*International Journal of Finance & Economics*

WILEY

RESEARCH ARTICLE OPEN ACCESS

# Effect of Prudential Policies on Sovereign Bond Markets: Evidence From the ASEAN-4 Countries

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**Received:** 8 June 2023 | **Revised:** 30 July 2025 | **Accepted:** 11 September 2025

**Keywords:** ASEAN | connectedness | prudential policy | risk networks | sovereign bond

## ABSTRACT

This paper examines the effects of prudential policies on the sovereign vulnerability of ASEAN-4 countries. We measure sovereign vulnerability within the network connectedness of sovereign bonds between ASEAN-4 countries (Indonesia, Malaysia, the Philippines and Thailand) and six other countries (the US, the UK, the European Union, China, India and Japan) from 2012 to 2022. Local projections (LPs) are employed to estimate the dynamic effects of prudential measures. The effects are analysed across various prudential instruments, including reserve requirements, capital requirements, capital buffers, loan-to-value ratio caps and concentration limits. The results suggest that markets with tighter prudential policies are significantly less exposed to the sovereign shocks of other economies. The efficacy period of prudential policy in mitigating sovereign vulnerability becomes significant after seven quarters. Capital requirements and concentration limits show immediate effects, while reserve requirements operate with a longer delay.

**JEL Classification:** E58, E63, G15, H63

## 1 | Introduction

The sovereign risk associated with government bonds has become an increasingly important concern for financial stability in emerging markets. As shown in Figure 1, the share of government bond obligations relative to gross domestic product (GDP) has grown substantially in ASEAN-4 countries (Indonesia, Malaysia, the Philippines and Thailand) over the past decade. The expanding reliance on government debt raises the possibility of heightened sovereign vulnerability and financial fragility. At the same time, ASEAN financial markets are undergoing rapid internationalisation, drawing greater attention from global investors and increasing their exposure to international financial cycles (Bacchetta et al. 2021; Canuto and Cavallari 2013; Hofmann et al. 2020). Under the uncertainty brought by global business cycles, economic volatility and geopolitical tensions, these markets have become increasingly vulnerable to external shocks (Banerji et al. 2014; Gimet 2011; Plummer and Click 2005; Uddin et al. 2024). While the primary aim of prudential regulations is to foster financial stability and mitigate systemic risk (Cerutti et al. 2016; Coman and Lloyd 2022; Hanson et al. 2011; Karamysheva and Seregina 2022; Masciandaro and Volpicella 2016), their broader implications for sovereign bond markets are not yet fully elucidated. Given the growing importance of sovereign debt sustainability in emerging market economies (EMEs), it is crucial to assess the effects of prudential policies on sovereign vulnerability empirically. To address the research gap, this paper examines whether and how prudential policies influence sovereign bond market vulnerability in the ASEAN context.

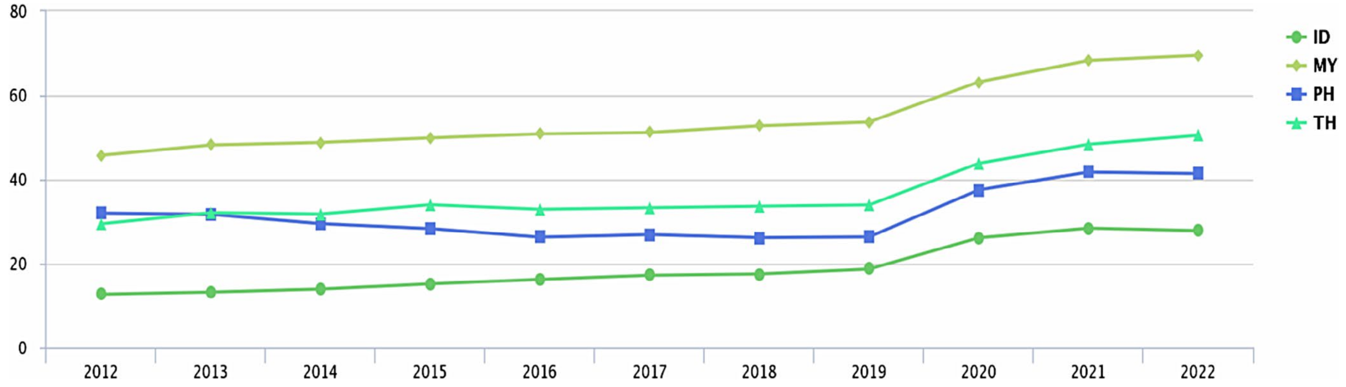


**FIGURE 1** | Size of local currency government bond market in % of GDP. This figure shows the level of government bond obligations as a percentage of nominal GDP in the ASEAN-4 countries, from 2012 to 2022. ID = Indonesia, MY = Malaysia, PH = Philippines, TH = Thailand. *Source:* Asian bonds online. [Colour figure can be viewed at wileyonlinelibrary.com]

The relationship between prudential policies and sovereign vulnerability presents a theoretically ambiguous nexus. On the one hand, prudential policies can help mitigate sovereign vulnerability by reinforcing financial institutions, enhancing market confidence and improving sovereign credit ratings. Empirical evidence highlights their effectiveness in curbing financial instability, particularly by reducing the growth of leverage, assets and non-core liabilities during economic booms (Claessens and Kose 2013; Karamysheva and Seregina 2022). These policies signal a more mature and well-regulated market, which is less prone to liquidity risks and thus exhibits lower sovereign vulnerability. Additionally, prudential policies alter the dynamics of cross-border capital flows. For example, a tighter prudential stance amplifies capital outflows during global risk-off episodes and inflows during risk-on periods (Chari et al. 2022), which may reduce foreign investor exposure and thus lessen global-to-local risk spillovers. In currency markets, countercyclical prudential policies can buffer against external shocks such as US interest rate hikes (Ouyang and Guo 2019), while also mitigating the adverse spillovers of foreign monetary policy on domestic credit conditions in emerging markets (Coman and Lloyd 2022).

On the other hand, such policies may also increase sovereign vulnerability by causing 'sovereign-bank nexus', a tightening of market liquidity, overallocation to foreign currency-denominated sovereign securities, and the slowdown of economic growth. Prudential tools such as higher reserve requirements, capital buffers, or loan-to-value caps often compel financial institutions to adjust their portfolios in favour of holding more liquid assets, particularly government bonds. As banks and other financial institutions already hold a substantial share of government securities (see Supporting Information Data S1),[1] this shift further strengthens the so-called 'sovereign-bank nexus' (Caporin et al. 2018; Fratzscher and Rieth 2019). An increased concentration of government bonds within the banking system may amplify liquidity demands and expose institutions to greater liquidity risk, especially during periods of market stress. Furthermore, the accumulation of both domestic and foreign sovereign bonds intensifies global financial interconnectedness, potentially accelerating the transmission of external shocks across borders and amplifying systemic risk. Additionally, the prudential policy affects many economic indicators, including potential inflation (Kim and Mehrotra 2022), slowing economic growth (Kim and Mehrotra 2022) and nudging the risk-free rate upward (Monnet and Vari 2023). Inflation and economic recession pressure are related to the reduction of government revenues and solvency, which could lead to a long-term possibility of sovereign vulnerability. Given ASEAN's high interest rates compared to developed sovereign markets, a well-regulated financial market can make ASEAN government bonds more appealing investments than other assets with lower returns, thereby increasing their capital interaction with the global market.

This paper examines the impact of prudential policies on sovereign vulnerability within the ASEAN-4 countries, that is, Indonesia, Malaysia, the Philippines and Thailand. This study rigorously tests different policy instruments, including reserve requirements, capital requirements, capital buffers, loan-to-value ratio caps, concentration limits and interbank exposure limits. To the best of our knowledge, this study is the first attempt to investigate the effects of prudential policies on sovereign vulnerability.

This paper uses a topological network of connectedness to measure sovereign vulnerability. The network is constructed based on the framework of Diebold and Yilmaz (2014), utilising vector autoregression (VAR) and generalised variance decomposition, which has been proven to be an effective indicator of sovereign vulnerability (Hamill et al. 2021). This paper utilises the yields of 40 government bonds (with maturities of 1, 3, 5, and 10 years) from four ASEAN countries (Indonesia, Malaysia, the Philippines and Thailand), the People's Republic of China (PRC), India, Japan (abbreviated to regional markets), European Union (EU), the UK and the US (abbreviated to global markets). The sample period spans from 4 January 2012 to 31 January 2022. From the result of the topological network, we find that among the four ASEAN countries, the two with higher credit ratings (Thailand and Malaysia) act as the intermediary channel that links the global markets with lower-rated countries. In terms of connectedness, ASEAN bonds appear to be the net risk receivers from the global markets. At the same time, the regional markets are net risk transmitters to ASEAN most of the time, except during the 2017 PRC–US trade war and the COVID-19 pandemic outbreak in 2020.

