannot be used because the sample size is not adequate for this study.

[19] Since this dataset comprises time series, it may have unit roots that potentially cause spurious correlation in the regression analyses. However, all variables used were first differenced in calculating a growth rate. Hence, such concern for problems concerning unit roots is more or less alleviated.

results – that multicollinearity does not exist – are the case in Estimations (2)−(6). Nevertheless, since the concern of multicollinearity is not entirely resolved, Estimations (3) and (4) include only one of the two variables and exclude *clui*. However, Estimations (5) and (6), using the full sample (1990−1999 and 2001−2021), do not include *ggdp,* because this variable is available only from 2000.[20]

[20] Actually, the indicators of 2000 were excluded, so the sample ranges from 2001 to 2021.

Table 4: OLS Regression Analysis of the Prediction Error of Real GDP Growth Rates

Dependent variable: *cgdp*

	Indonesia					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	0.714 **	0.730 **	0.702 **			
	(0.305)	(0.292)	(0.271)			
exm	-0.004	-0.009		0.021	0.110	0.104
	(0.021)	(0.025)		(0.022)	(0.075)	(0.069)
wui	-0.005	-0.005	-0.004	-0.008	0.003	0.003
	(0.003)	(0.003)	(0.003)	(0.005)	(0.010)	(0.009)
clui	0.024 **				0.032	
	(0.010)				(0.028)	
F-stat.	9.36 ***	11.72 ***	18.16 ***	2.35	1.49	2.19
Adi. R^2	0.626	0.617	0.632	0.119	0.047	0.073
#Obs.	21	21	21	21	31	31
	Malaysia					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	1.457 ***	1.457 ***	1.435 ***			
	(0.146)	(0.140)	(0.092)			
exm	-0.006	-0.006		0.122 **	0.196 ***	0.184 **
	(0.028)	(0.039)		(0.049)	(0.066)	(0.070)
wui	0.0004	0.0004	0.001	-0.004	-0.0004	-0.002
	(0.003)	(0.003)	(0.003)	(0.009)	(0.008)	(0.008)
clui	-0.0002				-0.060	
	(0.027)				(0.063)	
F-stat.	14.14 ***	20.03 ***	31.74	3.68 **	4.92 ***	6.79 ***
Adi. R^2	0.724	0.741	0.755	0.211	0.281	0.278
#Obs.	21	21	21	21	31	31
	Phlippines					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	1.903 ***	1.957 **	1.762 ***			
	(0.522)	(0.759)	(0.487)			
exm	-0.036	-0.041		0.133 **	0.133 ***	0.136 ***
	(0.038)	(0.052)		(0.034)	(0.041)	(0.042)
wui	-0.006 **	-0.003	-0.004	-0.018 *	-0.001	-0.001
	(0.003)	(0.004)	(0.003)	(0.009)	(0.011)	(0.011)
clui	-0.062 **				-0.025	
	(0.024)				(0.058)	
F-stat.	19.20 ***	23.34 ***	34.57 ***	4.42 **	2.21	3.33 *
Adi. R^2	0.784	0.770	0.770	0.255	0.108	0.135
#Obs.	21	21	21	21	31	31

Table 4 Continued: OLS Regression Analysis of the Prediction Error of Real GDP Growth Rates

Dependent variable: *cgdp*

	Singapore					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	0.893 ***	1.072 ***	1.748 ***			
	(0.226)	(0.249)	(0.420)			
exm	0.199 ***	0.171 ***		0.264 ***	0.275 ***	0.264 ***
	(0.039)	(0.034)		(0.042)	(0.039)	(0.037)
wui	-0.002	-0.003	-0.009	-0.005	-0.004	-0.005
	(0.003)	(0.004)	(0.007)	(0.005)	(0.004)	(0.004)
clui	-0.156 ***				-0.159 ***	
	(0.046)				(0.052)	
F-stat.	18.83 ***	18.96 ***	15.67 ***	16.91 ***	24.14 ***	27.88 ***
Adj. R^2	0.781	0.729	0.595	0.614	0.698	0.642
#Obs.	21	21	21	21	31	31
	Thailand					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	1.308 ***	1.316 ***	1.582 ***			
	(0.160)	(0.171)	(0.071)			
exm	0.077 **	0.080 **		0.210 ***	0.239 ***	0.254 ***
	(0.028)	(0.028)		(0.039)	(0.054)	(0.068)
wui	0.013 *	0.012	0.009	0.010	0.011	0.010
	(0.007)	(0.007)	(0.007)	(0.011)	(0.008)	(0.009)
clui	0.015				0.057	
	(0.015)				(0.048)	
F-stat.	15.04 ***	20.94 ***	26.29 ***	7.32 ***	5.45 ***	7.87 ***
Adj. R^2	0.737	0.749	0.717	0.387	0.308	0.314
#Obs.	21	21	21	21	31	31
	Viet Nam					
	(1)	(2)	(3)	(4)	(5)	(6)
ggdp	0.589 ***	0.565 ***	0.494 ***			
	(0.076)	(0.088)	(0.082)			
exm	-0.032 *	-0.021		0.032	0.056 ***	0.057 **
	(0.015)	(0.013)		(0.030)	(0.020)	(0.021)
wui	-0.001	0.001	0.002	-0.001	0.0000	0.0003
	(0.007)	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)
clui	-0.049				-0.026	
	(0.054)				(0.027)	
F-stat.	3.07 **	3.57 **	5.32 **	1.54	1.52	2.21
Adj. R^2	0.293	0.278	0.302	-0.028	0.050	0.075
#Obs.	21	21	21	21	31	31

GDP = gross domestic product, OLS = ordinary least squares.

Notes:

1. *cgdp* = country-level real GDP growth rate, *clui* = Country-Level Uncertainty Index, *exm* = merchandise exports growth rate, *ggdp* = global real GDP growth rate, *wui* = World Uncertainty Index.
2. The estimate of the intercept is omitted.
3: The numerical values in the parentheses denote the heteroskedasticity and autocorrelation consistent standard error.
4: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors.

The estimates of *ggdp* are all significant across the relevant estimations (Table 4). Thus, economic shocks that the six AMS received are strongly associated with unforeseen variations of global economic growth. On the other hand, the estimates of *exm* are not necessarily significant according to the country and sample periods. These estimates for Indonesia in Estimations (1)−(6) are all insignificant, which implies that unforeseen variations in merchandise export growth rates may not be a significant cause of economic shocks to the Indonesian economy. The same tendency can be observed in Estimations (1)−(4) for Viet Nam (i.e. the estimate in Estimation [1] is slightly significantly negative, which is inconsistent with the theoretically expected sign), but the estimates in Estimations (5) and (6) are significantly positive. With respect to Malaysia and the Philippines, while the estimates of *exm* are not significant in Estimations (1) and (2), those in Estimation (4) are significantly positive, because the estimates of *exm* absorb a part of the effect of *ggdp.*[21] Meanwhile, the estimates of *exm* in Estimations (1)−(6) for Singapore and Thailand are significantly positive. Because the estimates of both *ggdp* and *exm* are at the same time significant, unforeseen global economic and merchandise exports shocks can be separated for these two countries. In other words, Singapore and Thailand have crucial export sectors in the South-East Asia region, so unforeseen merchandise export growth variations have linkages to economic shocks when the global economic shocks are appropriately controlled.

The above-mentioned estimation results of the six AMS are summarised in Table 5, which were extracted from Table 4. More precisely, for relevant estimates to be comparable, the estimates of *ggdp* for 2001−2021 correspond to Estimation (3), and the estimates of *exm* for 2001−2021 and 1990−2021 (excluding 2000) to Estimations (4) and (6), respectively. Recall that the estimates of *exm* are likely to absorb a part of the effect of *ggdp*. In this context, these estimates are not likely to completely represent the effect of *exm*, but this simplification is convenient and useful for a comparison between the two different periods.

[21] Note that the adjusted R^2 is drastically smaller in Estimation (4).

Table 5: Summary of Estimation Results

	Time period	Indonesia	Malaysia	Philippines	Singapore	Thailand	Viet Nam
ggdp	2001–2021	0.702 **	1.435 ***	1.762 ***	1.748 **	1.582 ***	0.494 ***
exm	2001–2021	0.021	0.122 **	0.133 **	0.264 ***	0.210 ***	0.032
	1990–2021 (excluding 2000)	0.104	0.184 **	0.136 ***	0.264 ***	0.254 ***	0.057 **

GDP = gross domestic product.
Notes:
1. *exm* = merchandise exports growth rate, *ggdp* = global real GDP growth rate.
2. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors

The estimates of *ggdp* are the Philippines (1.762), Singapore (1.748), Thailand (1.582), Malaysia (1.435), Indonesia (0.702), and Viet Nam (0.494). These numerical values represent the degree of the countries' linkages to the global economy. Intriguingly, the estimate for the Philippines is the largest, and this result contrasts with the result regarding *exm.* A plausible reason is that remittances of Philippine overseas workers are affected by variations of the global economy, thus cause economic shocks to the Philippine economy through domestic consumption.[22] On the other hand, Thailand's large tourism sector (i.e. representing 20.1% of nominal GDP in 2021) attracts many foreign tourists, which may have a connection to the relatively large estimate of *ggdp*. Moreover, since Singapore is the largest economic, financial, and trade hub in South-East Asia, the country obviously has strong connectivity to the global economy.

