

Global Factors, Regional Factors, and Macro-Financial Linkages in East Asia*

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ABSTRACT

This paper examines macro-financial linkages in East Asia since the 1990s from both global and regional perspectives. First, we estimate dynamic factor models to identify global macroeconomic and financial factors in developed economies (G7) and then regional macroeconomic and financial factors in emerging market economies in East Asia and Europe. Second, we estimate VAR models for each emerging market economy in East Asia and Europe with these global and regional factors and evaluate their relative importance to output fluctuations through variance decomposition across periods and across emerging market regions. Our results reveal that total regional factors's contribution was more stable in East Asia compared to that of the total global factors before and after the global financial crisis, and of the total regional factor contribution the contribution of regional macro factors was larger in East Asia, whereas the contribution of regional financial factors was larger in emerging Europe.

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I. Introduction

The ongoing financial globalization appears to make real economies more volatile in response to financial fluctuations. Indeed, the global financial crisis (GFC) in 2008 drove many countries into a severe recession. However, the impact and pace of recovery vary across countries, particularly emerging market economies (EMEs). For example, the impact was relatively severe in EMEs in Europe but those in East Asia recovered relatively quickly.

This study focuses on macro-financial linkages in EMEs in East Asia from both global and regional perspectives. International capital and trade flows are expanding not only globally but also regionally against the backdrop of enhanced international supply chains. Regional supply chains may or may not have influenced the recessionary impacts and subsequent recovery speeds during the Global Financial Crisis (GFC).

The research questions examined in this study are as follows. First, to what extent are GDP growths in EMEs in East Asia affected by global as well as regional financial and (real) macroeconomic fluctuations? Second, which of the global and regional financial and real economic fluctuations affect their growths most? Third, were there any changes in how they affected these economies before and after the GFC? Finally, we also examine possible differences in global and regional spillovers between EMEs in East Asia and Europe.

To answer the above research questions, assuming that global factors are common fluctuations in G7 economies, we, first, identify global financial factors from financial variables in G7 economies and global macroeconomic factors from their GDP fluctuations. We use the global financial and macroeconomic factors estimated by Enya et al. (2022)¹. Second, we identify regional financial and macroeconomic factors for each group of EMEs in East Asia and Europe by estimating a dynamic factor model. We, third, estimate a VAR model that includes global and regional financial and macroeconomic factors as well as country-specific financial and macroeconomic variables for each economy. Finally, we evaluate the relative contributions of each factor to the GDP fluctuation of each economy through variance decomposition.

¹ Enya et al. (2022) considered the variation common to the G7 economies as a global factor. They identified the global factor by estimating a dynamic factor model using the maximum likelihood method. For financial factors, they identified three variable-specific global financial factors, focusing on prices in three financial markets: housing, equity, and bond markets. For macroeconomic factors, they identified global macroeconomic factors by focusing on real GDP.

Based on previous studies in related fields, this study attempts to be more comprehensive in that it deals with both global and regional spillovers through both macroeconomic and financial variables simultaneously. In addition, focusing on EMEs in East Asia, this study scrutinizes both time profiles before and after the GFC and conducts cross-regional comparisons with those economies in Europe. Specifically, we conducted two comparisons. First, we compare the global and regional macro-financial linkages in East Asia before and after the GFC. Second, we compare the global and regional macro-financial linkages in East Asian and European EMEs for the post-GFC period.

The main findings of this study are as follows: First, in the decade before the GFC, global financial factors were the largest contributors to GDP fluctuations, as large as 26% of the total in EMEs in East Asia. The contributions of both the global and regional factors were 31% and 33%, respectively, which overwhelmed those of the domestic counterparts. Second, in the decade following the GFC, the contributions of both global and regional factors decreased, mainly due to a decline in the contribution of global and regional financial factors. Third, in the decade following the GFC, regional macroeconomic factors accounted for much of the contribution of regional factors in East Asia. In contrast, regional financial factors did the same in Europe.

The structure of this paper is as follows. Section II summarizes the related literature and clarifies the uniqueness of this study. Section III explains our empirical method for measuring each emerging economy's exposure to global and regional macroeconomic and financial factors. Section IV presents the estimation results for global and regional macroeconomic and financial factors. Section V evaluates the relative contributions of global and regional factors to GDP fluctuations in East Asia. Finally, Section VI concludes the paper.

II. Related Literature

This study makes several contributions to related research areas. First, it relates to research on macro-financial linkages, that is, the interaction between the real economy and the financial sector. Several studies have been conducted in this area (Claessens & Kose, 2018). Theoretically and empirically, most studies focus on macro-financial linkages within a country. In financial markets with information asymmetry, changes in asset prices cause borrowers' balance sheets to expand and contract, increasing or decreasing credit, thereby causing macroeconomic fluctuations (balance sheet and

financial acceleration effects; Bernanke and Gertler, 1989; Kiyotaki et al., 1997). Claessens et al. (2011) identified financial cycles in credit, housing, and stock prices and found that credit and housing price cycles are highly synchronized within countries. Claessens et al. (2012) also found interactions between business and financial cycles within countries. Regarding the interactions between credit and business cycles, some studies distinguish between household and business credit and argue that an increase in household credit destabilizes or worsens the economy (Jordà et al., 2016; Mian et al., 2015). Rather than within a country, this study examines macro-financial linkages from both global and regional perspectives.

Second, this study is related to the study area of the global financial cycle, that is, the common fluctuations in asset prices and capital inflows in many countries and their impact on each economy. For example, Hirata et al. (2012) and Igan and Loungani (2012) identified global housing price cycles as fluctuations common to developed countries. Miranda-Agrippino and Rey (2015) found that the global financial cycle is a common variation in 858 financial variables in many countries around the world, arguing that, regardless of the exchange rate regime (fixed or floating), each country's economy is affected by the global financial cycle. Davis et al. (2019) found two common global factors in capital inflows in many countries: the global financial cycle and commodity price factors and argued that the impact of the global financial cycle on capital flows is stronger in countries with higher net debt liabilities. We focus on the impact of the global financial cycle on real economies and examine the issue within the framework of macro-financial linkages, focusing on the impact of global financial cycles and regional financial and macroeconomic cycles.

The research interests of Ha et al. (2020) are similar to this study. Ha et al. (2020) examined global macroeconomic and financial cycles and the spillovers between them for the G7 countries from 1985 to 2019. They find that global macroeconomic factors, not global financial factors, play a major role in explaining G-7 business cycles. Enya et al. (2022) analyzed global macro-financial linkages in emerging economies. Ha et al. (2020) and Enya et al. (2022) focus only on the relationship between global and domestic fluctuations.

Furthermore, this study is related to the study area of the impact of global and regional economic fluctuations on domestic economic fluctuations. Kose et al. (2003) developed a method to estimate (i) a dynamic factor common to all macroeconomic variables, regions, and countries (the world factor), (ii) some regional dynamic factors

common across aggregates within a region (the regional factors), and (iii) some country factors to capture dynamic co-movement across variables within each country (the country factors). Based on this method, Hirata et al. (2013) identify the business cycles shared by the Asian region and argue that the influence of global business cycles has been declining. In contrast, the influence of regional business cycles has grown stronger on domestic business cycles in East Asia. This study also focused on the impacts of common regional and global factors. However, unlike these studies, this study analyses the macro-financial linkage framework.

Thus, this study is unique in that it attempts to decompose the variation in each country's GDP into variations due to global and regional, financial and macroeconomic factors and domestic financial and macroeconomic variable shocks, and to assess their relative contributions.

III. Empirical Method and Data

This study examines macro-financial linkages from both the global and regional perspectives in three steps. First, we estimated a dynamic factor model to identify common global factors in financial and macroeconomic variables. We, second, estimate a dynamic factor model to identify common regional factors in the financial and macroeconomic variables, controlling for the global factors identified in the first step. Finally, we estimate a VAR model with estimated global and regional factors, and domestic financial and macroeconomic variables for each economy, and then we conduct a variance decomposition analysis to evaluate the relative importance of global and regional, financial and macroeconomic factors and domestic shocks in real macroeconomic fluctuations in each economy.

