Consumption Risk Sharing in ASEAN: A Comparison of the ASEAN+3, East Asia, the OECD, and the Eurozone

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This study analyzes the consumption risk sharing in the Association of Southeast Asian Nations (ASEAN) from a comparative perspective. Estimation results show that unlike ASEAN+3 and East Asia, the degree of consumption risk sharing increases in ASEAN after 1999. The increase is due to the rise in credit market smoothing among the ASEAN nonfounding members (Brunei, Cambodia, Laos, Myanmar, and Vietnam). Approximately twice as many shocks are shared in the Organization for Economic Cooperation and Development and the Eurozone than in ASEAN. The capital market smoothing increases after the adoption of the euro in 1999 in the Eurozone. From the empirical results, this study discusses the causes of increased risk sharing in ASEAN and the effects of the economic growth of ASEAN on the risk-sharing mechanism among the members.

Keywords: ASEAN, Eurozone, Common currency, Consumption risk sharing, Financial integration

JEL Classification: F02, F15, F36, F41

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I thank anonymous referees for the helpful comments and suggestions.

[**Seoul Journal of Economics** 2020, Vol. 33, No. 1]

I. Introduction

The 1997-1998 Asian financial crisis started in Thailand when speculative attacks hit the Thai baht. Then, the crisis spread across Asia, which mostly affected the Association of Southeast Asian Nations (ASEAN) members. Afterward, East Asian countries considered economic integration in the region as a regional mechanism that could forestall future crises.[1] The ASEAN members pursued policies for financial integration, which is an essential part of ASEAN's goal in establishing the ASEAN Economic Community (AEC).[2]

The policies are focused on three areas: (a) capital account liberalization, (b) capital market development, and (c) financial service liberalization.[3] The policies ensure that ASEAN member countries will not have to absorb domestic shocks fully on their own if financial markets in ASEAN develop and are well-integrated. Instead, domestic shocks with other member countries through consumption risk sharing can be shared (Kim, Kim, and Wang 2004). Specifically, capital and credit markets, such as risk-sharing channels, can absorb asymmetric output shocks in an individual country.[4] In capital markets, countries

[1] The Chiang Mai Initiative Multilateralization (CMIM) emerged from this background. ASEAN+3 established the CMIM to manage regional short-term liquidity problems and to avoid a recurrence of the Asian financial crisis. By contrast, the idea of establishing the Asian Monetary Fund (AMF) was unsuccessful.

[2] The Framework Agreement on Enhancing ASEAN Economic Cooperation, signed in 1992 in Singapore, marked the beginning of the economic integration process in the region. The main objective of the Agreement was to improve intraregional economic cooperation to foster economic growth and development of all ASEAN members. In 2003, the establishment of the AEC was first announced. The AEC Blueprint 2015 was signed in 2007, setting out the goals to build: "(a) a single market and production base, (b) a highly competitive economic region, (c) a region of equitable economic development, and (d) a region fully integrated into the global economy." The AEC was officially launched in 2015, marking a significant milestone in the regional economic integration process. At the same time, the AEC Blueprint 2025 was adopted, providing broad directions through strategic measures for the AEC from 2016 to 2025 (see Plummer (2006) for more details about the creation of the AEC).

[3] These areas are in the Roadmap for Monetary and Financial Integration of ASEAN, which ASEAN finance ministers approved in 2003.

[4] Although this study considers only capital and credit markets because of the limited data, governments or international organizations can arrange a fiscal

can share country-specific risks via cross-ownership of productive assets (portfolio diversification). In addition, countries can conduct smooth consumption through lending and borrowing in international credit markets (intertemporal trade; Kim, Kim, and Wang 2006).[5]

Asdrubali, Sørensen, and Yosha (1996) published the first study on how many asymmetric output shocks can be shared by the consumption risk-sharing mechanism among countries in an economic and monetary union by looking at a successful monetary union (states of the United States). The authors developed the cross-sectional variance decomposition method and showed that although full insurance was not achieved, a considerable risk sharing among the states is observed. Capital markets, credit markets, and the federal tax-transfer and grant system absorb 39%, 23%, and 13% of shocks to gross state product, respectively. Of the shocks, 25% are not shared.

The cross-sectional variance decomposition method has been used frequently as the first method for analyzing international risk sharing in various regions since then. For example, subsequent studies explored consumption risk sharing in the Organization for Economic Cooperation and Development (OECD), European Community (EC), East Asia, and the CFA franc zone. The CFA franc is the common currency for the franc zone. Approximately 40% of shocks to gross domestic product (GDP) are smoothed in the OECD and EC (Sorensen and Yosha 1998). Approximately 20% of shocks to GDP are shared in East Asia (Kim, Kim, and Wang 2006). The CFA franc zone consists of two monetary unions in Africa, namely, the Central African Economic and Monetary Community (CEMAC) and the West African Economic and Monetary

transfer system that can serve as a vehicle for further income and consumption smoothing (Kim, Kim, and Wang 2006). Thus, a tax-transfer system is one of the risk-sharing channels (see Andersson (2008), Arreaza, Sørensen, and Yosha (1998), and Buettner (2002) and Jüßen (2006) for more details on risk sharing through fiscal policy in Sweden, the OECD and European Union countries, and Germany, respectively). In addition to the tax-transfer system, Sørensen and Yosha (1998) considered a capital depreciation channel, and Asdrubali, Kim, Pericoli, and Poncela (2018) considered government consumption and real exchange rate channels.

[5] In this study, the keyword "consumption risk sharing" conceptually includes mutual insurance across states of nature against idiosyncratic regional risks, *ex ante* and diversification of idiosyncratic consumption across time, *ex post* (see Section II for more details).

Union (WAEMU).[6] Approximately 24% and 22% of shocks to GDP are shared in CEMAC and WAEMU, respectively (Yehoue 2011).