Second, if the estimates of *exm* for 2001−2021 are compared across the six AMS, the estimates are Singapore (0.264), Thailand (0.210), the Philippines (0.133), Malaysia (0.122), Viet Nam (0.032, insignificant), and Indonesia (0.021, insignificant). This order points to the magnitude of economic shocks that the countries receive through variations of merchandise export growth. In relative terms, the estimates for Singapore and Thailand are large, and those for Indonesia and Viet Nam are tiny and statistically insignificant. Specifically, the latter result shows that Indonesia and Viet Nam may be still in the process of enhancing connectivity with

[22] Remittances of $34.9 billion were so large that these accounted for about 10% of nominal GDP in 2021.

the global economy via exports and may have larger shares of domestic demand due to variations in their economies.

Third, a comparison of *exm* between 2001−2020 and 1990−2021 (excluding 2000) demonstrates while the estimates for the Philippines and Singapore almost remain the same, estimates for Malaysia and Thailand in the former period are smaller than in the latter one; and the estimate for Viet Nam is significantly positive only in the latter period, although the numerical value is still small.[23] Such 'attenuation' of the linkage with *exm* – particularly for Malaysia, Thailand, and Viet Nam in the more recent time period – is due to the diversification of export items, such as the export transformation from resource and primary products (e.g. crude oil, natural rubber) to manufacturing products (e.g. automobile products, electrical equipment). While resource and primary products are generally vulnerable to price fluctuations and productivity shocks, the effects of exports on these countries' economies become smaller as manufacturing products play greater roles in their merchandise exports. Another possible reason is an increase in service exports, which data on merchandise exports do not cover. In the 21st century, economic activities related to global service trade has been bolstered, owing to the advancement of information and communication technologies (ICT) and globalisation (Baldwin, 2016).

Estimation (2) attempts to estimate the impact of the external variation related to *ggdp*, *exm*, and *wui* (i.e. regression variation) on the variation of the economy as a whole (i.e. total variation).[24] Therefore, the (adjusted) R^2 signifies the share of the variation attributable to external shocks to the total variation. As expected, while the R^2 is high for Malaysia (0.741), the Philippines (0.770), Singapore (0.729), and Thailand (0.749), it is quite small for Viet Nam (0.278) and medium for Indonesia (0.617). Put differently, $1-R^2$ accounts for the residual variation that cannot be explained by the regression variation, that is, the domestic shock.

Furthermore, Table 6 shows the fitted values and residual values of the prediction errors of real GDP growth rates for the six AMS in 2001−2021 (i.e. 21

[23] Note that although the estimate for Indonesia in the latter period is also larger, the estimates in both periods are not significant.
[24] However, these estimates do not mean causal relation but mere correlation.

years) based on the estimated coefficients of Estimation (2). According to unreported calculations, since external variations were eliminated, the residual values rarely have positive correlations with each other across the AMS; the exceptions are only Malaysia−the Philippines and the Philippines−Thailand, which are significant at the conventional 5% level. Thus, domestic economic shocks seem to be mostly idiosyncratic (i.e. country-specific). For example, a large negative value of the residual, −2.86% points, for Thailand in 2011 includes a domestic economic shock caused by the domestic natural disaster (i.e. floods) specific to that year.

The estimates of *wui* for the Philippines in Estimations (1) and (4) are significantly negative, implying that the Philippine economy may have been affected by world uncertainty since the 2000s. As discussed, this is also possibly because the Philippine economy depends on remittances, which are susceptible to world uncertainty. However, since the relevant estimates in Estimations (2), (3), (5), and (6) are not significant, this finding is not robust.[25] Another interesting finding is the robustness of the negative estimates of *clui* for Singapore. Since the estimates are highly significant at the 1% level in both Estimations (1) and (5) and do not vary, this result on country-level uncertainty is fairly robust. One possible interpretation is that Singapore's well-maintained financial and capital markets may be immediately linked with domestic negative economic shocks by reflecting increased domestic uncertainty on decreases in stock and asset prices. In other words, these negative estimates seem to represent the characteristics of the Singaporean economy as a developed country. Furthermore, while the estimate of *clui* in Estimation (1) for the Philippines is also significantly negative, that in Estimation (5) is not; therefore, the negative correlation of country-level uncertainty with the Philippine economy is not decisive.

[25] The estimates of *wui* in Estimations (1)−(6) for Thailand are positive, opposite to a negative expectation. However, the estimate in only Estimation (1) is slightly significant at the 10% level, and this result is not robust.

Table 6: Fitted and Residual Values of the Prediction Errors of *cgdp*

	Indonesia			Malaysia			Philippines		
	E	F	R	E	F	R	E	F	R
2001	-1.50	-0.94	-0.56	-5.80	-1.98	-3.82	-1.30	-0.93	-0.37
2002	-0.20	-0.64	0.44	-1.90	-1.24	-0.66	0.10	-1.17	1.27
2003	1.40	-0.20	1.60	-0.40	0.07	-0.47	0.00	0.77	-0.77
2004	1.00	1.11	-0.11	2.10	1.66	0.44	1.70	3.06	-1.36
2005	1.20	-0.25	1.45	-0.60	-0.71	0.11	-0.10	0.10	-0.20
2006	-0.50	-0.01	-0.49	0.50	-0.72	1.22	0.40	-0.29	0.69
2007	0.30	-0.26	0.56	0.40	-0.69	1.09	1.80	-0.15	1.95
2008	-0.30	-1.32	1.02	-1.00	-3.00	2.00	-2.00	-2.69	0.69
2009	-1.60	-2.93	1.33	-7.50	-6.21	-1.29	-5.10	-6.52	1.42
2010	1.20	2.29	-1.09	2.80	4.73	-1.93	4.10	6.37	-2.27
2011	0.50	-0.33	0.83	0.10	-0.63	0.73	-1.00	0.32	-1.32
2012	-0.70	-1.14	0.44	0.30	-1.51	1.81	1.50	-2.18	3.68
2013	-1.10	-0.37	-0.73	-0.30	-1.10	0.80	2.10	-0.34	2.44
2014	-1.60	-0.18	-1.42	0.50	-0.77	1.27	0.30	-0.41	0.71
2015	-1.10	-0.33	-0.77	0.00	-0.46	0.46	-0.60	0.59	-1.19
2016	-1.00	-0.53	-0.47	-0.80	-0.47	-0.33	0.60	0.08	0.52
2017	-0.40	-0.10	-0.30	1.30	0.47	0.83	0.60	0.68	-0.08
2018	-0.10	-0.23	0.13	0.20	-0.14	0.34	-0.30	0.67	-0.97
2019	-0.30	-1.69	1.39	-0.60	-1.44	0.84	-0.80	-1.83	1.03
2020	-7.40	-5.47	-1.93	-10.30	-9.61	-0.69	-16.00	-12.12	-3.88
2021	-1.30	0.01	-1.31	-2.40	0.34	-2.74	-0.90	1.09	-1.99
	Singapore			Thailand			Viet Nam		
	E	F	R	E	F	R	E	F	R
2001	-8.10	-3.30	-4.80	-2.50	-3.28	0.78	-0.20	-0.76	0.56
2002	-2.80	-1.21	-1.59	0.80	-1.90	2.70	-0.50	-0.40	-0.10
2003	-3.60	1.76	-5.36	4.00	0.97	3.03	0.50	-0.14	0.64
2004	4.60	4.83	-0.23	0.80	1.57	-0.77	0.70	0.12	0.58
2005	2.50	2.22	0.28	-1.70	-1.55	-0.15	0.80	-0.56	1.36
2006	3.90	2.45	1.45	-0.60	-1.18	0.58	0.60	-0.66	1.26
2007	3.60	1.22	2.38	-0.60	-0.85	0.25	0.50	-0.47	0.97
2008	-4.00	-0.55	-3.45	-2.50	-3.10	0.60	-2.20	-1.46	-0.74
2009	-6.80	-7.93	1.13	-7.50	-8.16	0.66	-2.80	-1.85	-0.95
2010	11.30	9.07	2.23	4.80	5.46	-0.66	0.30	1.47	-1.17
2011	1.00	-0.66	1.66	-4.40	-1.54	-2.86	-0.90	-0.70	-0.20
2012	-1.40	-2.50	1.10	1.70	-1.39	3.09	-1.50	-0.64	-0.86
2013	0.20	-1.03	1.23	-2.80	-2.72	-0.08	-0.80	-0.50	-0.30
2014	-0.10	-1.11	1.01	-4.10	-2.21	-1.89	0.40	-0.39	0.79
2015	-1.90	-3.17	1.27	-1.50	-1.29	-0.21	0.90	-0.08	0.98
2016	-0.60	-1.03	0.43	-0.70	-0.52	-0.18	0.00	-0.14	0.14
2017	2.10	2.71	-0.61	0.60	1.15	-0.55	0.30	0.04	0.26
2018	1.20	3.05	-1.85	0.60	0.31	0.29	0.40	-0.13	0.53
2019	-1.80	-2.48	0.68	-1.90	-0.22	-1.68	0.20	-0.36	0.56
2020	-6.70	-8.33	1.63	-9.90	-8.28	-1.62	-3.80	-3.60	-0.20
2021	5.60	4.19	1.41	-0.90	0.44	-1.34	-4.20	-0.11	-4.09

E = prediction error, GDP = gross domestic product, F = fitted value, R = residual value.