III.1. Identifying the global and regional financial and macroeconomic factors

In the first step, we define global financial and macroeconomic factors as common fluctuations in asset prices and macroeconomic variables in G7 countries, as in Enya et al. (2022). This study focuses on the prices of three assets: housing, stocks, and short-term interest rates. For global financial and macroeconomic factors, we use estimates in a previous study by Enya et al. (2022). Enya et al. (2022) estimated a highly flexible

dynamic factor model to identify common factors². The dynamic factor model takes the following form:

$$Y_t = \beta F_t + \Gamma_t \quad (1)$$

$$\Gamma_t = \Psi(L)\Gamma_{t-1} + U_t \quad (2)$$

$$F_t = \Phi(L)F_{t-1} + V_t \quad (3)$$

where $E_t(U_t U_t') = \Omega$ and $E_t(V_t V_t') = I_k$. Y_t is an $n \times 1$ vector of observable variables. F_t is a $k \times 1$ vector of unobservable factors. β is an $n \times k$ matrix of the factor loading parameters that measure the response of each observable variable to each factor ($k < n$). Γ_t is an $n \times 1$ vector of the disturbances. Each element of Γ_t is assumed to follow an independent $AR(q)$ process; hence, $\Psi(L)$ is a block diagonally lagged polynomial matrix. Ω is the covariance matrix restricted to the diagonal. Unobservable factor F_t follows the $AR(p)$ process. When $m = kp$, which is the dimension of the state vector F , it comprises an $m \times 1$ vector of unobservable factors and their lags and $\Phi(L)$ is a matrix lag polynomial. The variance-covariance matrix in Eq. (3) is assumed to be an identity matrix for normalization. It is also assumed that $\Phi(L)$ is a block diagonal, implying that the latent factors are uncorrelated. The dynamic factor models represented by equations (1), (2), and (3) were estimated using the maximum likelihood (ML) method. The ML estimator is implemented by writing the model in the state-space form and using the Kalman filter to derive and implement the log likelihood³.

Second, we defined regional financial and macroeconomic factors as common fluctuations in emerging economies within the region. We focus on two regions: East Asia and Europe. We estimate the following dynamic factor model to identify the regional factors for each region:

² In estimating global financial factors, Enya et al. (2022) assume that their data contain only variable-specific global factors and detect variable-specific global financial factors common to the G7 countries by estimating a dynamic factor model with a one-factor model for each financial variable, such as housing prices, stock prices, and interest rates. Furthermore, we identify a global macroeconomic factor that captures the co-movement of GDPs in G7 countries by estimating a dynamic factor model.

³ Dynamic factor models are very flexible. But they are too flexible, and the maximum likelihood method does not converge frequently. As n grows, the number of parameters quickly exceeds the number that can be estimated. If the ML method does not converge within the maximum iteration number in the calculation, we regard it as a sign of the absence of a common factor. Dynamic factor models can be estimated by the Bayesian estimation method and by the ML method. The ML method has the advantage of obtaining statistically significant estimation results. Therefore, we use the ML method. Ha et al. (2020) estimate a dynamic factor model by Bayesian estimation method.

$$Y_t = \beta F_t^R + \alpha X_t + \Gamma_t \quad (4)$$

$$\Gamma_t = \Psi(L)\Gamma_{t-1} + U_t \quad (5)$$

$$F_t^R = \Phi(L)F_{t-1}^R + V_t \quad (6)$$

Y_t is the observable variable in the emerging economies in the region, F_t^R is the unobserved latent regional factor in the region, and X_t is the global factor estimated exogenously using the method described earlier. As to the other terms, the same assumptions in the previous model of equations (1) - (3) hold.

As in the estimation of the global factor, we estimated only variable-specific regional factors in each region. We detect variable-specific regional financial factors for East Asia common to the three emerging economies in East Asia, for which data have been available since 1994, by estimating a dynamic factor model with a one-factor model for each financial variable, such as housing prices, stock prices, and interest rates. Furthermore, by estimating a dynamic factor model, we identify a regional macro factor that captures the co-movement of the GDPs of the three emerging economies in East Asia⁴.

Similar to the regional factors for East Asia, we estimated the regional factors for the emerging European region. We detect variable-specific regional financial factors for emerging Europe common to the seven emerging economies in Europe for which data have been available since 2007. Furthermore, by estimating a dynamic factor model, we identify a regional macro factor that captures the co-movement of the GDPs of seven emerging market economies in Europe⁵.

This study uses the maximum likelihood method, which yields statistically significant results. If the ML method did not converge within the maximum iteration number (100) in the calculation, this was considered an indication of the absence of a common factor.

⁴ We identify the variations common to Korea, Malaysia, and Thailand as a regional factor for the emerging market economies in East Asia. This is because data for these three countries have been available since 1994.

⁵ We identify the variations common to Hungary, Czech Republic, Poland, Slovakia, Slovenia, Bulgaria, and Croatia as a regional factor for the emerging market economies in Europe. This is because data on housing prices in many of these economies have been available since 2006.

III.2. The method for evaluating the relative contribution of global and regional financial and macroeconomic factors

In order to evaluate the global and regional aspects of macro-financial linkages in emerging economies in East Asia and compares them to those in Europe, we estimate a VAR model with each country's global and regional macroeconomic and financial factors and then examine the global and regional factors' contributions to GDP fluctuation at a horizon of 30 quarters using Cholesky decomposition. We use a VAR model containing only the minimum necessary variables to examine the global and regional aspects of the global, regional, and domestic variables of macro-financial linkages related to finance and the macroeconomy. The VAR model includes three estimated variable-specific global financial factors, one estimated global macroeconomic factor, three estimated variable-specific regional financial factors, one estimated regional macroeconomic factor, three domestic financial variables, the real effective exchange rate, and GDP. Thus, we apply the VAR model, which consists of four global, four regional, and five domestic variables. All the variables were log-differenced. The only difference is in interest rates.

The order of the variables in the VAR model is as follows: global macroeconomic factors, regional macroeconomic factors, domestic GDP, global financial factors (housing price, stock price, and interest rate factors), regional financial factors (housing price, stock price, and interest rate factors), domestic financial variables (housing prices, stock prices, and interest rates), and exchange rates. Following Hirata et al. (2012), this order is motivated by the fact that real variables are likely to adjust more slowly than financial variables, from slow to fast adjustment variables⁶. The lag order is 2.

III.4. Data

Following Enya et al. (2022), we use the following data: real housing prices, real stock prices, real short-term interest rates, and real GDP for 1989Q3-2019Q4.

We estimated a dynamic factor model for each region for regional financial and macroeconomic factors. We focused on five emerging market economies in East Asia

⁶ For robustness testing, we also analysed in another orders. The contribution of early-order variables to GDP fluctuations tends to be slightly greater, but the main results remain largely unchanged.

and seven in Europe. However, to obtain regional factors for as long as possible, we estimated regional factors for East Asia from data on only three economies available since 1994 (common to three East Asian economies (EA3), they are Korea, Malaysia, and Thailand). In addition, we estimated regional factors for East Asia from the five economies available since 2002 in order to obtain regional factors common to more economies (common to five East Asian economies (EA5), they are Korea, Malaysia, Thailand, China and Indonesia).

After identifying the global and regional factors, we estimated the VAR model using the identified global and regional, macroeconomic and financial factors, and domestic macroeconomic and financial variables for five emerging economies in East Asia and seven emerging economies in Europe. We use real housing prices, real stock prices, short-term real interest rates, and real effective exchange rate variables as domestic financial variables and real GDP as the domestic macroeconomic variable.

All variables are deflated by the CPI, seasonally adjusted, and log-differenced (except for the interest rate). The data-availability period for each country was uneven. [Tables A1](#) show the sample countries and periods, respectively. [Table A2](#) lists the data sources used.

IV. Estimation Results

IV.1 Estimation results of dynamic factor models for East Asia

To identify the regional factors, we estimated dynamic factor models for each East Asian and emerging European region. Variations in the financial variables common to emerging economies within the region were estimated for each variable, assuming only financial variable-specific variations.

Panel (A) of [Table A3](#) shows the results of the dynamic factor model for housing prices common to three East Asian economies (EA3). The estimation results for the measurement equations (eq (4)) show that the regional housing price factor, which is common to housing prices in Asia, is significantly correlated only with housing prices in Malaysia. The estimation results of the transition equation for the common factor (eq (6)) also confirm the significant correlations between the first- and second-period lags of the factor.

Panel (B) of [Table A3](#) shows the results for stock prices common to EA3. The estimation results for the measurement equations (eq (5)) show that the estimated

regional stock price factor, common to stock prices in EA3, is significantly correlated with stock prices in Korea, Malaysia, and Thailand, as well as with the global stock price factor. However, the results of the transition equation show no significant correlation with the first- and second-period lags of factor. Therefore, we estimate a factor model that does not assume a lag structure in the error term of the observation equation or common factor (in Column (2) of Panel (B) of Table A3). The estimated regional stock price factor common to stock prices in East Asia was also significantly correlated with stock prices in Korea, Malaysia, and Thailand. Additionally, the global stock price factor also significantly correlates with stock prices in the three East Asian EMEs.

Panel (C) of **Table A3** shows the results for the interest rates common to EA3. As in the case of stock prices, we estimate factor models that do not assume the autoregression of common factors because the autoregression of common factors is not significant. The estimated regional interest rate factor, common to interest rates in East Asia, significantly correlates with interest rates in Korea, Malaysia, and Thailand. Finally, Panel (D) of **Table A3** shows the results for GDPs common to EA3. For the GDPs in EA3, we also identify regional macroeconomic factors common to GDP fluctuations in the three EMEs in East Asia.