Unlike the studies mentioned above, which focused on risk sharing among countries at the international level, several studies focused on consumption risk sharing at the intranational level.[7] In comparison of the results for both types of studies, consumption risk sharing at the international level is far lower than that at the intranational level. In other words, international financial markets among countries are less financially integrated. In addition, the degree of integration of international capital markets is lower than that of international credit markets. Informational barriers, capital controls, and the cost of transactions in many currencies are considered the leading causes of a low degree of capital market integration (Sørensen and Yosha 1998).

As part of the goal of forming the AEC, the ASEAN has been implementing policies to eliminate factors preventing economic integration, including the causes mentioned above. Rillo (2018) noted that as an effect of policies, ASEAN financial markets became more integrated over the past decade. Of all measures under the AEC Blueprint, 85% was completed by the ASEAN members at the end of 2015. Thus, this study investigates the following question: As the ASEAN economy became more integrated, what happened to the consumption risk sharing in ASEAN?

Given the background discussed, this study aims to analyze the consumption risk sharing in ASEAN from a comparative perspective. Thus, the study extends the scope of analysis of countries from within to outside the ASEAN. First, the study compares the ASEAN and its subgroups (founding and nonfounding members). Second, the study compares the ASEAN and its closely related regions (ASEAN+3 and East Asia). Additionally, the study estimates the degree of consumption risk sharing in the OECD and the Eurozone as benchmarks for high-

[6] The CEMAC consists of six countries: Cameroon, Central African Republic, Chad, Republic of the Congo, Equatorial Guinea, and Gabon. The CEMAC currency is the Central African CFA franc. The WAEMU consists of eight countries: Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal, and Togo. The WAEMU currency is the West African CFA franc.

[7] See Borge and Matsen (2004), Kim and Sheen (2007), Balli, Basher, and Louis (2012), Du, He, and Rui (2011), Hepp and von Hagen (2013), and Ko (in press) for more details on intranational risk sharing in Norway, Australia, Canada, China, Germany, and South Korea, respectively.

income countries and a monetary union, respectively. Finally, from the empirical results, the study discusses the cause of the increase in consumption risk sharing in ASEAN and the effects of future economic growth on the risk-sharing mechanism in ASEAN.

The ASEAN+3, East Asia, the OECD, and the Eurozone were selected as subjects of comparison for several reasons. First, the ASEAN+3 and East Asia include all and some ASEAN member countries, respectively; thus, a comparison of those three regions may help analyze the policies' effects in achieving the goals of AEC. Second, the OECD serves as a benchmark for high-income countries. Given that most ASEAN members are middle-income economies, comparing the ASEAN and the OECD shows how risk sharing differs according to the organization's economic development stage. Third, the Eurozone serves as a benchmark for a monetary union and is the most institutionally advanced example of financial integration, which could be the final development stage for the AEC.

Several studies focused on the consumption risk sharing in East Asian countries, including the ASEAN founding members (Kim, Kim, and Wang 2004, 2006; Hoffmann 2011). However, no study on risk sharing for the entire set of ASEAN countries (*i.e.*, all 10 members) has been conducted. Thus, this study is the first to analyze the consumption risk sharing among the 10 ASEAN member countries.

Estimation results answer the following question: What happened to the consumption risk sharing in ASEAN? Unlike ASEAN+3 and East Asia, the degree of consumption risk sharing increases from 24.5% (1971-1998) to 30.3% (1999-2017) in ASEAN. The base year of the two periods is 1999 when ASEAN became an association of 10 member countries in the same form as today. The increase is due to the rise in the credit market smoothing of the ASEAN nonfounding members (Brunei, Cambodia, Laos, Myanmar, and Vietnam). The smoothing role of the ASEAN founding members (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) decreases at the same time. Moreover, the OECD and the Eurozone, composed of high-income countries, absorb approximately twice as many shocks to GDP as ASEAN does. The capital market smoothing increases after the adoption of the euro in 1999 in the Eurozone.

The rest of this paper is organized as follows. Section Ⅱ explains the cross-sectional variance decomposition method. Section Ⅲ presents the data and the correlations of consumption and output growth rate.

Section IV reports the degree and evolutionary patterns of consumption risk sharing in ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone. Section V discusses the empirical results. Last, Section VI concludes.

II. Analytical Framework

The cross-sectional variance decomposition method of Asdrubali, Sørensen, and Yosha (1996) is explained in this section.[8] The key to the method is to set up an identity equation, such as equation (1), that considers the risk-sharing channels to be analyzed. Only two channels are considered because of the limitations of collecting data in this study: capital and credit markets. Capital markets are related to a net factor income, reflected in the National Accounts data as the difference between GDP and gross national income (GNI). Credit markets are related to national savings, that is, the difference between GNI and consumption (C). Thus, the following expression is drawn, which reflects the relation between the risk-sharing channels and National Accounts data:

$$GDP^i = \frac{GDP^i}{GNI^i} \times \frac{GNI^i}{C^i} \times C^i, \tag{1}$$

where i denotes an index of countries, GDP is gross domestic product, GNI is gross national income, and C is the sum of private and government consumption. The time index is excluded to emphasize the cross-sectional nature of this method. The first and second terms on the right side of the equation denote capital and credit market channels, respectively.

The logs and the first differences of equation (1) are taken to decompose the cross-sectional variance in GDP. Both sides of the equation are multiplied by $\Delta log\ GDP^i$. The expectations are taken such

[8] The method has an apparent weakness as a static smoothing channel approach. To complement the weaknesses, Asdrubali and Kim (2004) and Asdrubali, Kim, Pericoli, and Poncela (2018) used a panel vector autoregression framework to deal with the dynamic feedback among variables. Mélitz and Zumer (1999) revised the cross-sectional variance decomposition method, considering uneven sizes of regions and treatment of common shocks.

that:

$$\begin{aligned}\text{var}\{\Delta \log GDP^i\} = &\text{cov}\{\Delta \log GDP^i, \Delta \log GDP^i - \Delta \log GNI^i\} \\ &+ \text{cov}\{\Delta \log GDP^i, \Delta \log GNI^i - \Delta \log C^i\} \\ &+ \text{cov}\{\Delta \log GDP^i, \Delta \log C^i\}\end{aligned} \tag{2}$$

Then, by dividing equation (2) by the variance of $\Delta \log GDP^i$, the following is obtained:

$$1 = \beta_k + \beta_c + \beta_u, \tag{3}$$

where β_k is the coefficient in the regression of $\Delta \log GDP^i - \Delta \log GNI^i$ on $\Delta \log GDP^i$, β_c is the coefficient in the regression of $\Delta \log GNI^i - \Delta \log C^i$ on $\Delta \log GDP^i$, and β_u is the coefficient in the regression of $\Delta \log C^i$ on $\Delta \log GDP^i$.