Notes:

1. *cgdp* = country-level real GDP growth rate.
2. Fitted and residual values are calculated by the estimated coefficients of Estimation (2) in Table 4.

Source: Authors.

6. The Effect of the COVID-19 Pandemic

This section summarises the effect of the COVID-19 pandemic through the lens of prediction errors of macroeconomic indicators, in particular, real GDP growth rates. This analysis is not comprehensive, but it is helpful in examining whether such effect is *ex ante* anticipated, how external and domestic factors affect the economies, and how different economic shocks are distributed across the six AMS.

First, prediction errors of the 2020 real GDP growth rates were examined: Indonesia (−7.4% points), Malaysia (−10.3% points), the Philippines (−16.0% points), Singapore (−6.7% points), Thailand (−9.9% points), and Viet Nam (−3.8% points). Clearly, in 2020, all six AMS faced the largest negative economic shocks since the Asian financial crisis or global financial crisis. Considering the prediction error of the 2020 global real GDP growth rate of −6.7% points, the six AMS did not suffer the most severe economic downturns compared to others at the inception of the COVID-19 pandemic. In fact, the fitted and residual values of Table 6 indicate that these prediction errors are caused primarily by external shocks, such as a decrease in external demand and the disruption of global supply chains. In Singapore, the calculation demonstrates a positive residual value of 1.63% points in 2020, which compensates for the external shock to the economy.

There are also some differences in the effects of the COVID-19 pandemic in 2021. First, while negative prediction errors diminish in 2021 for all countries, they remain negative except for Singapore: Indonesia (−1.3% points), Malaysia (−2.4% points), the Philippines (−0.9% point), Singapore (5.6% points), Thailand (−0.9% point), and Viet Nam (−4.2% points). This implies that unforeseen negative economic shocks influenced the economies of five AMS even in 2021. Yet the prediction error of the 2021 global real GDP growth rate is positive at 0.3% point, and the global economy – centred on developed countries – did began to recover from the damage of the COVID-19 pandemic by easing economic and social regulations.

In contrast, many AMS worked to prevent outbreaks of COVID-19 by forcing lockdowns and were behind developed countries in expanding vaccinations

to their citizens. Indeed, Table 6 reveals that external shocks represented by the fitted values in 2021 are positive, excluding Viet Nam (−0.11%, but nearly null), while domestic shocks represented by the residual values are hugely negative in the other five ASEAN countries. Moreover, according to Tables 7−12 that summarise macroeconomic indicators of individual countries, prediction errors of the 2021 merchandise export growth rates are huge: Indonesia (35.5% points), Malaysia (17.9% points), the Philippines (6.1% points), Singapore (16.5% points), Thailand (8.8% points), and Viet Nam (11.2% points). Thus, the negative economic shocks in 2021 stemmed mostly from domestic shocks in these countries.

The recovery from the negative economic shocks of the COVID-19 pandemic differ amongst the six AMS. Only Singapore enjoyed a positive economic shock in 2021, as both its external and domestic shocks are positive, as the country removed most regulations through a speedy expansion of vaccinations. In contrast, Viet Nam experienced a large domestic shock represented by the residual value of −4.09% in 2021, possibly due to the prevalence of COVID-19 in the latter half of 2021 and the resulting delay in eliminating regulations and expanding vaccinations. While the negative shocks of the COVID-19 pandemic came mainly from external shocks in 2020, in 2021, they came from domestic shocks.[26]

7. Background of Economic Shocks

In this section, the historical backgrounds behind country-specific economic shocks and contemporary uncertainty are explained by analysing prediction errors in each AMS. First, actual values, prediction values, and prediction errors of real GDP growth rates, inflation rates, and merchandise export growth rates were tabulated. While data on real GDP growth rates were derived from ADB (1989−2022), IMF (1999−2022), and World Bank (2007−2022), those on inflation rates came from ADB (1989−2022) and IMF (1999−2022). These values were

[26] It is difficult to correctly distinguish the effect of economic shocks between external and domestic. In cases in which domestic factories were shut down to prevent COVID-19 infections from spreading amongst workers, this negative shock was counted as an external shock through a decrease in exports.

simply averaged across the 1990s, 2000s, 2010s, and the total period, but concrete values in specific years were referred to if necessary. The description of this Section also depends to a large extent on Institute of Developing Economies (1990−2021).

7.1. Indonesia

At first glance, Indonesia's data have upward biases attached to the prediction of real GDP growth rates in the 2010s, published by all of the international organisations. Specifically, the upward biases shown by data from ADB and World Bank are larger than those of IMF, which suggests that IMF, on average, made more conservative economic predictions. Whereas ADB and World Bank, as regional development banks, tend to highlight country growth potential, IMF works to maintain the international financial system, such as emergency loans and monitoring of foreign exchange markets and debt situations. In contrast to the real GDP growth rates, IMF also predicted a higher inflation rate in the 2010s than ADB. Moreover, ADB exhibited an upward bias of the merchandise export growth rates. This differing predictions are also observed in the other AMS.

1990s. Indonesia's economy in the first half of the 1990s remained stable, but the average prediction errors of the real GDP growth rates in the 1990s recorded −1.83% points due to the large negative economic shock caused by the Asian financial crisis. Indeed, the real GDP growth rates from 1997, 1998, and 1999 are 4.7% (prediction error: −3.0% points),[27] −13.1% (−21.0% points), and 0.9% (−0.1% point), respectively. The Asian financial crisis spread to Indonesia in 1998, causing a substantial depreciation of the Indonesian rupiah, a reduction in production, the shutdown of many businesses, an increase in unemployment, and a price surge in imported goods. The inflation rate rose to 58.5% (50.5% point) in 1998 at a record pace, which critically affected daily living. The Asian financial crisis made various economic problems facing Indonesia clear, including accumulated debt as an adverse effect of pursuing high growth, the high-cost economy due to government regulations, an insufficient depreciation of the rupiah relative to the US dollar, and bubbles produced by excessive investments in real

[27] The numerical value in parentheses represents a prediction error (i.e. percentage point) hereafter.

estate. To address these problems, IMF required that the government undertake immediate economic structural adjustments. In addition, President Suharto was forced to resign in May 1998 due to the deepening of the domestic economic crisis. Indonesia thus fell into a vicious cycle, in which the economic crisis caused a political crisis, and vice versa. As shown in Table 1, Indonesia experienced the biggest decline in its economy from the Asian financial crisis amongst the six AMS.

2000s. The decline in Indonesia's economy in the 2000s was limited; the real GDP growth rate was 5.07% (−0.02% point). Thus, in a relative sense, negative economic shocks were small, and uncertainty was low during this period. An uncertain price surge was also restrained, as the average inflation rate was not high at 8.76% (2.74% points). Although the real GDP growth rate slowed to 3.5% (−1.5% points) in 2001 due to the information technology bubble bursting, the downturn of the US and global economies, reduced investments and exports stemming from lower international competitiveness, and domestic political instability, Indonesia successfully avoided a serious economic recession, supported by relatively stable domestic demand, owing to a wage increase and an interest rate decline as well as government spending.[28] In addition, a recovery sign of investments was observed. When the global financial crisis happened, the rupiah depreciated, but the domestic economy was kept stable through appropriate and immediate government measures. The real GDP growth rate was sustained at 4.6% (−1.6% points) in 2009, which implied a weak negative economic shock compared to the other AMS, because domestic demand and economic stimulus policies contributed. Indonesia then began to attract investors' attention to its economic potentiality.

2010s. During the 2010s, Indonesia achieved more than 5% real GDP growth rates every year excluding 2015. The 2010s average real GDP growth rate was 5.45% (−0.46% point), and the negative prediction error is not large in the absolute value. In the beginning of the 2010s, since the economy was driven by domestic demand, exports of resources and primary products, and government internal economic policies, healthy economic conditions were maintained as foreign capital

[28] However, the 2001 merchandise export growth rate was largely negative at −12.3% (−21.3% points).

flowed into the market, and stock prices were boosted. However, prediction errors of the real GDP growth rate were negative for 8 consecutive years from 2012 to 2019 (beyond 2020, 10 consecutive years), which highlights the possibility that Indonesia could not realise economic development on par with its expected economic potential despite the absence of large negative economic shocks or a high degree of uncertainty. Specifically in the mid-2010s, while the unemployment rate stabilised at a low level, factors – such as the rise in import costs, a decrease in exports due to lower international commodity prices (e.g. crude oil), and a delay of infrastructure development – dampened Indonesia's economy. In the latter half of the 2010s, the economy ended with stable, but somewhat slow, growth, although it cannot be regarded as an extreme slump.