By estimating local projections with panel specification, we evaluate the effect of prudential policies on market connectedness. In this context, connectedness reflects the extent to which ASEAN sovereign bonds are exposed to regional and global sovereign bond markets. We find that the aggregated prudential policy implemented in the current quarter significantly reduces this exposure over the long term (seven quarters ahead). Specifically, tightening measures, such as capital requirements and concentration limits, show statistically significant effects in reducing sovereign vulnerability immediately (after one quarter). After 3 years of a tightened reserve requirement, the connectedness can witness a significant decline.

The remainder of this paper is structured as follows. Section 2 introduces the methodologies. Section 3 presents the data utilised in the empirical study. Section 4 discusses the effects of the prudential policy on sovereign vulnerability. Section 5 concludes with the paper's main findings.

## 2 | Methodology

### 2.1 | Measuring Sovereign Vulnerability

Sovereign debt risk refers to the possibility that a government may fail to meet its debt obligations. It relates to the sustainability of a country's fiscal and macroeconomic fundamentals, and concerns the government's ability to roll over short-term obligations under market stress. Common indicators used to assess sovereign debt risk include debt-to-GDP ratios, fiscal deficits, foreign reserve adequacy, credit ratings, and sovereign bond spreads (Alfaro and Kanczuk 2009; Gibson et al. 2017; Hürtgen and Rühmkorf 2014). In market-based approaches, sovereign yield levels and their volatility serve as forward-looking signals of perceived creditworthiness and uncertainty regarding repayment capacity, based on the relationship between the yield curve and many economic and financial factors such as economic growth, inflation, investor confidence and monetary policy (Cieslak and Povala 2016; Gürkaynak et al. 2007; Leippold and Matthys 2022).

Volatility in sovereign bond yields reflects the degree of uncertainty investors attach to a country's fiscal and macroeconomic outlook. Frequent or large fluctuations in yields, particularly when disconnected from changes in domestic fundamentals, may indicate unstable investor sentiment, shallow market depth, or heightened sensitivity to global risk factors. When yield volatility appears to be significantly influenced by developments in other countries, this suggests that the domestic bond market may not be fully insulated from external conditions (Caporin et al. 2018; Della Corte et al. 2022; Hürtgen and Rühmkorf 2014; Lane 2012; Li and Zinna 2018). Such responsiveness implies that external shocks can be quickly transmitted into domestic pricing, thereby increasing the likelihood of funding stress or investor flight. In this sense, the more foreign factors drive a country's yield dynamics, the more vulnerable its sovereign debt market is to global instability.

To capture the degree to which a sovereign bond market is exposed to extent countries, we go beyond standard volatility metrics and assess the source of yield fluctuations. A market may exhibit high volatility, but if that volatility is largely driven by domestic fundamentals, the implications for external vulnerability are limited. In contrast, if a substantial portion of yield variance can be statistically attributed to innovations originating in other countries, this reflects a high degree of external dependence. Connectedness measures of Diebold and Yilmaz (2014), typically derived from forecast error variance decomposition techniques, quantify the share of a country's yield volatility that is explained by shocks from the rest of the system. The connectedness measure indicates the level of vulnerability in the sovereign debt market (Hamill et al. 2021).[2] Higher connectedness signifies increased risk spillovers, making bond markets more vulnerable to external shocks. As such, they provide a model-based, forward-looking indicator of sovereign vulnerability to foreign shocks.

A key distinction should be made between vulnerability and market openness. While market openness[3] reflects the extent of formal integration into global markets, vulnerability pertains to how sensitive a country's sovereign yields are to foreign shocks. A market may remain formally closed yet still be vulnerable if global conditions exert significant influence on its pricing dynamics through indirect channels such as investor sentiment, benchmark indices or shared macroeconomic narratives. In this context, empirical measures based on the connectedness of Diebold and Yilmaz (2014) capture not openness per se, but rather the degree of exposure to external sovereign risk.

We estimate the connectedness of Diebold and Yilmaz (2014) by building a topological network consisting of the government bonds of ASEAN, global markets and regional markets, between each pair of bonds using a VAR process and generalised variance decomposition. Consider a $p$-order VAR:

$$y_t = \sum_{k=1}^{p} A_k y_{t-k} + \varepsilon_t, \varepsilon_t \sim i.i.d(0, \Sigma) \quad (1)$$

where the $y_t = \{y_{1,t}, y_{2,t}, \dots, y_{N,t}\}$ is an $N$-dimensional multivariate log return series of bond yields, $A_k$ is $N \times N$ parameter matrix for lag $k$, $\Sigma$ is the variance matrix of the error vector $\varepsilon_t$. With an $H$-step-ahead generalised variance decomposition, the pairwise directional connectedness from $j$th bond to $i$th bond is given by

$$\theta_{ij}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' \Theta_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i' \Theta_h \Sigma \Theta_h' e_i\right)} \quad (2)$$

where $\sigma_{jj}$ denotes the error term's standard deviation for $j$th series, the selection vector $e_i$ equals to 1 for $j$th element and otherwise 0. $\Theta_h = A_1\Theta_{h-1} + A_2\Theta_{h-2} + \dots + A_p\Theta_{h-p}$ are $N \times N$ coefficient matrices for $h = 0, 1\ 2, \dots$ The $\Theta_h$ is an identity matrix for $h = 0$, and becomes to zero matrix for $h < 0$. Following Diebold and Yilmaz (2014), the results of Equation (2) are normalised by $\sum_{j=1}^{N} \tilde{\theta}_{ij}^{g}(H) = 1$, with the normalised pairwise directional connectedness $\tilde{\theta}_{ij}^{g}(H) = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{N} \theta_{ij}^{g}(H)}$.

For a more explicitly named indicator, we convert from $\tilde{\theta}^g_{ij}(H)$ to $C^H_{i\leftarrow j}$ ($C$ is for connectedness). The total connectedness from all other bonds to bond $i$ is

$$C^H_{i\leftarrow \cdot} = \sum_{\substack{j=1 \\ j\neq i}}^{N} \tilde{\theta}^g_{ij}(H) \tag{3}$$

The total connectedness from bond $j$ to all other bonds is

$$C^H_{\cdot\leftarrow j} = \sum_{\substack{i=1 \\ i\neq j}}^{N} \tilde{\theta}^g_{ij}(H) \tag{4}$$

For each link in the network, there is an import node and an export node, which respectively correspond to the bonds $i$ and $j$ in $C^H_{i\leftarrow j}$. Further, given group $M$ and $N$ as import and export panels, respectively, the connectedness that measures the spillover from group $N$ to $M$ is specified as

$$C^H_{M\leftarrow N} = \sum_{\substack{j=\mathrm{M} \\ i=N \\ j\neq i}} C^H_{i\leftarrow j} \tag{5}$$

Note that connectedness is a directional linkage, and the magnitude could be unequal for linkages between two nodes with different directions. Each linkage has an exporter and an importer of sovereign risk. Higher exported connectedness implies that sovereign shocks in this country can easily be transmitted to others. The higher imported connectedness means the sovereign market is easy to affect by other countries. If both the values of exported and imported connectedness are very low, this country is considered isolated. Essentially, higher connectedness implies a greater degree of vulnerability among sovereign bonds, meaning that economic or financial shocks in one country can easily be transmitted to others.

### 2.2 | Local Projections

We estimate the Local projections (LPs, Jordà 2005) to study the effects of prudential policies on sovereign bond vulnerability. Alfaro and Kanczuk (2009), Gibson et al. (2017), and Hürtgen and Rühmkorf (2014) show that local projections and VARs estimate the same population impulse responses when the lag structure is unrestricted. However, with finite lag truncation, typical in empirical work, their estimates differed. While VARs extrapolate responses from a limited number of autocovariances, LPs directly estimate each horizon-specific response. Their simulation results demonstrate that LPs exhibit lower bias and more accurate interval coverage in settings with model misspecification, making them a robust methodology when the true dynamic structure is uncertain.