Equation (3) has the following variables. First, β_k is the percentage of risk sharing compared with idiosyncratic output shocks via a capital market channel. This variable also captures the net factor income movements as a consequence of risk sharing achieved by the international portfolio diversification. Second, β_c is the amount of the intertemporal consumption smoothing through a credit market channel. The variable reflects saving movements as a consequence of smoothing an output shock via regional lending and borrowing from credit markets. Third, β_u is interpreted as the fraction of consumption volatility that is not smoothed by any risk-sharing channel. Equation (3) shows that β_u is equal to 0, and the sum of β_k and β_c is equal to 1 with full risk sharing. The sum is less than one in the case of imperfect risk sharing.

Risk sharing (β_k) and intertemporal consumption smoothing (β_c) are conceptually different (Kim, Kim, and Wang 2006). Risk sharing means mutual insurance across states of nature against idiosyncratic regional risks *ex ante* and is consistent with sharing through capital markets. An intertemporal consumption smoothing means diversification of idiosyncratic consumption across time *ex post* and is consistent with sharing via credit markets. Market trades based on portfolio diversification may be complemented by other markets or institutional mechanisms. Hence, Asdrubali, Sørensen, and Yosha (1996) integrated these two risk-sharing channels in a single framework (*i.e.*, cross-sectional variance decomposition method). Thus, consumption risk sharing, which is the

core of this study, includes both concepts.[9]

The following panel equation system can be estimated at the practical level:

$$\begin{aligned} \Delta \log GDP_t^i - \Delta \log GNI_t^i &= \upsilon_{k,t} + \beta_k \Delta \log GDP_t^i + u_{k,t}^i \\ \Delta \log GNI_t^i - \Delta \log C_t^i &= \upsilon_{c,t} + \beta_c \Delta \log GDP_t^i + u_{c,t}^i \\ \Delta \log C_t^i &= \upsilon_{u,t} + \beta_u \Delta \log GDP_t^i + u_{u,t}^i, \end{aligned} \tag{4}$$

where $\upsilon_{\cdot,t}$ is the time fixed effects that capture the year-specific impacts on growth rates, most notably, the impact of the growth in aggregate output. Consequently, the coefficients of the $\Delta \log GDP_t^i$ terms should reflect impulses stemming from the regional deviations in output growth from the national growth rates.

Equation (4) is estimated in two steps based on the study of Asdrubali, Sørensen, and Yosha (1996). First, the system in equation (4) is estimated through pooled ordinary least squares (OLS) to adjust the heteroscedasticity, which is equivalent to seemingly unrelated regression (SUR) because of all the equations in the system have the same regressors. The variance of the error terms in each country is estimated from the residuals of the pooled OLS. Hence, each equation of the system is divided by the estimated variance. Second, equation (4) is estimated by the SUR to control the error terms' correlation. Given that each equation in equation (4) is corrected one by one in the first step, the regressor is no longer identical; thus, the SUR is not equivalent to the pooled OLS.

The estimation procedure does not restrict the sum of β coefficients to have the value of 1, such as equation (3) or the sign of β coefficients to be positive. Thus, the sum of the β coefficients in Tables 2 and 3 is slightly smaller or larger than 100%. Several risk-sharing channels can have a negative value for the β coefficients; hence, the channel amplifies shocks to GDP and does not absorb them.

III. Data

The annual datasets from 1970 to 2017 are constructed for the GDP, GNI, and C for 34 countries. The variables for the current analysis are

[9] See Asdrubali and Kim (2008) for more details.

defined using the variables in National Accounts: GNI = GDP + net factor income from abroad; C (total consumption) = private consumption + government consumption.

Data for GDP, GNI, C, and population are obtained from the United Nations' (UN) National Accounts Main Aggregates Database. GDP and C are expressed in constant prices in domestic currency; thus, real per-capita figures are obtained by normalizing the population data. GNI is expressed in current prices in domestic currency; thus, real per-capita figures are obtained by normalizing the population data and the GDP deflator of the corresponding country.[10] Furthermore, the time-differenced specification in equation (4) is considered appropriate considering that the null hypothesis that the data series exhibits a unit root cannot be rejected in nearly all cases.[11]

Figure 1 shows that the dataset is composed of 34 countries from five regions, namely, the ASEAN, ASEAN+3, East Asia, the Eurozone, and the OECD. The ASEAN has 10 official member countries and are divided into founding and nonfounding members. Founding members are more developed and integrated than nonfounding members. The ASEAN was founded in 1967 with five members: Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Then, the ASEAN was enlarged by Brunei in 1984, Vietnam in 1995, Laos and Myanmar in 1997, and Cambodia in 1999. ASEAN+3 denotes the 10 ASEAN members plus China and Hong Kong, Japan, and South Korea. East Asia represents the nine relatively developed countries in ASEAN+3. This approach facilitates comparisons between the present and previous studies on financial integration in East Asia. Although the Eurozone consists of 19 members today, in this study, the Eurozone includes the 11 countries

[10] The deflator is obtained by dividing the nominal GDP by the real GDP. Both GDP figures are obtained from the UN National Accounts Main Aggregates Database.

[11] The ADF-GLS test is run as suggested by Elliott, Rothenberg, and Stock (1996). The test is based on univariate AR(p) models with the number of lags p selected according to the MAIC criterion of Ng and Perron (2001) under the constraint

$$P \leq [12(\frac{T}{100})^{1/4}].$$

The ADF-GLS regression for the data in levels includes a deterministic term and a linear time trend. Detailed results are available from the author upon request.