Table 7: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Indonesia

	Real GDP							Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		World Bank		A	ADB		A	ADB		IMF			
		P	E	P	E	P	E		P	E		P	E	P	E	L	FD
1990s	4.40	6.23	-1.83	n.a.	n.a.	n.a.	n.a.	8.59	11.95	-3.36	12.29	8.28	4.01	n.a.	n.a.	19.97	1.24
	6.18	1.92	6.52	n.a.	n.a.	n.a.	n.a.	7.87	2.23	7.59	15.73	2.27	16.40	n.a.	n.a.	6.83	7.79
	1.40	0.31		n.a.		n.a.		0.92	0.19		1.28	0.27		n.a.		0.34	
2000s	5.07	5.12	-0.02	4.82	0.25	n.a.	n.a.	9.71	8.82	-1.10	8.76	6.58	2.74	6.59	2.17	27.58	-2.03
	0.80	0.97	1.04	1.25	1.03	n.a.	n.a.	13.34	2.88	13.95	3.09	1.07	3.54	1.66	4.30	13.55	14.84
	0.16	0.19		0.26		n.a.		1.37	0.33		0.35	0.16		0.25		0.49	
2010s	5.45	5.91	-0.46	5.66	-0.21	5.87	-0.42	4.97	10.01	-5.04	4.85	5.01	-0.16	5.28	-0.43	13.17	2.02
	0.56	0.59	0.79	0.86	1.07	0.47	0.58	14.66	7.27	16.60	1.15	0.93	1.24	0.82	1.03	9.25	13.43
	0.10	0.10		0.15		0.08		2.95	0.73		0.24	0.19		0.15		0.70	
2020	-2.10	5.30	-7.40	5.17	-7.27	5.30	-7.40	-3.00	5.50	-8.50	2.00	3.30	-1.30	3.55	-1.55	11.19	-15.89
2021	3.70	5.00	-1.30	8.20	-4.50	5.20	-1.50	42.50	7.00	35.50	1.60	2.80	-1.20	2.94	-1.34	11.90	0.70
Total	4.71	5.74	-1.03	5.37	-0.52	5.87	-1.11	8.51	10.05	-2.16	8.21	6.39	1.96	5.69	0.66	19.69	-0.09
	3.74	1.34	4.02	1.26	2.03	0.52	1.87	13.67	4.86	14.64	9.60	2.18	9.72	1.60	3.29	11.65	12.45
	0.79	0.23		0.23		0.09		1.61	0.48		1.17	0.34		0.28		0.59	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html (accessed 16 May 2022).

7.2 Malaysia

1990s. The 1990s average real GDP growth rate was 6.79% (−0.75% point), as the country grew at a solid rate. The inflation rate in this period was also controlled appropriately. However, the Asian financial crisis had a serious impact on Malaysia in 1997, erasing its economic boom. While, as of the end of 1997, the crisis did not affect the overall Malaysian economy, the 1998 real GDP growth rate declined to −7.4% (−15.9% points). The Asian financial crisis spread to Malaysia because, like Thailand, the ringgit that moved with US dollar was overvalued, the current balance had a large deficit, and real estate bubbles burst. The decline in the value of ringgit and stock prices invited a decrease in domestic demand and uncovered weak financial systems; as a result, rapid credit contraction and an economic recession occurred. The 1997 and 1998 merchandise export growth rates drastically dropped to 1.2% (−15.3% points) and −7.3% (−22.3% points), respectively. Under this severe recession, the government implemented tight fiscal and monetary policies at the end of 1997, but transformed these to an aggressive stance by mid-1998 by formulating capital transaction restrictions, stabilising the financial system, and easing foreign capital restrictions. Thus, exports increased, supported by the depreciation of ringgit as well as the economic recovery in Asia, resulting in a higher growth rate of 6.1% (1.6% points) than expected.

2000s. In the 2000s, economic slumps and negative economic shocks were conspicuous. On average, prediction errors of the real GDP growth rate made by ADB and IMF recorded −1.58% points and −0.88% point, respectively.[29] During this period, remarkable negative economic shocks were observed in 2001 and 2009. In the 2001 economic recession, the merchandise export growth rate turned negative to −10.6% (−18.6% points), because of the US economic slowdown and the global demand decline in ICT equipment such as semiconductors. Consequently, the 2001 real GDP growth rate was kept barely positive at 0.3% (−5.8% points). Although an economic recovery began by 2002, the 2002 real GDP growth rate showed moderate growth of 4.1% (−1.9% points) because the inflow of foreign direct investment in the manufacturing sector slumped. During the global financial

[29] Again, IMF made more pessimistic predictions than ADB.

crisis, the real GDP growth rate stagnated at 4.7% (−1.0% point), and the inflation rate rose to 5.4% (2.7% points). In 2009, the real GDP growth rate slowed down to −1.6% (−7.5% points), because the exports of electrical and electronic components – which accounted for around the half of the total exports of Malaysia – dramatically decreased; the 2009 merchandise export growth rate was −21.1% (−28.9% points). In response to this economic slump, the government carried out large-scale economic stimulus polices such as employment measures and support to private firms.

2010s. The economy in the 2010s grew at a stable rate. The average real GDP growth rate and prediction error were both positive at 5.27% (0.35% point), which are the same if using data from IMF or the World Bank. In addition, the country-level uncertainty index decreased from 14.10 in the 2000s to 10.39 in the 2010s. Specifically, prediction errors were negative due to economic shocks only in 2013, 2016, and 2019. In 2013, exports faltered because of a decrease in foreign demand and the downturn of the Chinese economy. In 2016, the depreciation of the ringgit accelerated due to the low price of crude oil, stagnation of the Chinese economy, and unstable internal political conditions. While the 2016 merchandise export growth rate turned negative at −5.1% (−11.7% points), the absolute value was small compared to that in 2015 at −15.9% (−23.9% points). In 2019, Malaysia was heavily affected by the US–China trade conflict; hence, its growth rate of merchandise exports turned negative to −4.3% (−9.9% points). Malaysia could not experience strong exports in the 2010s. Nevertheless, domestic demand continued to be strong, so a serious economic recession was avoided in the 2010s.

Table 8: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Malaysia

	Real GDP							Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		World Bank		A	ADB		A	ADB		IMF			
		P	E	P	E	P	E		P	E		P	E	P	E	L	FD
1990s	6.79	7.54	-0.75	n.a.	n.a.	n.a.	n.a.	13.61	15.96	-2.35	3.67	4.32	-0.65	n.a.	n.a.	9.15	-0.17
	4.83	1.24	5.19	n.a.	n.a.	n.a.	n.a.	9.75	3.46	10.49	0.85	0.47	0.92	n.a.	n.a.	5.18	5.92
	0.71	0.16		n.a.		n.a.		0.72	0.22		0.23	0.11		n.a.		0.57	
2000s	4.54	5.70	-1.58	5.42	-0.88	n.a.	n.a.	7.19	10.68	-4.58	2.21	2.67	-0.39	2.83	-0.62	14.10	-1.40
	2.87	0.31	2.93	1.17	3.43	n.a.	n.a.	12.29	2.67	11.68	1.36	0.51	1.60	0.76	1.68	14.84	20.78
	0.63	0.05		0.22		n.a.		1.71	0.25		0.61	0.19		0.27		1.05	
2010s	5.27	4.92	0.35	4.59	0.68	4.95	0.32	3.58	6.95	-3.37	2.15	2.76	-0.61	2.71	-0.56	10.39	0.40
	0.84	0.34	0.99	1.10	1.79	0.36	0.99	11.77	1.28	12.14	0.93	0.43	0.86	0.47	1.07	7.02	11.40
	0.16	0.07		0.24		0.07		3.29	0.18		0.43	0.16		0.18		0.68	
2020	-5.60	4.70	-10.30	4.80	-10.40	4.60	-10.20	-6.20	4.00	-10.20	-1.10	2.70	-3.80	2.55	-3.65	14.70	10.73
2021	3.10	5.50	-2.40	9.00	-5.90	4.50	-1.40	27.50	9.60	17.90	2.50	1.30	1.20	2.79	-0.29	38.85	24.14
Total	5.11	6.00	-1.00	5.17	-0.83	5.01	-1.20	8.28	10.93	-2.93	2.55	3.19	-0.60	2.76	-0.72	12.19	0.72
	3.85	1.34	3.88	1.42	3.63	0.46	3.33	12.43	4.62	11.80	1.40	0.94	1.30	0.61	1.49	10.96	14.44
	0.75	0.22		0.27		0.09		1.50	0.42		0.55	0.29		0.22		0.90	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html (accessed 16 May 2022).