Similar to Fernández-Gallardo Romero et al. (2023), this study adopts a narrative identification strategy[4] to examine the effects of macroprudential policy. Our study targets sovereign vulnerability, which is neither a standard objective of macroprudential policy nor directly targeted in its design. Given the lack of institutional or theoretical grounds for expecting a systematic link between prudential policy and sovereign risk, we treat the variation in prudential policy as plausibly exogenous with respect to our outcome variable. In this context, we refer to the changes in prudential policy as identified shocks. Moreover, we explicitly control for a broad set of macro-financial variables, including GDP growth, inflation, and global uncertainty, to mitigate concerns about residual confounding.

We model the impact of a prudential policy shock of ASEAN country $i$, in time t, $Pru_{i,t}$, on the vulnerability of sovereign bonds in ASEAN

$$C_{i,t+h} - C_{i,t-1} = \alpha^h + \beta^h Pru_{i,t} + \gamma^{h\prime} X_{i,t-1} + f_i^h + f_t^h + \varepsilon_{i,t+h} \tag{6}$$

where $C_{i,t}$ represents the sum of the imported connectedness of a specific ASEAN bond $i$, exposed to external shocks from all the regional and global bonds. We estimate the local projections to investigate the effect of prudential policy on mitigating the imported connectedness of ASEAN-4 from other regional and global markets. The value of the rolling window connectedness is quarterly averaged. The $X_{i,t-n}$ represents the control variables at both the risk and fundamental perspectives, with further details provided in Section 3. The $f_i^h$ and $f_t^h$ denote bond and year fixed effects, respectively. The $\beta^h$ captures the effect of prudential policy from $h$ quarters ago on connectedness, while $\varepsilon_{i,t+h}$ denotes the residual term.

## 3 | Data Construction

This section outlines the construction of the dataset used in the empirical analysis. The study utilises government bond yield data from Indonesia, Malaysia, the Philippines and Thailand (ASEAN-4), as well as from the PRC, India, and Japan (regional markets), and the EU, the UK and the US (global markets). The sample period spans from 4 January 2012 to 31 January 2022, comprising 2491 daily observations.

We focus on government bonds with maturities of 1, 3, 5, and 10 years. Yield data are obtained from the Bloomberg Database. The analysis is based on the log returns of daily yields, computed as 100 times the logarithmic difference between yields at time $t$ and $t-1$. Supporting Information Data S1 presents correlation heatmaps that reveal patterns of yield co-movement, providing initial insights into potential cross-market linkages. Figure 2 illustrates the evolution of government bond yields across different maturities and countries. Yields in Indonesia and the Philippines are generally higher than those in Malaysia and Thailand, while yields in Japan and the global markets (the EU, UK and US) remain consistently lower than in the ASEAN-4 economies. As expected, longer-term bonds tend to exhibit higher yields than shorter-term bonds, reflecting a typical upward-sloping yield curve.

Between January 2018 and December 2020, the ASEAN-4 markets exhibited broadly similar yield dynamics. Yields rose during

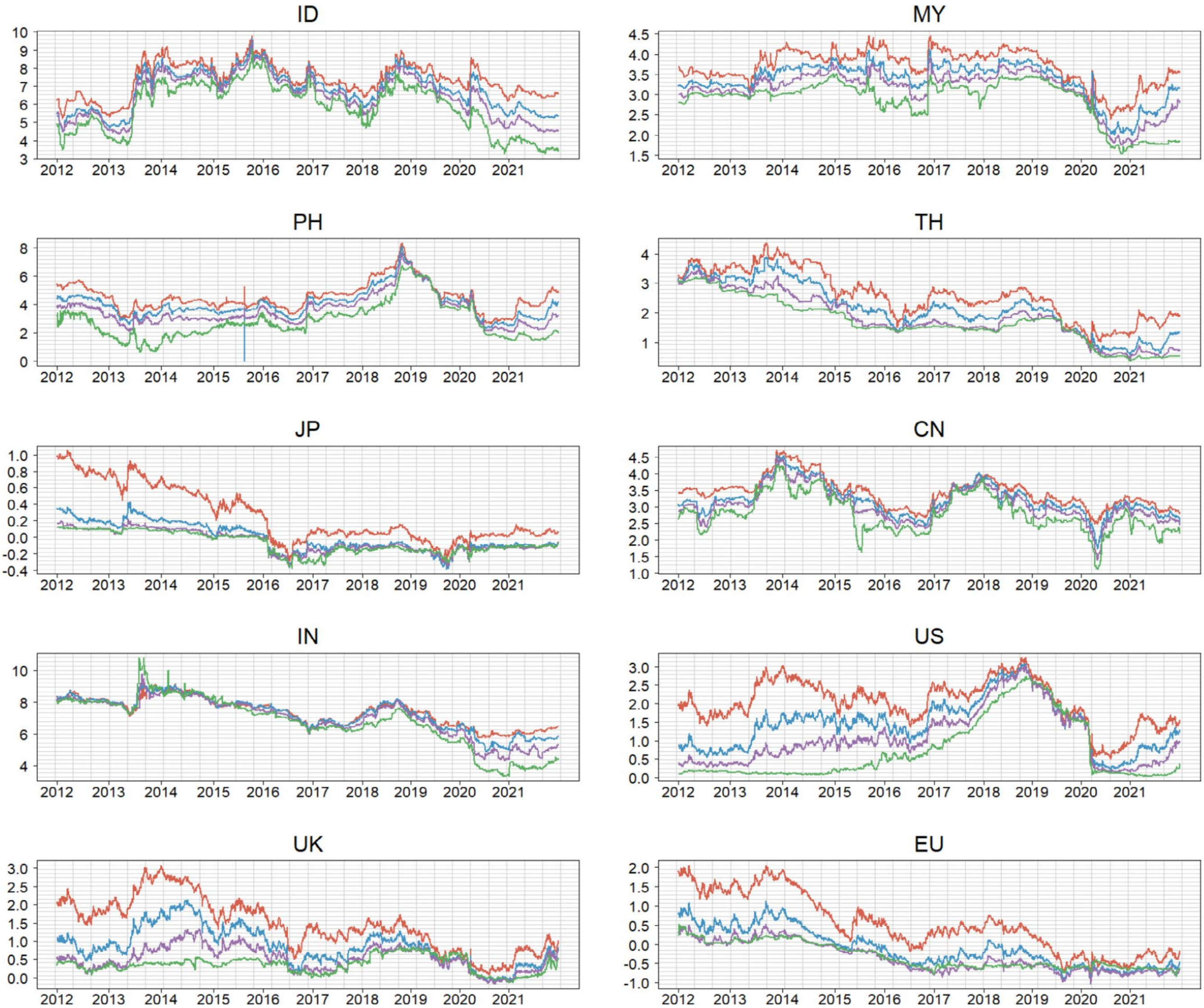


**FIGURE 2** | Government bond yields. CN = the People's Republic of China, EU = European Union, ID = Indonesia, IN = India, JP = Japan, MY = Malaysia, PH = Philippines, TH = Thailand, UK = United Kingdom, US = United States. Data collection spans over a period from 4 January 2012 to 31 January 2022 with 2491 daily observations. Yields for 10-, 5-, 3-, and 1-year government bonds are indicated in red, blue, purple, and green, respectively. Source: Bloomberg. [Colour figure can be viewed at wileyonlinelibrary.com]

the first three quarters of 2018, likely driven by rising expectations of higher global risk-free rates amid PRC–US trade tensions and signs of regional economic recovery. However, yields began to decline in the fourth quarter of 2018, potentially related to mounting economic pressure and the signals of a pause in the US interest rate hike. In early 2020, a sharp but short-lived spike in yields was observed, likely in response to the initial outbreak of COVID-19 in the PRC, which introduced heightened uncertainty across ASEAN markets. From March 2020 onward, as the pandemic spread throughout the region, investor confidence in ASEAN sovereign bonds deteriorated further, prompting a flight to quality toward perceived safe-haven assets, particularly US Treasuries.

Regarding the construction of the prudential policy indicator, this paper utilises Cerutti et al. (2016)'s dataset, which records the changes in various types of prudential policies, including capital buffers, capital requirements, banks' concentration limits, interbank exposure limits, loan-to-value ratio caps, reserve requirements, and so on. Following Cerutti et al. (2016), we code instrument-specific changes on a quarterly basis as −1, 0, or +1, reflecting loosening, no change or tightening, respectively.