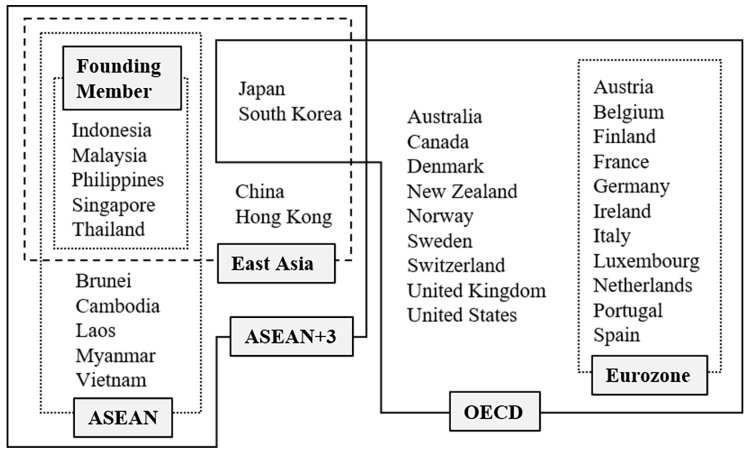

FIGURE 1
COMPOSITION OF REGIONS: ASEAN, ASEAN+3, EAST ASIA, THE OECD, AND THE EUROZONE

that first adopted the euro in 1999, to analyze the changes in risk-sharing patterns before and after the introduction of the euro. The OECD denotes 22 high-income UN members (based on the 2019 fiscal year) among all OECD member countries, which includes the Eurozone.

A. Preliminary Data Analysis: Correlations of Consumption and Output Growth Rate

Correlations of the per-capita consumption and output growth rate of an individual ASEAN member with the per-capita aggregate consumption and output growth rate of the ASEAN and East Asia are discussed in this subsection. In addition to the correlation in the whole period (1971-2017), subperiod statistics (1971-1998 and 1999-2017) are discussed to analyze the changes in the correlations between the two subperiods. The whole period is divided this way because influential events for ASEAN and the Eurozone occurred in 1999. During this time, the ASEAN became an association of 10 member countries in the same form as today. The Eurozone was established in 1999 and adopted the euro as its common currency.

The aggregate consumption and output growth rate of ASEAN, East Asia, and the Eurozone are calculated on two bases. First, Kim, Kim,

and Wang (2004) stated that a particular country's consumption can be positively correlated with regional consumption even without risk sharing, given that the aggregate consumption of the region includes the country's consumption. Thus, the country under investigation is excluded to capture the relevant consumption and output correlation correctly. Second, the aggregate variables are calculated as the weighted average of (real per-capita) consumption and output growth rate of individual countries according to Beyer, Doornik, and Hendry (2001). The weight is determined by the relative size of the individual country's consumption and output to the aggregate consumption and output of the region.[12]

Table 1 shows that the numbers without brackets indicate the correlation of the individual ASEAN countries with ASEAN. Numbers within parentheses indicate the correlation of the individual ASEAN countries within East Asia. The statistics reveal interesting findings regarding the economic integration among ASEAN member countries.

First, in the row showing the ASEAN average for the whole period, numbers without brackets (0.06 and 0.14), the average correlations with ASEAN, are smaller than those within parentheses (0.09 and 0.22), which are the average correlations with East Asia. This trend is also found in the results for the subperiods and is more prominent among the ASEAN founding members. Thus, the members of ASEAN, specifically the founding members, appear to be more integrated with the East Asian countries. Moreover, the degree of integration between the founding members and the nonfounding members appears to be low within the ASEAN because the correlations of founding members are higher than the average values, and nonfounding members are lower than the average.

Second, the comparisons between the 1971-1998 and 1999-2017 periods show that output correlations of ASEAN member countries

[12] The weights ($w_{i,t}$) and the growth rate of the aggregate variables ($\Delta \log Z_t$) are constructed as the following equations:

$w_{i,t} = \frac{x_{i,t}}{\sum_{i=1}^{N} x_{i,t}}$ and $\Delta \log z_t = \sum_{t=1}^{N} w_{i,t-1} \Delta \log z_{i,t}$, respectively, where x denotes real variables in US dollars, N denotes the number of countries in the region, z denotes real variables in domestic currency, and i denotes the country's index. Consumption and GDP expressed in constant prices in US dollars and domestic currency are obtained from the UN National Accounts Main Aggregates Database.

Table 1
Consumption and Output Correlations for 10 ASEAN Member Countries

			Whole period		Subperiod 1		Subperiod 2	
			1971-2017		1971-1998		1999-2017	
			C	Y	C	Y	C	Y
ASEAN	ASEAN founding members	Indonesia	0.15 (0.44)	0.20 (0.61)	0.21 (0.48)	0.20 (0.74)	-0.39 (-0.53)	0.23 (0.31)
		Malaysia	0.24 (0.45)	0.48 (0.66)	0.22 (0.57)	0.47 (0.62)	0.43 (0.41)	0.72 (0.84)
		Philippines	0.08 (−0.11)	0.31 (0.24)	0.07 (0.12)	0.32 (0.38)	-0.19 (-0.07)	0.42 (0.59)
		Singapore	0.07 (0.62)	0.21 (0.76)	0.25 (0.67)	0.25 (0.68)	-0.13 (0.56)	0.58 (0.87)
		Thailand	0.07 (0.54)	0.25 (0.62)	0.07 (0.63)	0.22 (0.63)	0.15 (0.15)	0.62 (0.61)
		Average	0.12 (0.39)	0.29 (0.58)	0.16 (0.49)	0.29 (0.61)	-0.03 (0.10)	0.51 (0.64)
	ASEAN nonfounding members	Brunei	0.07 (0.02)	0.21 (0.18)	0.14 (0.06)	0.22 (0.18)	-0.12 (0.14)	0.35 (0.38)
		Cambodia	-0.10 (-0.37)	-0.17 (-0.17)	-0.17 (-0.28)	-0.27 (-0.14)	-0.10 (0.03)	0.45 (0.59)
		Laos	0.16 (-0.04)	-0.37 (-0.19)	0.11 (0.04)	-0.50 (-0.16)	0.30 (0.20)	-0.04 (0.06)
		Myanmar	0.02 (-0.41)	0.05 (-0.35)	-0.07 (-0.23)	0.02 (-0.34)	-0.05 (-0.28)	0.22 (0.25)
		Vietnam	-0.20 (-0.27)	0.25 (-0.16)	-0.29 (-0.18)	0.25 (-0.14)	-0.10 (-0.06)	0.31 (0.38)
		Average	-0.01 (-0.21)	-0.01 (-0.14)	-0.06 (-0.12)	-0.06 (-0.12)	-0.01 (0.01)	0.26 (0.33)
	Average of ASEAN		0.06 (0.09)	0.14 (0.22)	0.05 (0.19)	0.12 (0.25)	-0.02 (0.06)	0.38 (0.49)
Average of Eurozone			0.67	0.74	0.58	0.65	0.69	0.83