7.3. Philippines

1990s. In the 1990s, negative prediction errors were frequent, while the actual real GDP growth rates fell below prediction values. Thus, the 1990s average real GDP growth rate fell to 4.40% (−1.83% points). Specific to the Philippines, prediction errors became negative in as many as 9 years over the decade. Notably, in 1991, a negative real GDP growth rate of −0.5% (−6.7% points) was recorded, and the inflation rate rose to 18.7% (9.7% points). The country's economic deterioration from 1990 was attributable to huge external debt and debt repayments, the overvaluation of the Philippine peso, sluggish exports due to lower international competitiveness, and small capital formation amid a consumption-led economy. In addition, an expansion of financial deficit caused inflation and increased interest rates. At the same time, natural disasters (e.g. earthquakes, volcanic eruptions, and hurricanes) and a political crisis worsened economic conditions. After 1991, observing other AMS prosperity, the Philippines transformed its economic policy into one emphasising economic stability and advancing a liberalisation and openness policy. This economic reform enabled the Philippines to get back on a growth path. However, the Asian financial crisis gave the Philippines a large negative shock, provoked the depreciation of the Philippine peso, decreased stock prices, increased interest rates, and thereby deteriorated firm management. The 1998 real GDP growth rate declined to a mere −0.6% (−7.1% points), which suggests a only minor negative economic shock on the Philippines compared to those on Indonesia and Thailand.

2000s. Although it maintained a certain level of growth in the beginning of the 2000s, the Philippines continued to show little growth compared to other AMS. A vicious circle occurred between the economy and politics, in which political disturbances brought about depreciation of the Philippine peso and lowered stock prices, while the ailing economy caused political disturbances, such as a presidential resignation. In 2001, when the global recession occurred, a large decrease was observed in exports of semiconductor and electronic components, which were main exports of the Philippines. Consequently, the merchandise export growth rate of that year turned significantly negative to −16.2% (−30.2% points). However, the economy gradually realised high growth amid unstable politics,

underpinned by both stable domestic and external demand since the mid-2000s. For example, the 2007 real GDP growth rate reached 7.1% (1.8% points), which was the highest growth rate in the past 30 years. The inflation rate was also kept low, while the Philippine peso appreciated simultaneously. Despite such high growth, the economy marked a sizable drop in 2008−2009 due to the global financial crisis. The real GDP growth rates of these 2 years slowed to 3.7% (−2.0% points) and 1.1% (−5.1% points), respectively. Although exports slumped, the low share of exports to GDP compared to those of Malaysia and Thailand seems to have contributed to the positive 2009 real GDP growth rate.

2010s. Unlike the 1990s and 2000s, the 2010s average real GDP growth rate achieved 6.34% (0.65% point), which was much higher than expected. Moreover, the average inflation rate remained stable at a lower level of 3.20% (−0.73% point) than the prediction. The 2011 real GDP growth rate stagnated at 3.6% (−1.0% point), but consistent high growth from 6.0% to 7.0% was attained between 2012 and 2019. Such high growth included positive factors, such as political stability and confidence, sound public finance, solid domestic demand, increased investments, and continuous inflow of foreign direct investment. Positive prediction errors in 2012 (1.5% points) and 2013 (2.1% points) were attributable to the large positive residual values of 3.68% points and 2.44% points, respectively.

Table 9: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Philippines

	Real GDP							Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		World Bank		A	ADB		A	ADB		IMF			
		P	E	P	E	P	E		P	E		P	E	P	E	L	FD
1990s	2.77	5.17	-2.40	n.a.	n.a.	n.a.	n.a.	16.40	16.70	-0.30	9.73	8.78	0.95	n.a.	n.a.	15.77	0.87
	2.27	0.84	2.56	n.a.	n.a.	n.a.	n.a.	6.78	4.91	6.27	3.67	1.62	3.90	n.a.	n.a.	9.15	14.19
	0.82	0.16		n.a.		n.a.		0.41	0.29		0.38	0.18		n.a.		0.58	
2000s	4.46	4.97	-0.50	4.61	-0.15	n.a.	n.a.	1.65	8.77	-7.93	5.32	5.34	0.08	4.73	0.59	23.07	1.09
	1.58	0.64	1.99	0.85	1.98	n.a.	n.a.	11.46	2.20	13.53	1.99	0.92	2.56	0.74	2.47	9.18	11.91
	0.36	0.13		0.18		n.a.		6.94	0.25		0.37	0.17		0.16		0.40	
2010s	6.34	5.69	0.65	5.28	1.06	5.82	0.52	7.81	9.23	-1.42	3.20	3.93	-0.73	3.71	-0.51	11.80	-1.13
	1.02	1.03	1.49	1.70	2.09	1.12	1.35	13.67	2.73	12.15	1.22	0.60	1.17	0.49	1.20	6.53	7.14
	0.16	0.18		0.32		0.19		1.75	0.30		0.38	0.15		0.13		0.55	
2020	-9.60	6.40	-16.00	6.61	-16.21	6.60	-16.20	-9.80	5.20	-15.00	2.40	3.50	-1.10	3.27	-0.87	21.54	8.66
2021	5.60	6.50	-0.90	7.62	-2.02	6.20	-0.60	12.40	6.30	6.10	3.90	2.40	1.50	2.88	1.02	31.21	9.67
Total	4.12	5.36	-1.25	5.14	-0.41	5.96	-1.38	8.16	11.28	-3.15	5.90	5.84	0.11	4.12	0.04	17.48	0.83
	3.29	0.92	3.57	1.47	4.03	0.99	4.56	12.61	5.12	11.44	3.66	2.41	2.80	0.84	1.94	9.64	11.35
	0.80	0.17		0.29		0.17		1.54	0.45		0.62	0.41		0.20		0.55	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html (accessed 16 May 2022).

7.4. Singapore

1990s. Singapore achieved sharp economic growth as a member of Asian Newly Industrialized Economies in the 1990s, when both its average real economic growth and prediction error were positive at 7.28% (0.51% point). While the real GDP growth rate slightly fell to around 6.0% due to the stagnation of exports in 1991−1992, it rose to 10.1% (3.1% points) and 10.5% (4.5% points) in 1993 and 1994, respectively. Not only were investments in capital-intensive and high-technology manufacturing sectors (e.g. electronic components, chemicals) conducted, but also exports increased more than expected. Against the background of high growth and the appreciation of the Singapore dollar, Singapore was already acknowledged as almost a developed country by the mid-1990s. Even in the beginning of the Asian financial crisis, the main economic indicators demonstrated favourable conditions, as the 1997 real GDP growth rate was recorded at 8.0% (0.5% point). However, the adverse effects of the Asian financial crisis touched Singapore by 1998, and its 1998 real GDP growth rate rapidly decelerated to 0.1% (−7.9% points) due to a decline in stock prices. The decrease of exports was also caused by the stagnation of Asian markets and increased production costs. As this negative economic shock was attributable mostly to external factors, it would be difficult for Singapore to circumvent it only through policy efforts. After the Asian financial crisis, the economy immediately returned to a recovery path by 1999, achieving a high growth rate of 9.4% in 2000.[30]

2000s. The 2010s Singaporean economy can be separated into high and low growth periods. During the 2001 economic recession, a decrease in demand for ICT-related products affected the export sector as did the 11 September attacks in the US. The 2011 real GDP, as a result, registered negative growth of −1.9% (−8.1% points). In 2002 and 2003, it stagnated at 3.2% (−2.8% points) and 2.9% (−3.6% points), respectively, because the manufacturing sector fell into a prolonged slump and the unemployment rate continued to hover.[31] Especially in the first half of 2003, severe acute respiratory syndrome (SARS) imposed a heavy burden on the

[30] The prediction error derived by IMF was 5.2% points.
[31] As demonstrated in Table 6, the large negative residual values were −4.80% points, −1.59% points, and −5.36% points in 2001, 2002, and 2003, respectively.

economic recovery in Singapore. The Singaporean economy did achieve high growth from 7.0% to 8.0% between 2004 and 2007. During these 4 years, exports from the manufacturing sector were strongly reinforced by trade facilitation policies and active external investments in Asia, such as in Viet Nam. However, the 2008 global financial crisis spread to Singapore – the economic centre of South–East Asia – soon after the recession in the US. Singapore's 2008 real GDP growth rate decreased more rapidly to 1.5% (−4.0% points) than the other AMS, and the inflation rate increased to 6.6% (5.6% points). In 2009, the merchandise export growth rate decreased to −18.7% (−24.9% points), and the real GDP growth rate became negative at −1.0% (−6.8% points). To address this economic downturn, the government spent down the national reserve to prepare for the global financial crisis. The 2010s average real GDP growth rate was 4.68% (−1.19% points).

2010s. In the 2010s after the global financial crisis, high growth of real GDP was not observed; rather, the Singaporean economy was put on a stable growth track from 3.0% to 4.0%. Singapore did not encounter any large negative economic shocks in this period, but it maintained positive economic growth. Furthermore, Singapore continued to engage in strengthening its competitiveness as an economic hub in the region (e.g. through human capital enhancement, productivity improvement, and structural reforms). As evidence, the residual values were positive in 8 years of the 2010s, excluding 2017 and 2018.