We employ two alternative approaches to construct the prudential policy index. The first approach is a threshold-based specification, which assigns a value of +1 (−1) if at least one of the instruments is tightened (loosened). This specification is designed to capture the activation of the macroprudential policy stance, emphasising the binary nature of regulatory intervention. It reflects the idea that any policy action may have a signalling effect, regardless of how many instruments are involved. This construction is particularly suited to identifying the presence of policy shifts and isolating their potential effects from periods of regulatory inactivity.

The second approach is an additive specification, which aggregates the directional changes across instruments to reflect the cumulative policy stance within each quarter. This specification is motivated by the observation that simultaneous adjustments across multiple instruments may convey a stronger policy signal and have greater economic salience. It also aligns more closely with the empirical practice in (Coman and Lloyd 2022), and allows for finer differentiation across policy episodes in terms of scale.

Both specifications are incorporated in the empirical analysis to assess the robustness of results and to examine whether the intensity or mere activation of macroprudential actions is more relevant for sovereign bond market dynamics. The details about the change of prudential policy during our sample period are listed in Supporting Information Data S1.

We incorporate control variables from both risk and fundamental perspectives. To control the effects of global risk sentiment on the sovereign vulnerability, we include several indicators of international market volatility and uncertainty: the Chicago Board Options Exchange Volatility Index (VIX), the Emerging Markets ETF Volatility Index (VXEEM), the Crude Oil ETF Volatility Index (OVX), the Geopolitical Risk (GPR) Index developed by Caldara and Iacoviello (2022), and the Twitter-based Economic Uncertainty Index for English-speaking countries (TEU-ENG) from Baker et al. (2021). Regarding to the fundamental control variables, we include Gross Domestic Product (GDP) and the Consumer Price Index (CPI) for ASEAN countries to account for domestic economic conditions, and control for financial variables including exchange rate returns, stock market indices and credit rating upgrades. Supporting Information Data S1, provide detailed descriptions of all variables, including series identifiers, mnemonics, transformation codes, definitions, data sources, frequencies and coverage periods. The dynamics and correlation structures of these control variables are presented in Supporting Information Data S1.

## 4 | Empirical Results

### 4.1 | Sovereign Vulnerability

We begin the empirical analysis by examining sovereign vulnerability in a static setting. Figure 3 presents the static connectedness results, estimated using the generalised forecast error variance decomposition described in Equation (2), with a sample of $T = 2491$ daily observations, a VAR lag order of $P = 1$, and a forecast horizon of $H = 12$ days. To better illustrate the structure of cross-market linkages, Figure 4 provides a topological network visualisation of the connectedness matrix.

We observe that the topological structure of the bond network is primarily clustered by sovereign issuers. Moreover, connections

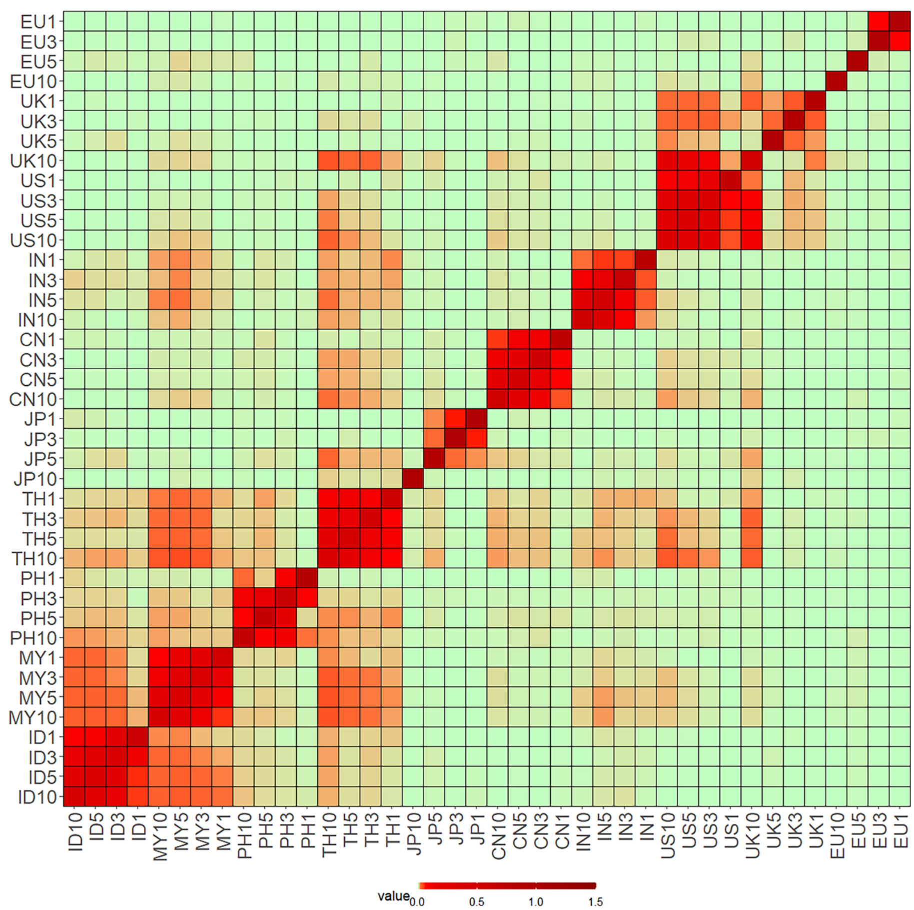


**FIGURE 3** | Connectedness heatmap. CN = the People's Republic of China, EU = European Union, ID = Indonesia, IN = India, JP = Japan, MY = Malaysia, PH = Philippines, TH = Thailand, UK = United Kingdom, US = United States. The figure is a heatmap representation of connectedness. The colour of dark red indicates a higher value of connectedness. The results are estimated by generalised variance decomposition in Equation (2) with $T = 2491$ days, $p = 1$, and $H = 12$. The $x$-axis denotes the source of risk spillover, while the y-axis denotes the target. The bonds are named as 'country-maturity'. Source: Authors' own calculation. [Colour figure can be viewed at wileyonlinelibrary.com]

