Regional Integration and Decoupling in the Asia Pacific: A Bayesian Panel VAR Approach

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Abstract

Policymakers have been debating for over a decade whether Asia is decoupling from the US. Increasingly, deepening regional integration is cited as a possible driver of this decoupling. Using large Bayesian Panel Vector Autoregressions, estimated over different subperiods, we jointly examine bilateral macro-financial interdependencies between Asia Pacific countries and between each Asia Pacific country and the US. We uncover no evidence of decoupling. Instead, we find that both global and regional interdependencies deepened following the Asian financial crisis, before receding after the Global financial crisis. We also show that while US shocks are important, attention should also be devoted to regional shocks which play a large role in Asia Pacific countries across all subperiods considered. Our results also suggest that there have been shifts in the relative importance of different transmission channels over time. Following the Asian financial crisis, as regional interdependencies deepened, US financial shocks began to play a larger role than US macroeconomic shocks. These results support the view that rising intra-regional trade contributed to a fall in the importance of US macroeconomic shocks. They are also consistent with research suggesting that strong, common global financial linkages increase the synchronization of Asian regional business cycles.

Keywords: Regional Integration, Decoupling, Economic Fluctuations, Stochastic Search Variable Selection, Bayesian Panel VAR.

JEL Codes: C11, C33, E32, F15, F36, F62.

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1 Introduction

For more than a decade, Asia's possible decoupling from the US economy has been under intense scrutiny. Academic research in this area has rapidly grown, with researchers based in policy institutions in Asia (He and Liao, 2012; Kim, Lee and Park, 2011; Park, 2017), the US (Leduc and Spiegel, 2013) and Europe (Lam and Yetman, 2013) regularly contributing to the debate.

In these studies, deepening regional integration in Asia is frequently cited as an important possible driver of Asia's decoupling (see e.g. Park and Shin, 2009; Kim, Lee and Park, 2011; Park, 2017). However, when analyzing economic interdependence between the US and Asia, accounting for regional interdependencies within Asia presents a major empirical challenge. Although factor models and small-scale Panel Vector Autoregressions (PVARs) can be used to examine the relative importance of regional and global factors or aggregates, overparameterization problems can quickly arise if attempting to model interdependencies between individual countries. Nonetheless, as the US begins to account for a smaller share of Asian countries' trade with the rest of the world, using bilateral or trilateral PVARs rather than multilateral PVARs is likely to lead to a decline in the accuracy of spillover estimates (see Canova and Ciccarelli, 2013 and Georgiadis, 2017).

Following the global financial crisis (GFC), there has been renewed interest in the effects of financial integration on decoupling (see e.g. Park and Shin, 2009; Leduc and Spiegel, 2013; Lam and Yetman, 2013). However, attempting to model financial as well as macroeconomic interdependencies between the US and Asia can also result in the empirical model becoming too large to estimate. Similarly, relaxing the assumption that US variables are not influenced by Asian variables within a PVAR framework (as in Kim, Lee and Park, 2011) increases the number of parameters to be estimated and the computational burden.

This paper contributes to the literature by using large Bayesian PVARs, estimated over different subperiods, to jointly examine bilateral macro-financial interdependencies between

Asia Pacific countries and between each Asia Pacific country and the US.[1] Our modelling approach allows us to examine the decoupling hypothesis within a wider context. Specifically, we can assess the interplay between regional and global interdependence and the relative importance of different transmission channels.

To undertake our analysis we estimate five PVARs. Our largest 52 variable PVAR is used to investigate the relative importance and transmission of different regional shocks. A sample period after the Asian Financial Crisis (AFC) is used (1999Q1-2019Q4) since interest rates and exchange rates are included in this model and many countries altered their exchange rate and monetary policy regimes after the AFC.

To analyze the evolution of regional and global interdependencies and implications for decoupling, we then estimate four additional 28 variable PVARs. These correspond to the full sample (1987Q1-2019Q4) and three different subperiods: the period before the AFC (1987Q1-1997Q1); the period after the AFC but before the GFC (1999Q1-2007Q3); and the period after the GFC (2009Q3-2019Q4). For each subperiod, we can therefore quantify the relative importance of global shocks originating from the US, regional shocks originating from other AP countries and domestic shocks. We also briefly consider whether spillovers are only seen from the US to AP countries or whether bidirectionality is present with AP shocks spilling over to the US.

To surmount the challenge posed by overparameterization, we estimate our PVARs using Bayesian variable selection methods. Specifically, we deploy the Stochastic Search Specification Selection (S^4) approach of Koop and Korobilis (2016), estimating interdependencies between countries which are supported by the data and setting unimportant interdependencies to zero. The latter leads to a parsimonious model, overcoming overparameterization concerns.

Our main findings are as follows. First, we do not find any evidence of the Asia Pacific

[1] In our analysis, we include China, Japan, Indonesia, South Korea, Thailand, the Philippines, Malaysia and Singapore. We also consider their large neighbors India and Australia. New Zealand is also included in our largest model.

decoupling from the US economy. Instead, our results show that global and regional interdependence deepened between the 1990s and 2000s, a process which then slowed and possibly reversed after the GFC. We also find that spillovers from the Asia Pacific to the US, while smaller and predominately financial, also exhibit the same pattern. The decline in interdependence seen after the GFC occurred amidst the Great Recession and global slowdown in trade growth (Aslam and others, 2018) to which China contributed disproportionately (Hong and others, 2017). Starting in 2014, a deterioration in global financial integration between the US and Asia and regional financial integration amongst Asian countries has also been documented by Fry-McKibbin, Hsiao and Martin (2018).

Second, we show that regional shocks and shifts in the relative importance of different transmission channels should receive more attention. While US shocks are important, regional shocks explain a larger share of variation in AP countries' variables across all subperiods considered. We also find that the deepening regional interdependence seen after the AFC was accompanied by a decrease in the importance of US macroeconomic shocks for AP countries. Over the same period, US financial, and to a lesser extent, uncertainty shocks became more important. These results align with research by Gong and Kim (2018) who find that strong common global financial linkages increase the synchronization of regional business cycles in Asia. They also support the view that rising intra-regional trade contributed to a fall in the importance of US macroeconomic shocks.

The rest of this paper is structured as follows. In section 2, we review the literature on Asian economic integration and decoupling. In section 3, we discuss our data, different PVAR models and the Bayesian techniques used for estimation. Section 4 presents our results. Using our largest PVAR model, estimated over the post AFC period, we consider the importance of regional shocks and their transmission. We then use our four other PVAR models to examine how the importance of different regional and US shocks have changed over time. We also briefly examine bidirectional spillovers. Section 5 concludes. The appendix includes a data appendix, technical appendix and appendix with supplementary figures.

2 Literature on Economic Integration and Decoupling

There is a considerable theoretical and empirical literature investigating the effect of economic integration on business cycle synchronization. While trade integration can lead to spillovers in aggregate demand shocks (Frankel and Rose, 1998), greater product specialization could reduce co-movement (Kose and Yi, 2002). Most empirical studies, however, find evidence of a positive relationship between trade integration and business cycle synchronization (e.g. Frankel and Rose, 1998; Baxter and Kouparitsas, 2005; Kose and Yi, 2006) particularly when vertical production chains result in trade in complements (Ng, 2010).

Empirical evidence on the relationship between financial integration and output comovement is more mixed. Some studies (see Imbs, 2006 and Kose, Prasad and Teronnes, 2003) detect a positive relationship. Similarly, the contagion literature also emphasizes a positive link, particularly during times of crisis (see Kaminsky and Reinhart, 2000). Kalemli-Ozcan, Papaioannou and Peydro (2013), however, detect a negative relationship with Heathcote and Perri (2004) also suggesting that financial globalization has led to a decline in business cycle synchronization between the US and the rest of the world. Davis (2014) argues that these conflicting findings can be reconciled by distinguishing between debt and equity market integration. In equity markets, gains are shared proportionally between investors and financiers leading to positive business cycle comovement. In debt markets, financial integration has a negative effect on business cycle comovement since gains realized from a project are not shared between the investor and financier.

Another important consideration in the empirical literature is the respective roles played by regional and global integration in business cycle synchronization. This issue is critical in the Asia Pacific where deepening regional integration has, in part, fueled the hypothesis that the region may be decoupling from the US economy. Consequently, the literature has begun to model explicitly regional interdependencies. Studies using factor models find that a sizable fraction of output dynamics in Asian countries can be explained by a common, regional factor (Moneta and Rüffer, 2009) and that the importance of this regional factor has increased over time (He and Liao, 2012 and Hirata, Kose and Otrok, 2013). Similarly, using small-scale trilateral VARs, Kim, Lee and Park (2011) find that the contribution of regional shocks to individual output fluctuations in East Asian countries saw a fourfold increase after the AFC. Most of these studies (see e.g. He and Liao, 2012; Kim, Lee and Park, 2011) also find that interdependencies with the rest of the world have become more important over time, but changes at the regional level still explain a larger fraction of output fluctuations after the AFC.

We build on the literature analyzing the relative importance of regional and global interdependencies by deploying large PVARs. Our PVARs are estimated using Bayesian methods, allowing us to overcome overparameterization concerns and gain a disaggregated view of cross-country interdependencies. In particular, rather than including a measure of regional output, we will allow data on all AP countries to enter each PVAR. We will also include data on a variety of US variables in order to examine the effect of different US shocks on each AP country.

Following the GFC, the decoupling literature has sought to consider financial as well as macroeconomic interdependencies (see e.g. Park and Shin, 2009). Although comovement between the US and some Asian countries increased during the GFC (Lam and Yetman, 2013), the subsequent fall in business cycle synchronization was unusually high given historical standards (Leduc and Spiegel, 2013). Nonetheless, Park (2017) finds that after the AFC, global financial shocks explain, on average, more than a quarter of output fluctuations in Asian countries. This rises to a third in the post GFC period. Recent work by Gong and Kim (2018) also suggests that countries which share large, similar global linkages have more synchronized regional business cycles. They find that in Asia, common global financial linkages in particular have positive effects on the synchronization of regional business cycles. In our large PVARs, we will therefore include financial data on the US and all AP countries so that we can disentangle the roles played by regional and global financial interdependencies as well as macroeconomic interdependencies.

Another important issue now being considered in the decoupling literature is the possibility of bidirectional spillovers between Asia and the US. Kim, Lee and Park (2011), for instance, find that that in the 2000s, East Asian aggregate output shocks explain about half of G7 output fluctuations at longer horizons. Our paper will also relax the block exogeneity assumption, allowing us to gain further insight into how a variety of US variables are affected by Asian shocks.

3 Empirical Strategy

Here, we outline our empirical strategy. We begin by introducing the countries included in our analysis and giving an overview of key trends in Asia's economic integration. We then discuss the data and the five PVARs which will be estimated. The econometric methods adopted are then discussed.

3.1 Countries Included and Trends in Asia's Economic Integration

In the Asia Pacific, an important economic and political union is the ASEAN+3 which consists of the the 10 members of the Association of Southeast Asian Nations (ASEAN) and the "Plus three" East Asian countries. Given the availability of quarterly data, in our analysis we will include the five founding members of ASEAN, the "Plus Three" East Asian countries and three other key AP countries. The 11 countries included in our analysis and subregional groupings are summarized in Table 1.

Before discussing the data collected, we consider key trends in economic integration across our East Asian countries, Southeast Asian countries and other AP countries in Figure 1. We see deepening regional trade integration across all countries except China. This trend is particularly strong across the Southeast Asian economies and Australia. In contrast, the US trade share with AP countries has been declining over time, falling particularly sharply between 2000 and 2007.

Regional financial integration in Asia has lagged regional trade integration (Park and Shin, 2009) and financial integration with the US. Regional stock market integration has traditionally been highest across Southeast Asian countries but has not increased substantially over time. Across East Asia, equity market integration has increased albeit from a low base. Unlike Australia and New Zealand, India is also becoming more integrated with the wider region. With the exception of China and New Zealand, most AP countries exhibit rising levels of equity market integration with the US over time and experience a temporary spike during the GFC.

If we consider debt market integration, based on recent data, integration is highest across the Southeast Asian countries, with Korea and India becoming more integrated with the wider region. Evidence of more substantial debt market integration with the US is only present among the industrialized countries Australia, Japan and Singapore as well as Thailand.

Table 1: Summary of Countries Included

Subregion		
Southeast Asia	East Asia	Other Asia Pacific
Indonesia (IDN)	China (CHN)	India (IND)
Thailand (THA)	Japan (JPN)	Australia (AUS)
Philippines (PHL)	Rep. of Korea (KOR)	New Zealand (NZL)
Malaysia (MYS)		
Singapore (SGP)		

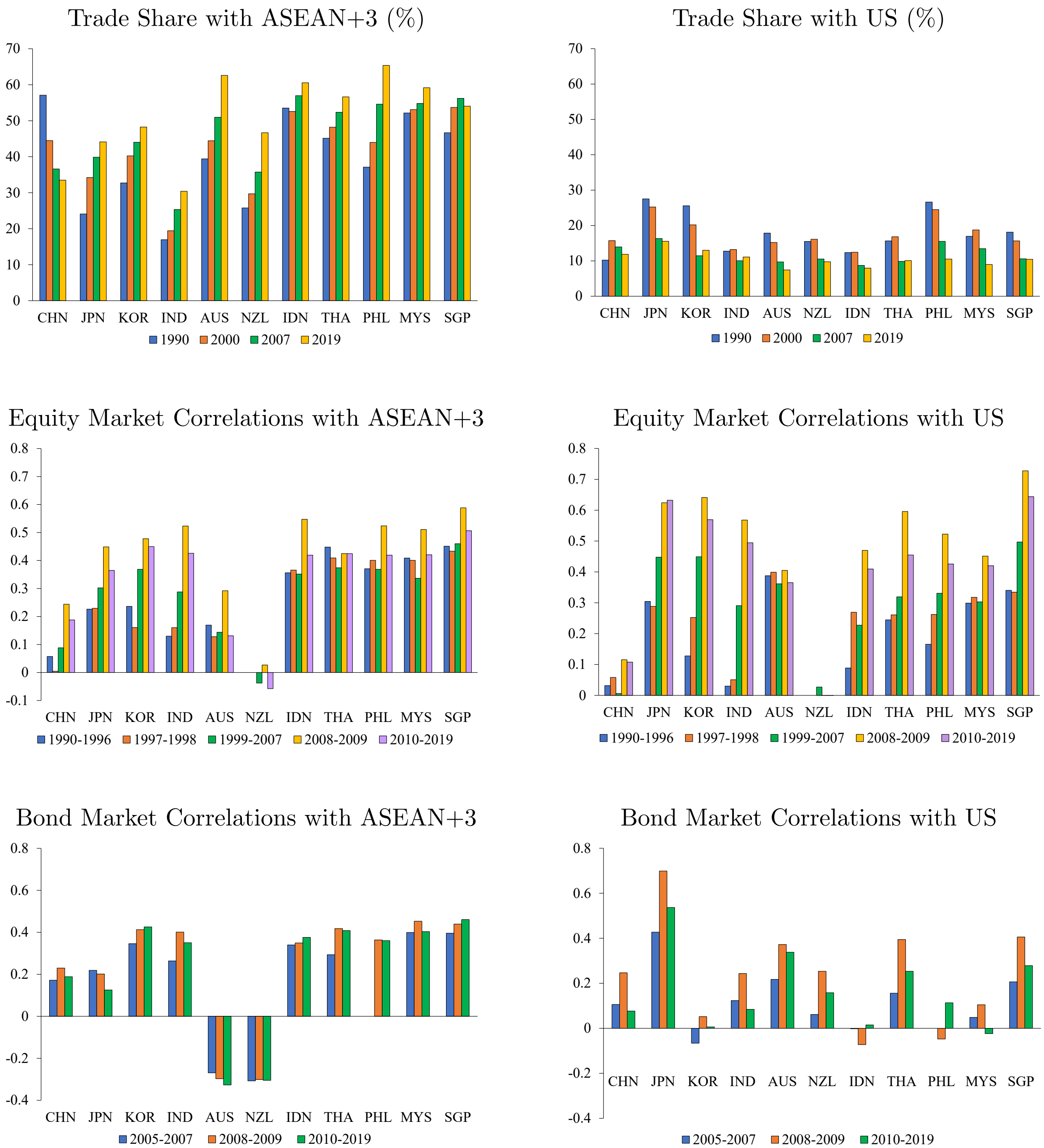


Figure 1: Trends in Asia's Regional and Global Trade and Financial Integration

Notes: Trade share with US (ASEAN+3) is the percentage of trade with the US (ASEAN+3) to total trade of a country. Equity and bond market correlations show average dynamic conditional correlations over different subperiods. Source: ADB. Asia Regional Integration Center. Integration Indicators Database. https://aric.adb.org/database/integration (accessed 01/22).