Panel (A), Panel (B), Panel (C) and Panel (D) of **Table A4** shows the results for housing prices, stock prices, the interest rates, and GDPs common to EA5, respectively. Housing prices common to the five East Asian countries are only significantly correlated with housing prices in Malaysia (Panel (A) of **Table A4**). Therefore, we interpret that there is no housing price common to the five East Asian economies.

IV.2 Estimation results of dynamic factor models for Emerging Europe

Panel (A), Panel (B), Panel (C) and Panel (D) of **Tables A5** show the results of the dynamic factor models estimated for housing prices, stock prices, interest rates, and GDPs, respectively, common to the emerging European region (EE7). As in the case of the East Asian region, for stock prices and interest rates, we estimate factor models that do not assume the autoregression of common factors (Panel (B) and Panel (C) of **Tables A5**) because the autoregression of common factors is not significant.

Housing prices in many emerging European economies are significantly correlated with the estimated regional and global housing price factors. Additionally, stock prices and interest rates in many European EMEs significantly correlate with the estimated regional stock prices and interest rate factors (except for stock prices in Poland). The GDP fluctuations in many emerging market economies in Europe significantly correlate with the estimated fluctuations in regional and global macroeconomic factors.

IV.3 Estimated variable-specific regional factors in East Asia and Emerging Europe

Panels (a), (b), (c), and (d) in Figure 1 show the estimated global, East Asian regional (R_EA3 and R_EA5), and emerging European regional factors (R_EE7), respectively, for home prices, stock prices, interest rates, and GDP. Concerning housing prices, there is no notable trend in changes in the East Asian regional factor. Still, the emerging European regional factor has been declining since 2009, slightly later than the global factor (Panel (a) in Figure 1). Regarding stock prices, the East Asia factor declined during the 1997 Asian and global financial crises, while the European factor rose significantly around 2004 when more countries joined the European Union. Additionally, the European factor showed a large increase around 2004 when the number of countries joining the European Union increased (Panel (b) in Figure 1)⁷.

Regarding interest rates, the East Asian factor declined after the Asian and global financial crises, whereas the European factor declined during and after the global financial crisis. Finally, regarding GDP, the East Asia factor declined during the Asian and global financial crises but recovered quickly. However, the European factor declined during the global financial crises and then recovered slowly.

V. Variance decompositions of GDP fluctuations

Table A6 and Table A7 shows the variance contributions of global, regional, and idiosyncratic macroeconomic and financial factors to GDP fluctuations for each of the

⁷ Ten countries joined the EU on May 1, 2004. Estonia, Poland, the Czech Republic, Slovenia, Hungary, Cyprus, Latvia, Lithuania, Slovakia, and Malta.

three EMEs in East Asia (EA3) across the four periods (Table A6) and for each of the five EMEs in East Asia (EA5) and each of the seven EMEs in Europe (EE7) in the decade after the GFC (Table A7).

V.1 Contribution of factors to GDP fluctuations across periods in East Asia

Figure 2 shows the average contributions of the EA3. Panels (a), (b), and (c) in Figure 2 show the contributions of global, regional, and domestic variables, respectively. Each panel presents the contributions of the four periods. The following features were identified in Figure 2:

First, in the period before the crisis (i.e., from 1995 to 2007), the contributions of global factors were not as large (left bar chart in Panel (a) of Figure 2). The contributions of the global factors in this period were 18% (of which 11% were contributed by global financial factors and 7% by global macroeconomic factors). Second, in the decade before the GFC (1998-2007), global financial factors were the largest contributors to GDP fluctuations (see the middle bar chart in Panel (a) of Figure 2). Global financial factors contributed 26% of GDP fluctuations, and global macroeconomic factors contributed 7%. The contribution of global financial factors increased drastically during this period (from 11% to 26%). Particularly, the increase in the contribution of global equity financial factors was impressive. Third, in the decade after the GFC (2007-2019), the contribution of global financial factors declined to 12% of that in the 1995-2007 period (right bar chart in Panel (a) of Figure 2). Global financial and macroeconomic factors contributed 20% to GDP fluctuations. The findings regarding the contribution of global factors are consistent with those of Enya et al. (2022).

Fourth, in the period before the crisis (1995-2007), the contributions of the regional factors were larger than those of the global factors (left bar chart in Panel (b) of Figure 2). Most of the contributions of regional factors come from regional equity and macroeconomic factors. Regional financial factors contributed 12% of the GDP change, and regional macroeconomic factors contributed 12%. Fifth, in the decade before the GFC (1998-2007), the contributions of regional factors did not increase as much as those of global factors (12% were contributed by regional financial factors and 12% by regional macroeconomic factors). Sixth, after the financial crisis (2007-2019), the contributions of regional factors decreased significantly, as did those of the global

factors. The decline in the contributions of regional factors is largely due to the decline in the contributions of regional financial factors. In contrast, regional macro factors do not decline as much (9% is contributed by regional financial factors and 12% by regional macroeconomic factors).

The following points are of particular interest: First, the contributions of global and regional financial factors declined before and after the crisis, whereas the contributions of macro factors did not decline and remained negligible. The contribution of financial factors appears to be more variable than that of macro factors. Second, in the post-crisis period, the contribution of the regional macro factors was larger than that of the global macro factors. The contribution of global factors appears to be dominated by the contribution of global financial factors, whereas that of regional factors appears to be dominated by the contribution of regional macro factors.

V.2 Contributions of factors in the period 2009-2019: comparisons between emerging market economies in East Asia and those in Europe

Figure 3 shows the average contributions of the five EMEs in East Asia (EA5), and the seven in Europe (EE7) from to 2009-2019 period. No significant differences were observed between EA3 (right bar chart of Figure 2) and EA5 groups (left bar chart of Figure 3). Global factors contributed 20% of the GDP fluctuation for EA3 (12% was contributed by financial factors, 8% by macroeconomic factors) and 23% for EA5 (15% by financial factors and 8% by macroeconomic factors), while regional factors contributed 21% of the GDP change for EA3 (9%, 12%) and 20% for EA5 (9%, 11%).

It would be interesting to compare the features of EA5 with those of EE7. It can be observed that the contributions of the global and regional factors are slightly smaller in EA5 (the contributions of the global and regional factors were 23% and 20%, respectively) than in EE7 (25% and 26%, respectively, as well). We also identified substantial differences in the features of EA5 and EE7 in the breakdown of the regional factor contributions. Regional macroeconomic factors account for much of the contribution of regional factors for EA5 (11% by regional macroeconomic factors). In contrast, regional financial factors account for much of the contribution of regional factors for EE7 (20% by regional financial factors).

VI. Conclusion

This study examines the macro-financial linkages in East Asian EMEs from global and regional perspectives. As financial and production activities have become increasingly internationalized, global and regional spillovers have increased. Moreover, business cycles may be increasingly linked not only to the domestic financial sector but also to neighboring regions and global financial and business cycles. Therefore, we examine the characteristics of the global and regional macro-financial linkages of East Asia and compare them with those of European EMEs.

The main findings of this study are as follows. First, in the pre-GFC decade, global financial factors were the largest contributors to GDP fluctuations, accounting for as much as 26% of the total EMEs in East Asia. The contributions of global and regional factors were 31% and 33%, respectively, overwhelming those of domestic factors. Second, in the post-GFC decade, the contributions of both global and regional factors decrease, mainly because of a decline in the contribution of global and regional financial factors. Third, during the post-GFC decade, regional macroeconomic factors account for much of the contribution of regional factors to EMEs in East Asia. In contrast, regional financial factors account for much of the contribution of regional factors to EMEs in Europe.

What causes these differences in the regional macro-financial linkages between EMEs in East Asia and Europe? First, the significant contribution of regional macroeconomic factors to East Asia may reflect the development of value chains in the region. In East Asia, the value chain appears to be regional rather than global. Second, the large contribution of regional macro factors to EMEs in East Asia and the large contribution of regional financial factors to EMEs in Europe may be understood with the characteristics of capital flows in the region. Enya et al. (2019) confirmed that capital flows in the form of stable foreign direct investment were dominant in East Asia in the post-GFC period. In contrast, capital flows in the form of portfolio investments were dominant in EMEs in Europe. After the GFC, EMEs in East Asia made a larger contribution from regional macroeconomic factors than EMEs in Europe, which may have provided stronger resilience to EMEs in East Asia.

Some studies show that stock prices are more strongly correlated between two countries with a value chain relationship (Auer et al., 2022). The significant contribution of regional financial factors to European EMEs may reflect this effect. It is

important to note the relationship between the development of value chains and the contributions of global financial factors in East Asia.