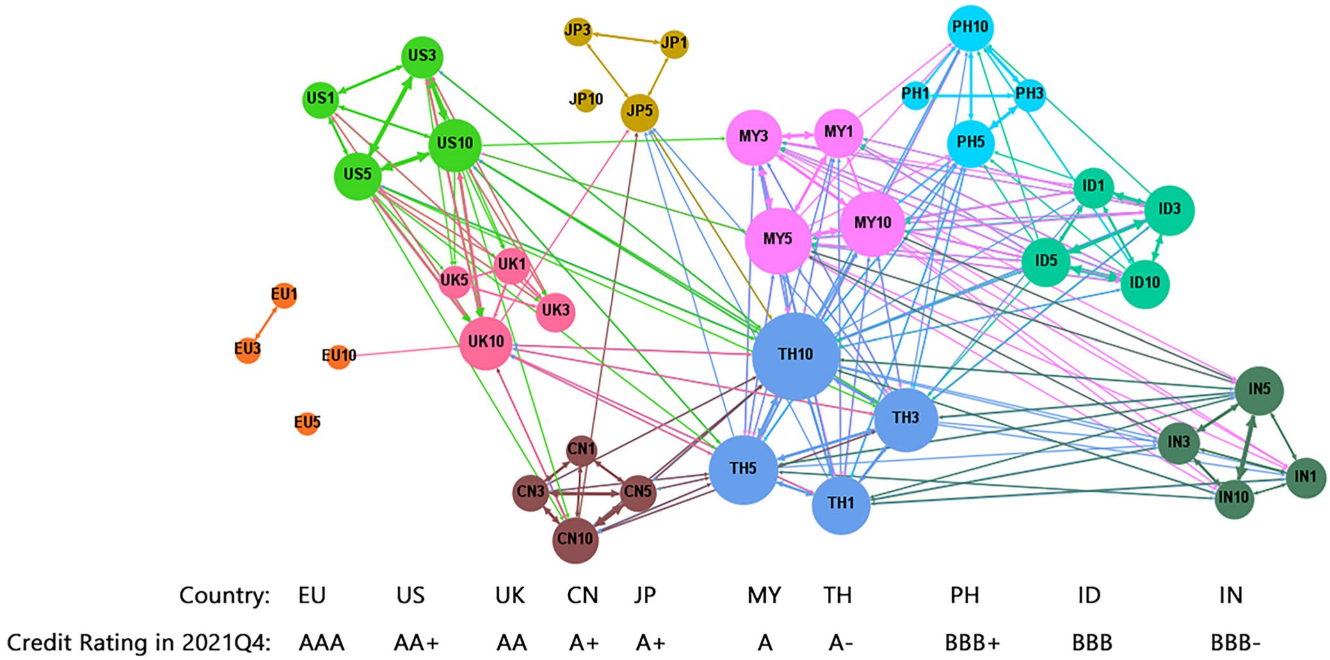


**FIGURE 4** | Topological network of connectedness. CN = the People's Republic of China, EU = European Union, ID = Indonesia, IN = India, JP = Japan, MY = Malaysia, PH = Philippines, TH = Thailand, UK = United Kingdom, US = United States. The figure is a topological network representation of connectedness. The colour of the arrow denotes the source country of connectedness. The results are estimated by generalised variance decomposition in Equation (2) with $T = 2491$ days, $p = 1$, and $H = 12$. To capture the essential structure of the network, we filter out weaker connectedness and retain only the top 300 strongest links. In the visualisation, thicker and darker arrows indicate higher levels of connectedness between nodes. The size of each node reflects its degree centrality, with larger nodes representing higher connectivity. Each node is labelled according to the issuing country and bond maturity (e.g., 'TH10' refers to a 10-year government bond issued by Thailand). *Source:* Authors' own calculation. The credit ratings are S&P Long-Term Issue Credit Ratings sourced from Bloomberg. [Colour figure can be viewed at wileyonlinelibrary.com]

tend to be stronger between bonds with smaller maturity differences, which can be attributed to the typical shape of the yield curve, where bonds of equal credit quality but different maturities exhibit predictable yield spreads.

The arrows predominantly point from left to right, indicating that countries with higher credit ratings tend to act as long-term net risk exporters to lower-rated sovereign bonds in the global market. This suggests that homogeneous global yield trends are often driven by bonds issued in the US and UK, consistent with the significant spillover effects of US risk-free rates, monetary policy and the business cycle on both advanced and emerging economies (Albagli et al. 2010; Gilchrist et al. 2019; Pontines et al. 2023). The UK 10-year bond, in particular, shows strong spillover effects on US, EU and Thai bonds.

Thailand and Malaysia appear to function as long-term intermediary channels, linking the global market with lower-rated ASEAN countries. Thai bonds are the major exporter of connectedness to the other three ASEAN countries. Notably, Thai bonds have an impact on regional markets, such as Japan and China, as well as global markets, including the US and the UK. The more substantial impact of Thai bonds could be related to Thailand being more open in trade and commercial policy settings (Hill and Menon 2021), such as the strong bilateral trade between Thailand and Japan (Pastpipatkul et al. 2020) because of the Japan–Thailand Economic Partnership Agreement and the ASEAN–Japan Comprehensive Economic Partnership respectively signed in 2007 and 2008. Additionally, the results suggest that sovereign vulnerability is regionally clustered within ASEAN, underscoring the significance of intra-regional linkages in understanding spillover channels.

We now turn to the short-term analysis of sovereign vulnerability among bond markets. Figure 5 plots the time-varying patterns of international connectedness, estimated by a rolling sample panel of volatility, with $T = 250$, $P = 1$, and $H = 12$. The left panel illustrates the connectedness between ASEAN and regional markets. Prior to 2016, the vulnerability between ASEAN and regional markets was broadly symmetrical. However, in 2016 and 2017, the connectedness from ASEAN to regional markets increased, indicating that ASEAN markets were relatively more exposed as net transmitters of vulnerability during this period. This result may reflect heightened capital flow fluctuations in ASEAN markets during the Fed's monetary tightening cycle, as well as regional political developments (e.g., the presidential election in the Philippines and the passing of King Bhumibol in Thailand) that amplified risk transmission to neighbouring economies. At the beginning of 2020, coinciding with the outbreak of the COVID-19 pandemic, sharp spikes in vulnerability emerged simultaneously in both directions, reflecting heightened cross-market synchronicity.

The right panel plots the short-term risk spillovers between ASEAN and global sovereign bond markets. Overall, ASEAN bond markets have generally acted as net recipients of external shocks, with the global market serving as the primary source of market influence. However, there is a notable peak in 2020,

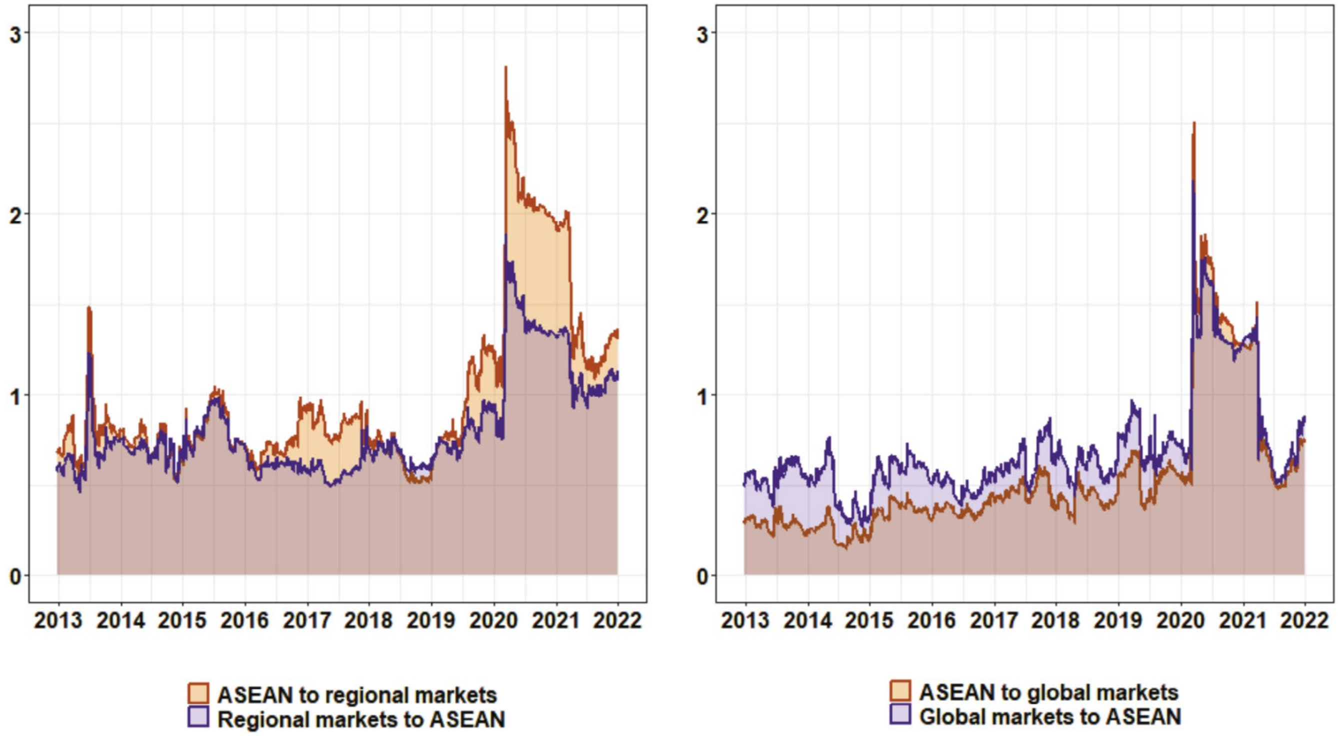


**FIGURE 5** | Dynamic connectedness. ASEAN = Association of Southeast Asian Nations, including Indonesia, Malaysia, Philippines, and Thailand. Regional markets = PRC, India, and Japan. Global markets = European Union, United Kingdom and United States. The results of connectedness are calculated by generalised variance decomposition in Equation (2), estimated by rolling sample panel of volatility, with $T = 250$, $p = 1$, and $H = 12$. The left figures show the connectedness between ASEAN and regional markets. The right figures show the connectedness between ASEAN and the global markets. The x-axis marks the date at the end of each rolling window. *Source:* Authors' own calculation. [Colour figure can be viewed at wileyonlinelibrary.com]

following the outbreak of COVID-19, which temporarily reversed the direction of spillovers. The impact of ASEAN market conditions on the three major global markets intensified, at times even exceeding the influence of these larger markets.