3.2 Data and Models

To undertake our analysis, for each of our 11 AP countries, we collect quarterly data on: GDP growth (G); the short-term interest rate (R); the real effective exchange rate (E); and changes in the stock price (S). These variables are important in determining the transmission and effect of US shocks. They also allow us to consider regional shocks to economic conditions, monetary policy, international competitiveness and financial markets.

We also include the following US variables: GDP growth (USA G); the short-term interest rate (USA R); changes in the stock price (US S); the excess bond premium (USA EBP) developed by Gilchrist and Zakrajšek (2012) which reflects financial conditions; and measures of real and financial uncertainty (USA RU and USA FU) developed by Jurado, Ludvigson and Ng (2015) and Ludvigson, Ma and Ng (2021). This allows us to consider a broad array of US shocks to economic conditions, monetary policy, financial conditions and uncertainty. We do not, however, consider the effects of US quantitative easing programs after the GFC.

Both non-oil commodity prices and the oil price appear to play a role in explaining Asian business cycle synchronization (Moneta and Rüffer, 2009). Consequently, we also control for the non-fuel commodity price (COM) and oil price (OIL). For further details on data sources and transformations, the reader is referred to the data appendix (Appendix A).

Using our data, we estimate the five large PVAR models summarized in Table 2. Model 1 contains 52 endogenous variables and is used to provide an overview of regional interdependencies and the transmission of regional shocks. We select a sample period after the AFC since many countries included altered their exchange rate regime, monetary policy or capital account restrictions following the crisis (Kim and Yang, 2012). In this model, we also include two exogenous variables, a time trend and global financial crisis dummy.

To examine decoupling in further detail we estimate four additional PVARs. Model 2 spans the full sample of data while models 3, 4 and 5 are estimated over different subperiods which exclude the AFC and GFC.[2] Since each subperiod is short with approximately 40

[2]We follow Park (2017) in selecting our subperiods.

observations, we drop New Zealand, the smallest country, from this analysis and focus on regional macro-financial interdependencies. Despite this, we still have 28 endogenous variables. The large number of variables relative to the number of observations makes these PVARs, particularly challenging to estimate. We discuss how we overcome this in the rest of this section.

Table 2: Summary of PVAR Models Estimated

	Model 1	Model 2	Model 3	Model 4	Model 5
Endogenous Variables	1999:1 - 2019:4	1987:1 - 2019:4	1987:1 - 1997:1	1999:1 - 2007:3	2009:3 - 2019:4
USA: G, R, EBP, S, FU, RU	•	•	•	•	•
11 AP countries: G, R, E, S	•				
10 AP countries: G, S		•	•	•	•
COM, OIL	•	•	•	•	•

3.3 The Multi-Country PVAR

Our multi-country PVARs are defined as follows[3]:

$$\begin{bmatrix} Y_t \\ z_t \end{bmatrix} = \underbrace{\begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}}_{\text{A}} \begin{bmatrix} Y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_t \\ e_t \end{bmatrix} \qquad u_t = (\varepsilon_t,\ \epsilon_t)' \sim N(0, \Sigma) \tag{1}$$

where y_{it} is a vector of variables for AP country i ($i = 1, ..., N$) and, since we have regional interdependencies, $Y_t = (y_{1t}^{'}, ..., y_{Nt}^{'})^{'}$. Across all models, our vector of global variables is given by $z_t = (US\ G_t,\ US\ R_t,\ US\ EBP_t,\ US\ S_t,\ US\ FU_t,\ US\ RU_t,\ COM_t,\ OIL_t)'$. Due to having short time-series, we follow Canova (2005) and allow for one lag rather than choosing the lag length based on information criteria or maximizing the marginal likelihood.

Our PVAR has several notable features. First, AP country i variables depend on lags

[3]For simplicity, this notation does not include exogenous right-hand side variables. In our first model, exogenous variables are included and in all models our data is standardized so we do not include an intercept.

of other AP countries' variables. For instance, Singaporean GDP growth last quarter, may affect Malaysian GDP growth this quarter. These regional interdependencies are captured by the elements of the matrix A_{11}. There may also be contemporaneous linkages. A rise in Indonesia's international competitiveness may, for example, affect Korea's GDP growth in the same period. In this case, regional interdependencies are captured by the elements in the cross-covariance term $cov(\varepsilon_{it}, \varepsilon_{jt}) = \Sigma_{ij}$.

Second, we relax the block exogeneity assumption and allow for bidirectional spillovers. We achieve this by treating US and global variables as endogenous. This means we allow lags of US and global variables to influence regional variables via the elements of A_{12} and vice versa via A_{21}. For example, Chinese GDP growth in the previous quarter, may affect real uncertainty in the US in this quarter. Again, relationships can also be contemporaneous. For example, changes in US financial uncertainty may affect the Japanese stock market and vice versa. These are captured by the the elements in the cross covariance matrix $cov(\varepsilon_{it}, \epsilon_t) = \Sigma_{i\epsilon}$.

In the Bayesian PVAR literature (see Canova and Ciccarelli, 2013 for a review), the elements in A_{11}, A_{12} and A_{21} are termed dynamic interdependencies (DIs). Investigating whether regional DIs exist therefore involve checking whether elements of A_{11} are non-zero. Similarly investigating whether DIs exist from global variables to AP variables and vice versa involves checking whether elements of A_{12} and A_{21} are non-zero respectively.

Contemporaneous interdependencies captured by the elements in the cross-covariance terms Σ_{ij} and $\Sigma_{i\epsilon}$ are referred to as static interdependencies (SIs). By checking whether elements of the Σ_{ij} are non-zero we evaluate whether regional SIs exist. Similarly, checking whether elements of $\Sigma_{i\epsilon}$ are non-zero we evaluate whether SIs exist between regional and global variables.

3.4 Bayesian Estimation of the PVAR

Bayesian methods can be used to address the overparameterization problems associated with estimating multi-country PVARs. To deploy Bayesian methods we require a prior and a method of posterior computation. The latter is used to approximate the distributions of estimated model parameters. In this paper, we use the Stochastic Search Specification Selection (S^4) methods developed by Koop and Korobilis (2016) which explicitly consider the DIs and SIs described above.

S^4 is the multi-country extension of stochastic search variable selection (SSVS), developed for use in VARs by George, Ni and Sun (2008). To illustrate the intuition behind variable selection, consider the jth VAR coefficient which we denote α_j. A conventional Normal prior takes the form:

$$\alpha_j \sim N\left(\underline{\alpha}, \underline{v}^2\right). \tag{2}$$

The choice of prior variance, $\underline{v}^2$, determines the strength of the prior shrinkage. If the prior mean, $\underline{\alpha}$, is zero then a small value for $\underline{v}^2$ implies prior shrinkage of the coefficient to be near zero.

The S^4 prior is a mixture of two Normal priors, one of which has a very small prior variance and the other a large prior variance. The S^4 algorithm lets the data determine which prior is selected. To be precise, the prior takes the form:

$$\alpha_j|\gamma_j \sim (1-\gamma_j)N(0, \underline{c} \times \tau_j^2) + \gamma_j N(0, \tau_j^2) \tag{3}$$

where $\underline{c}$ is a relatively small value chosen by the researcher. If $\gamma_j = 1$, the first term in (3) disappears, we select the noninformative prior with high prior variance and α_j undergoes relatively little shrinkage. In other words, the DI under consideration is included in the model. Conversely, if $\gamma_j = 0$, the second term in (3) disappears, we select the informative prior with low prior variance and α_j is shrunk towards zero. Put differently, the DI under consideration is excluded from the model. We can use the same approach to consider elements of the residual variance covariance matrix and which SIs should be included and excluded from the model. By using this data-driven approach to evaluate which interdependencies should be excluded from the reduced-form model, we achieve parsimony.

The final detail in the S^4 prior is the choice of τ_j and γ_j. In the literature, it is common to assume that γ_j is unknown and follows a Bernoulli distribution whereby $Pr(\gamma_j = 1) = \pi_j$. The values of the parameters τ_j and π_j are then selected by the researcher. Koop and Korobilis (2016) extend the standard approach and use hierarchical priors for τ_j and π_j. Rather than selecting the value of τ_j and π_j, they assume these are unknown parameters with Beta and Gamma priors respectively.

In practice, rather than considering individual parameters, S^4 considers blocks of coefficients (or covariance terms) which correspond to bilateral relationships between countries. Since our empirical work involves global and regional variables, we modify this approach instead restricting single elements as already described.

To undertake posterior computation we use Gibbs sampling.[4] To illustrate the intuition, let us focus on the search for DIs. Given initial values of our parameters, we sequentially simulate the following steps:

1. We draw a new coefficient matrix from the corresponding Normal posterior distribution.

2. We draw a new τ_j^2 from the corresponding Gamma posterior distribution.

3. We draw a new γ_j from the corresponding Bernoulli posterior distribution.

4. We draw a new π_j from the corresponding Beta posterior distribution.

5. We draw the diagonal elements of the new residual variance covariance matrix from the corresponding Gamma posterior distribution.

6. We draw the off-diagonal elements of the new residual variance covariance matrix from the corresponding Normal posterior distribution.

[4]For a more detailed explanation of Gibbs sampling see Koop (2003), pp.62-64

Further details of the Gibbs sampler algorithm and hyperparameter values selected are also provided in the technical appendix (Appendix B).

3.5 Impulse Response Functions and Forecast Error Variance Decompositions

To analyze regional and global shocks, we calculate generalized impulse response functions (GIRFs) as in Koop, Pesaran and Potter (1996) and Pesaran and Shin (1998) and generalized forecast error variance decompositions (GFEVDs) as in Lanne and Nyberg (2016). GIRFs and GFEVDs are invariant to the way the variables in the PVAR are ordered. This is an attractive feature since we have a large number of variables and do not wish to impose a specific ordering. If we have a one standard error shock to the rth element of u_t, the GIRF is given by:

$$GIRF_r(h) = \sigma_{rr}^{-\frac{1}{2}} B_h \Sigma e_r, \quad h = 0, 1, 2, ... \tag{4}$$

where B_h is the hth coefficient-matrix from the moving average representation of the PVAR model, $\Sigma = \{\sigma_{rs}, r, s = 1, ..., K\}$ where K is the number of variables in the model, and e_r is a $K \times 1$ selection vector with its rth element set to one and all other elements set to zero. The GFEVD is then defined as:

$$GFEVD_{sr}(h) = \frac{\sum_{l=0}^{h} GIRF(h)_{sr}^2}{\sum_{r=1}^{K} \sum_{l=0}^{h} GIRF(h)_{sr}^2}, \quad s, r = 1, ..., K. \tag{5}$$

4 Results

In this section, we summarize our results. Using our first PVAR model, we discuss the relative importance of different types of regional shocks and shock transmission in the Asia Pacific. We then use our four other PVAR models, estimated over different subperiods, to quantify how regional interdependencies in Asia have evolved over time and their role in decoupling. Last, drawing on evidence from all five PVAR models, we examine how spillovers from the Asia Pacific to the US have evolved over time.

As outlined in Section 3, we define Southeast Asia as Indonesia, Thailand, the Philippines, Singapore and Malaysia and East Asia as China, Japan and Korea. Australia and India are referred to as other Asia Pacific countries.[5] For brevity, we refer to shocks to the change in the stock price, as stock price shocks. When considering whether our GIRFs are non-zero, an 84% credible is used. We also present all GFEVDs at a horizon of 4 quarters ahead. Additional figures using a 68% credible interval and a horizon of 12 quarters ahead are provided in Appendix C where we briefly discuss robustness.

4.1 The Importance of Regional Shocks and Shock Transmission

In this subsection, we use the GIRFs and GFEVDs obtained from our first model to examine the different types of regional shocks and shock transmission in the Asia Pacific. With 52 endogenous variables in our PVAR, we could discuss up to 52^2 GIRFs.[6] Instead, we consider whether an adverse one standard deviation shock to each US variable has a negative effect on each AP country's GDP growth or stock price change. If the response is non-zero, we record the magnitude of the median GIRF's trough. Otherwise, we set the recorded response to zero.

To illustrate the relationship between our GIRFs and bar plots/tables, we show the effects of a US stock price shock on the growth rates of four AP countries in Figure 2. We can see that this shock does not have an effect on Indonesian GDP growth since the credible interval spans zero. Consequently, in Figure 3 (top left) we set the recorded response to zero. In contrast, there is a non-zero effect on Japanese, Korean and Singaporean GDP growth. We focus on the trough of the median GIRF so in Figure 3 record responses of 0.2, 0.4 and 0.6 respectively.

[5]We recall that New Zealand is included in our first PVAR model but not included in our subperiod analysis since the data is short.

[6]These are available from the author upon request.