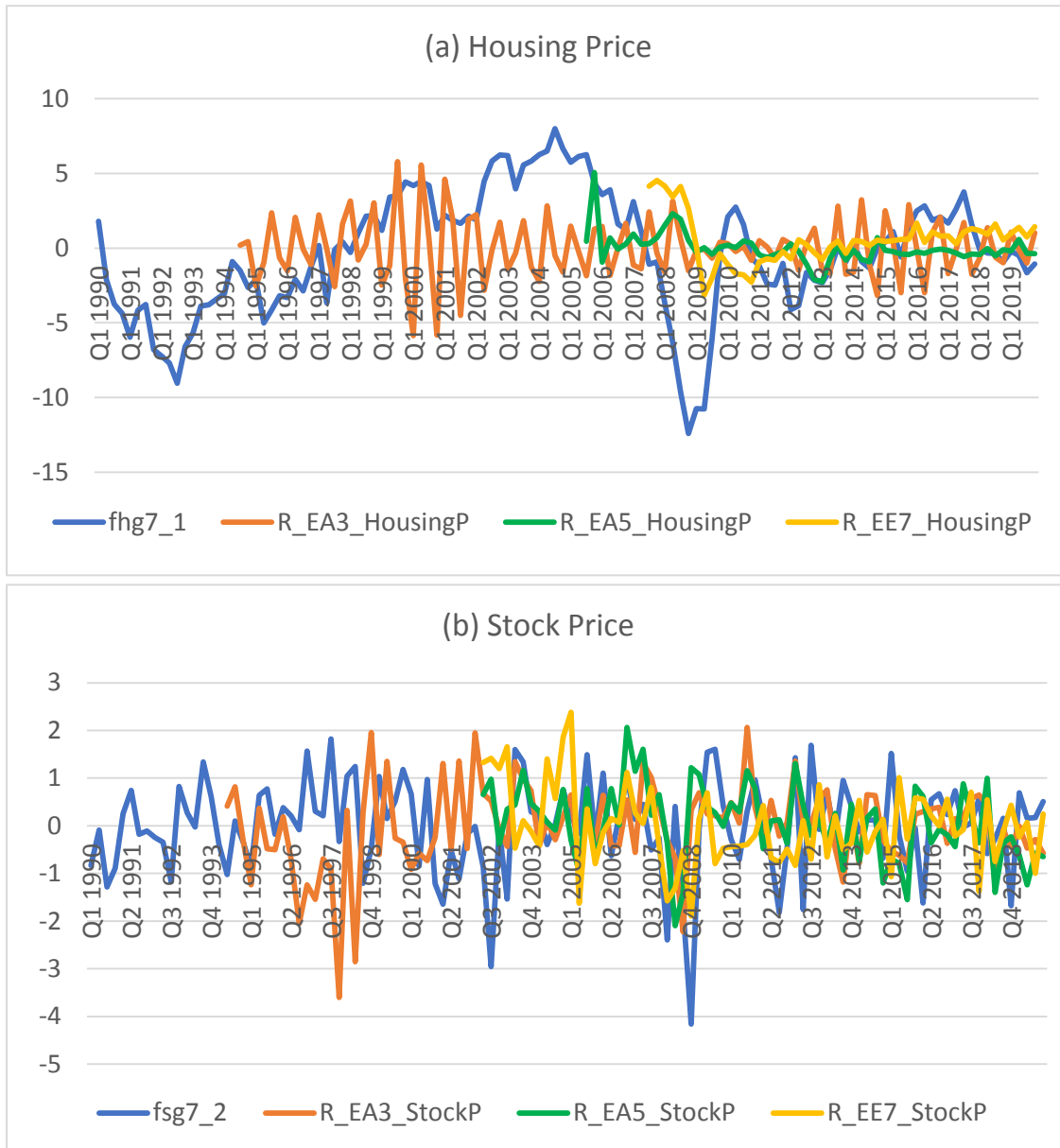
This study has the following limitations. First, our 'global factors' and 'regional factors' are not exactly 'global' common factors across full sample economies and 'regional' common factors across full sample economies in the region, respectively. This is because we cannot find the existence of global and regional common factors across full-sample economies due to the statistical availability of the EMEs' data and the ML method. Second, although we perform various robustness checks on the model selection, our VAR model may have overlooked some important variables relevant to the dynamics of our macroeconomic and financial variables. Despite these and other limitations, our results quantitatively indicate the significant impacts of global and regional macroeconomic and financial factors on domestic business cycles and their possibly heterogeneous patterns across periods and regions.

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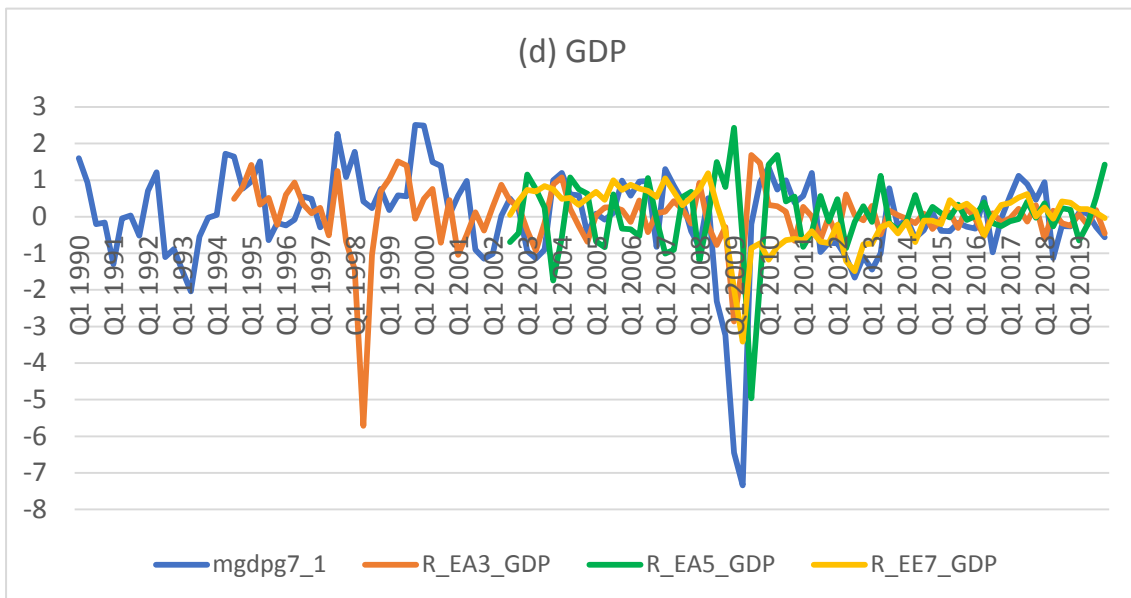
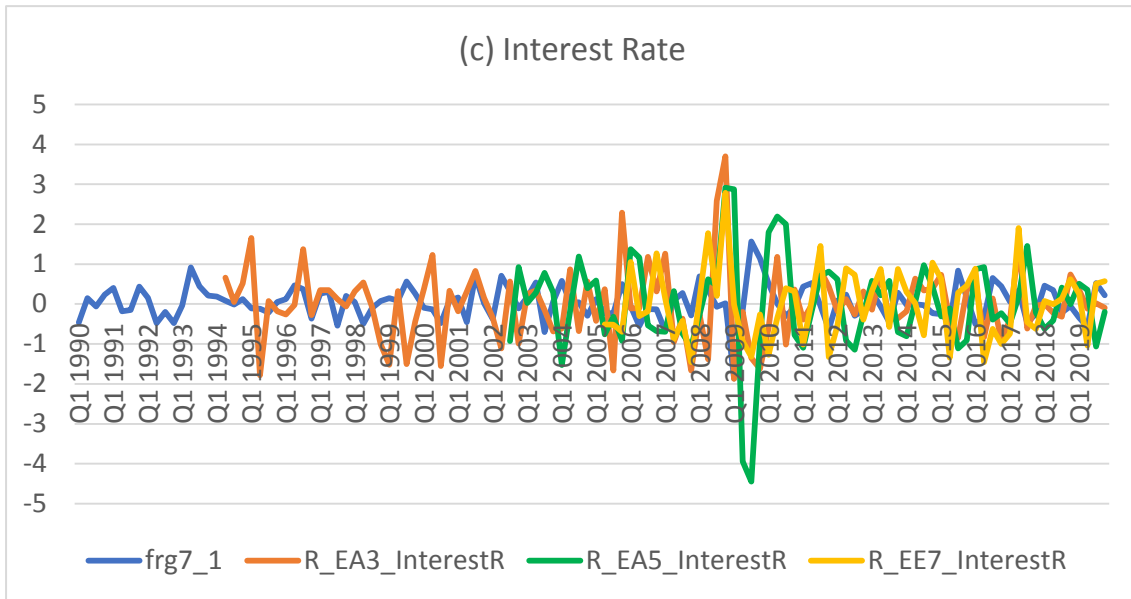
Figure 1: Common Factors (Global and Regional factors for EMEs in East Asia (EA) and emerging Europe (EE))



Note: Global factors (fhg7_1, fsg7-2, frg7_1, mgdpg7_1) are those estimated by Enya et al. (2022). The regional factors for the EA3 (R_EA3_HousingP, R_EA3_StockP, R_EA3_InterestR, and R_EA3_GDP) are the fluctuations common to the three East Asian economies (Korea, Malaysia, and Thailand) over the period 1994-2019, obtained by estimating a dynamic factor model, whereas the regional factors for the EA5 (R_EA5_HousingP, R_EA5_StockP, R_EA5_InterestR, and R_EA5_GDP) are those common to the five East Asian economies (EA3 economies plus China and Indonesia) over the period 2002-2019. The regional factors for EE7 (R_EE7_HousingP, R_EE7_StockP, R_EE7_InterestR, and R_EE7_GDP) are those common to the seven emerging European economies (Hungary, Czech Republic, Poland, Slovakia, Slovenia, Bulgaria, and Croatia) over the period 2002-2019.