Table 10: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Singapore

	Real GDP					Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		A	ADB		A	ADB		IMF			
		P	E	P	E		P	E		P	E	P	E	L	FD
1990s	7.28	6.77	0.51	n.a.	n.a.	9.92	10.40	-0.48	1.96	3.00	-1.04	n.a.	n.a.	8.60	0.46
	2.75	1.14	3.32	n.a.	n.a.	10.48	3.11	10.73	1.22	0.32	1.46	n.a.	n.a.	5.62	7.94
	0.38	0.17		n.a.		1.06	0.30		0.62	0.11		n.a.		0.65	
2000s	4.68	5.34	-1.19	4.78	-0.10	9.11	8.13	-0.23	1.49	1.63	-0.12	1.69	-0.20	10.62	-1.30
	4.04	0.79	4.61	0.80	4.66	13.18	1.87	12.29	1.83	0.66	2.30	0.34	1.93	7.75	11.32
	0.86	0.15		0.17		1.45	0.23		1.23	0.41		0.20		0.73	
2010s	4.64	3.64	1.00	3.27	1.37	3.63	6.32	-2.69	1.66	1.92	-0.26	2.01	-0.35	5.64	0.22
	3.62	0.93	3.66	1.51	4.67	11.48	4.74	13.48	1.91	0.74	1.96	0.77	1.96	3.56	4.46
	0.78	0.26		0.46		3.16	0.75		1.15	0.38		0.38		0.63	
2020	-4.10	2.60	-6.70	2.36	-6.46	-5.60	5.00	-10.60	-0.20	0.90	-1.10	1.39	-1.59	13.12	8.63
2021	7.60	2.00	5.60	2.96	4.64	20.60	4.10	16.50	2.30	1.30	1.00	0.51	1.79	21.85	8.73
Total	5.30	5.06	0.11	3.90	0.50	7.55	8.05	-0.90	1.66	2.13	-0.46	1.77	-0.24	8.86	0.35
	4.00	1.73	4.16	1.42	4.82	12.16	3.87	12.39	1.68	0.86	1.92	0.66	1.93	6.53	8.43
	0.75	0.34		0.36		1.61	0.48		1.01	0.40		0.37		0.74	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html（accessed 16 May 2022）.

7.5. Thailand

1990s. The average prediction error was negative in all periods: the 1990s, 2000s, and 2010s. This indicates the existence of negative economic shocks in Thailand over 1990−2019. Thailand has experienced a gradual decrease in its real GDP growth rates since the 1990s, and its potential GDP growth is highly likely to slow. The 1990s average real GDP grew at a sluggish pace of 4.93% (−2.41% points), and the prediction error showed a large negative value. Although the real GDP of Thailand expanded by an average of over 8% annually until 1995 – owing to the development of manufacturing and assembly sectors such as for automobiles and electronics – the growth curve curled downward after the Asian financial crisis. Indeed, Thailand was the source of the Asian financial crisis and a target of speculations in baht. Thailand did have an increase in defaulted real estate and construction credit, which was brought about by the promotion of financial liberalisation in the 1990s; thus, loan races in line with capital inflow were intensified. In 1998, the economic crisis further worsened, recording the largest decrease in the real GDP growth rate at −10.8% (−17.4% points) amongst the six AMS. Despite the drastic depreciation of baht, the 1998 merchandise export growth rate was negative at only −6.8% (−14.8% points). The indicators, with respect to production, also dropped, as exemplified by a more than 50% decrease in automobile sales in 1998. In response, the government advanced financial system reforms, the restructuring of firm debts, and encouraged privatisation.

2000s. Thailand was resurrected from the Asian financial crisis in the 2000s, but the average real GDP growth rate of 4.01% (−1.09% points) was lower than the IMF prediction due to the global financial crisis. During the economic recovery, the ratio of defaulted credits of financial institutions drastically fell, and exports rapidly increased, primarily in the electrical and electronic equipment and automobile sectors. However, the merchandise export growth rate dropped to −7.1% (−15.1% points) in 2001, influenced by the US recession; hence, the real GDP growth rate was only 2.1% (−2.5% points). In 2002−2004, the domestic demand expansion policy formulated by the Thaksin Shinawatra administration led the real GDP to stable

growth of more than 5.0%.[32] The residual values, particularly of 2002 and 2003 in Table 6, exhibited large values of 2.70% points and 3.03% points, respectively. In turn, after 2005, while exports continued to grow steadily, domestic demand entered an adjustment phase due to increasing interest rates and rising crude oil prices. During the global financial crisis, the Thai economy was exacerbated, accompanied by shrinking export markets. As a result, the 2009 real GDP growth rate was negative at −2.3% (−7.5% points). This decrease was the largest amongst the six AMS, too, perhaps because of the typical economic structure of Thailand, that is, exports that accounted for around 70% of total GDP.

2010s. In 2010, the real GDP rapidly recovered at a growth rate of 7.8% (4.8% points), facilitated by economic stimulus packages and export increases. However, the economy generally became sluggish in the 2010s. The shutdown of Japanese-affiliated firms prevailed in Thailand due to the 2011 Tōhoku earthquake and tsunami. Moreover, industrial estates and parks were directly damaged by catastrophic floods that occurred around Bangkok from September to November 2011. Although factories were not damaged by the floods, they were forced to shut down operations because logistics were seriously disrupted. The negative effect expanded to a wide variety of sectors, such as automobiles, that had driven exports, as well as the global economy. In short, Thailand was subjected to a negative economic shock that initiated from the inside. Consequently, the 2011 real GDP growth rate fell, and the prediction error became considerably negative at 0.1% (−4.4% points), wherein the residual value was −2.86% points. In addition, a military coup broke out in 2014; therefore, private consumption stagnated due to uncertainty, as shown by the negative residual value of −1.89% points. Both the 2015 and 2016 actual real GDP growth rates were lower than the predictions. Moreover, exports slumped due to the effect of the US–China trade conflict, which resulted in a 0.9% (−4.1% points) 2019 real GDP growth rate.

[32] The residual values, particularly of 2002 and 2003 in Table 6, exhibited large values of 2.70% points and 3.03% points, respectively.

Table 11: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Thailand

	Real GDP							Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		World Bank		A	ADB		A	ADB		IMF			
		P	E	P	E	P	E		P	E		P	E	P	E	L	FD
1990s	4.93	7.34	-2.41	n.a.	n.a.	n.a.	n.a.	11.54	14.86	-3.32	5.01	5.63	-0.62	n.a.	n.a.	19.63	1.06
	6.16	2.21	6.05	n.a.	n.a.	n.a.	n.a.	10.27	3.97	8.85	1.95	1.35	3.22	n.a.	n.a.	7.16	7.25
	1.25	0.30		n.a.		n.a.		0.89	0.27		0.39	0.24		n.a.		0.36	
2000s	4.01	5.03	-1.09	4.90	-0.89	n.a.	n.a.	10.94	9.46	0.53	2.43	2.72	-0.20	2.48	-0.05	21.78	-2.13
	2.54	0.88	2.96	1.08	3.06	n.a.	n.a.	11.63	2.44	12.26	1.84	0.57	2.19	0.89	2.38	14.90	20.08
	0.63	0.18		0.22		n.a.		1.06	0.26		0.76	0.21		0.36		0.68	
2010s	3.49	4.26	-0.77	4.08	-0.59	4.08	-0.59	5.23	9.40	-4.17	1.60	2.38	-0.78	2.42	-0.82	20.27	0.45
	2.22	0.72	2.67	1.58	3.38	0.80	2.29	9.29	5.37	10.76	1.42	0.67	1.37	0.90	1.28	8.99	7.23
	0.64	0.17		0.39		0.20		1.78	0.57		0.89	0.28		0.37		0.44	
2020	-6.20	3.70	-9.90	3.55	-9.75	3.90	-10.10	-6.50	4.50	-11.00	-0.80	1.00	-1.80	1.27	-2.07	8.59	-2.62
2021	1.60	2.50	-0.90	6.07	-4.47	2.80	-1.20	18.80	10.00	8.80	1.20	0.40	0.80	0.56	0.64	20.10	11.52
Total	3.74	5.40	-1.69	4.52	-1.32	4.12	-1.94	9.04	11.04	-2.33	2.84	3.42	-0.54	2.31	-0.46	20.17	0.08
	4.38	2.00	4.40	1.40	3.67	0.85	3.47	10.97	4.88	10.79	2.32	1.84	2.35	0.97	1.91	10.76	12.84
	1.17	0.37		0.31		0.21		1.21	0.44		0.82	0.54		0.42		0.53	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html (accessed 16 May 2022).

7.6. Viet Nam

1990s. Viet Nam aggressively promoted a market economy and the introduction of inward foreign direct investment through Doi Moi starting in 1986, achieving economic take-off and industrialisation in the 1990s, when the average real GDP growth rate was recorded at 7.27% (−0.42% point). Nevertheless, the economy encountered rampant inflation, the rates of which were 67.5%, 83.1%, and 37.6% in 1990, 1991, and 1992, respectively. The reasons for this high inflation included shifting to international procurement of resources such as crude oil, the price rise caused by the Gulf War, and financial instability due to an increase in liquidity. Although inflation calmed down from the mid-1990s, the average inflation rate in the 1990s was 23.93% (−4.37% points). The economy in the last half of the 1990s stagnated due partly to the slump of light manufacturing sectors, but the country realised a real GDP growth rate of 9.5% (−0.5% point) in 1995. The economy was on a solid growth path by the mid-1990s, and this growth was regarded as a result of measures formulated by 'Doi Moi'. During the Asian financial crisis, Viet Nam avoided large-scale rapid capital movements because it was less integrated with the global economy, and its capital markets were still underdeveloped. Since the effect of the crisis on the Vietnamese economy was minimal, a 1998 real GDP growth rate of 4.4% (−4.9% points) was maintained. However, given that other AMS increased their international competitiveness by taking advantage of the depreciation of their currencies, Viet Nam was forced to address its relatively low competitiveness.