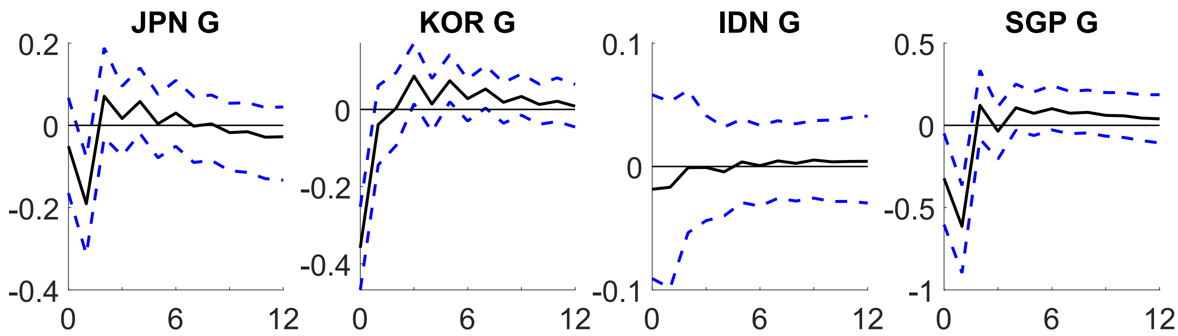
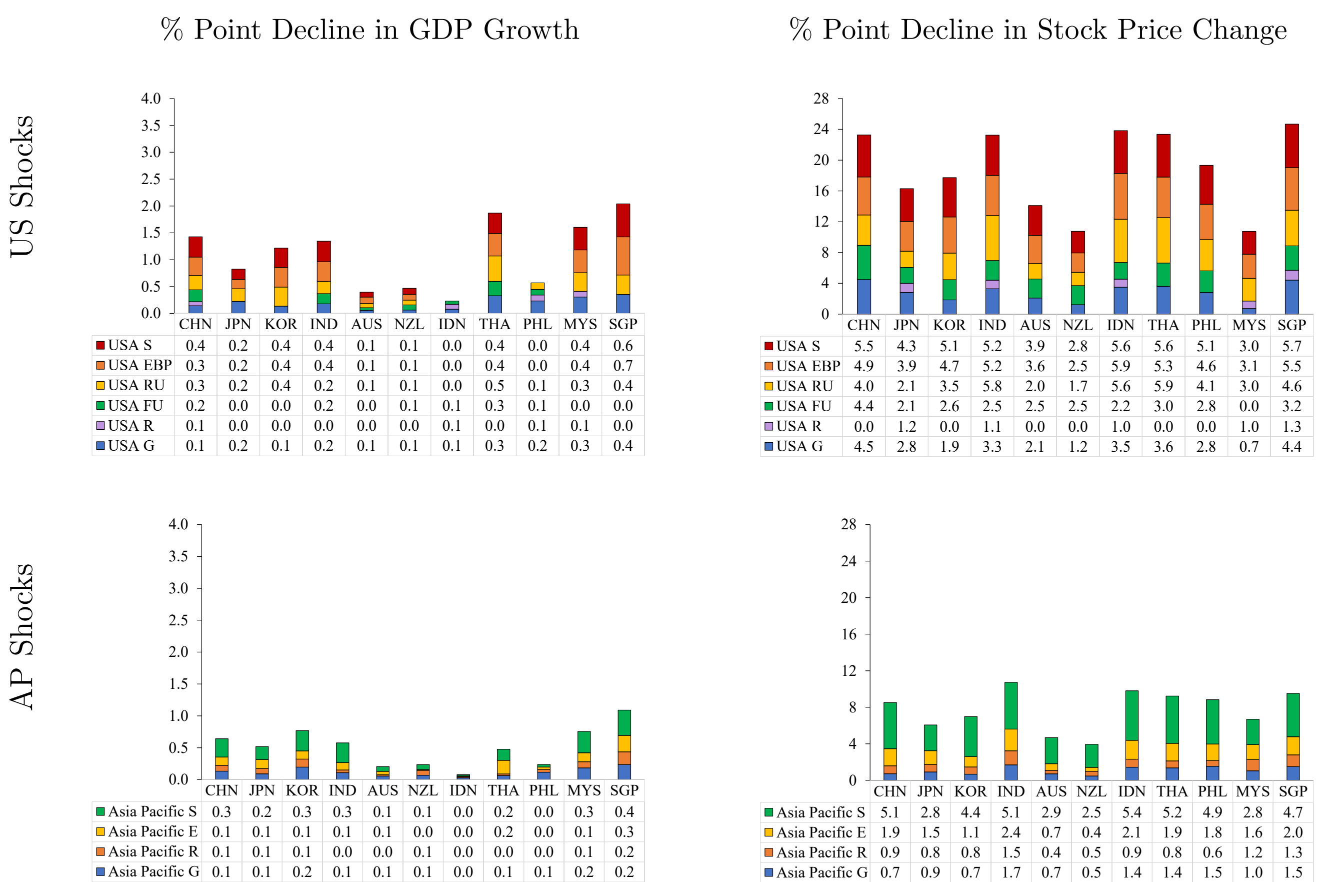


Figure 2: The Effect of Adverse US Stock Price Shocks on Selected AP Growth Rates



US Shocks – % Point Decline in GDP Growth

	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
USA S	0.4	0.2	0.4	0.4	0.1	0.1	0.0	0.4	0.0	0.4	0.6
USA EBP	0.3	0.2	0.4	0.4	0.1	0.1	0.0	0.4	0.0	0.4	0.7
USA RU	0.3	0.2	0.4	0.2	0.1	0.1	0.0	0.5	0.1	0.3	0.4
USA FU	0.2	0.0	0.0	0.2	0.0	0.1	0.1	0.3	0.1	0.0	0.0
USA R	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
USA G	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.3	0.2	0.3	0.4

US Shocks – % Point Decline in Stock Price Change

	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
USA S	5.5	4.3	5.1	5.2	3.9	2.8	5.6	5.6	5.1	3.0	5.7
USA EBP	4.9	3.9	4.7	5.2	3.6	2.5	5.9	5.3	4.6	3.1	5.5
USA RU	4.0	2.1	3.5	5.8	2.0	1.7	5.6	5.9	4.1	3.0	4.6
USA FU	4.4	2.1	2.6	2.5	2.5	2.5	2.2	3.0	2.8	0.0	3.2
USA R	0.0	1.2	0.0	1.1	0.0	0.0	1.0	0.0	0.0	1.0	1.3
USA G	4.5	2.8	1.9	3.3	2.1	1.2	3.5	3.6	2.8	0.7	4.4

AP Shocks – % Point Decline in GDP Growth

	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
Asia Pacific S	0.3	0.2	0.3	0.3	0.1	0.1	0.0	0.2	0.0	0.3	0.4
Asia Pacific E	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.3
Asia Pacific R	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2
Asia Pacific G	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.2

AP Shocks – % Point Decline in Stock Price Change

	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
Asia Pacific S	5.1	2.8	4.4	5.1	2.9	2.5	5.4	5.2	4.9	2.8	4.7
Asia Pacific E	1.9	1.5	1.1	2.4	0.7	0.4	2.1	1.9	1.8	1.6	2.0
Asia Pacific R	0.9	0.8	0.8	1.5	0.4	0.5	0.9	0.8	0.6	1.2	1.3
Asia Pacific G	0.7	0.9	0.7	1.7	0.7	0.5	1.4	1.4	1.5	1.0	1.5

Figure 3: The Effect of Adverse US and Regional Shocks on AP Countries

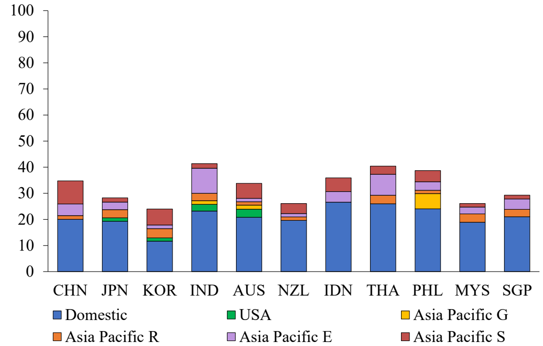
Notes: Charts display whether an adverse US or AP shock has a negative effect on either GDP growth or the change in the stock price in each AP country. For US shocks, we report the magnitude of the median GIRF's trough. For AP shocks, we report each country's response to foreign AP stock price, exchange rate, monetary policy and GDP growth shocks.

We then repeat the same process considering adverse one standard deviation shocks to each AP variable. When analyzing shocks to international competitiveness, we focus on the effects of a depreciation which is likely to have an adverse effect on neighboring export-oriented economies. We also exclude responses to domestic shocks, instead focusing on regional spillovers. To analyze different types of regional shocks, we summarize our results using one further step. To illustrate let us consider the responses of Chinese GDP growth to adverse monetary policy shocks in the other ten AP countries. Having recorded ten responses, we take the average, allowing us to capture how Chinese GDP growth responds to an adverse monetary policy shock in another AP country. Generalizing, we can undertake similar calculations to determine how GDP growth and the stock price in each AP country responds to GDP growth, monetary policy, exchange rate and stock price shocks in other AP countries. These results are also summarized in Figure 3.

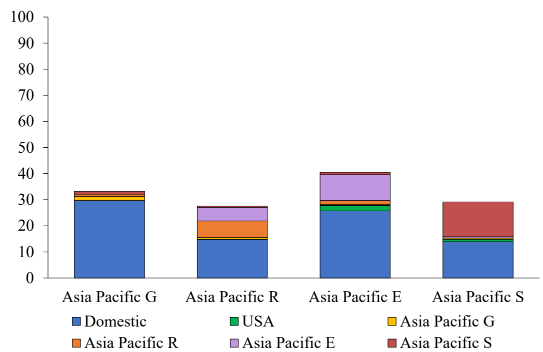
For each AP country, we can also analyze the GFEVD. We take the average across variables, assessing the contribution of domestic shocks, other regional shocks and US shocks. We can also analyze the GFEVD for each AP variable by averaging across countries. Given the heterogeneity in country size across the AP countries considered, we compare simple averages with averages weighted by country size (proxied by GDP). With 44 AP variables in each PVAR model, the importance of the region can be exaggerated if each AP variable contributes a negligible amount to the GFEVD. Consequently, we exclude contributions from any given variable which are below 5%. Our GFEVDs are presented in Figure 4.

Our results confirm that there are important regional interdependencies within the Asia Pacific as well as global interdependencies between the US and Asia Pacific. We will discuss the relative importance and evolution of these interdependencies in more detail in the subsequent section. For now, we note that while the US is an important source of adverse shocks it does not appear to play a dominant role. This finding is even more pronounced if we consider our GFEVDs which indicate that US shocks only contribute to variation in some AP countries.

Country GFVEDs



Variable GFEVDs:
Simple Average



Variable GFEVDs:
Average Weighted by Country Size

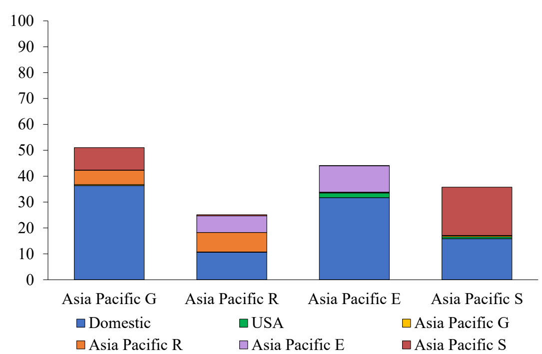


Figure 4: AP Countries' GFEVDs

Notes: We report the GFEVDs averaged across variables for each AP country (top) and the GEFVDs averaged across countries for each type of AP variable (middle and bottom). Charts display the contribution of domestic shocks, US shocks and the four types of regional shocks. We exclude contributions from any given variable which are below 5%.

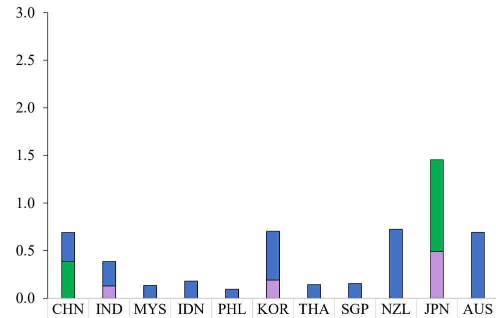
Regional shocks affect all AP countries, with the financial sector being hit harder than the real sector. If we consider the effects of regional shocks, we find that shocks to different countries' financial markets, economic conditions and international competitiveness are important. Regional monetary policy shocks have the smallest adverse impact, particularly if we consider their effects on GDP growth. Our GFEVDs, however, show that regional monetary policy shocks do explain a notable fraction of variation in AP countries' interest rates. Our GFEVDs do not change substantially if we take the average across variables according to country size, with the exception that regional monetary policy shocks explain a larger fraction of variation in AP countries' GDP growth.

Using our first model, we can further consider the transmission of foreign shocks to monetary policy and international competitiveness in the Asia Pacific as shown in Figure 5. To examine the effect of a US monetary policy contraction, we consider the response of the domestic interest rate and exchange rate in each AP country. If the response is non-zero, we record the magnitude of the median GIRF's peak (if considering interest rates) or trough (if considering exchange rates). Otherwise, we set the recorded response to zero. To determine the role of the exchange rate regime, we also order our AP countries (from left to right) according to the restrictiveness of their de facto exchange rate regime.[7]

We can also undertake one further step to analyze the effects of foreign AP monetary policy shocks. To illustrate let us consider the responses of the Malaysian interest rate to adverse monetary policy shocks in the three East Asian countries. Having recorded three responses, we take the average, allowing us to capture how Malaysian interest rates respond to a monetary policy shock in an East Asian country. Generalizing, we can undertake similar calculations to determine how interest rates and exchange rates in each AP country respond to a foreign AP monetary policy contraction.

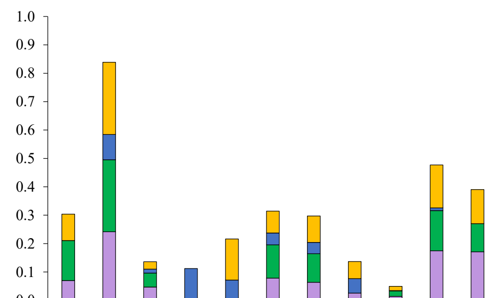
[7] We calculate the ranking using data on exchange rate regime classifications from Ilzetzki, Reinhart and Rogoff (2019).