Source: Enya et al. (2022), Authors

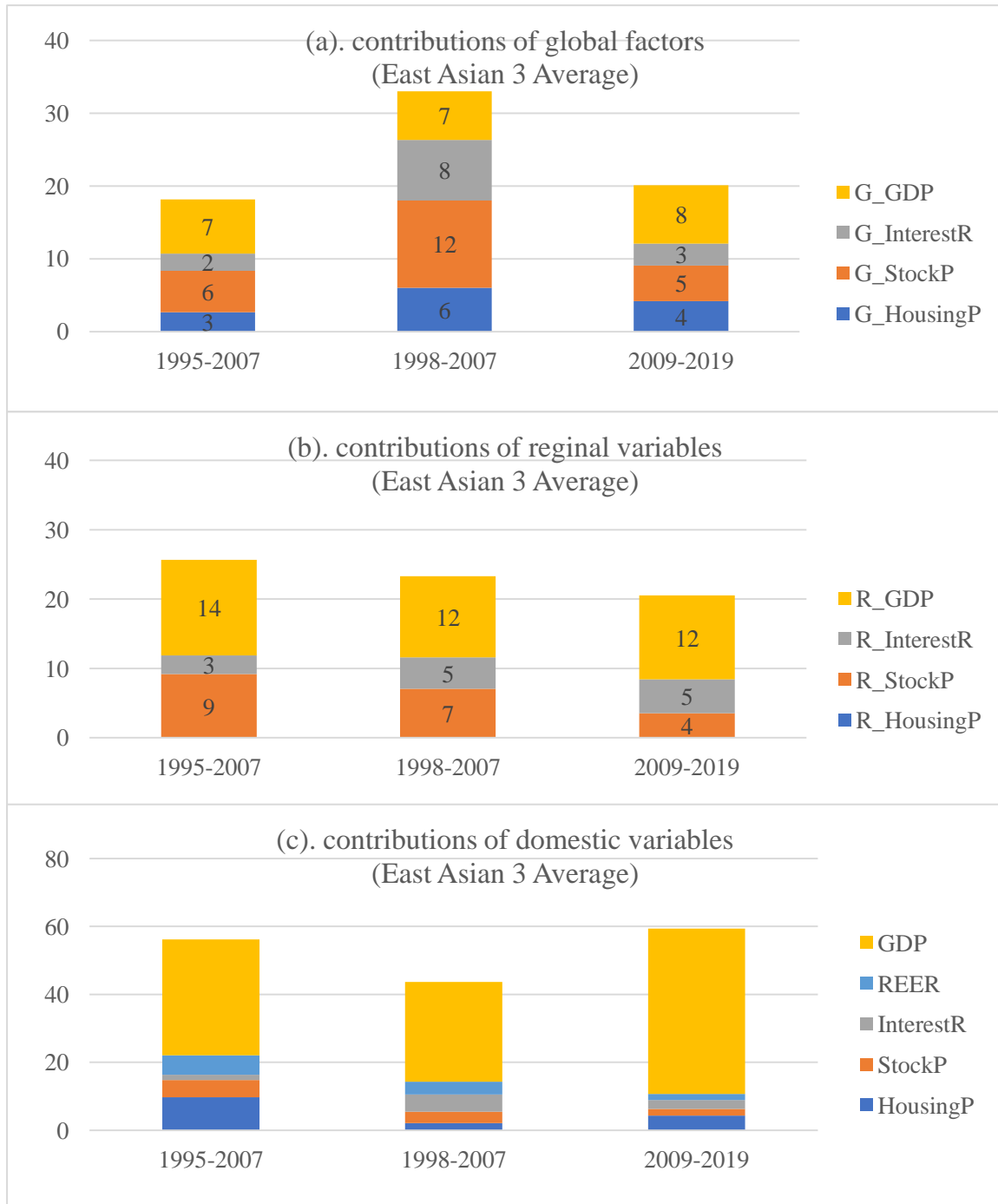
Figure 1: Common Factors (Global and Regional factors for EMEs in East Asia (EA) and emerging Europe (EE)) (continued)



Note: Global factors (fhg7_1, fsg7-2, frg7_1, mgdpg7_1) are those estimated by Enya et al. (2022). The regional factors for the EA3 (R_EA3_HousingP, R_EA3_StockP, R_EA3_InterestR, and R_EA3_GDP) are the fluctuations common to the three East Asian economies (Korea, Malaysia, and Thailand) over the period 1994-2019, obtained by estimating a dynamic factor model, whereas the regional factors for the EA5 (R_EA5_HousingP, R_EA5_StockP, R_EA5_InterestR, and R_EA5_GDP) are those common to the five East Asian economies (EA3 economies plus China and Indonesia) over the period 2002-2019. The regional factors for EE7 (R_EE7_HousingP, R_EE7_StockP, R_EE7_InterestR, and R_EE7_GDP) are those common to the seven emerging European economies (Hungary, Czech Republic, Poland, Slovakia, Slovenia, Bulgaria, and Croatia) over the period 2002-2019.

Source: Enya et al. (2022), Authors

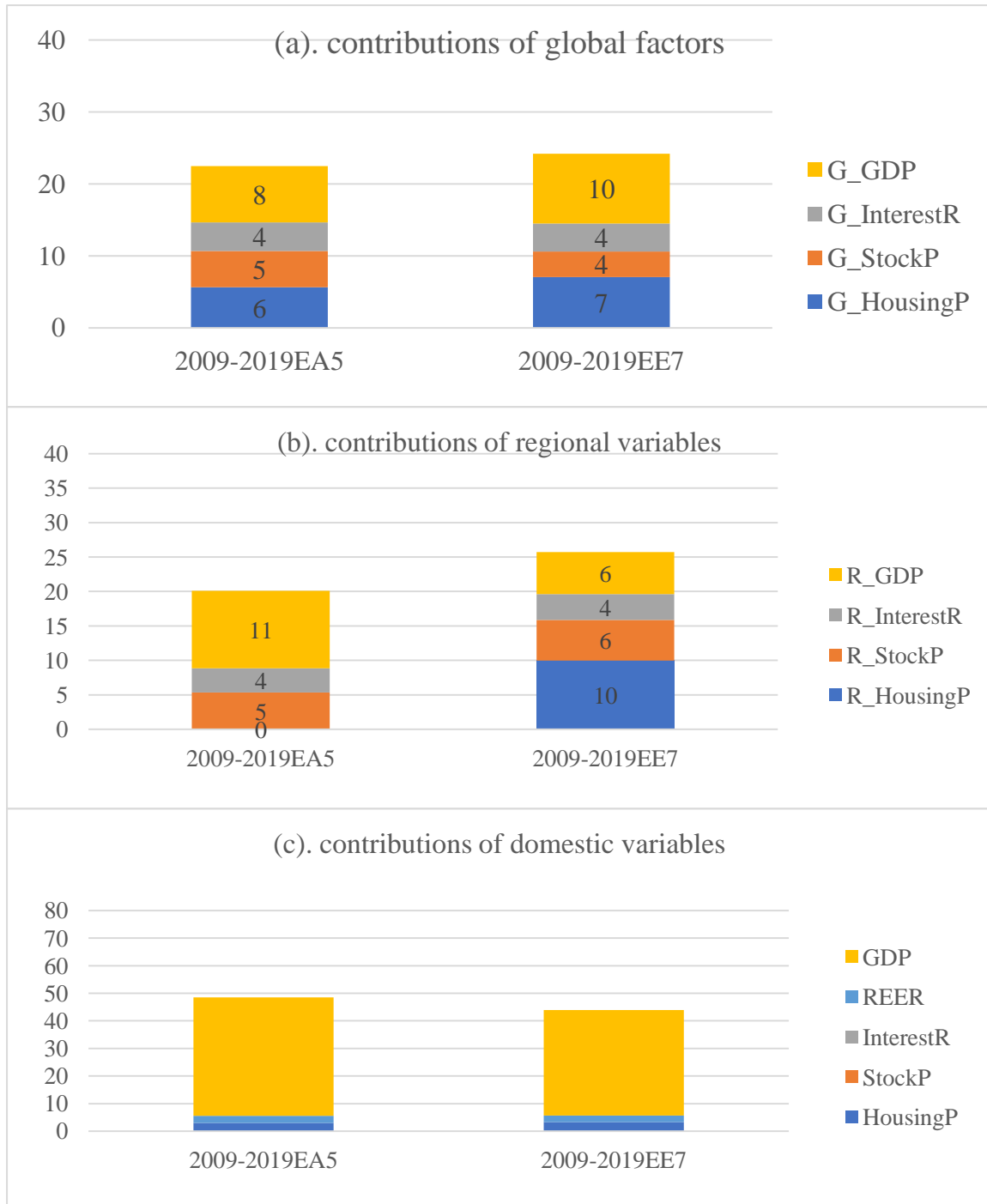
Figure 2: Contributions to GDP fluctuations for the three East Asian Economies across periods (Korea, Malaysia, Thailand)