Figure 6 illustrates the short-term pairwise sovereign risk spillovers among ASEAN bond markets, capturing both within-country and cross-country connectedness measures. The connectedness results are calculated using generalised variance decomposition in Equation (2), estimated from a rolling sample panel of volatility with $T = 250$, $P = 1$, and $H = 12$. The x-axis marks the date at the end of each rolling window. Diagonal panels consistently show elevated levels of within-market connectedness, reflecting the strong relationship among sovereign bonds with different maturities issued by the same country. It can be observed that in 2017 and 2020, internal connectedness in ASEAN bond markets decreased, while cross-border connectedness increased. Taking this into account, along with the rising influence of the three major global markets, the findings suggest that the large shock associated with US trade policy in 2018–2019 reduced the strength of regional bond market integration.

The off-diagonal panels provide insights into the evolution of directional connectedness across markets. While the static topological network shows a net average spillover from Malaysia to Indonesia, the rolling window estimates reveal that directional spillovers can reverse over time. In most years preceding COVID-19, changes in Indonesian bond yields had a positive impact on the other three ASEAN countries.

Between late 2016 and 2017, the Philippine bond market experienced heightened domestic political uncertainty following the presidential election and the early phase of the Duterte administration (Atienza 2019). Although significant policy shifts and investor concerns marked this period, the empirical results indicate that the Philippines primarily acted as a net recipient of regional spillovers rather than as a transmitter of risk to other ASEAN markets. This asymmetry may be explained by the relatively small size and liquidity of the Philippine sovereign bond market, which limits its capacity to transmit shocks outward. Instead, increased uncertainty likely heightened its dependence on regional capital flows, making it more vulnerable to shocks originating in larger neighbouring markets, such as Indonesia and Malaysia.

A more pronounced surge is evident at the onset of the COVID-19 pandemic in early 2020, when bilateral spillovers spiked simultaneously across ASEAN markets. This pattern suggests that the pandemic served as a common shock, triggering synchronised market responses and temporarily altering the net direction of risk transmission within the region. Notably, some ASEAN markets, which typically function as net recipients of external shocks, such as Thailand, became net transmitters during this period.

Overall, these dynamics suggest that although ASEAN sovereign bond markets are generally more exposed to global drivers, region-specific shocks and extreme events can substantially reshape local spillover channels. This evidence reinforces the

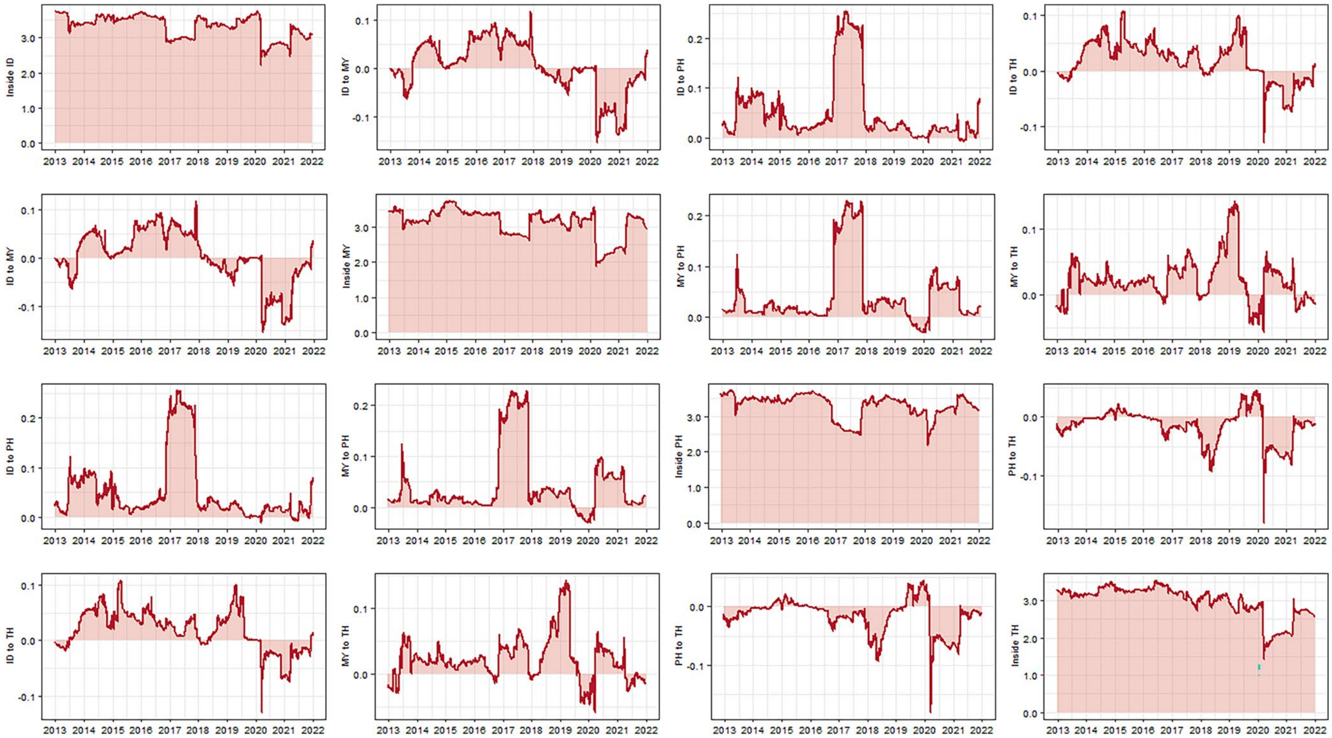

**FIGURE 6** | Dynamic connectedness in ASEAN countries. ASEAN = Association of Southeast Asian Nations, ID = Indonesia, MY = Malaysia, PH = Philippines, TH = Thailand. The diagonal figures show the connectedness value in an ASEAN country. The figures below the diagonal show the net value of connectedness between two ASEAN countries, obtained by taking the difference of the two directional connectedness. The connectedness results are calculated by generalised variance decomposition in Equation (2), estimated by a rolling sample panel of volatility, with $T = 250$, $p = 1$, and $H = 12$. The $x$-axis marks the date at the end of each rolling window. *Source:* Authors' own calculation. [Colour figure can be viewed at wileyonlinelibrary.com]

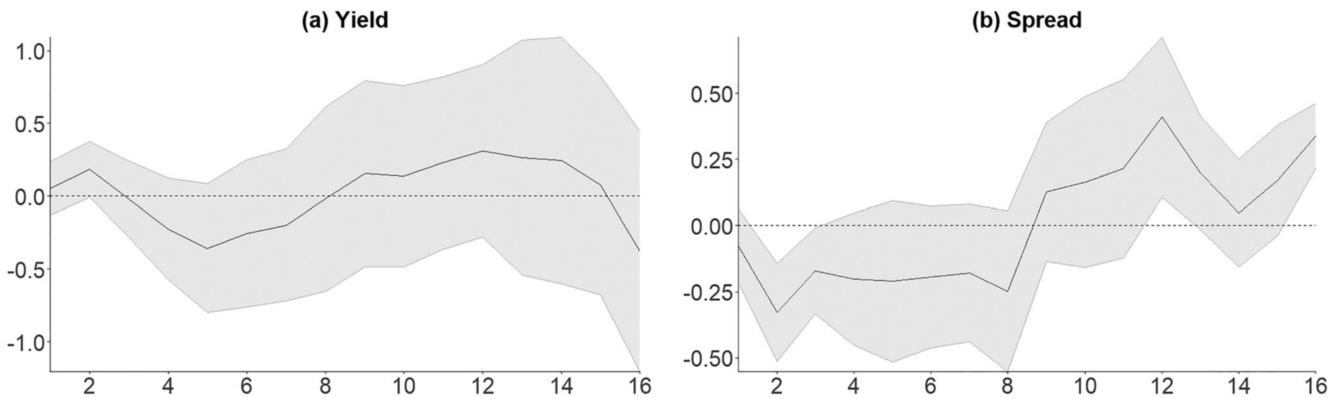


**FIGURE 7** | Response of bond yield and spread, shocked by prudential policies. Subfigure (a) displays the impulse response of all government bonds' yield to prudential policy shocks, while subfigure (b) illustrates the response of the spread between 1- and 10-year bonds. Both responses are estimated by local projection in Equation (6), with connectedness variable replaced by yield or spread. The light grey shaded area denotes the 90% confidence interval around point estimate, constructed from Driscoll and Kraay's (1998) standard errors. *Source:* Authors' own calculation.

importance of monitoring both global and intra-regional linkages when assessing sovereign vulnerability and supports the case for coordinated macroprudential measures to mitigate contagion during periods of elevated stress.