Foreign Monetary Policy Shock: Depreciation in Domestic Exchange Rate



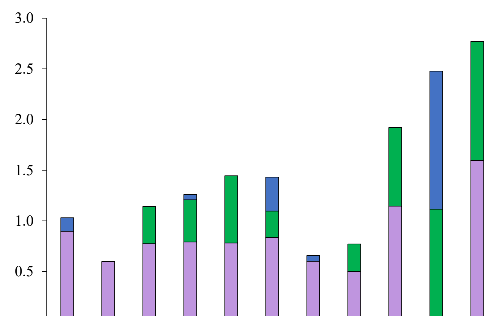
	CHN	IND	MYS	IDN	PHL	KOR	THA	SGP	NZL	JPN	AUS
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Southeast Asia R	0.3	0.3	0.1	0.2	0.1	0.5	0.1	0.2	0.7	0.0	0.7
Other Asia Pacific R	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
East Asia R	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5	0.0

Foreign Monetary Policy Shock: % Point Increase in Domestic Interest Rate



	CHN	IND	MYS	IDN	PHL	KOR	THA	SGP	JPN	NZL	AUS
USA R	0.1	0.3	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.2	0.1
Southeast Asia R	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Other Asia Pacific R	0.1	0.3	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1
East Asia R	0.1	0.2	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.2

Foreign Competitiveness Shock: Appreciation in Domestic Exchange Rate



	CHN	IND	MYS	IDN	PHL	KOR	THA	SGP	NZL	JPN	AUS
Other Asia Pacific E	0.1	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.0	1.4	0.0
CHN E	0.0	0.0	0.4	0.4	0.7	0.3	0.0	0.3	0.8	1.1	1.2
JPN E	0.9	0.6	0.8	0.8	0.8	0.8	0.6	0.5	1.1	0.0	1.6

Figure 5: The Transmission of Foreign Monetary Policy and Competitiveness Shocks

Notes: For a US monetary policy shock, we report the magnitude of the median GIRF's trough/peak. We also report each country's response to a foreign Southeast Asian, East Asian or other Asia Pacific monetary policy shock. For Chinese and Japanese competitiveness shocks, we report the magnitude of the median GIRF's peak. We also report each country's cumulative response to other AP competitiveness shocks.

Like Kim and Yang (2012) we find that in the Asia Pacific, the exchange rate channel does not play an important role in the transmission of US monetary policy shocks even among floaters. This result may be more reflective of responses to US monetary expansions rather than contractions, given the "fear of appreciation" which is believed to have characterized Asian exchange rate regimes in the 2000s (see Pontines and Rajan, 2011). We also find that domestic interest rates are more responsive to US monetary policy shocks. However, unlike Kim and Yang (2012), having also accounted for India, our results do not always suggest that the interest rate response is more muted among countries with fixed exchange rate regimes.

Although their impact on GDP growth is relatively small, regional monetary policy shocks do affect interest rates in other AP countries. In response to rising interest rates in larger AP countries, most other AP countries also increase interest rates. Following monetary policy shocks in Southeast Asia, only other Southeast Asian countries and India increase their interest rates. Comovement in policy rates may partly arise from increased comovement in inflation between Asian countries which trade more with each other (Auer and Mehrotra, 2014). If we consider the exchange rate channel small depreciations occur, with responses more pronounced in larger economies, especially those with flexible exchange rates.

Turning to shocks to international competitiveness (captured by shocks to the exchange rate), only our two largest economies, China and Japan, trigger widespread currency appreciations following a depreciation in their exchange rate (see also Figure 11 in Appendix C for the full range of GIRFs). Our results also show that responses are more pronounced among fully floating economies. The resulting increase in Japanese GDP growth and demand offsets the decrease in exports leading to an increase in GDP growth across affected AP countries. A Chinese depreciation also triggers currency appreciations in some AP countries, reflecting the renminbi's growing importance after the GFC.

4.2 The Evolution of Global and Regional Interdependencies and Implications for Decoupling

In this subsection, we use the GIRFs and GFEVDs obtained from our four smaller models to examine the relative importance and evolution of regional interdependencies and interdependencies between the US and Asia Pacific. We present results for the full sample, the subperiod before the Asian Financial Crisis (Pre AFC), the subperiod after the Asian Financial Crisis but before the Global Financial Crisis (Post AFC) and the subperiod after the Global Financial Crisis (Post GFC). As before, for each of our ten AP countries, we consider whether an adverse one standard deviation shock to each US variable has a negative effect on either GDP growth or the change in the stock price. We then record the magnitude of the median GIRF's trough if the response is non-zero (Figures 6 and 7).

We then consider adverse one standard deviation shocks to each AP variable, focusing on regional spillovers and excluding responses to domestic shocks. To disentangle the role played by macroeconomic and financial AP shocks as well as the relative importance of different subregions, we undertake one further step to summarize our results. To illustrate let us consider how Australian GDP growth responds to adverse stock price shocks in the five Southeast Asian countries. We take the average of our five recorded responses. This allows us to assess how Australian GDP growth responds to an adverse stock price shock in a Southeast Asian country. We can undertake similar calculations to determine how GDP growth and the stock price in each AP country responds to foreign shocks to GDP growth and stock prices. Our results are summarized in Figures 6 and 8.

To obtain GFEVDs, for each of our ten AP countries, we take the average across variables, assessing the contribution of domestic shocks, other regional shocks and US shocks to the volatility of each country. Specifically, we assess the contribution from different regions and transmission channels in Figures 6 and 9. When distinguishing between US macroeconomic and financial shocks, we assume that a monetary policy shock belongs to the former category, but this assumption does not affect our findings. With 20 AP variables in each PVAR model, the importance of the region can be exaggerated if each AP variable contributes a negligible amount to the GFEVD. Contributions from any given variable which are below 5% are therefore excluded.

We begin by presenting the GIRFs and GFEVDs obtained from estimating our PVAR over the full sample (Figure 6). Overall, these results tend to show that larger countries such as China, Japan and Australia depend more on their own domestic shocks while the smaller Southeast Asian countries are more sensitive to foreign shocks. The latter group of countries, together with Korea, also exhibit a higher degree of trade openness and were quicker to undertake financial liberalization. Importantly, though, these results are partly driven by the inclusion of two important crisis periods, the AFC and GFC. The AFC, which originated in Thailand, affected other Southeast Asian countries as well as Korea most strongly. With the exception of the Philippines these countries were also affected by the GFC more than other countries in our sample.

This distinction between large and small countries is less well defined if we exclude crisis periods and consider our GIRFs from different subperiods (Figures 7 and 8). By undertaking this dynamic analysis, we are able to capture a number of important trends which the static analysis conceals. We first consider the evolution of regional and global interdependencies. In line with previous studies (Kim, Lee and Park 2011; He and Liao, 2012), we find that the effects of US and regional shocks intensified after the AFC. Notably, however, the relative importance of different shocks changed after the AFC. As the importance of shocks to US GDP growth waned, the importance of shocks to GDP growth in Asia rose. For example, shocks to East Asian GDP growth, bolstered by China's rapid economic growth, affected all countries in the post AFC period. An important driver of these changes was likely to be the rise in ASEAN+3 intra-regional trade and the corresponding decline in trade with the US.

Despite a fall in the importance of shocks to US GDP growth, US financial and uncertainty shocks began to play a more prominent role in the post AFC period. These shocks reflect global financial conditions and risk aversion, and can influence domestic conditions via a variety of channels as demonstrated by Miranda-Agrippino and Rey (2020). These findings are unsurprising given Asia's deepening financial integration with the US in the post AFC period (see Kim and Lee, 2012 and Fry-McKibbin, Hsiao and Martin, 2018). Our findings also complement Deb, Nadeem and Peiris (2021) who find that shocks to external financial conditions affect emerging markets in Asia more strongly than real shocks.

Shocks to stock prices in Asia also had larger effects in the post AFC period. This is consistent with Fry-McKibbin, Hsiao and Martin (2018) who find, using daily stock return data, that in the post AFC period there is deepening regional financial integration in East and Southeast Asia, mirroring the increase in financial integration between the region and US. Our results also reflect that while India has become more financially integrated with the wider region, Australia has not.

If we turn to the post GFC period, we find that the effects of US and regional shocks receded substantially, a trend which is more marked if we consider the real effects of external shocks. This aligns with Leduc and Spiegel (2013) who find that the fall in business cycle synchronization between Asia and the US following the GFC was unusually high given historical standards. The decline in the effect of US shocks can be explained by a number of factors. This trend coincided with a weak global recovery from the GFC, US monetary policy reaching the zero lower bound, and a global slowdown in trade growth. While the slowdown in trade growth is partly attributable to the slowdown in GDP growth, changes in trade costs (tariffs, non-tariff barriers, cross-border transportation costs) also played an important role, particularly in emerging markets (Aslam and others, 2018). After the GFC, Fry-McKibbin, Hsiao and Martin (2018) also uncover a deterioration in Asian financial integration with the US, particularly during the European debt crisis and between 2014 and 2016, their sample end date.

Turning to the decline in the effect of regional shocks, there were also important changes in the nature of Asian trade. China's rebalancing from export-oriented growth to domestic consumption resulted in a disproportionate contribution to the slowdown in global trade growth (Hong and others, 2017). Together with the slowdown in global vertical specialization (Constantinescu, Mattoo and Ruta, 2020), this resulted in Asia's regional trade integration beginning to slow. Fry-McKibbin, Hsiao and Martin (2018) also find that their measure of Asian regional financial integration deteriorates from 2014 but, unlike financial integration with the US, is less affected by the European debt crisis.

Changes to Asian macroeconomic fundamentals over the last two decades may also explain the resilience to external shocks seen in the post GFC period. In particular, when considering emerging markets' vulnerability to financial shocks, Adler and Tovar (2012) find that exchange rate flexibility and external sustainability alter the impact of shocks. If we exclude Japan and Australia (i.e. countries that had freely floating exchange rates across all subperiods), in the post AFC period the average de facto exchange rate regime in our sample of countries was still a regime involving narrow bands. In the post GFC period, however, the average regime in our sample was a managed float. Over the last two decades, these countries have also made improvements in terms of their current account and external debt.

We next consider the relative importance of global and regional interdependencies. Across all subperiods, reflecting changing trade patterns, we find that shocks to US GDP growth tend to have weaker and less widespread real effects than shocks to Asian GDP growth. However, in the post AFC and post GFC subperiods, we find that the financial effects of US stock price shocks and Asian stock price shocks are comparable in magnitude as regional financial integration improves. With the US failing to play a dominant role, this underscores the importance of using a multi-country PVAR which accounts for a wider range of interdependencies.

We also find that countries which are affected more strongly by US shocks also tend to be affected strongly by regional shocks. This link is stronger if we consider the effects of external shocks on stock prices. Importantly, this trend is also seen among large countries with lower levels of trade and financial openness such as Japan and India. This aligns with work by Gong and Kim (2018) who find that countries that have strong common global interdependencies, also have more synchronized regional business cycles. Put differently, Asia's deepening integration with the US, particularly financial integration, has been one driver of deepening regional integration.

It is also important to highlight that our approach uncovers considerable cross-country heterogeneity. Unsurprisingly, before the AFC we find that smaller, rapidly growing economies with a high degree of trade openness tended to be hit harder by external US and regional shocks. These include the five ASEAN countries as well as the smallest East Asian economy, Korea. With the exception of Singapore, all these countries had restrictive exchange rate regimes with pegs or narrow bands, increasing their susceptibility to external shocks.

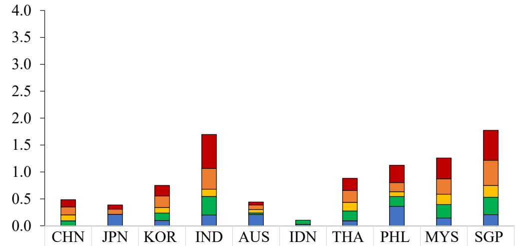
After the AFC, GDP growth in Malaysia and Singapore, countries with the highest levels of trade openness, continued to be hit particularly hard by external shocks. As equity market synchronicity increases in East Asia and lessens in Southeast Asia, we also find that East Asian and Indian stock prices are hit harder by external shocks. Australia, one of the few countries with fully flexible exchange rates, and with lower levels of financial integration with the region, is most resilient to external shocks. Following the GFC, Thailand, the ASEAN whose growth contracted considerably during the GFC together with Singapore, is hit hardest in real terms by external shocks.

If we consider the evolution of regional and global interdependencies, our GFEVDs (Figure 9) again show that external shocks became more important in the post AFC period before diminishing in the post GFC period. Specifically, domestic shocks accounted for 35%, 21% and 37% of fluctuations in your average AP country in the pre AFC, post AFC and post GFC period respectively.

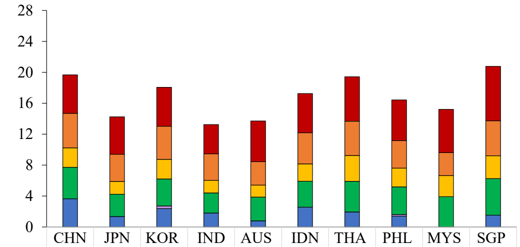
% Point Decline in GDP Growth

% Point Decline in Stock Price Change

US Shocks

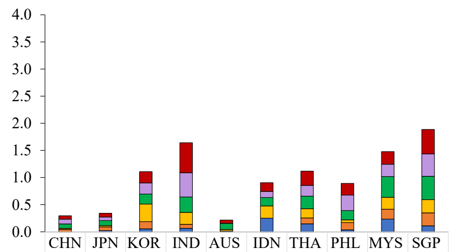


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.1	0.1	0.2	0.6	0.1	0.0	0.2	0.3	0.4	0.6
USA EBP	0.1	0.1	0.2	0.4	0.1	0.0	0.2	0.2	0.3	0.5
USA RU	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.2	0.2
USA FU	0.1	0.0	0.1	0.3	0.0	0.1	0.2	0.2	0.3	0.3
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA G	0.0	0.2	0.1	0.2	0.2	0.0	0.1	0.4	0.1	0.2

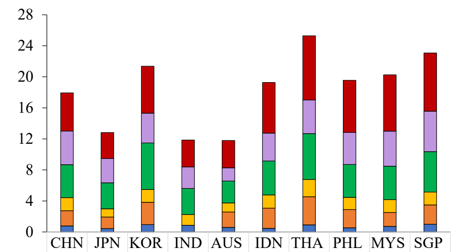


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	5.0	4.8	5.0	3.8	5.3	5.1	5.8	5.3	5.6	7.0
USA EBP	4.5	3.5	4.3	3.4	3.0	4.0	4.4	3.6	3.0	4.5
USA RU	2.5	1.7	2.5	1.6	1.5	2.2	3.3	2.4	2.7	2.9
USA FU	4.1	2.9	3.5	2.6	3.1	3.4	4.0	3.6	3.9	4.7
USA R	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0
USA G	3.7	1.4	2.4	1.8	0.8	2.6	1.9	1.4	0.0	1.5

AP Shocks



	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	0.1	0.1	0.2	0.6	0.1	0.2	0.3	0.2	0.2	0.5
Other Asia Pacific S	0.1	0.1	0.2	0.4	0.0	0.1	0.2	0.3	0.2	0.4
East Asia S	0.1	0.1	0.2	0.3	0.1	0.2	0.2	0.2	0.4	0.4
Southeast Asia G	0.0	0.0	0.3	0.2	0.0	0.2	0.2	0.1	0.2	0.2
Other Asia Pacific G	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.2	0.2
East Asia G	0.0	0.0	0.1	0.1	0.0	0.3	0.1	0.0	0.2	0.1