Notes: The values are the contribution of each factor to the GDP fluctuations, calculated by variance decomposition. The aggregate contribution of the global housing price factor (G_HousingP), stock price factor (G_StockP), and interest rate factor (G_InterestR) is considered the contribution of the global financial factor, while the contribution of the global GDP factor (G_GDP) is considered the contribution of the global macroeconomic factor. Similarly, the aggregate contribution of the regional housing price factor (R_HousingP), stock price factor (R_StockP), and interest rate factor (R_InterestR) is considered the contribution of the regional financial factor, and the contribution of

the regional GDP factor (R_GDP) is considered the contribution of the regional macroeconomic factor. The regional Asian factor is the fluctuation common to the three Asian economies (Korea, Malaysia, and Thailand) .

Figure 3: Comparison of the contribution of factors to GDP fluctuations in the post-crisis period between EA5 and EE7



Notes: The values are the contribution of each factor to the GDP fluctuations, calculated by variance decomposition. The aggregate contribution of the global housing price factor (G_HousingP), stock price factor (G_StockP), and interest rate factor (G_InterestR) is considered the contribution of the global financial factor, while the contribution of the global GDP factor (G_GDP) is considered the contribution of the global macroeconomic factor. Similarly, the aggregate contribution of the regional housing price factor (R_HousingP), stock price factor (R_StockP), and interest rate factor (R_InterestR) is considered the contribution of the regional financial factor, and the contribution of

the regional GDP factor (R_GDP) is considered the contribution of the regional macroeconomic factor. The regional Asian factor is the fluctuation common to the five Asian economies (Korea, Malaysia, Thailand, China, and Indonesia), and the regional Emerging European factor is the fluctuation common to the seven Emerging European economies (Hungary, Czech Republic, Poland, Slovakia, Slovenia, Bulgaria, and Croatia).

Table A1: Sample countries and periods

East Asia (EA)		Emerging Europe (EE)		
EA3		1994Q3 - 2019Q4	EE7	2007Q3 - 2019Q4
Korea	KOR		Hungary	HUN
Malaysia	MYS		Czech Republic	CZE
Thailand	THA		Poland	POL
			Slovakia	SVK
EA5		2006Q1 - 2019Q4	Slovenia	SVN
Korea	KOR		Bulgaria	BGR
Malaysia	MYS		Croatia	HRV
Thailand	THA			
Indonesia	IDN			
China	CHN			

Table A2: Variable List and Data Source

Variable	Definition	Source	Transformation
HousingPrice (fh)	real housing price	BIS: Real property price, Index,	log difference
StockPrice (fs)	real stock price	OECD, IFS: Total Share Prices for All Shares	log difference
InterestRate (fr)	3-month interest rate (tresuary bill or interbank)	OECD, IFS: 3-Month or 90-day Rates and Yields	difference
REER	Real Effective Exchange Rate	BIS, IFS	log difference
GDP (mgdp)	real GDP	OECD, IFS: Gross Domestic Product by Expenditure in Constant Prices	log difference
R_EA3_HousingPrice	Common regional housing price factor in East Asia (3 countries)	Comovement of HousingPrice (fh) across 3 economies in East Asia	
R_EA3_StockPrice	Common regional stock price factor in East Asia (3 countries)	Comovement of StockPrice (fs) across 3 economies in East Asia	
R_EA3_InterestRate	Common regional interest rate factor in East Asia (3 countries)	Comovement of InterestRate (fr) across 3 economies in East Asia	
R_EA3_GDP	Common macroeconomic factor in East Asia (3 countries)	Comovement of GDP (mgdp) across 3 economies in East Asia	
R_EA5_HousingPrice	Common regional housing price factor in East Asia (5 countries)	Comovement of HousingPrice (fh) across 5 economies in East Asia	
R_EA5_StockPrice	Common regional stock price factor in East Asia (5 countries)	Comovement of StockPrice (fs) across 5 economies in East Asia	
R_EA5_InterestRate	Common regional interest rate factor in East Asia (5 countries)	Comovement of InterestRate (fr) across 5 economies in East Asia	
R_EA5_GDP	Common macroeconomic factor in East Asia (5 countries)	Comovement of GDP (mgdp) across 5 economies in East Asia	
R_EE7_HousingPrice	Regional housing price facor in Emerging Europe	Comovement of HousingPrice (fh) across 7 economies in Emerging Europe	
R_EE7_StockPrice	Regional stock price facor in Emerging Europe	Comovement of StockPrice (fs) across 7 economies in Emerging Europe	
R_EE7_InterestRate	Regional interest rate facor in Emerging Europe	Comovement of InterestRate (fr) across 7 economies in Emerging Europe	
R_EE7_GDP	Regional macro facor in Emerging Europe	Comovement of GDP (mgdp) across 7 economies in Emerging Europe	
G_HousingPrice	Global housing price facor	Comovement of HousingPrice (fh) across G7 countries	Enya et al. (2022)
G_StockPrice	Global stock price facor	Comovement of StockPrice (fs) across G7 countries	Enya et al. (2022)
G_InterestRate	Global interest rate facor	Comovement of InterestRate (fr) across G7 countries	Enya et al. (2022)
G_GDP	Global macro facor	Comovement of GDP (mgdp) across G7 countries	Enya et al. (2022)

Notes: Data frequency was quarterly. Macroeconomic and financial variables are adjusted seasonally. Financial variables are deflated by each country's CPI. We use the log differences of all variables (except for interest rates).

Table A3: Estimation Results of Regional Factors in East Asia (3 countries)

(A) Regional Housing Price Factor

a. Measurement Equations

	kor_fh	mys_fh	tha_fh
R_EA3_HousingPrice	0.000 (0.712)	0.001 * (0.037)	0.005 (0.066)
G_HousingPrice	0.000 (0.830)	0.000 (0.659)	0.000 (0.487)
constant	-0.001 (0.774)	0.006 (0.160)	0.001 (0.770)

b. Transition equations of common factors

R_EA3_HousingPrice	
R_EA3_HousingPrice (t-1)	-0.751 *** (0.000)
R_EA3_HousingPrice (t-2)	-0.927 *** (0.000)
Sample Periods	1994q2 - 2019q4
Number of Observation	103

(B) Regional Stock Price Factor

a. Measurement Equations

	(1)			(2)		
	kor_fs	mys_fs	tha_fs	kor_fs	mys_fs	tha_fs
R_EA3_StockPrice	0.619 *** (0.000)	0.403 *** (0.000)	0.627 *** (0.000)	0.610 *** (0.000)	0.395 *** (0.000)	0.758 *** (0.000)
G_StockgPrice	0.497 *** (0.000)	0.471 *** (0.000)	0.384 *** (0.000)	0.473 *** (0.000)	0.442 *** (0.000)	0.348 *** (0.000)
constant						

b. Transition equations of common factors

	R_EA3_StockPrice	R_EA3_StockPrice
R_EA3_StockPrice (t-1)	0.198 (0.143)	
R_EA3_StockPrice (t-2)	0.265 * (0.033)	
Sample Periods	1994q2 - 2019q4	1994q2 - 2019q4
Number of Observation	103	103

Table A3: Estimation Results of Regional Factors in East Asia (3 countries) (continued)