Notes: C is the cross-country correlation of consumption growth rate (per capita). Y is the cross-country correlation of output growth rate (per capita). Numbers without brackets indicate that the correlation of the individual ASEAN countries with ASEAN. Numbers in parentheses indicate the correlation of the individual ASEAN countries with East Asia. The Average of Eurozone is the average correlation of 11 individual Eurozone members with the Eurozone.

with ASEAN increase from 0.12 (1971-1998) to 0.38 (1999-2017) on average. This scenario likely results from an economic development and increased trade volume in ASEAN after 1999. Specifically, the intra-ASEAN trade has proliferated since 2000 (Almekinders, Mourmouras, Zhou, and Fukuda 2015), and the increased trade has led ASEAN member countries to a closer economic integration and business cycle synchronization (Cortinhas 2009).

Last, the average correlations with the Eurozone (0.67 and 0.74) from the whole period are bigger than the average correlations with ASEAN (0.06 and 0.14). The same pattern occurs in the subperiods. This result confirms that the level of economic integration in ASEAN is lower than that in the Eurozone. In addition, the correlations in the Eurozone increased after the euro was used as the common currency.

IV. Empirical Results

The degree and the evolution of consumption risk sharing in ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone are compared in this section. The discussion begins with an analysis of the estimation results for ASEAN and its subgroups. The consumption risk sharing for ASEAN and its surrounding areas is then discussed, where the scope of the analysis is extended outside the ASEAN.

A. Consumption Risk Sharing for ASEAN and Its Subgroups

The changes in risk-sharing patterns within ASEAN are analyzed in this subsection. Table 2 shows the consumption risk sharing by period for ASEAN, ASEAN founding members (Indonesia, Malaysia, the Philippines, Singapore, and Thailand), and ASEAN nonfounding members (Brunei, Cambodia, Laos, Myanmar, and Vietnam). According to the estimates for ASEAN in Table 2, capital markets and credit markets absorb 2.8% and 20.6% shocks to GDP, respectively in 1971-2017. A total of 77.1% consumption volatility is not smoothed by any risk-sharing channel. Based on these results, 23.4% of shocks to GDP, the sum of β_k and β_c, are smoothed among the ASEAN member countries. In addition, 31.0% and 24.5% of shocks to GDP are shared in the ASEAN founding and nonfounding members, respectively. Hence, the founding members are more critical in the risk-sharing mechanism of ASEAN than the nonfounding members from 1971 to 2017.

The subperiod and subgroup analyses revealed that the total risk sharing in ASEAN increases after 1999 when the ASEAN became an association of 10 member countries. The increase is due to the rise in the credit market smoothing of the ASEAN nonfounding members. First, comparisons between the 1971-1998 and 1999-2017 periods show that the degree of total risk sharing increases from 24.5% (1971-1998)

Table 2
Consumption Risk Sharing (%) for ASEAN and Its Subgroups

		ASEAN	ASEAN founding member	ASEAN nonfounding member
Whole period 1971-2017	Total risk sharing	23.4	31.0	24.5
	Capital markets (β_k)	2.8* (0.7)	3.7 (2.2)	2.0 (1.1)
	Credit markets (β_c)	20.6* (3.2)	27.3* (5.3)	22.5* (5.8)
	Not smoothed (β_u)	77.1* (2.8)	69.3* (4.1)	76.9* (4.9)
Subperiod 1 1971-1998	Total risk sharing	24.5	33.0	15.7
	Capital markets (β_k)	1.2* (0.5)	3.5 (1.8)	1.6* (0.8)
	Credit markets (β_c)	23.3* (3.2)	29.5* (5.9)	14.1* (5.7)
	Not smoothed (β_u)	75.9* (2.9)	66.8* (5.1)	85.2* (4.9)
Subperiod 2 1999-2017	Total risk sharing	30.3	27.5	39.2
	Capital markets (β_k)	3.0 (1.8)	1.1 (7.7)	−0.5 (3.2)
	Credit markets (β_c)	27.3* (6.5)	26.4 (12.7)	39.7* (9.7)
	Not smoothed (β_u)	67.8* (5.5)	71.7* (7.6)	60.8* (7.9)

Notes: Percentages of shocks to GDP absorbed at each channel. The standard errors are in parentheses, and the point estimates with asterisks are statistically significant at the 5% level or less. ASEAN founding members are Indonesia, Malaysia, the Philippines, Singapore, and Thailand. ASEAN nonfounding members are Brunei, Cambodia, Laos, Myanmar, and Vietnam. β_k denotes the coefficient in the regression of $\Delta\log GDP^i - \Delta\log GNI^i$ on $\Delta\log GDP^i$, β_c denotes the coefficient in the regression of $\Delta\log GNI^i - \Delta\log C^i$ on $\Delta\log GDP^i$, and β_u denotes the coefficient in the regression of $\Delta\log C^i$ on $\Delta\log GDP^i$. β_k and β_c are interpreted as the incremental amounts of smoothing achieved at each level. β_u is interpreted as the fraction of consumption volatility that is not smoothed by any risk-sharing channel. Total risk sharing is the sum of β_k and β_c.

to 30.3% (1999-2017) in ASEAN. Specifically, credit market smoothing increases from 23.3% to 27.3%. Second, the subgroup analysis revealed that the amount of total risk sharing decreases from 33.0% to 27.5% for the ASEAN founding members. However, the degree of total risk sharing increases from 15.7% to 39.2% for the ASEAN nonfounding members. This increase is due to the increase in credit market smoothing from 14.1% to 39.7%. Therefore, the smoothing role of founding members decreases, and increases for the nonfounding members before and after 1999.