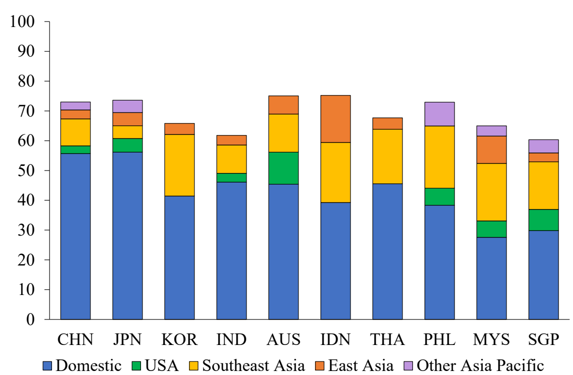


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	4.9	3.3	6.1	3.5	3.5	6.5	8.3	6.7	7.3	7.5
Other Asia Pacific S	4.3	3.1	3.8	2.8	1.7	3.6	4.3	4.1	4.5	5.2
East Asia S	4.3	3.3	6.0	3.4	2.8	4.4	5.9	4.2	4.3	5.2
Southeast Asia G	1.7	1.1	1.6	1.4	1.2	1.7	2.2	1.6	1.7	1.7
Other Asia Pacific G	2.0	1.5	2.9	0.0	2.0	2.6	3.6	2.4	1.8	2.5
East Asia G	0.8	0.4	0.9	0.9	0.6	0.5	0.9	0.5	0.7	1.0

By Subregion

By Transmission Channel

GFEVD



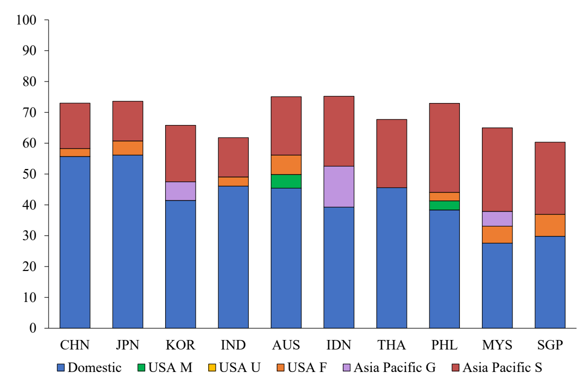
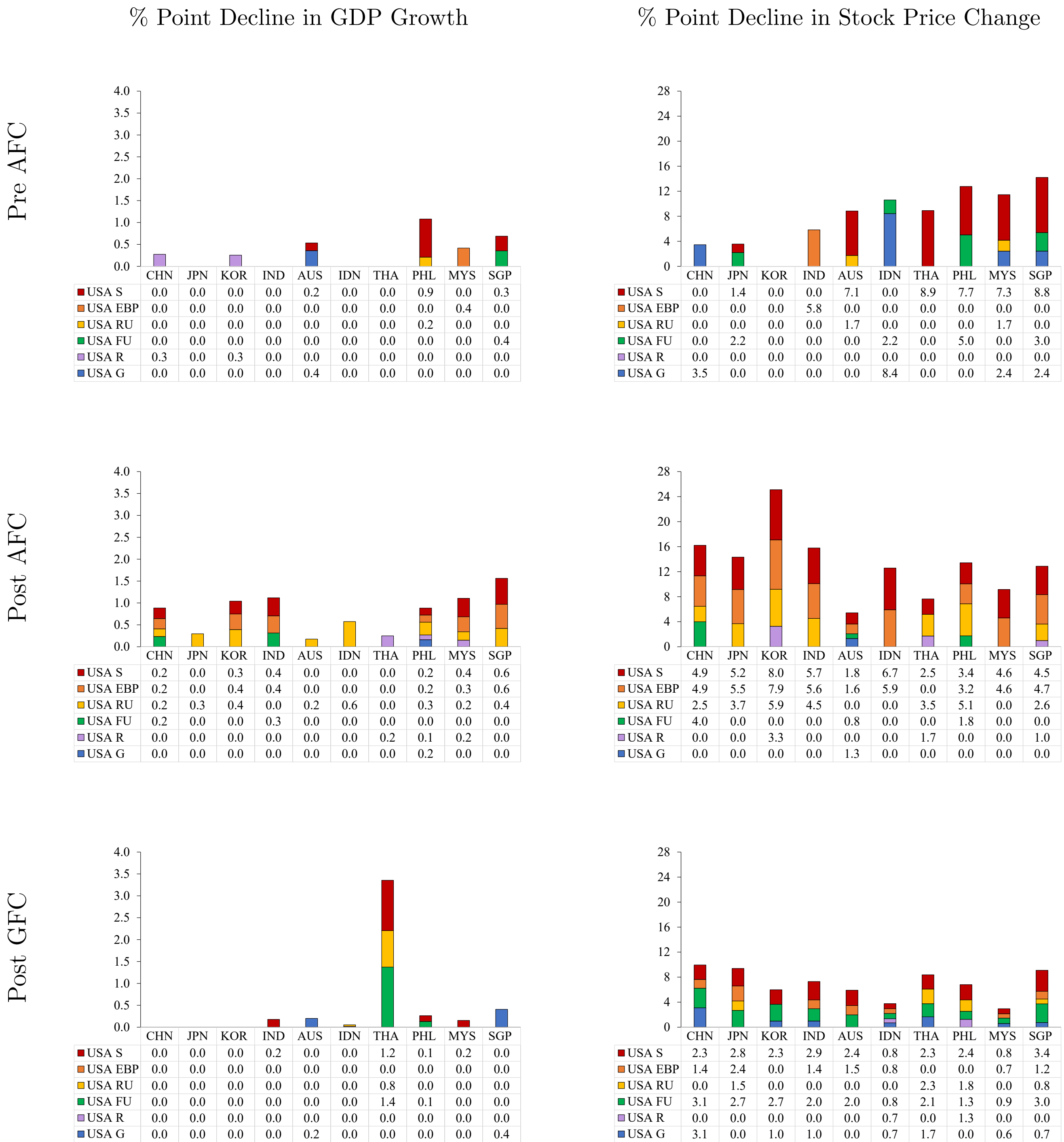


Figure 6: The Effect of Adverse US and Regional Shocks on AP Countries in the Full Sample

Notes: We display whether an adverse US or AP shock has a negative effect on GDP growth or the change in the stock price in each AP country (top and middle). For US shocks, we report the magnitude of the median GIRF's trough. For AP shocks, we report each country's response to foreign AP stock price and GDP growth shock. We also report GFEVDs averaged across variables, showing the contribution of US shocks, shocks from different AP subregions (bottom left) and different types of shocks (bottom right). We exclude contributions from any variable below 5%.



Pre AFC — % Point Decline in GDP Growth

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.9	0.0	0.3
USA EBP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
USA RU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
USA FU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
USA R	0.3	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA G	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0

Pre AFC — % Point Decline in Stock Price Change

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.0	1.4	0.0	0.0	7.1	0.0	8.9	7.7	7.3	8.8
USA EBP	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0
USA RU	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	1.7	0.0
USA FU	0.0	2.2	0.0	0.0	0.0	2.2	0.0	5.0	0.0	3.0
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA G	3.5	0.0	0.0	0.0	0.0	8.4	0.0	0.0	2.4	2.4

Post AFC — % Point Decline in GDP Growth

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.2	0.0	0.3	0.4	0.0	0.0	0.0	0.2	0.4	0.6
USA EBP	0.2	0.0	0.4	0.4	0.0	0.0	0.0	0.2	0.3	0.6
USA RU	0.2	0.3	0.4	0.0	0.2	0.6	0.0	0.3	0.2	0.4
USA FU	0.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.0
USA G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0

Post AFC — % Point Decline in Stock Price Change

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	4.9	5.2	8.0	5.7	1.8	6.7	2.5	3.4	4.6	4.5
USA EBP	4.9	5.5	7.9	5.6	1.6	5.9	0.0	3.2	4.6	4.7
USA RU	2.5	3.7	5.9	4.5	0.0	0.0	3.5	5.1	0.0	2.6
USA FU	4.0	0.0	0.0	0.0	0.8	0.0	0.0	1.8	0.0	0.0
USA R	0.0	0.0	3.3	0.0	0.0	0.0	1.7	0.0	0.0	1.0
USA G	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0

Post GFC — % Point Decline in GDP Growth

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.0	0.0	0.0	0.2	0.0	0.0	1.2	0.1	0.2	0.0
USA EBP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA RU	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
USA FU	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.1	0.0	0.0
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA G	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.4

Post GFC — % Point Decline in Stock Price Change

	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	2.3	2.8	2.3	2.9	2.4	0.8	2.3	2.4	0.8	3.4
USA EBP	1.4	2.4	0.0	1.4	1.5	0.8	0.0	0.0	0.7	1.2
USA RU	0.0	1.5	0.0	0.0	0.0	0.0	2.3	1.8	0.0	0.8
USA FU	3.1	2.7	2.7	2.0	2.0	0.8	2.1	1.3	0.9	3.0
USA R	0.0	0.0	0.0	0.0	0.0	0.7	0.0	1.3	0.0	0.0
USA G	3.1	0.0	1.0	1.0	0.0	0.7	1.7	0.0	0.6	0.7

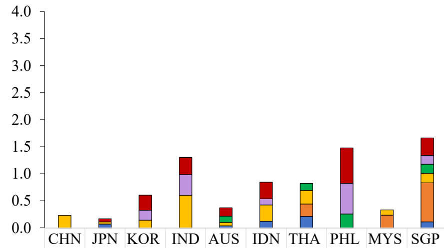
Figure 7: The Effect of Adverse US Shocks on AP Countries in Different Subperiods

Notes: Charts display whether an adverse US shock has a negative effect on either GDP growth or the change in the stock price in each AP country. We report the magnitude of the median GIRF's trough.

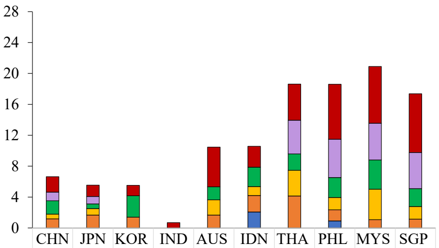
29

% Point Decline in GDP Growth — % Point Decline in Stock Price Change

Pre AFC

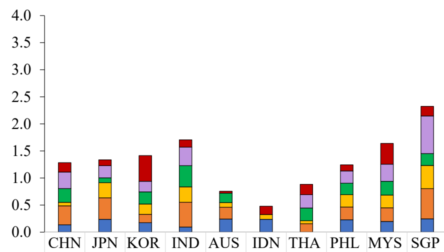


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	0.0	0.1	0.3	0.3	0.2	0.3	0.0	0.7	0.0	0.3
Other Asia Pacific S	0.0	0.0	0.2	0.4	0.0	0.1	0.0	0.6	0.0	0.2
East Asia S	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.2
Southeast Asia G	0.2	0.0	0.1	0.6	0.1	0.3	0.3	0.0	0.1	0.2
Other Asia Pacific G	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.7
East Asia G	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1

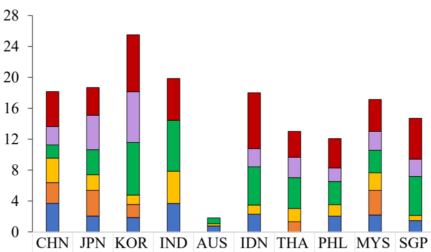


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	2.0	1.5	1.4	0.7	5.1	2.7	4.7	7.1	7.3	7.6
Other Asia Pacific S	1.1	1.0	0.0	0.0	0.0	0.0	4.4	5.0	4.7	4.7
East Asia S	1.7	0.6	2.8	0.0	1.7	2.5	2.1	2.6	3.8	2.3
Southeast Asia G	0.6	0.8	0.0	0.0	2.0	1.2	3.3	1.6	4.0	1.6
Other Asia Pacific G	1.2	1.7	1.4	0.0	1.7	2.1	4.1	1.4	1.1	1.1
East Asia G	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.9	0.0	0.0

Post AFC

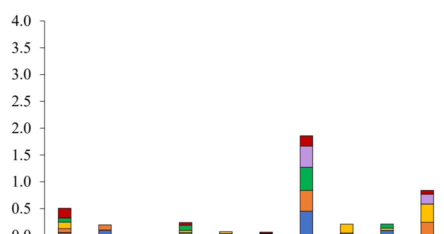


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	0.2	0.1	0.5	0.1	0.0	0.2	0.2	0.1	0.4	0.2
Other Asia Pacific S	0.3	0.2	0.2	0.3	0.0	0.0	0.2	0.2	0.3	0.7
East Asia S	0.3	0.1	0.2	0.4	0.2	0.0	0.2	0.2	0.3	0.2
Southeast Asia G	0.1	0.3	0.2	0.3	0.1	0.1	0.1	0.2	0.2	0.4
Other Asia Pacific G	0.4	0.4	0.2	0.5	0.2	0.0	0.2	0.2	0.3	0.6
East Asia G	0.1	0.2	0.2	0.1	0.2	0.2	0.0	0.2	0.2	0.2

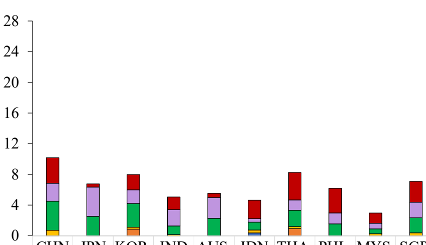


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	4.5	3.6	7.4	5.4	0.0	7.2	3.4	3.8	4.1	5.3
Other Asia Pacific S	2.4	4.5	6.6	0.0	0.0	2.4	2.6	1.8	2.4	2.2
East Asia S	1.7	3.2	6.8	6.6	0.8	4.9	4.0	3.0	2.9	5.0
Southeast Asia G	3.2	2.0	1.2	4.2	0.3	1.2	1.7	1.5	2.3	0.7
Other Asia Pacific G	2.7	3.3	1.7	0.0	0.0	0.0	1.3	0.0	3.2	0.0
East Asia G	3.7	2.0	1.8	3.7	0.8	2.3	0.0	2.0	2.2	1.5

Post GFC



	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	0.2	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.1
Other Asia Pacific S	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
East Asia S	0.1	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.1	0.0
Southeast Asia G	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3
Other Asia Pacific G	0.1	0.1	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
East Asia G	0.1	0.1	0.0	0.1	0.0	0.0	0.5	0.0	0.1	0.0



	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
Southeast Asia S	3.4	0.4	2.0	1.6	0.5	2.4	3.6	3.2	1.3	2.7
Other Asia Pacific S	2.3	3.8	1.8	2.1	2.7	0.5	1.3	1.4	0.7	2.0
East Asia S	3.8	2.5	3.1	1.1	2.3	1.0	2.1	1.5	0.6	2.0
Southeast Asia G	0.7	0.0	0.2	0.2	0.0	0.4	0.3	0.0	0.3	0.4
Other Asia Pacific G	0.0	0.0	0.9	0.0	0.0	0.0	0.9	0.0	0.0	0.0
East Asia G	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0

Figure 8: The Effect of Adverse Regional Shocks on AP Countries in Different Subperiods

Notes: Charts display whether an adverse AP shock has a negative effect on either GDP growth or the change in the stock price in each AP country. We report each country's response to a foreign AP stock price and GDP growth shock from a given subregion.