(C) Regional Interest Rate Factor

a. Measurement Equations

	kor_fr		mys_fr		tha_fr	
R_EA3_Interest Rate	1.068 *		1.268 **		2.122 ***	
	(0.036)		(0.020)		(0.000)	
G_Interest Rate	0.170		-0.865		1.399	
	(0.817)		(0.375)		(0.365)	
constant	-0.061		0.056		-0.034	
	(0.608)		(0.720)		(0.880)	

b. Transition equations of common factors

	R_EA3_Interest Rate
R_EA3_Interest Rate (t-1)	-0.064
	(0.914)
R_EA3_Interest Rate (t-2)	-0.29
	(0.057)
Sample Periods	1994q2 - 2019q4
Number of Observation	103

(D) Regional Macroeconomic Factor

a. Measurement Equations

	kor_mgdp		mys_mgdp		tha_mgdp	
R_EA3_GDP	0.007 ***		0.008 ***		0.007 ***	
	(0.000)		(0.000)		(0.000)	
G_GDP	0.000		0.001		0.000	
	(0.905)		(0.203)		(0.902)	
constant	0.011 ***		0.012 ***		0.008 ***	
	(0.000)		(0.000)		(0.000)	

b. Transition equations of common factors

	R_EA3_GDP
R_EA3_GDP (t-1)	0.9 ***
	(0.000)
R_EA3_GDP (t-2)	-0.392 **
	(0.041)
Sample Periods	1994q2 - 2019q4
Number of Observation	103

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A4: Estimation Results of Regional Factors in East Asia (5 countries)**(A) Regional Housing Price Factor**

a. Measurement Equations

	kor_fh		mys_fh		tha_fh		chn_fh		idn_fh
R_EA5_HousingPrice	0.001		0.010	***	0.001		0.000		0.001
	(0.363)		(0.000)		(0.766)		(0.583)		(0.436)
G_HousingPrice	0.001	**	0.000		-0.001		0.001		-0.001
	(0.012)		(0.992)		(0.204)		(0.063)		(0.307)
constant	0.003	*	0.006		0.003		0.004		-0.005
	(0.047)		(0.246)		(0.257)		(0.191)		(0.129)

b. Transition equations of common factors

	R_EA5_HousingPrice
R_EA5_HousingPrice (t-1)	-0.018
	(0.938)
R_EA5_HousingPrice (t-2)	-0.029
	(0.874)
Sample Periods	2005q3 - 2019q4
Number of Observation	58

(B) Regional Stock Price Factor

a. Measurement Equations

	(1)									
	kor_fs		mys_fs		tha_fs		chn_fs		idn_fs	
R_EA5_StockPrice	0.201		0.548	***	0.303	**	0.255		0.446	***
	(0.091)		(0.001)		(0.023)		(0.078)		(0.004)	
G_StockgPrice	0.593	***	0.464	***	0.484	***	0.322	***	0.056	
	(0.000)		(0.000)		(0.000)		(0.002)		(0.622)	
constant										

b. Transition equations of common factors

	R_EA5_StockPrice
R_EA5_StockPrice (t-1)	
R_EA5_StockPrice (t-2)	
Sample Periods	2002q2 - 2019q4
Number of Observation	71

Table A4: Estimation Results of Regional Factors in East Asia (5 countries) (continued)**(C) Regional Interest Rate Factor**

a. Measurement Equations

	kor_fr		mys_fr		tha_fr		chn_fr		idn_fr	
R_EA3_Interest Rate	0.318	***	0.635	***	1.389	***	0.606	***	0.699	**
	(0.001)		(0.004)		(0.000)		(0.000)		(0.025)	
G_Interest Rate	0.424		-0.079		2.946	***	1.534	***	-0.367	
	(0.256)		(0.929)		(0.002)		(0.006)		(0.769)	
constant	-0.028		0.027		-0.066		-0.113		0.004	
	(0.745)		(0.891)		(0.774)		(0.490)		(0.991)	

b. Transition equations of common factors

	R_EA5_Interest Rate	
R_EA5_Interest Rate (t-1)	0.920	***
	(0.000)	
R_EA5_Interest Rate (t-2)	-0.725	***
	(0.000)	
Sample Periods	2002q2 - 2019q4	
Number of Observation	71	

(D) Regional Macroeconomic Factor

a. Measurement Equations

	kor_mgdp		mys_mgdp		tha_mgdp		chn_mgdp		idn_mgdp	
R_EA5_GDP	-0.003	***	-0.005	***	-0.005	***	-0.002	***	0.000	*
	(0.000)		(0.000)		(0.000)		(0.000)		(0.036)	
G_GDP	0.001	*	0.003	***	0.002		0.000		0.000	
	(0.032)		(0.000)		(0.114)		(0.485)		(0.469)	
constant	0.009	***	0.013	***	0.010	***	0.021	***	0.013	***
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	

b. Transition equations of common factors

	R_EA3_GDP	
R_EA5_GDP (t-1)	0.830	***
	(0.000)	
R_EA5_GDP (t-2)	-0.663	***
	(0.000)	
Sample Periods	2002q2 - 2019q4	
Number of Observation	71	

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A5: Estimation Results of Regional Factors in Emerging Europe (7 countries)

(A) Regional Housing Price Factor

a. Measurement Equations

	hun_fh		cze_fh		pol_fh		svk_fh		svn_fh		bgr_fh		hrv_fh
R_EE7_HousingPrice	-0.002		0.009 ***		0.007 ***		0.011 ***		0.004 ***		0.014 ***		0.004 ***
	(0.519)		(0.000)		(0.001)		(0.000)		(0.007)		(0.000)		(0.009)
G_HousingPrice	0.003 **		0.001		0.003 **		0.003 **		0.003 ***		0.003 *		0.001
	(0.022)		(0.443)		(0.010)		(0.012)		(0.000)		(0.036)		(0.259)
constant													

b. Transition equations of common factors

	R_EE7_HousingPrice	
R_EE7_HousingPrice (t-1)	0.928 ***	
	(0.000)	
R_EE7_HousingPrice (t-2)	-0.043	
	(0.831)	
Sample Periods	2007q2 - 2019q4	
Number of Observation	51	

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A5: Estimation Results of Regional Factors in Emerging Europe (7 countries) (continued)

(B) Regional Stock Price Factor (Without lag structure in the factor)

a. Measurement Equations		(1)											
	hun_fs		cze_fs		pol_fs		svk_fs		svn_fs		bgr_fs		hrv_fs
R_EE7_StockPrice	0.368 *** (0.000)		0.282 *** (0.004)		0.203 (0.163)		0.568 *** (0.000)		0.389 *** (0.004)		0.487 *** (0.000)		0.324 *** (0.004)
G_StockgPrice	0.651 *** (0.000)		0.714 *** (0.000)		-0.088 (0.425)		0.161 (0.160)		0.350 *** (0.001)		0.446 *** (0.000)		0.553 *** (0.000)
constant	0.044 (0.579)		0.025 (0.762)		-0.003 (0.979)		0.007 (0.953)		0.020 (0.859)		0.036 (0.704)		0.016 (0.859)
b. Transition equations of common factors													
R_EE7_StockPrice													
R_EE7_StockPrice (t-1)													
R_EE7_StockPrice (t-2)													
Sample Periods	2002q2 - 2019q4												
Number of Observation	71												

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A5: Estimation Results of Regional Factors in Emerging Europe (7 countries) (continued)

(C) Regional Interest Rate Factor (Without lag structure in the factor)

a. Measurement Equations		(1)											
		hun_fr	cze_fr	pol_fr	svk_fr	svn_fr	bgr_fr	hrv_fr					
R_EA3_Interest Rate		1.400 ***	1.281 ***	1.004 ***	0.846 ***	1.284 ***	1.575 ***	1.204 ***					
		(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)					
G_Interest Rate		1.506 **	0.528	2.150 ***	-0.141	0.856 *	-0.023	-0.457					
		(0.015)	(0.253)	(0.000)	(0.740)	(0.039)	(0.979)	(0.440)					
constant		-0.173	-0.034	-0.122	-0.063	-0.085	-0.007	-0.058					
		(0.490)	(0.854)	(0.490)	(0.688)	(0.628)	(0.981)	(0.783)					
b. Transition equations of common factors													
R_EA3_Interest Rate													
R_EE7_Interest Rate (t-1)													
R_EE7_Interest Rate (t-2)													
Sample Periods 2005q2 - 2019q4													
Number of Observation 59													

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A5: Estimation Results of Regional Factors in Emerging Europe (7 countries) (continued)

(D) Regional Macroeconomic Factor

a. Measurement Equations														
(1)														
	hun_mgdp		cze_mgdp		pol_mgdp		svk_mgdp		svn_mgdp		bgr_mgdp		hrv_mgdp	
R_EE7_GDP	0.006	***	0.004	***	0.001		0.004	***	0.019	***	0.004	***	0.006	***
	(0.000)		(0.000)		(0.182)		(0.000)		(0.000)		(0.000)		(0.000)	
G_GDP	0.002		0.002	***	0.001	*	0.004	***	0.001		0.002	**	0.001	
	(0.103)		(0.003)		(0.042)		(0.000)		(0.669)		(0.030)		(0.158)	
constant	0.006	*	0.008	***	0.010	***	0.010	***	0.002		0.009	***	0.005	*
	(0.034)		(0.000)		(0.000)		(0.000)		(0.781)		(0.000)		(0.047)	

b. Transition equations of common factors												
R_EE7_GDP												
R_EE7_GDP (t-1)	0.527	***										
	(0.003)											
R_EE7_GDP (t-2)	0.152											
	(0.320)											

Sample Periods	2007q2 - 2019q4
Number of Observation	51

Note: The error term of the measurement equation is assumed to follow a second order autoregressive process (AR (2)). R_XXX and G_XXX are regional and global factors, respectively. p-values are reported in parentheses. *, **, and *** denote significance at the 5%, 3% and 1% levels, respectively.