B. Consumption Risk Sharing for ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone

The degree of consumption risk sharing in ASEAN is evaluated through cross-region comparisons. Specifically, whether the increase in risk sharing for ASEAN, shown in Section IV, *A*, arises from a universal phenomenon in Asia is investigated. Table 3 shows the consumption risk sharing by period for ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone. The discussion starts with an analysis of the estimation results for the whole period. The changes in risk-sharing patterns before and after 1999 and the evolutionary patterns of consumption risk sharing are discussed.

a) Cross-region Comparisons in the Whole Period (1971-2017)

According to the estimates for the whole period in Table 3, 77.1% of shocks to GDP are unsmoothed, but only 23.4% are smoothed for the ASEAN. A total of 39.8% of shocks to GDP are unsmoothed, but more than half, which is 57.7%, are smoothed for the Eurozone. Thus, the Eurozone absorbs shocks to GDP more than twice as much as ASEAN does. In addition, ASEAN+3, East Asia, and the OECD absorb 24.0%, 29.6%, and 43.8% of shocks to GDP, respectively. Given those results, the degree of total risk sharing is increasing in the order of ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone.

The smoothing role of credit markets is also increasing in the same order as the total risk sharing. The credit markets in ASEAN, ASEAN+3, East Asia, the OECD, and the Eurozone absorb 20.6%, 22.0%, 27.9%, 44.4%, and 51.4% of shocks to GDP, respectively. However, their smoothing role is minimal in the case of capital markets. Capital markets in ASEAN absorb 2.8% of shocks to GDP and 6.3% in the Eurozone. The degree of consumption risk sharing via capital markets

TABLE 3
CONSUMPTION RISK SHARING (%) FOR ASEAN, ASEAN+3, EAST ASIA, THE OECD, AND THE EUROZONE

		ASEAN	ASEAN+3	East Asia	OECD	Eurozone
Whole period 1971-2017	Total risk sharing	23.4	24.0	29.6	43.8	57.7
	Capital markets (β_k)	2.8* (0.7)	2.0* (0.5)	1.7* (0.8)	−0.6 (0.8)	6.3* (2.1)
	Credit markets (β_c)	20.6* (3.2)	22.0* (2.3)	27.9* (2.8)	44.4* (1.9)	51.4* (3.0)
	Not smoothed (β_u)	77.1* (2.8)	76.0* (2.0)	70.1* (2.4)	54.2* (1.6)	39.8* (2.3)
Subperiod 1 1971-1998	Total risk sharing	24.5	28.6	37.1	39.4	51.8
	Capital markets (β_k)	1.2* (0.5)	0.9* (0.4)	1.9* (0.9)	−0.8 (0.7)	2.0 (1.7)
	Credit markets (β_c)	23.3* (3.2)	27.7* (2.5)	35.2* (3.5)	40.2* (2.4)	49.8* (4.0)
	Not smoothed (β_u)	75.9* (2.9)	71.5* (2.3)	62.5* (3.1)	58.5* (2.1)	43.7* (3.5)
Subperiod 2 1999-2017	Total risk sharing	30.3	20.8	17.3	46.6	60.4
	Capital markets (β_k)	3.0 (1.8)	1.8 (1.0)	1.1 (1.6)	1.7 (2.1)	17.1* (4.3)
	Credit markets (β_c)	27.3* (6.5)	19.0* (4.3)	16.2* (4.5)	44.9* (3.4)	43.3* (5.0)
	Not smoothed (β_u)	67.8* (5.5)	77.2* (3.7)	81.2* (3.6)	48.7* (2.7)	40.9* (3.8)

Notes: Percentages of shocks to GDP absorbed at each channel. The standard errors are in parentheses, and the point estimates with asterisks are statistically significant at the 5% level or less. β_k denotes the coefficient in the regression of $\Delta\log GDP^i - \Delta\log GNI^i$ on $\Delta\log GDP^i$, β_c denotes the coefficient in the regression of $\Delta\log GNI^i - \Delta\log C^i$ on $\Delta\log GDP^i$, and β_u denotes the coefficient in the regression of $\Delta\log C^i$ on $\Delta\log GDP^i$. β_k and β_c are interpreted as the incremental amounts of smoothing achieved at each level. β_u is interpreted as the fraction of consumption volatility that is not smoothed by any risk-sharing channel. Total risk sharing is the sum of β_k and β_c.

in the rest of the regions is smaller than in ASEAN. Therefore, all five regions rely much more on credit markets for consumption risk sharing

than capital markets.

b) Cross-region Comparisons in the Subperiods (1971-1998 and 1999-2017)

First, Table 3 shows that the amount of risk sharing decreases in ASEAN+3 and East Asia unlike the increase in the total risk sharing in ASEAN between the 1971-1998 and 1999-2017. Specifically, in ASEAN, the degree of total risk sharing increases from 24.5% (1971-1998) to 30.3% (1999-2017), but in ASEAN+3, the degree decreases from 28.6% to 20.8% and in East Asia, from 37.1% to 17.3%.