In addition, we find that the connectedness between ASEAN bonds and the other bonds in regional and global markets is more volatile than the intragroup connectedness within ASEAN. A significant reason is the disproportionate influence exerted by larger economies, as well as the inherent susceptibility of ASEAN markets. The ASEAN bond markets, being deeply integrated with major global economies, exhibit heightened sensitivity to shifts in economic conditions, financial policies and geopolitical events originating from these dominant markets. This inquiry further substantiates the underlying motivation of our study, as the demonstrated vulnerability of the ASEAN sovereign bond market is compellingly corroborated by the observed results.

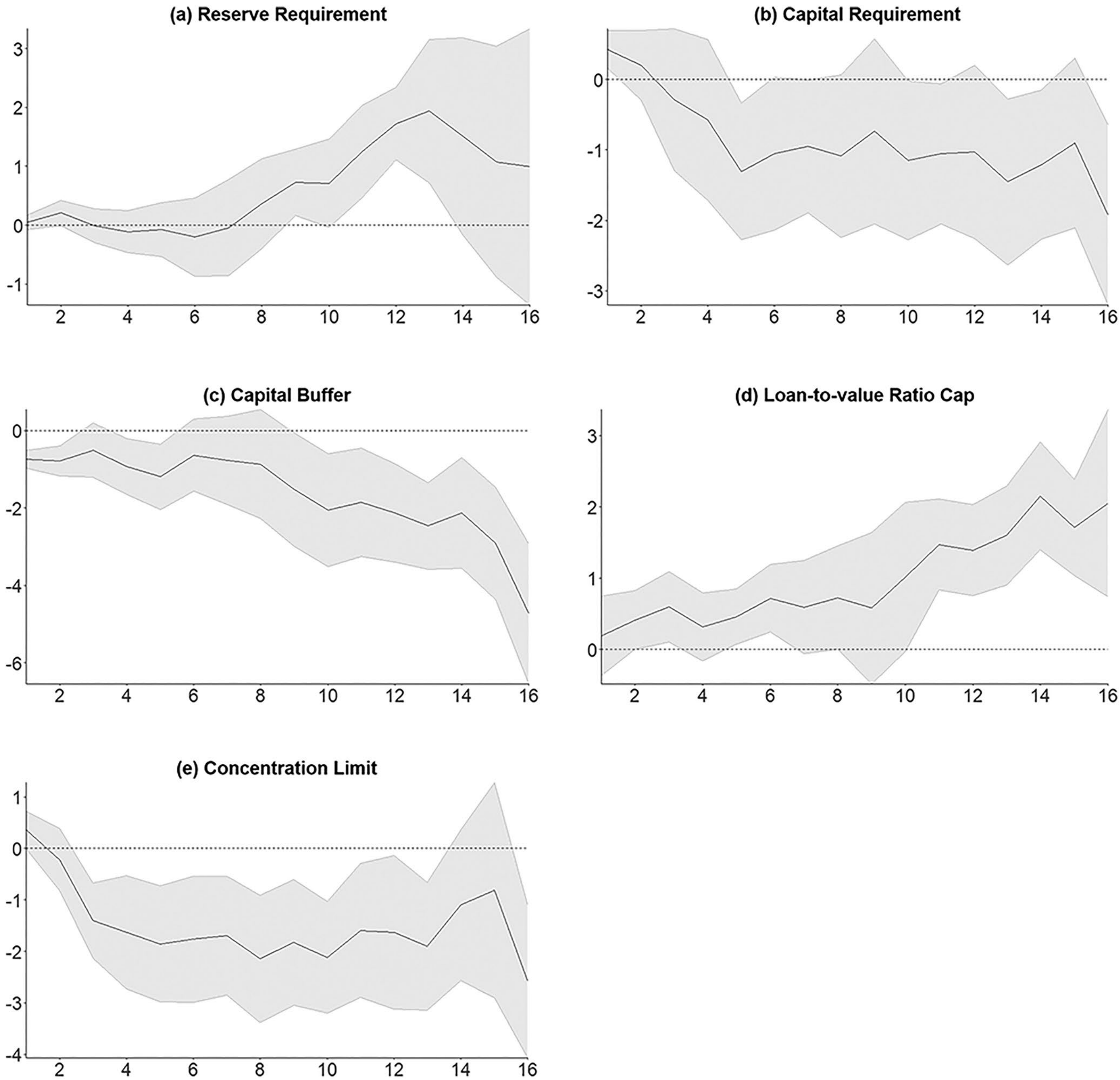


**FIGURE 8** | Response of yield, shocked by prudential policies. Subfigures (a–e) present the responses of bond yields to shocks from reserve requirements, capital requirements, capital buffers, loan-to-value ratio caps, and concentration limits, respectively. The black line shows the parameter $\beta^h$ for quarters 1–16, estimated by linear panel local projection in Equation (6). The light grey shaded area denotes the 90% confidence interval around the point estimate, constructed from Driscoll and Kraay's (1998) standard errors. *Source:* Authors' own calculation.

## 4.2 | Baseline Reactions to Prudential Policy

Before analysing how prudential policy affects sovereign market vulnerability, we first conduct a baseline exercise to examine how sovereign bond yields and spreads respond to changes in prudential policy.

We obtain quarterly sovereign yields by calculating the average daily yield for each treasury in our sample. We obtain sovereign spread by using the 10-year sovereign treasury yield minus the 1-year sovereign treasury yield, reflecting not only credit risk but also expectations related to inflation, monetary policy and broader macroeconomic conditions. Figure 7 presents the responses of sovereign bond yields and spreads to prudential policy shocks, estimated using the local projection framework outlined in Section 2.2. The *y*-axis quantifies the response volume of sovereign bond yields to a prudential policy shock. The *x*-axis, denoting sequential quarters, facilitates the examination of the temporal evolution of these effects. The shaded areas surrounding the main line of the graph represent the confidence intervals, which highlight the statistical uncertainty associated with these projections.

Figure 7a displays the impulse response of sovereign bond yields to a prudential policy shock over a 16-quarter horizon. The estimated response initially declines before rising gradually, peaking around the 14th quarter. However, the response remains statistically