Table A6: Contributions of Factors to GDP fluctuations for the 3 East Asian economies across 3 periods

Period	(1) 1995q1-2007Q4				(2) 1998q1-2007Q4				(3) 2009q1-2019Q4			
	Korea	Malaysia	Thailand	Average_EA3	Korea	Malaysia	Thailand	Average_EA3	Korea	Malaysia	Thailand	Average_EA3
G_HousingPrice	1.6	3.0	3.4	2.7	7.0	3.7	7.4	6.0	3.1	7.0	2.4	4.2
G_StockPrice	1.6	11.1	4.4	5.7	4.5	21.4	10.1	12.0	3.3	4.1	7.3	4.9
G_InterestRate	2.6	1.7	2.8	2.4	4.6	8.8	11.6	8.3	4.2	4.2	0.7	3.0
Global Financial Factors	5.8	15.7	10.6	10.7	16.1	33.9	29.1	26.3	10.6	15.3	10.4	12.1
G_GDP	7.1	7.5	7.7	7.5	12.3	4.0	3.7	6.7	5.4	14.8	3.8	8.0
Global Macroeconomic Factors	7.1	7.5	7.7	7.5	12.3	4.0	3.7	6.7	5.4	14.8	3.8	8.0
Global Factors	12.9	23.3	18.3	18.2	28.4	37.8	32.8	33.0	16.0	30.1	14.2	20.1
R_EA3_HousingPrice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R_EA3_StockPrice	7.6	11.3	8.7	9.2	7.7	9.4	4.0	7.0	2.5	4.9	3.3	3.5
R_EA3_InterestRate	4.5	1.4	2.2	2.7	7.6	2.4	3.6	4.5	7.9	5.2	1.5	4.9
Regional Financial Factors	12.1	12.6	10.9	11.9	15.4	11.8	7.6	11.6	10.4	10.0	4.8	8.4
R_EA3_GDP	9.4	18.7	13.2	13.8	12.1	10.6	12.5	11.7	16.8	12.2	7.3	12.1
Regional Macroeconomic Factors	9.4	18.7	13.2	13.8	12.1	10.6	12.5	11.7	16.8	12.2	7.3	12.1
Regional Factors	21.5	31.4	24.1	25.7	27.4	22.4	20.1	23.3	27.2	22.2	12.1	20.5
HousingPrice	5.9	20.0	3.2	9.7	1.8	1.5	3.0	2.1	6.1	2.6	4.4	4.4
StockPrice	4.8	7.1	3.3	5.1	1.2	2.3	6.7	3.4	3.2	0.9	1.7	1.9
InterestRate	1.7	1.2	1.8	1.6	0.9	9.0	5.1	5.0	5.6	1.3	0.8	2.6
REER	5.2	5.2	6.8	5.7	7.7	2.3	1.3	3.8	3.2	0.4	1.8	1.8
GDP	48.0	11.8	42.4	34.1	32.5	24.7	31.0	29.4	38.6	42.5	65.0	48.7
Domestic Variables	64.3	41.1	52.1	56.2	38.4	29.9	38.4	43.7	56.8	47.7	73.7	59.4
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The Variance decomposition of GDP fluctuations was calculated using Cholesky decomposition at a horizon of 30 quarters. The Cholesky order was as follows: global macroeconomic factors (G_GDP), regional macroeconomic factors (R_EA3_GDP), domestic GDP (GDP), global financial factors (G_HousingPrice, G_StockPrice, and G_InterestRate), regional financial factors (R_EA3_StockPrice, and R_EA3_InterestRate), domestic financial variables (HousingPrice, StockPrice, and interest rate), and exchange rate (REER).

Table A7: Contributions of Factors to GDP fluctuations for the 5 East Asian and 7 emerging European economies in the post-crisis period (2009q1-2019Q4)

	Korea	Malaysia	Thailand	Indonesia	China	EA5	Hungary	Czech Republic	Poland	Slovakia	Slovenia	Bulgaria	Croatia	EE7
G_HousingPrice	3.5	4.5	3.2	9.3	7.6	5.6	13.9	1.7	1.1	1.6	4.2	14.6	12.3	7.1
G_StockPrice	6.3	6.6	5.5	1.5	5.4	5.1	3.7	3.2	3.2	2.7	8.7	1.2	2.1	3.5
G_InterestRate	0.8	8.5	1.5	4.2	4.7	3.9	2.3	7.4	6.9	5.0	3.4	1.3	1.0	3.9
Global Financial Factors	10.6	19.6	10.3	15.1	17.7	14.6	20.0	12.4	11.2	9.3	16.2	17.1	15.4	14.5
G_GDP	4.8	14.1	2.6	15.2	2.6	7.8	11.6	4.1	6.2	21.2	7.3	10.5	6.9	9.7
Global Macroeconomic Factors	4.8	14.1	2.6	15.2	2.6	7.8	11.6	4.1	6.2	21.2	7.3	10.5	6.9	9.7
Global Factors	15.3	33.7	12.8	30.3	20.3	22.5	31.6	16.5	17.4	30.5	23.5	27.5	22.3	24.2
R_EA5_HousingPrice	0.0	0.0	0.0	0.0	0.0	0.0								
R_EA5_StockPrice	3.3	5.8	5.6	7.4	4.5	5.3								
R_EA5_InterestRate	5.0	3.1	2.7	2.8	4.0	3.5								
R_EE7_HousingPrice							16.2	21.8	6.5	0.7	3.4	12.3	8.9	10.0
R_EE7_StockPrice							7.0	2.4	4.7	7.9	10.6	4.8	4.1	5.9
R_EE7_InterestRate							3.5	3.6	5.1	4.2	2.5	2.0	5.4	3.8
Regional Financial Factors	8.3	8.9	8.4	10.2	8.5	8.9	26.6	27.8	16.3	12.8	16.5	19.1	18.4	19.6
R_EA5_GDP	6.1	17.3	8.1	2.0	22.8	11.3								
R_EE7_GDP							2.7	8.5	16.5	7.1	1.4	2.6	3.8	6.1
Regional Macroeconomic Factors	6.1	17.3	8.1	2.0	22.8	11.3	2.7	8.5	16.5	7.1	1.4	2.6	3.8	6.1
Regional Factors	14.4	26.2	16.5	12.2	31.3	20.1	29.4	36.2	32.8	19.9	17.9	21.7	22.2	25.7
HousingPrice	4.9	3.0	3.5	1.3	2.0	3.0	1.9	3.5	2.9	0.7	6.2	3.7	3.8	3.2
StockPrice	4.8	3.8	1.1	6.0	3.9	3.9	2.0	2.3	5.2	1.3	3.3	0.9	4.0	2.7
InterestRate	2.5	4.6	2.2	11.6	4.3	5.0	3.2	4.0	1.7	5.1	4.0	1.5	4.4	3.4
REER	0.6	0.6	6.3	2.2	3.3	2.6	2.0	2.5	4.3	1.3	0.3	1.3	5.0	2.4
GDP	57.5	28.1	57.7	36.4	34.9	42.9	30.0	34.9	35.8	41.2	44.7	43.3	38.2	38.3
Domestic Factors	70.3	40.1	70.7	57.6	48.4	57.4	39.1	47.2	49.8	49.6	58.5	50.8	55.5	50.1
total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: The Variance decomposition of GDP fluctuations was calculated using Cholesky decomposition at a horizon of 30 quarters. The Cholesky order was as follows: global macroeconomic factors (G_GDP), regional macroeconomic factors (R_EA5/EE7_GDP), domestic GDP (GDP), global financial factors (G_HousingPrice, G_StockPrice, and G_InterestRate), regional financial factors (R_EE7_HousingPrice, R_EA5/EE7_StockPrice, and R_EA5/EE7_InterestRate), domestic financial variables (HousingPrice, StockPrice, and interest rate), and exchange rate (REER).