Additionally, the decomposition of the total risk sharing into channels shows that the increase and decrease arise from the changes in the smoothing role of credit markets. In ASEAN, the degree of consumption risk sharing through credit markets increases from 23.3% (1971-1998) to 27.3% (1999-2017). However, in ASEAN+3, the degree decreases from 27.7% to 19.0%, and in East Asia from 35.2% to 16.2%. Unlike the changes in credit market smoothing, few changes in the smoothing role of capital markets before and after 1999 are observed for ASEAN, ASEAN+3, and East Asia. Therefore, the increase in risk sharing for ASEAN does not result from a universal phenomenon in Asia.

Second, unlike most ASEAN members (which are middle-income economies), the OECD and the Eurozone are composed of high-income countries. The Eurozone is not only a high-income region but also a monetary union. Thus, analysis of the OECD and the Eurozone shows how risk sharing differs according to the economic development stage.

Table 3 shows that the degree of total risk sharing increases from 39.4% (1971-1998) to 46.6% (1999-2017) in the OECD. The increase is because of the smoothing role of credit markets increases from 40.2% to 44.9%. However, the capital market smoothing in the OECD is smaller than that in ASEAN.

However, unlike the OECD, the smoothing role of capital markets in the Eurozone increases after the adoption of the euro in 1999. Table 3 shows that in the Eurozone, the degree of total risk sharing increases from 51.8% (1971-1998) to 60.4% (1999-2017). Specifically, the degree of consumption risk sharing via credit markets decreases from 49.8% to 43.3%, but through capital markets, such a degree increases from 2.0% to 17.1%. This phenomenon is notable because the smoothing role of capital markets is very limited in all regions except the Eurozone.

c) Evolutionary Patterns of Consumption Risk Sharing

Given that the sample in this study is large and encompasses different periods, risk sharing may reasonably vary over time. Rolling-window estimates are computed from the empirical model (equation (4)) to descibe evolutionary patterns of consumption risk sharing. The first subperiod covers 1971-1985. A year is added or removed at the end or beginning of the subperiod, the estimation is repeated, and then, the same method is applied until 2017 is reached. Figure 2 shows the estimated results as a stacked area graph.[13] Figure 2 depicts that the upper, middle, and bottom areas are the amount unshared, the amount shared by credit markets, and the amount shared by capital markets, respectively. The sum of the middle and bottom areas indicates the degree of total risk sharing. The year that appears on the horizontal axis is the ending year of each subperiod.

Figure 2 shows that the smoothing role through capital markets is minimal for ASEAN, ASEAN+3, and East Asia, and no noticeable pattern change is observed. Second, the differences in the evolutionary pattern of risk sharing via credit markets between those regions are shown before and after 1997. The smoothing role of credit markets decreases after 1997 for all three regions and can likely be interpreted as a negative effect of the 1997-1998 Asian financial crisis on the Asian economy. However, the degree of consumption risk sharing through credit markets increases for ASEAN after the crisis, but the degree does not increase for ASEAN+3 and East Asia. This result is also consistent with comparisons in the subperiods for ASEAN, ASEAN+3, and East Asia (Section IV, *B*, b).

The evolutionary patterns of consumption risk sharing for the Eurozone show that the smoothing role of capital markets tends to increase after 1998, unlike other regions. Second, a remarkable decline is observed in the degree of consumption risk sharing through credit markets after 2009. This event is due to the Greek government-debt crisis, which started in late 2009 and not by the 2007-2008 global financial crisis. Unlike the decrease in credit market smoothing in ASEAN,

[13] In practice, the sum of the empirical results for each subperiod is not precisely 100% and is slightly smaller or larger than 100% because in the estimation procedure, the sum of β coefficients is not restricted to be one as in equation (3). Thus, the empirical results for each subperiod have been rescaled to add up to 100% to draw a stacked area graph.