2000s. In general, Viet Nam maintained good growth, as it was not affected by large negative economic shocks in the 2000s. Its average real GDP growth rate was 7.01% (−0.29% point), and the negative values of prediction errors were small. Inflation also began to calm down, the rate of which was 6.78% (1.80% points). The factors contributing to this high economic growth included the stable development of manufacturing sectors, increased inward foreign direct investment, growth of private and foreign firms, and expansion of exports. In addition, the government accelerated economic and institutional reforms, deregulation, and trade liberalisation to promote the private sector. In 2007, Viet Nam was admitted to the World Trade Organization, thanks to its strenuous efforts for economic enhancement. During the 2008 global financial crisis, the country suffered a high inflation rate of 23.0%

(16.7% points), and a lower real GDP economic growth rate of 6.3% (−2.2% points). However, Viet Nam still maintained a relatively high real GDP growth rate of 5.3% (−2.8% points) in 2009 compared to the other AMS. Despite a slump in exports caused by the global recession, domestic demand steadily grew, owing to measures contributing to macroeconomic stabilisation.[33]

2010s. The real GDP growth rates in the 2010s decelerated more than in the 2000s, but it was 6.31% (−0.07% point) annually on average. The average prediction error was almost 0% point, which means that Viet Nam in the 2010s achieved its potential growth rate as previously predicted. However, Viet Nam needed to address rising inflation in the last half of the 2010s. Firm activities were forced to stagnate, because financial austerity policies were implemented to constrain high inflation. Consequently, the real GDP growth rate between 2010 and 2013 decreased to 6.8% (0.3% point), 5.9% (−0.9% point), 5.2% (−1.5% points), and 5.4% (−0.8% point), respectively; as shown in Table 6, the residual values of these 4 years were negative. The actual real GDP growth rates frequently fell below the predictions during this period. Viet Nam was in the midst of negative economic shocks and uncertainty, but after 2014, it realised a real GDP growth rate of more than 6.0% while diminishing the adverse effect of the global economy, strengthening economic integration with foreign markets, and promoting domestic reforms.

[33] It is notable from Table 6 that the residual values of the 7 years were positive in the 2010s excluding 2002, 2008, and 2009.

Table 12: Summary of Macroeconomic Indicators and Country-Level Uncertainty Index, Viet Nam

	Real GDP							Merchandise exports			Inflation					Country-level uncertainty	
	A	ADB		IMF		World Bank		A	ADB		A	ADB		IMF			
		P	E	P	E	P	E		P	E		P	E	P	E	L	FD
1990s	7.27	7.69	-0.42	n.a.	n.a.	n.a.	n.a.	23.50	19.47	4.03	23.93	28.30	-4.37	n.a.	n.a.	7.88	-0.53
	1.90	1.89	2.49	n.a.	n.a.	n.a.	n.a.	10.19	8.23	13.13	27.71	28.27	16.97	n.a.	n.a.	5.66	9.13
	0.26	0.25		n.a.		n.a.		0.43	0.42		1.16	1.00		n.a.		0.72	
2000s	7.01	7.40	-0.29	6.65	0.36	n.a.	n.a.	17.82	13.42	3.58	6.78	5.80	1.80	5.15	1.63	7.46	1.78
	1.11	0.73	1.26	0.96	1.14	n.a.	n.a.	11.77	4.55	15.09	6.30	1.77	6.29	1.93	6.25	5.78	6.95
	0.16	0.10		0.14		n.a.		0.66	0.34		0.93	0.31		0.37		0.77	
2010s	6.31	6.38	-0.07	5.92	0.39	6.40	-0.09	16.83	12.31	4.52	6.08	6.31	-0.23	5.74	0.34	10.22	-1.78
	0.64	0.40	0.71	0.78	1.14	0.62	0.96	8.06	2.19	8.43	4.98	2.30	4.68	2.23	3.82	8.40	6.99
	0.10	0.06		0.13		0.10		0.48	0.18		0.82	0.37		0.39		0.82	
2020	2.90	6.70	-3.80	6.50	-3.60	6.50	-3.60	7.00	10.00	-3.00	3.20	3.80	-0.60	3.30	-0.10	5.59	5.59
2021	2.60	6.80	-4.20	7.00	-4.40	6.50	-3.90	19.00	7.80	11.20	1.80	3.50	-1.70	3.90	-2.10	8.52	2.93
Total	6.61	7.12	-0.50	6.33	-0.02	6.63	-0.90	18.98	14.72	4.06	11.65	13.08	-1.04	5.28	0.79	8.43	0.10
	1.67	1.29	1.87	0.91	1.67	0.75	1.61	10.43	6.43	12.16	18.15	19.26	10.84	2.08	5.02	6.64	7.73
	0.25	0.18		0.14		0.11		0.55	0.44		1.56	1.47		0.39		0.79	

A = actual value, ADB = Asian Development Bank, E = prediction error (A − P), FD = first difference, GDP = gross domestic product, IMF = International Monetary Fund, L = level, NA = not applicable, P = prediction value.

Notes:

1. Values of real GDP, merchandise exports, and inflation are calculated at the annual growth rate (%).
2. The first, second, and third rows of each period represent the simple mean, standard deviation, and coefficient of variation (standard deviation/simple mean).

Sources: ADB (1989−2022), IMF (1990−2022), World Bank (2007−2022), Economic Policy Uncertainty. https://www.policyuncertainty.com/index.html (accessed 16 May 2022).

8. Conclusion

Analyses of economic shocks in 1990−2021 to six selected AMS were conducted from the perspective of global, domestic, and uncertainty factors. In constructing the analyses, prediction errors were calculated as the deviations between actual and prediction values of annual macroeconomic indicators published by international organisations. The broad overview of prediction errors of real GDP growth rates demonstrates that the countries experienced negative prediction errors on average over the total sample period and that those economic predictions made by international organisations tended to have an upward, or optimistic, bias. This simple observation hints that the six AMS were subjected to negative economic shocks through, for example, unforeseen global economic recessions such as the Asian financial crisis and the global financial crisis, domestic downturns, and uncertainty.

Next, to confirm whether business cycles and economic shocks within the six AMS and with the world were synchronised, simple correlation analyses of the actual real GDP growth rates and their prediction errors were conducted. The correlation coefficients of the two analyses exhibit large numerical values in the total sample period, which suggests that, as existing literature already demonstrated, business cycles and economic shocks are strongly synchronised within the region and with the world economy. At the same time, if sub-sample periods and countries are treated separately, differences exist in the degree of correlation and statistical significance. Moreover, OLS regression analyses were conducted that regressed the prediction errors of real GDP growth rates on the prediction errors of global real GDP growth rates, merchandise export growth rates, and global and domestic uncertainty indices for each AMS. Such regression analyses indicated that variations of the global real GDP growth rates are positively associated with economic shocks on the six AMS. Through this regression analysis, varied typical characteristics across countries were discovered; for example, estimates of the global real GDP growth rates are tiny or insignificant – particularly for Indonesia and Viet Nam. Economic shocks were separated into global and domestic shocks based on the estimations, and then implications were derived for individual variations of the real GDP growth rates. With respect to the uncertainty factors, the estimates of the global and domestic

uncertainty indices were related to negative economic shocks for the Philippines and Singapore, respectively. Some speculations were also introduced on the effects of the COVID-19 pandemic, and economic and historical backgrounds of individual countries were reviewed for generating prediction errors.

Future research challenges must be noted. First, data could not be directly incorporated into variations of domestic demand; instead, they were measured as 'residuals' that cannot be explained by variations in the world economy. Other data sources than ADB (1989−2022) must also be examined. Second, economic shocks were evaluated by using prediction data of annual macroeconomic indicators, but as the sample coverage is very limited on an annual basis, it is only possible to understand the rough macroeconomic trends of countries. Although it may be difficult to obtain monthly or quarterly prediction data, an analysis of relationship of mutual dependence in South-East Asia could be conducted by formulating structural VAR models (e.g. Selover, 1999) by increasing samples. In reference to existing studies, such as Morikawa (2016), it is beneficial to conduct microeconomic research that directly observes subjective probabilities of firms' uncertainty through microstatistics and questionnaire surveys to probe the relationship between economic shocks or uncertainty and local firms' investment activities or performance.

References

Allegret, J.P. and E. Essaadi (2011), 'Business Cycles Synchronization in East Asian Economy: Evidence from Time-Varying Coherence Study', *Economic Modeling*, 28(1−2), pp.351−65.

Arslan, Y., A. Atabek, T. Hulagu, and S. Şahinöz (2015), 'Expectation Errors, Uncertainty, and Economic Activity', *Oxford Economic Papers*, 67(3), pp.634−60.