If we first focus on regional shocks, taking the average across countries, their contribution rose slightly in the post AFC period before declining in the post GFC period. After the AFC, shocks from Southeast Asian countries tended to become less important with their contribution to volatility in the average AP country falling from 20% to 14% to 12% during the pre AFC, post AFC and post GFC periods respectively. This, however, was offset by the the contribution of East Asian shocks increasing from 1% to 10% before falling to 6% in the post GFC period. As before, we therefore find that, as ASEAN countries grow at a slower pace and recover from the AFC, growth in East Asia becomes relatively more important.

In addition to the contribution of different subregions changing over time, the relative importance of macroeconomic and financial shocks has changed over time. The contribution of regional macroeconomic shocks has slowly fallen from 10% to 8% to 4% whereas the contribution of regional financial shocks has risen from 15% to 20% back down to 17%.

Turning to US shocks, we again find that across countries and subperiods, regional shocks play a more important role. We find that, on average, the contribution of US shocks was approximately 6% across subperiods, however, this conceals considerable cross-country heterogeneity and changes in the relative importance of different US shocks. After the AFC, a noticeable increase in the contribution of US shocks is seen in Japan, Korea, Indonesia and Singapore, with India, China and Australia seeing a decline in the contribution of US shocks. In the post AFC period, the contribution of US macroeconomic shocks became negligible, contributing less than 1%, on average; the contribution of US financial shocks remained stable at 4% but affecting a wider range of countries; and the contribution of US uncertainty shocks increased from less than 1% to 2%. In the post GFC period, US shocks were less important among China and Southeast Asian countries, which were able to recover more quickly following the GFC. In this period, the contribution of US macroeconomic, financial and uncertainty shocks was less than 1%, 3% and 3% respectively.

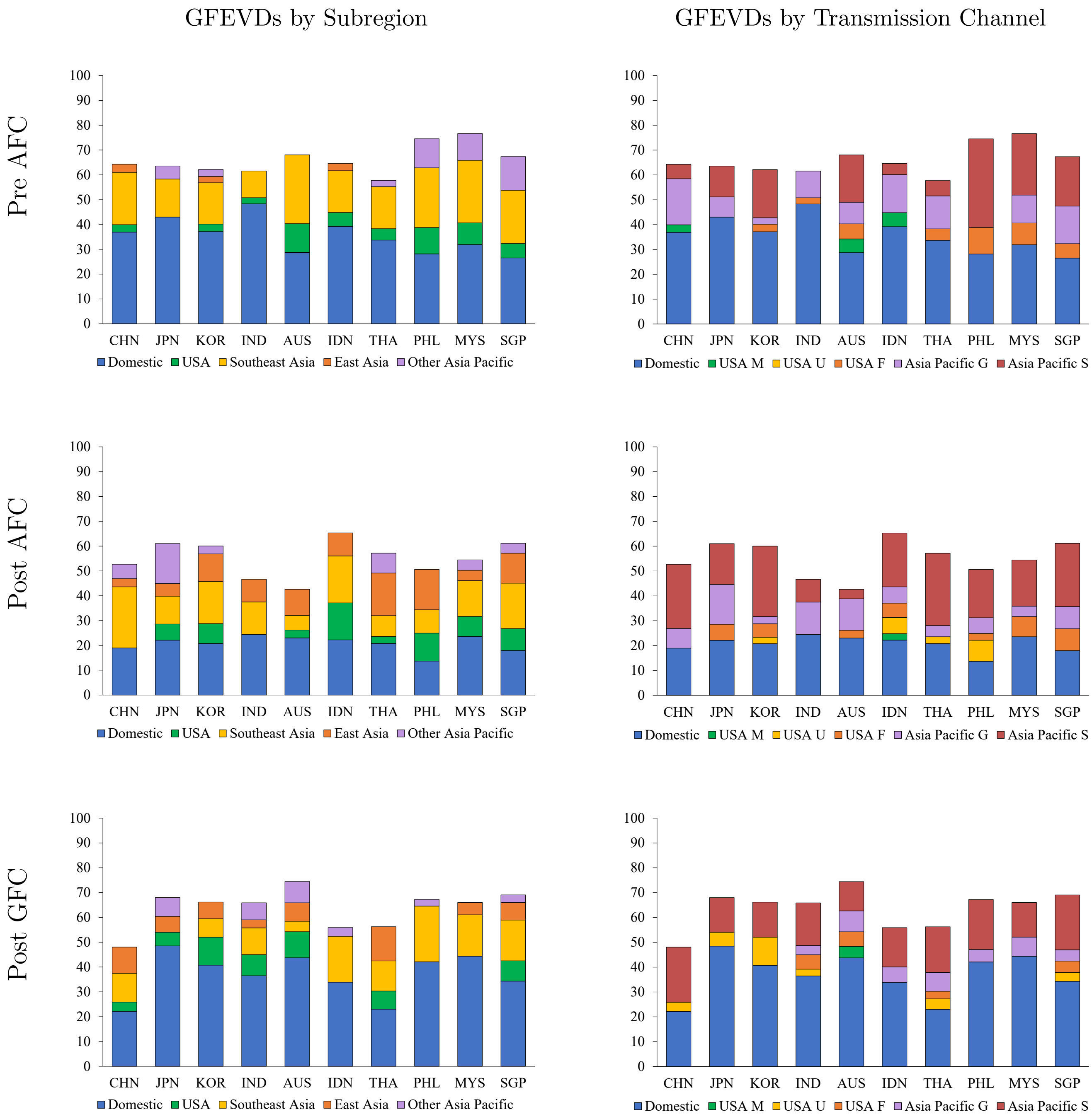


Figure 9: AP Countries' GFEVDs in Different Subperiods

Notes: We report the GFEVD averaged across variables for each AP country. We show the contribution of domestic shocks, US shocks, Southeast Asian shocks, East Asian shocks and other Asia Pacific shocks (left). We also display the contribution of domestic shocks, three types of US shocks and two types of Asian shocks (right). We exclude contributions from any given variable which are below 5%.

32

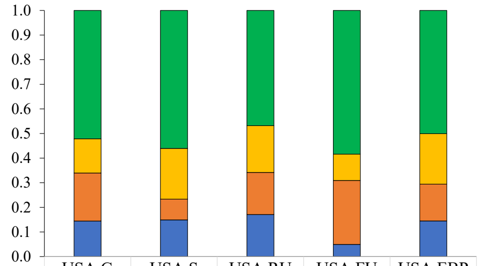
4.3 Spillovers from the Asia Pacific to the US

Before concluding we briefly consider whether there is evidence of spillovers from the Asia Pacific to the US indicating a bidirectional relationship. We focus on the GIRFs from our five models since GFEVDs may overestimate the effect Asian shocks have on the US unless the US' interdependencies with other countries, particularly the G7, are accounted for.

Our 52 variable PVAR model uses a post AFC subsample and can be used to assess the relative importance of different AP shocks. For each US variable, we consider whether an adverse AP shock has a negative effect causing GDP growth or the change in the stock price to decline, or real uncertainty, financial uncertainty or the excess bond premium to rise. Since US variables are in different units, the magnitude of their responses cannot be compared. To determine which types of Asian shocks play the largest role we therefore normalize the responses (Figure 10, top left). We can clearly see that spillovers from Asian financial markets dominate other types of Asian shocks.

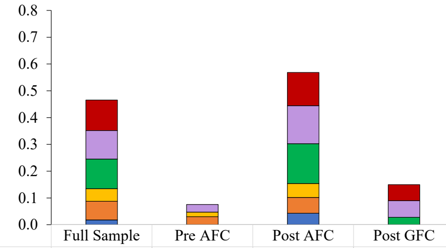
In Figure 10 we also consider results from our remaining four models estimated over different subperiods. We find that financial conditions and uncertainty are most affected if we undertake estimation using the full sample and include the AFC and GFC. However, across our different subperiods, we also detect non-zero spillovers from the Asia Pacific to the US indicating a bidirectional relationship as in Kim, Lee and Park (2011). Mirroring our results in the previous subsection, we find that interdependencies typically intensified after the AFC before receding following the GFC. In the post GFC period, only US financial conditions and financial uncertainty are notably affected by AP shocks. Overall, our findings align with other studies confirming that financial spillovers from emerging economies influence global conditions not only during times of crisis but also during "good" times (Cuadro-Sáez, Fratzscher and Thimann, 2009 and IMF, 2016).

Relative Importance of Different Spillovers



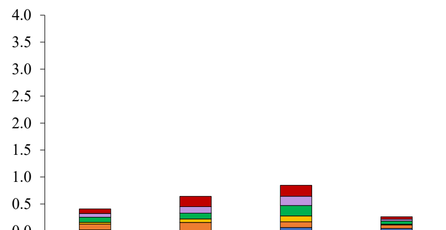
	USA G	USA S	USA RU	USA FU	USA EBP
Asia Pacific S	0.14	2.95	0.07	0.14	0.17
Asia Pacific E	0.04	1.09	0.03	0.03	0.07
Asia Pacific R	0.05	0.44	0.02	0.06	0.05
Asia Pacific G	0.04	0.79	0.02	0.01	0.05

Increase in Excess Bond Premium



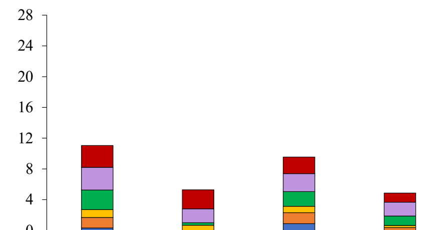
	Full Sample	Pre AFC	Post AFC	Post GFC
Southeast Asia S	0.11	0.00	0.12	0.06
Other Asia Pacific S	0.11	0.03	0.14	0.06
East Asia S	0.11	0.00	0.15	0.03
Southeast Asia G	0.05	0.02	0.05	0.00
Other Asia Pacific G	0.07	0.03	0.06	0.00
East Asia G	0.02	0.00	0.04	0.00

% Point Decline in GDP Growth



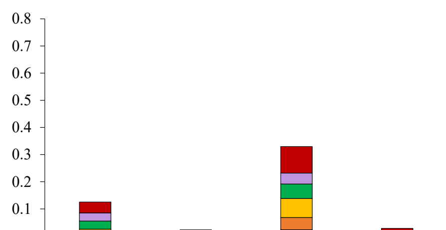
	Full Sample	Pre AFC	Post AFC	Post GFC
Southeast Asia S	0.08	0.19	0.20	0.04
Other Asia Pacific S	0.07	0.12	0.17	0.03
East Asia S	0.10	0.11	0.19	0.06
Southeast Asia G	0.03	0.06	0.11	0.01
Other Asia Pacific G	0.10	0.16	0.11	0.07
East Asia G	0.02	0.00	0.06	0.05

% Point Decline in Stock Price Change



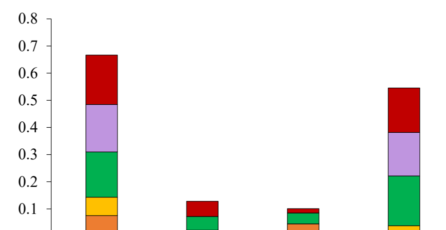
	Full Sample	Pre AFC	Post AFC	Post GFC
Southeast Asia S	2.85	2.47	2.16	1.20
Other Asia Pacific S	2.95	1.81	2.34	1.79
East Asia S	2.55	0.34	1.90	1.24
Southeast Asia G	1.03	0.66	0.84	0.28
Other Asia Pacific G	1.36	0.00	1.42	0.36
East Asia G	0.31	0.00	0.88	0.00

Increase in Real Uncertainty



	Full Sample	Pre AFC	Post AFC	Post GFC
Southeast Asia S	0.04	0.00	0.10	0.02
Other Asia Pacific S	0.03	0.02	0.04	0.00
East Asia S	0.03	0.00	0.05	0.00
Southeast Asia G	0.01	0.00	0.07	0.01
Other Asia Pacific G	0.01	0.00	0.05	0.00
East Asia G	0.00	0.00	0.02	0.00

Increase in Financial Uncertainty



	Full Sample	Pre AFC	Post AFC	Post GFC
Southeast Asia S	0.18	0.06	0.02	0.16
Other Asia Pacific S	0.18	0.00	0.00	0.16
East Asia S	0.17	0.05	0.04	0.18
Southeast Asia G	0.07	0.02	0.00	0.04
Other Asia Pacific G	0.06	0.00	0.05	0.00
East Asia G	0.02	0.00	0.00	0.00

Figure 10: Spillovers from the Asia Pacific to the US

Using our first PVAR model, we report each US variable's response to an adverse AP stock price, exchange rate, monetary policy and GDP growth shock (top left). Using the remaining models, we report whether adverse Asian shocks have negative effects over different subperiods.

Importantly, though, our results do not indicate that spillovers from the Asia Pacific to the US are as large as those from the US to Asia. Although financial spillovers are most prominent, the effects of US shocks on AP stock prices (Figure 7, right column) are still larger than the effects of AP shocks on US stock prices (Figure 10). Similarly, if we consider the responses of GDP growth and stock prices, we also find that the effects of Asian shocks on other countries in the region (Figure 8) are larger than the effects on US variables (Figure 10).

5 Conclusions

This paper investigates regional interdependencies in the Asia Pacific, the evolution of these interdependencies and the region's possible decoupling from the US economy. Using large Bayesian PVARs, estimated over different subperiods, we are able to jointly model global and regional interdependencies, and macroeconomic and financial linkages.

We find no evidence that the Asia Pacific has decoupled from the US economy. Instead, we show that both global and regional interdependencies intensified after the AFC before receding following the GFC. This recent decline in interdependence occurred during a global slowdown in trade growth (Aslam and others, 2018) to which China contributed disproportionately (Hong and others, 2017). The decline in global financial integration between the US and Asia and Asian regional integration has also been documented by Fry-McKibbin, Hsiao and Martin (2018). Across all subperiods, we also detect financial spillovers from the Asia Pacific to the US indicating a bidirectional relationship as in Kim, Lee and Park (2011).

Our results underscore two important issues to which greater attention should be devoted. The first is the importance of regional shocks and the evolution of regional integration in the Asia Pacific. While US shocks are important, they do not dominate, with regional shocks explaining a larger share of variation in AP countries' variables across all subperiods considered. The second issue which warrants further investigation is the relative importance of different transmission channels. We find that as regional interdependencies deepened, US financial shocks began to play a larger role than US macroeconomic shocks. These findings support the view that rising intra-regional trade contributed to a decline in the importance of US macroeconomic shocks. The results are also consistent with research suggesting that large common global financial linkages have a positive effect on regional business cycle synchronization in Asia (Gong and Kim, 2018).