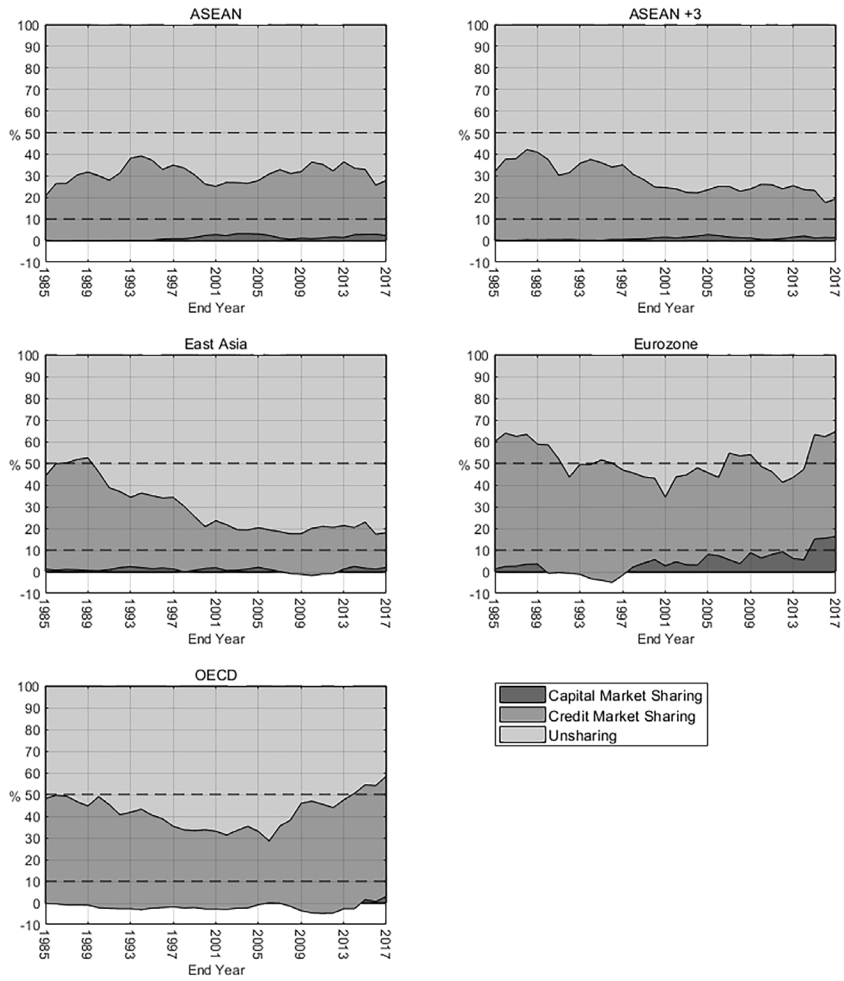

FIGURE 2
COMPOSITION OF REGIONS: ASEAN, ASEAN+3, EAST ASIA, THE OECD, AND THE EUROZONE

ASEAN+3, and East Asia after the Asian financial crisis, no noticeable declines are observed in the degree of consumption risk sharing in 2007 or 2008 for all six regions. Thus, the 2007-2008 global financial crisis appears to have an insignificant impact on the risk-sharing mechanism. Moreover, although in this study, Greece is excluded for analysis purposes as it joined the Eurozone in 2001 because the Eurozone is a

monetary union, the impact of the Greek crisis can be observed in the graph.

V. Discussion

The empirical results (Section IV) revealed two facts. First, the total risk sharing in ASEAN increases after 1999 unlike in ASEAN+3 and East Asia. These results are due to the increase in the credit market smoothing of ASEAN nonfounding members. Second, the smoothing role of capital markets is limited in other regions regardless of the period. The capital market smoothing increases after the adoption of the euro in the Eurozone in 1999. Results are discussed in the following subsections.

A. What factor causes the increased consumption risk sharing in the ASEAN?

Several determinants can increase consumption risk sharing, namely, the industrial specializations, real per-capita GDP, common language, a currency union, and financial, social, and political integration (see Kalemli-Ozcan, Sørensen, and Yosha 2003; Shin 2006; Balli, Pericoli, and Pierucci 2018). Thus, the disappearance of intermember barriers within ASEAN after the dissolution of the Communist bloc, and ASEAN's rapid economic growth could be the factors that increase the amount of consumption risk sharing in ASEAN.[14]

However, among the ASEAN, ASEAN+3, and East Asia, only the ASEAN has continually enforced policies for financial integration to achieve the goals set by the AEC (see footnote 2). In addition, discussions about a monetary union at the pan-East Asia level have not made important progress due to differences in opinion among countries (Wang 2004). The ASEAN-driven policies have strengthened financial integration among ASEAN member countries (Rillo 2018). Hence, it appears that such policies played an important role in increasing consumption risk sharing in ASEAN after 1999. Specifically, the policies seem to help the credit markets of nonfounding members integrate and

[14] The founding members' shared fear of communism motivated the creation of ASEAN in 1967. Cambodia, Laos, and Vietnam, which are nonfounding members, were part of the Communist bloc.

develop.

B. What changes can the ASEAN's economic growth make to its risk-sharing pattern?

The OECD and the Eurozone include high-income countries. However, unlike the striking increase in the smoothing role of capital markets in the Eurozone, the capital market smoothing in the OECD is smaller than that in ASEAN. This event means that economic growth would not guarantee an increase in the degree of consumption risk sharing via capital markets.

Given that the most significant difference between the OECD and the Eurozone is the adoption of the euro, the common currency seems to have increased in the capital market smoothing. As discussed in Section II, capital markets measure the degree of risk sharing achieved by an international portfolio diversification. In reality, an international portfolio diversification has increased for Eurozone members since the adoption of a single currency; thus, risk sharing has increased (Demyanyk, Ostergaard, and Sørensen 2008). Hence, the rise in capital market smoothing in the Eurozone can be interpreted as the impact of increased international portfolio diversification due to the adoption of the euro.

Theoretically, the adoption of a common currency eliminates transaction costs and exchange rate risk among member countries. Hence, the member countries can facilitate cross-border investment in financial assets and enhance capital market integration (Kim, Kim, and Wang 2006). However, the adoption of a common currency will necessarily lead to an increase in capital market smoothing must not be concluded. For instance, although in the CFA franc zone, members use a common currency, their capital markets dis-smooth shocks to GDP (Yehoue 2011).

Therefore, from the high risk sharing in the OECD and the Eurozone, the policies for economic integration under the AEC Blueprint 2025 and ASEAN's future economic growth are expected to increase the degree of consumption risk sharing in ASEAN. However, the rise in risk sharing is most likely to be represented only in the credit markets. For strengthening capital market smoothing, ASEAN should arrange agreements and institutions to facilitate international portfolio diversification before adopting a common currency as the last

development stage of the AEC (see Plummer (2006) for policy lessons from the European Union).

VI. Concluding Remarks

This study analyzes the consumption risk sharing in ASEAN from a comparative perspective using the cross-sectional variance decomposition method. Several interesting findings emerge from the analysis. First, the degree of consumption risk sharing increases in ASEAN after 1999 but decreases in ASEAN+3 and East Asia. Specifically, the increase in ASEAN is due to the increase in credit market smoothing in ASEAN nonfounding members. However, the smoothing role of ASEAN founding members decreases. Second, the OECD and the Eurozone, composed of high-income countries, absorb approximately twice as many shocks to GDP as ASEAN does. Third, the common characteristic of all regions is that credit market smoothing accounts for most of the total risk sharing in each region, and the capital market smoothing is minimal. However, the capital market smoothing has increased after the adoption of the euro in the Eurozone in 1999.

Based on the empirical results, the following inferences are made. The ASEAN-driven policies for financial integration played an essential role in increasing consumption risk sharing in ASEAN. The ASEAN's future economic growth is expected to increase the consumption risk sharing, but the rise is most likely to be represented only in the credit markets. However, the inferences have a limitation because the estimation and analysis process could not have ruled out the possibility that the third factor (such as economic development, increase in trade, and characteristics of each country) would lead to changes in consumption risk sharing. Thus, further studies are required to identify specific factors or policies that change risk-sharing patterns.

(Received 25 January 2020; Revised 5 February 2020; Accepted 5 February 2020)

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