Ashiya, M. (2007), 'Forecast Accuracy of the Japanese Government: Its Year-Ahead GDP Forecast Is Too Optimistic', *Japan and the World Economy*, 19(1), pp.68−85.

Asian Development Bank (ADB), *Asian Development Outlook*, Manila (33 years: 1989−2022).

Bachmann, R., S. Elstner, and E.R. Sims (2013), 'Uncertainty and Economic Activity: Evidence from Business Survey Data', *American Economic Journal: Macroeconomics*, 5(2), pp.217−49.

Baker, S.R., N. Bloom, and S.J. Davis (2016), 'Measuring Economic Policy Uncertainty', *Quarterly Journal of Economics*, 131(4), pp.1593−636.

Baldwin, R. (2016), *The Great Convergence: Information Technology and the New Globalization*, Cambridge, MA: Harvard University Press.

Bloom, N. (2014), 'Fluctuations in Uncertainty', *Journal of Economic Perspectives*, 28(2), pp.153−76.

Cortinhas, C. (2007), 'Intra-Industry Trade and Business Cycles in ASEAN', *Applied Economics*, 39(7), pp.893−902.

Economic Policy Uncertainty, https://www.policyuncertainty.com/index.html (accessed 20 April 2022)

Frankel, J. (2011), 'Over-Optimism in Forecasts by Official Budget Agencies and Its Implications', *Oxford Review of Economic Policy*, 27(4), pp.536−62.

Gong, C., and S. Kim (2013), 'Economic Integration and Business Cycle Synchronization in Asia', *Asian Economic Papers*, 12(1), pp.76−99.

He, D. and W. Liao (2012), 'Asian Business Cycle Synchronization', *Pacific Economic Review*, 17(1), pp.106−35.

Institute of Developing Economies, *Yearbook of Asian Affairs*, Chiba (30 years: 1990−2020).

International Monetary Fund (IMF), World Economic Outlook Database, Washington, DC (23 years: 1999−2022), https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending (accessed 16 May 2022).

Jiang, W., Y. Li, and S. Zhang (2019), 'Business Cycle Synchronisation in East Asia: The Role of Value-Added Trade', *The World Economy*, 42(1), pp.226−41.

Kim, S. and S.H. Kim (2013), 'International Capital Flows, Boom–Bust Cycles, and Business Cycle Synchronization in the Asia Pacific Region', *Contemporary Economic Policy*, 31(1), pp.191−211.

Li, L. (2017), 'The Impact of Intra-Industry Trade on Business Cycle Synchronization in East Asia', *China Economic Review*, 45, pp.143–54.

Merola, R. and J.J. Perez (2013), 'Fiscal Forecast Errors: Governments versus Independent Agencies?', *European Journal of Political Economy*, 32, pp.285−99.

Moneta, F. and R. Rüffer (2009), 'Business Cycle Synchronisation in East Asia', *Journal of Asian Economics*, 20(1), pp.1−12.

Morikawa, M. (2016), 'Business Uncertainty and Investment: Evidence from Japanese Companies', *Journal of Macroeconomics*, 49, pp.224−36.

——— (2019), 'Uncertainty over Production Forecasts: An Empirical Analysis Using Monthly Quantitative Survey Data', *Journal of Macroeconomics*, 60, pp.163−79.

——— (2020), 'Uncertainty in Long-Term Macroeconomic Forecasts: Ex Post Evaluation of Forecasts by Economics Researchers', Research Institute of Economy, Trade, and Industry (RIETI) Discussion Paper Series, No. 19-E-084, Tokyo: RIETI.

Newey, W.K. and K.D. West (1987), 'A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix', *Econometrica*, 55(3), pp.703−08.

Nguyen, V., T. Hoang, and M.S. Nguyen (2020), 'The Effect of Trade Integration on Business Cycle Synchronization in East Asia', *Journal of Asian Finance Economics and Business*, 7(8), pp.225−31.

Pain, N., C. Lewis, T.T. Dang, Y. Jin, and P. Richardson (2014), 'OECD Forecasts during and after the Financial Crisis', *Organisation for Economic Co-operation and Development (OECD) Economics Department Working Papers,* No. 1107, Paris: OECD.

Park, Y.J. (2013), 'Regional Business Cycle in East Asia: Synchronization and Its Determinants', *Journal of East Asian Economic Integration*, 18(2), pp.103−28.

Pontines, V. and F. Parulian (2010), 'Business Cycle Synchronization and Financial Integration in the Asia-Pacific Region', in C. Findlay, F. Parulian, and J. Corbett (eds.), *Linkages between Real and Financial Aspects of Economic Integration in East Asia,* Jakarta: Economic Research Institute for ASEAN and East Asia (ERIA), pp.94−129.

Rena, P.B. (2007), 'Economic Integration and Synchronization of Business Cycles in East Asia', *Journal of Asian Economics*, 18(5), pp.711−25.

Rena, P.B., T. Cheng, and W.M. Chia (2012), 'Trade Intensity and Business Cycle Synchronization: East Asia versus Europe', *Journal of Asian Economics*, 23(6), pp.701−6.

Selover, D.D. (1999), 'International Interdependence and Business Cycle Transmission in ASEAN', *Journal of Japanese and International Economics*, 13(3), pp.230−53.

Sethapramote, Y. (2015), 'Synchronization of Business Cycles and Economic Policy Linkages in ASEAN', *Journal of Asian Economics*, 39(6), pp.126–36.

Shin, K. and Y. Wang (2003), 'Trade Integration and Business Cycle Synchronization in East Asia', *Asian Economic Papers*, 2(3), pp.1−20.

Sng, H.Y., L. Dou, and P.B. Rana (2017), 'Catalyst of Business Cycle Synchronization in East Asia', *The Singapore Economic Review*, 62(3), pp.703−19.

Takeuchi, F. (2011), 'The Role of Production Fragmentation in the International Business Cycle Synchronization in East Asia', *Journal of Asian Economics*, 22(6), pp.441−59.

Timmermann, A. (2007), 'An Evaluation of the World Economic Outlook Forecasts', *International Monetary Fund (IMF) Staff Papers*, 54(1), pp.1−33.

Xie, S., T. Cheng, and W.M. Chia (2013), 'Trade, Finance, Specialization and Synchronization in the Asia-Pacific', *Journal of the Asia Pacific Economy*, 18(2), pp.253−70.

World Bank, *Global Economic Prospects*, Washington, DC (25 years: 2007−2022).

ERIA Discussion Paper Series

No.	Author(s)	Title	Year
2021-63 (no. 430)	Ikumo ISONO and Kazuhiro NARA	COVID-19, Telework Patterns Within a City, and Changes in Urban Structure – Preliminary Findings	April 2022
2021-62 (no. 429)	Linh BUI, Huyen HOANG, and Hang BUI	Entry Mode Choice and Performance of Foreign Direct Investment Firms in Emerging Economies: Micro-evidence from Viet Nam	March 2022
2021-61 (no. 428)	Fauziah ZEN and Michael REGAN	Projecting Infrastructure Needs and the Financing Mechanism: A Review of Estimations by ADB, McKinsey, and the OECD	March 2022
2021-60 (no. 427)	Astrid DITA and Sandy MAULANA	Implicit Subsidies for Infrastructure and Their Implications for Contingent Liabilities in Selected East Asian Countries	March 2022
2021-59 (no. 426)	Teguh Yudo WICAKSONO and Andre SIMANGUNSONG	Digital Technology Adoption and Indonesia's MSMEs during the COVID-19 Pandemic	March 2022
2021-58 (no. 425)	Mitsuyo ANDO, Fukunari KIMURA, and Kenta YAMANOUCHI	East Asian Production Networks Go Beyond the Gravity Prediction	March 2022
2021-57 (no. 424)	Tadashi ITO and Yukiko Umeno SATO	Chief Executive Officer Attributes and Trade	February 2022
2021-56 (no. 423)	Cassey LEE	Global Value Chains and Premature Deindustrialisation in Malaysia	February 2022
2021-55 (no. 422)	Oscar FERNANDO and Lili Yan ING	Indonesia's Local Content Requirements: An Assessment on Consistency with Free Trade Agreement Commitments	February 2022
2021-54 (no. 421)	HA Thi Thanh Doan and Hongyong ZHANG	Technical Barriers to Trade, Product Quality and Trade Margins: Firm-level Evidence	February 2022
2021-53 (no. 420)	Oscar FERNANDO and Lili Yan ING	Indonesia's Local Content Requirements: An Assessment on Consistency with Free Trade Agreement Commitments	February 2022
2021-52 (no. 419)	Nobuaki YAMASHITA and Doan Thi Thanh HA	Participation in Global Value Chains and Rent Sharing by Small Firms in Viet Nam	January 2022
2021-51 (no. 418)	Huy Hoang NGUYEN and Quang Hoan TRUONG	The Nexus between Inward Foreign Direct Investment and Global Value Chains in Developing Countries: A Case Study of Viet Nam	January 2022

ERIA discussion papers from the previous years can be found at:

http://www.eria.org/publications/category/discussion-papers