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Appendices

A. Data Appendix

The following table describes the data sources and transformations applied. All variables are also standardized prior to estimation with the GIRFs rescaled to reverse standardization.

Table 3: Data

Variables	Description	Source	Trans.
OIL	Deflated crude oil prices: WTI	FRED	Δ ln
$USA\ FU$	Financial uncertainty	LMN	levels
$USA\ G$	Real GDP index of US	MR	Δ ln
$USA\ RU$	Real uncertainty	LMN	levels
$USA\ EBP$	Excess bond premium	GZ	levels
$USA\ S$	Deflated S&P 500 Index	FRED	Δ ln
COM	Deflated world non-fuel commodity price index	Datastream	Δ ln
$USA\ R$	US 3 month T-Bill rate (%)	FRED	levels
G_i	Real GDP index of country i	MR	Δ ln
R_i	Short-term interest rate of country i (%)	MR	levels
E_i	Real effective exchange rate of country i	Darvas	Δ ln
S_i	Deflated equity price index of country i	MR	Δ ln

Note: The crude oil price index, non-fuel commodity price index and S&P 500 Index are all deflated by the US GDP deflator extracted from FRED. For China and Indonesia, we obtain equity market data from Datastream and deflate these indices using IMF IFS CPI data. EX_i is measured so that an increase indicates an appreciation of the home currency against a basket of trading partners' currencies. IMF IFS = IMF international financial statistics database. LMN = Ludvigson, Ma and Ng (2021). MR = Mohaddes and Raissi (2020). GZ = Gilchrist and Zakrajšek (2012). Darvas = Zsolt Darvas (2012). FRED = St Louis. Federal Reserve Economic Data.

B. Technical Appendix

Here, we provide additional details of the the hyperparameter values selected and Gibbs sampler algorithm. The following table describes the hyperparameter values chosen which are very similar to those used by Koop and Korobilis (2016).

Table 4: Hyperparameter Values

Hyperparameter	Value
$\underline{c}^{DI}$	1e-6
$\underline{c}^{SI}$	1e-6
$\underline{\theta}^{DI}$	10
$\underline{\theta}^{SI}$	10
$\underline{\psi}$	1
$\underline{\kappa}_2^2$	4
$\underline{\rho}_1$	0.01
$\underline{\rho}_2$	0.01

The Gibbs sampler algorithm provided is very similar to the algorithm in Koop and Korobilis (2016), however, we consider element by element restrictions. We do not search for cross-sectional homogeneity restrictions since this would simply amount to checking for homogeneity in the persistence of each variable. Gibbs sampling is undertaken by sequentially simulating the following steps.

1. We draw a new coefficient matrix from

   $(vec(A)|-) \sim N(\mu_\alpha, D_\alpha)$,

   where $D_\alpha = (\Sigma^{-1} \otimes X'X + (V'V)^{-1})^{-1})$ and $\mu_\alpha = D_\alpha[(\Sigma^{-1} \otimes X'X)\alpha_{OLS}]$, where α_{OLS} is the OLS estimate of α, and V is a diagonal matrix which has its respective diagonal elements equal to τ_j^2 if $\gamma_j^{DI} = 1$ or $\tau_j^2 \times \underline{c}^{DI}$ if $\gamma_j^{DI} = 0$.

2. We draw a new τ_j^2 from

$(\tau_j^2|-) \sim Gamma(1+\frac{1}{2}, \underline{\theta}^{DI} + 1/2\frac{\alpha_j^2}{(\underline{c}^{DI})^{1-\gamma_j{}^{DI}}})$.

3. We draw a new γ_j^{DI} from

   $(\gamma_j^{DI}|-) \sim Bernoulli(\omega_j^{DI})$,

   where $\omega_j^{DI} = \frac{u_{2,j}}{u_{1,j}+u_{2,j}}$ with $u_{1,j} = \phi(\alpha_j|0, \tau_j^2)\pi_j^{DI}$ and $u_{2,j} = \phi(\alpha_j|0, \underline{c} \times \tau_j^2)(1-\pi_j^{DI})$ and $\phi(x|a,b)$ denotes the p.d.f. of the Normal distribution with mean a and variance b evaluated at x.

4. We draw a new π_j^{DI} from

   $(\pi_j^{DI}|-) \sim Beta(1+\sum\gamma_j^{DI}, \underline{\varphi}\sum(1-\gamma_j^{DI}))$.

5. We draw the diagonal and off diagonal elements of the new residual variance covariance matrix following exactly the algorithm of Appendix A of George, Ni and Sun (2008) as applied to individual elements.

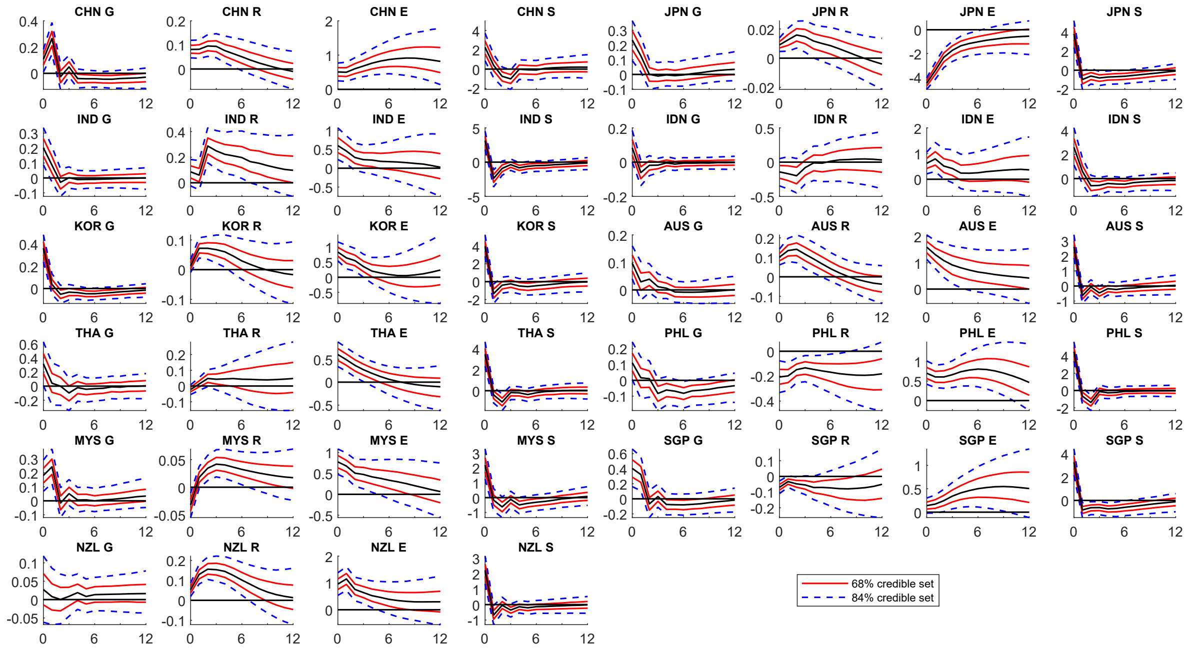
   For each model, we repeat this algorithm 50,000 times. An initial 20,000 draws are discarded. From the remaining 30,000 we save every 10th draw.

C. Additional Figures and Robustness

Dynamic Responses to a Japanese and Chinese Depreciation

In this Appendix, we include selected additional figures. We first provide additional detail on the responses to a Chinese and Japanese depreciation obtained from our first 52 variable PVAR model. If we use a less conservative credible interval, we find that the effects of a Chinese depreciation are more pronounced. Specifically, we find that Chinese GDP growth rises in response to a Chinese depreciation, boosting GDP growth in several AP countries, with Australia being the only country adversely affected.

Responses to a Japanese Depreciation



Responses to a Chinese Depreciation

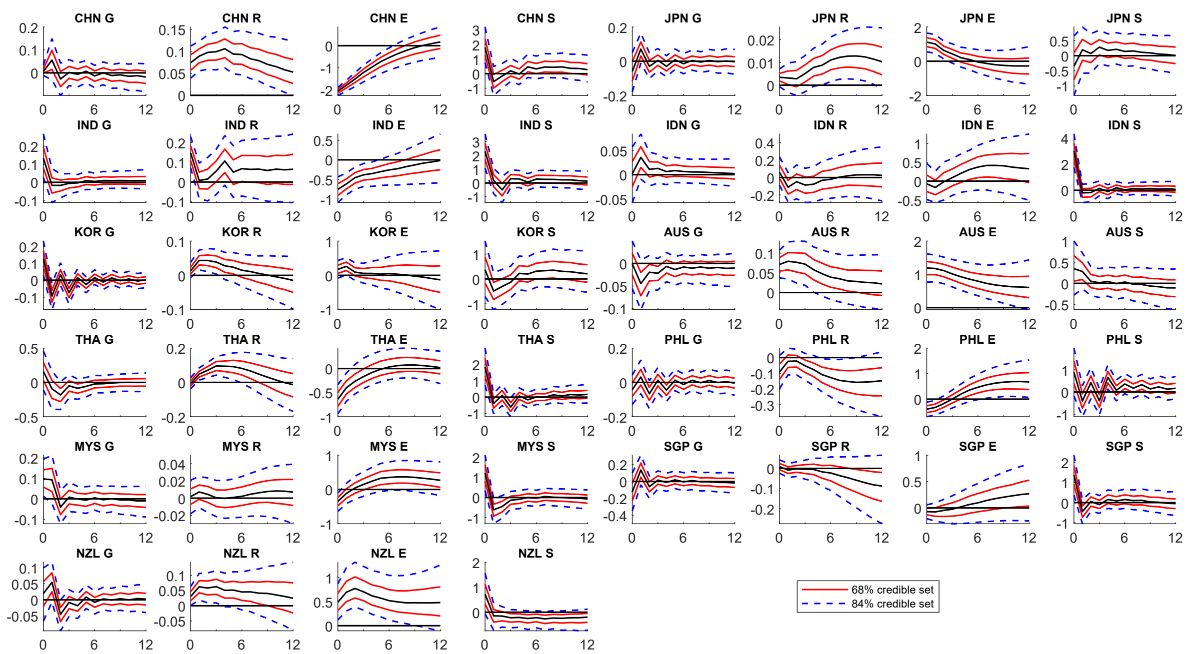


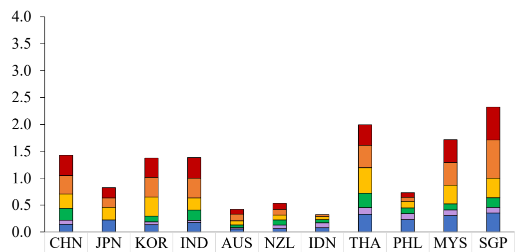
Figure 11: The Transmission of International Competitiveness Shocks

Selected Results Using a Less Conservative Credible Interval

We next consider whether our results change if we use a less conservative credible interval of 68%. Our results relating to the relative importance of US and AP shocks do not change substantially. However, as shown below, US monetary policy shocks are generally found to be more important if a less conservative interval are used. Aditionally, the decline in the importance of shocks to US GDP growth after the AFC is even more pronounced. Figure 12 shows our results from our first 52 variable model while Figure 13 shows the results from our remaining models, estimated over different subperiods.

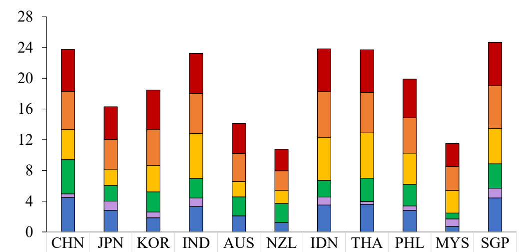
US Shocks

% Point Decline in GDP Growth



	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
USA S	0.4	0.2	0.4	0.4	0.1	0.1	0.0	0.4	0.1	0.4	0.6
USA EBP	0.3	0.2	0.4	0.4	0.1	0.1	0.0	0.4	0.1	0.4	0.7
USA RU	0.3	0.2	0.4	0.2	0.1	0.1	0.1	0.5	0.1	0.3	0.4
USA FU	0.2	0.0	0.1	0.2	0.0	0.1	0.1	0.3	0.1	0.1	0.2
USA R	0.1	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
USA G	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.3	0.2	0.3	0.4

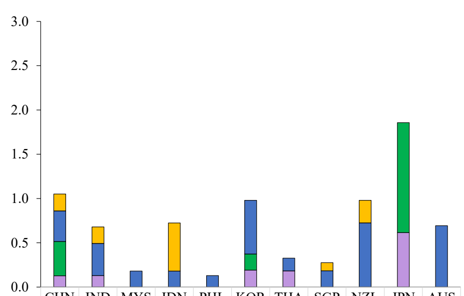
% Point Decline in Stock Price Change



	CHN	JPN	KOR	IND	AUS	NZL	IDN	THA	PHL	MYS	SGP
USA S	5.5	4.3	5.1	5.2	3.9	2.8	5.6	5.6	5.1	3.0	5.7
USA EBP	4.9	3.9	4.7	5.2	3.6	2.5	5.9	5.3	4.6	3.1	5.5
USA RU	4.0	2.1	3.5	5.8	2.0	1.7	5.6	5.9	4.1	3.0	4.6
USA FU	4.4	2.1	2.6	2.5	2.5	2.5	2.2	3.0	2.8	0.8	3.2
USA R	0.5	1.2	0.7	1.1	0.0	0.0	1.0	0.4	0.6	1.0	1.3
USA G	4.5	2.8	1.9	3.3	2.1	1.2	3.5	3.6	2.8	0.7	4.4

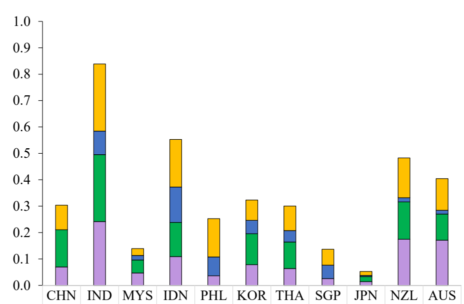
Monetary Policy Shocks

Depreciation in Domestic Exchange Rate



	CHN	IND	MYS	IDN	PHL	KOR	THA	SGP	NZL	JPN	AUS
USA R	0.2	0.2	0.0	0.5	0.0	0.0	0.0	0.1	0.3	0.0	0.0
Southeast Asia R	0.3	0.4	0.2	0.2	0.1	0.6	0.1	0.2	0.7	0.0	0.7
Other Asia Pacific R	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	1.2	0.0
East Asia R	0.1	0.1	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.6	0.0

% Point Increase in Domestic Interest Rate



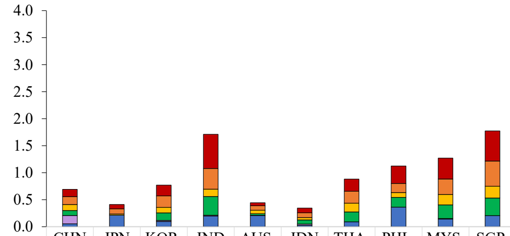
	CHN	IND	MYS	IDN	PHL	KOR	THA	SGP	JPN	NZL	AUS
USA R	0.1	0.3	0.0	0.2	0.1	0.1	0.1	0.1	0.0	0.2	0.1
Southeast Asia R	0.0	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0
Other Asia Pacific R	0.1	0.3	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.1	0.1
East Asia R	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.2	0.2

Figure 12: The Effect of Adverse US and Monetary Policy Shocks on AP Countries (68% credible interval)

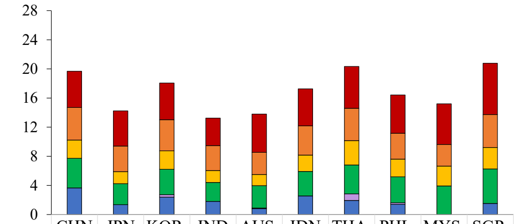
46

% Point Decline in GDP Growth | % Point Decline in Stock Price Change

Full Sample

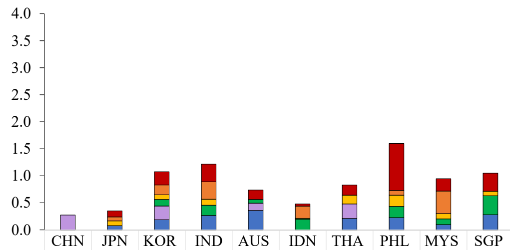


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.1	0.1	0.2	0.6	0.1	0.1	0.2	0.3	0.4	0.6
USA EBP	0.1	0.1	0.2	0.4	0.1	0.1	0.2	0.2	0.3	0.5
USA RU	0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.1	0.2	0.2
USA FU	0.1	0.0	0.1	0.3	0.0	0.1	0.2	0.2	0.3	0.3
USA R	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
USA G	0.1	0.2	0.1	0.2	0.2	0.0	0.1	0.4	0.1	0.2

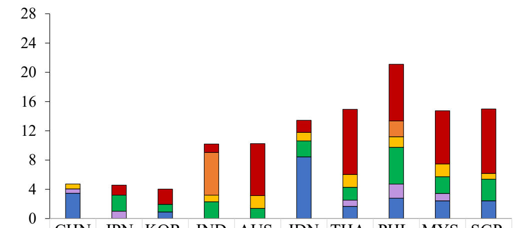


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	5.0	4.8	5.0	3.8	5.3	5.1	5.8	5.3	5.6	7.0
USA EBP	4.5	3.5	4.3	3.4	3.0	4.0	4.4	3.6	3.0	4.5
USA RU	2.5	1.7	2.5	1.6	1.5	2.2	3.3	2.4	2.7	2.9
USA FU	4.1	2.9	3.5	2.6	3.1	3.4	4.0	3.6	3.9	4.7
USA R	0.0	0.0	0.3	0.0	0.1	0.0	0.9	0.2	0.0	0.0
USA G	3.7	1.4	2.4	1.8	0.8	2.6	1.9	1.4	0.0	1.5

Pre AFC

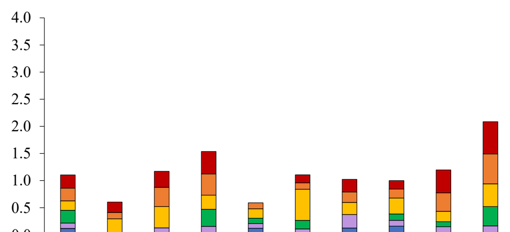


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.0	0.1	0.2	0.3	0.2	0.0	0.2	0.9	0.2	0.3
USA EBP	0.0	0.1	0.2	0.3	0.0	0.2	0.0	0.1	0.4	0.0
USA RU	0.0	0.1	0.1	0.1	0.0	0.0	0.2	0.2	0.1	0.1
USA FU	0.0	0.0	0.1	0.2	0.1	0.2	0.0	0.2	0.1	0.4
USA R	0.3	0.0	0.3	0.0	0.1	0.0	0.3	0.0	0.0	0.0
USA G	0.0	0.1	0.2	0.3	0.4	0.0	0.2	0.2	0.1	0.3

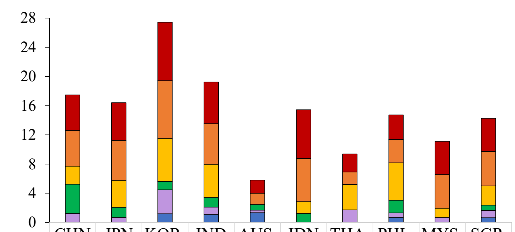


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.0	1.4	2.1	1.2	7.1	1.7	8.9	7.7	7.3	8.8
USA EBP	0.0	0.0	0.0	5.8	0.0	0.0	0.0	2.2	0.0	0.0
USA RU	0.7	0.0	0.0	0.9	1.7	1.2	1.8	1.4	1.7	0.8
USA FU	0.0	2.2	1.1	2.3	1.4	2.2	1.8	5.0	2.3	3.0
USA R	0.6	1.0	0.0	0.0	0.0	0.0	0.9	1.9	1.0	0.0
USA G	3.5	0.0	0.9	0.0	0.0	8.4	1.7	2.8	2.4	2.4

Post AFC

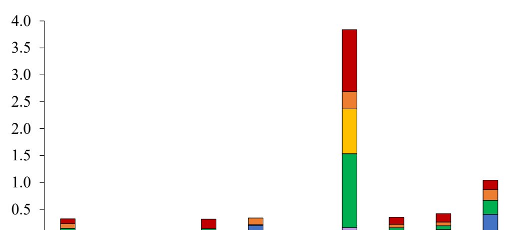


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.2	0.2	0.3	0.4	0.0	0.1	0.2	0.2	0.4	0.6
USA EBP	0.2	0.1	0.4	0.4	0.1	0.1	0.2	0.2	0.3	0.6
USA RU	0.2	0.3	0.4	0.3	0.2	0.6	0.2	0.3	0.2	0.4
USA FU	0.2	0.0	0.0	0.3	0.1	0.2	0.0	0.1	0.1	0.4
USA R	0.1	0.0	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.2
USA G	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.0

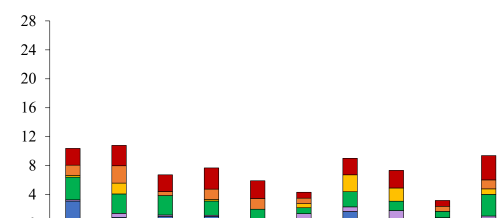


	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	4.9	5.2	8.0	5.7	1.8	6.7	2.5	3.4	4.6	4.5
USA EBP	4.9	5.5	7.9	5.6	1.6	5.9	1.7	3.2	4.6	4.7
USA RU	2.5	3.7	5.9	4.5	0.0	1.6	3.5	5.1	1.3	2.6
USA FU	4.0	1.4	1.1	1.3	0.8	1.2	0.0	1.8	0.0	0.7
USA R	1.2	0.7	3.3	1.0	0.4	0.0	1.7	0.6	0.7	1.0
USA G	0.0	0.0	1.2	1.1	1.3	0.0	0.0	0.7	0.0	0.6

Post GFC



	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	0.1	0.0	0.0	0.2	0.0	0.0	1.2	0.1	0.2	0.2
USA EBP	0.1	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.1	0.2
USA RU	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
USA FU	0.1	0.0	0.0	0.1	0.0	0.0	1.4	0.1	0.1	0.3
USA R	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
USA G	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.4



	CHN	JPN	KOR	IND	AUS	IDN	THA	PHL	MYS	SGP
USA S	2.3	2.8	2.3	2.9	2.4	0.8	2.3	2.4	0.8	3.4
USA EBP	1.4	2.4	0.5	1.4	1.5	0.8	0.0	0.0	0.7	1.2
USA RU	0.2	1.5	0.0	0.2	0.0	0.5	2.3	1.8	0.0	0.8
USA FU	3.1	2.7	2.7	2.0	2.0	0.8	2.1	1.3	0.9	3.0
USA R	0.2	0.5	0.2	0.2	0.0	0.7	0.6	1.3	0.2	0.3
USA G	3.1	0.9	1.0	1.0	0.0	0.7	1.7	0.5	0.6	0.7

Figure 13: The Effect of Adverse US Shocks on AP Countries in Different Subperiods (68% credible interval)

GFEVDs 12 Quarters Ahead

Last, we show that the trends in our GFEVDs do not change if we use a longer horizon. Figures 14 and 15 show results from our first PVAR model and models estimated over different subperiods respectively.

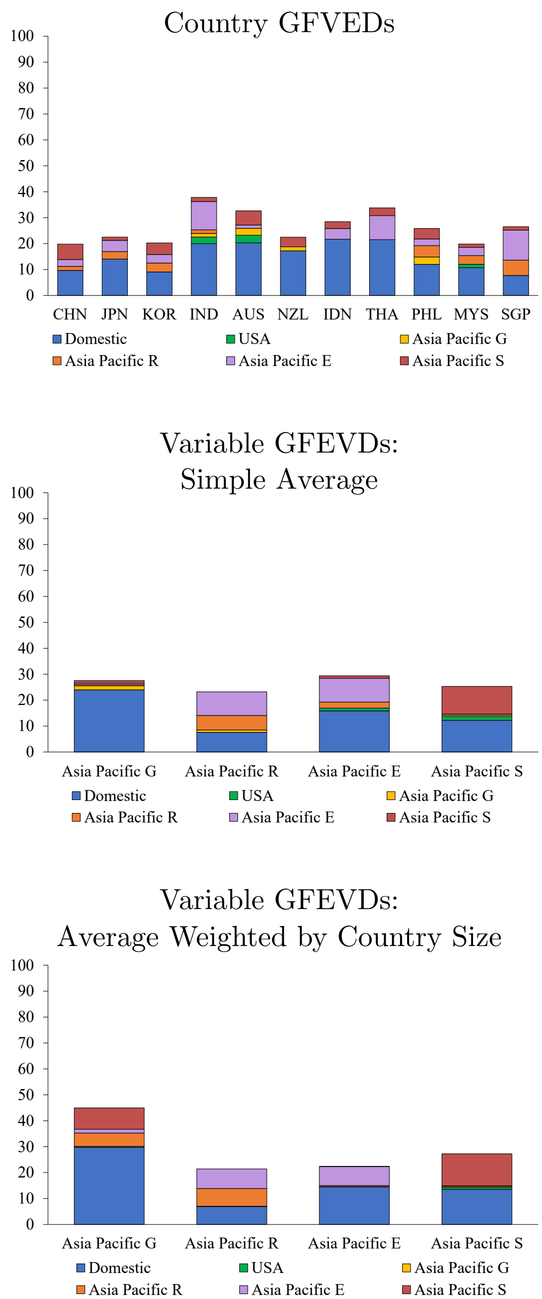


Figure 14: AP Countries' GFEVDs 12 Quarters Ahead

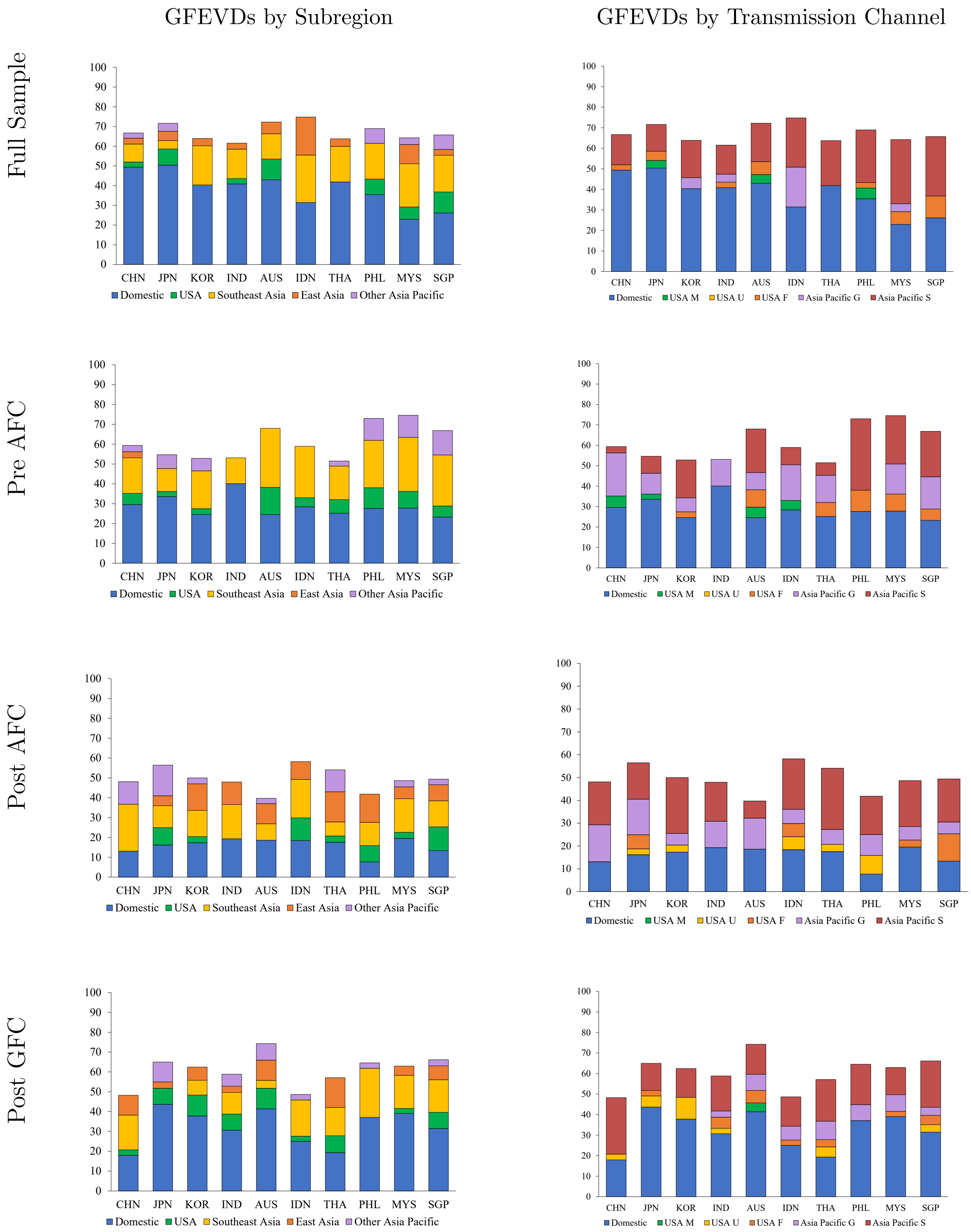


Figure 15: AP Countries' GFEVDs in Different Subperiods 12 Quarters Ahead