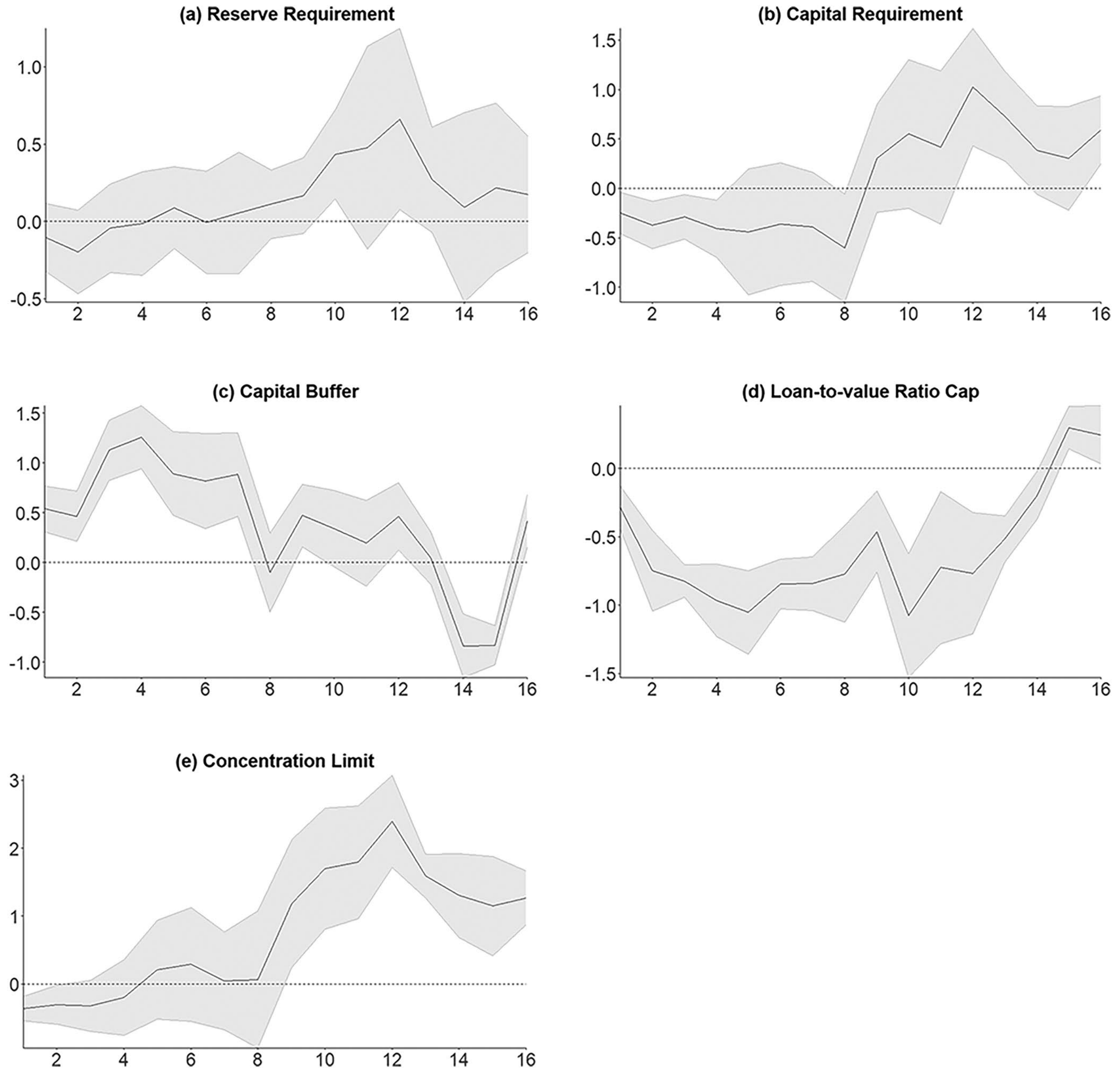


**FIGURE 9** | Response of spread, shocked by prudential policies. Subfigures (a–e) present the responses of bond spreads to shocks from reserve requirements, capital requirements, capital buffers, loan-to-value ratio caps, and concentration limits, respectively. The black line shows the parameter $\beta^h$ for quarters 1–16, estimated by linear panel local projection in Equation (6). The light grey shaded area denotes the 90% confidence interval around the point estimate, constructed from Driscoll and Kraay's (1998) standard errors. *Source:* Authors' own calculation.

insignificant throughout, as the confidence bands consistently include zero. While the point estimates suggest a possible delayed upward adjustment in yields, the wide confidence intervals indicate a high degree of uncertainty, and the results should be interpreted with caution. This weak response may reflect limited direct transmission from prudential measures to sovereign borrowing costs or offsetting macroeconomic dynamics.

Figure 7b plots the impulse response of sovereign spreads to a prudential policy shock. The estimated response is modestly negative in the immediate aftermath of the shock but gradually turns positive over the medium term. Beginning around the eighth quarter, the spread increases persistently, with the point estimates peaking around the 12th quarter. Although the response remains statistically imprecise, the upward trend suggests that markets may reassess sovereign credit risk following prudential tightening, possibly in anticipation of indirect macro-financial feedback or increased borrowing costs.

Figure 8 plots the estimated responses of sovereign bond yields to prudential policy shocks from individual prudential instruments, with 90% confidence intervals shaded in grey. A decline in yield implies improved sovereign financing conditions, as new debt can be issued at lower cost when existing bonds mature. Conversely, an increase in yield reflects tightening liquidity conditions or heightened risk perceptions. The shape and statistical significance

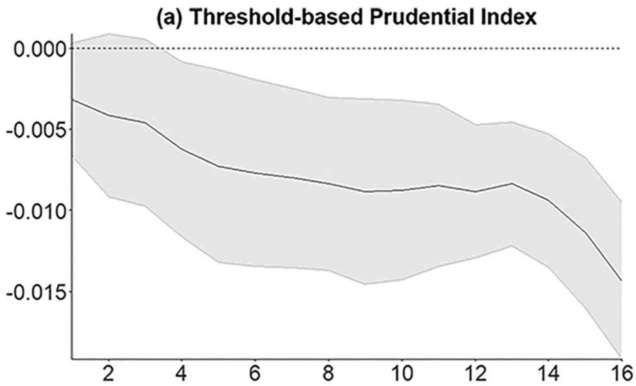


**FIGURE 10** | Response of connectedness, shocked by prudential policies. The black line shows the parameter $\beta^h$ for quarters 1–16, estimated by linear panel local projection in Equation (6). Subfigure (a) employs a threshold-based prudential index, while subfigure (b) adopts an additive prudential index. The light grey shaded area denotes the 90% confidence interval around the point estimate, constructed from Driscoll and Kraay's (1998) standard errors. *Source:* Authors' own calculation.

of each response vary substantially across instruments, shedding light on the differential transmission channels linking macroprudential policy and sovereign debt markets. Capital-related measures, including both capital requirements and capital buffers, consistently reduce yields, with statistically significant declines suggesting that markets perceive these instruments as strengthening the stability of sovereign bondholders, that is, banks. Similarly, concentration limits lower yields in a persistent and significant manner, likely reflecting reduced sovereign-bank risk channels. In contrast, reserve requirements and loan-to-value caps are associated with increases in yields, although the estimates are statistically insignificant in the short term. These patterns highlight the importance of distinguishing between liquidity-oriented tools and structural risk constraints when evaluating the sovereign implications of macroprudential policy.

Figure 9 presents the responses of sovereign bond spreads to shocks in individual prudential instruments. A notable feature is the distinct dynamic pattern of capital buffer shocks compared to the other instruments. While most tools, including reserve requirements, capital requirements, LTV caps and concentration limits, exhibit a delayed upward trajectory in sovereign spreads, capital buffer adjustments generate a different profile: spreads increase initially and then decline gradually over the projection horizon.

Taken together, Figures 8 and 9 reveal an interesting asymmetry in the response of sovereign yields and spreads to LTV cap shocks. While yields begin to rise steadily from the fourth quarter onward, spreads exhibit an initial decline before increasing only in the later quarters. This pattern suggests that the upward movement in yields is not primarily driven by changes in sovereign credit risk, but rather by expectations of tighter short-term financial conditions or liquidity constraints triggered by the policy. The upward response of yields following an increase in LTV caps may reflect a shift in banks' portfolio composition rather than a deterioration in sovereign creditworthiness. As stricter LTV limits constrain mortgage lending, banks may reallocate funds toward highly liquid and regulatory-compliant instruments such as short-term government bonds. This reallocation can lead to price pressures in the sovereign bond market, particularly if concentrated on specific maturities, resulting in rising short-term yields.

## 4.3 | Effects of Aggregated Prudential Policy

Figure 10 reports the estimated responses of sovereign market connectedness to prudential policy shocks using two alternative policy index constructions. Figure 10a employs a threshold-based specification, which records a tightening (loosening) episode if at least one prudential instrument is activated. Figure 10b adopts an additive index that aggregates directional changes across all instruments to reflect the cumulative intensity of policy adjustments within each quarter.

Despite differences in index construction, both specifications yield remarkably similar dynamic patterns: the estimated impact of prudential tightening on sovereign connectedness becomes statistically significant around the seventh quarter and remains negative over the medium term. This temporal convergence suggests that markets may take time to internalise the effects of prudential adjustments.

While both specifications yield qualitatively similar results, the underlying construction of the prudential policy indices captures different aspects of policy intensity. The slight differences in response magnitude across the two panels may reflect the fact that different instruments have heterogeneous transmission effects on sovereign markets. This motivates a more disaggregated analysis, which we present in the next section, to examine how distinct prudential instruments contribute to sovereign vulnerability.

## 4.4 | Effects of Specific Prudential Policy

Figure 11 presents responses of sovereign connectedness to different types of prudential policy shocks.[5] The results reveal substantial heterogeneity in both the timing and significance of the effects. Among all instruments, capital requirements and concentration limits exhibit the earliest significant responses, with their estimated effects becoming distinguishable from zero as early as the second or third quarter following the policy shock. These tools appear to send relatively strong and immediate signals to markets, likely due to their direct influence on banks' capital allocation and sovereign exposures. In contrast, reserve requirements show the cumulative effect over time, but their statistical

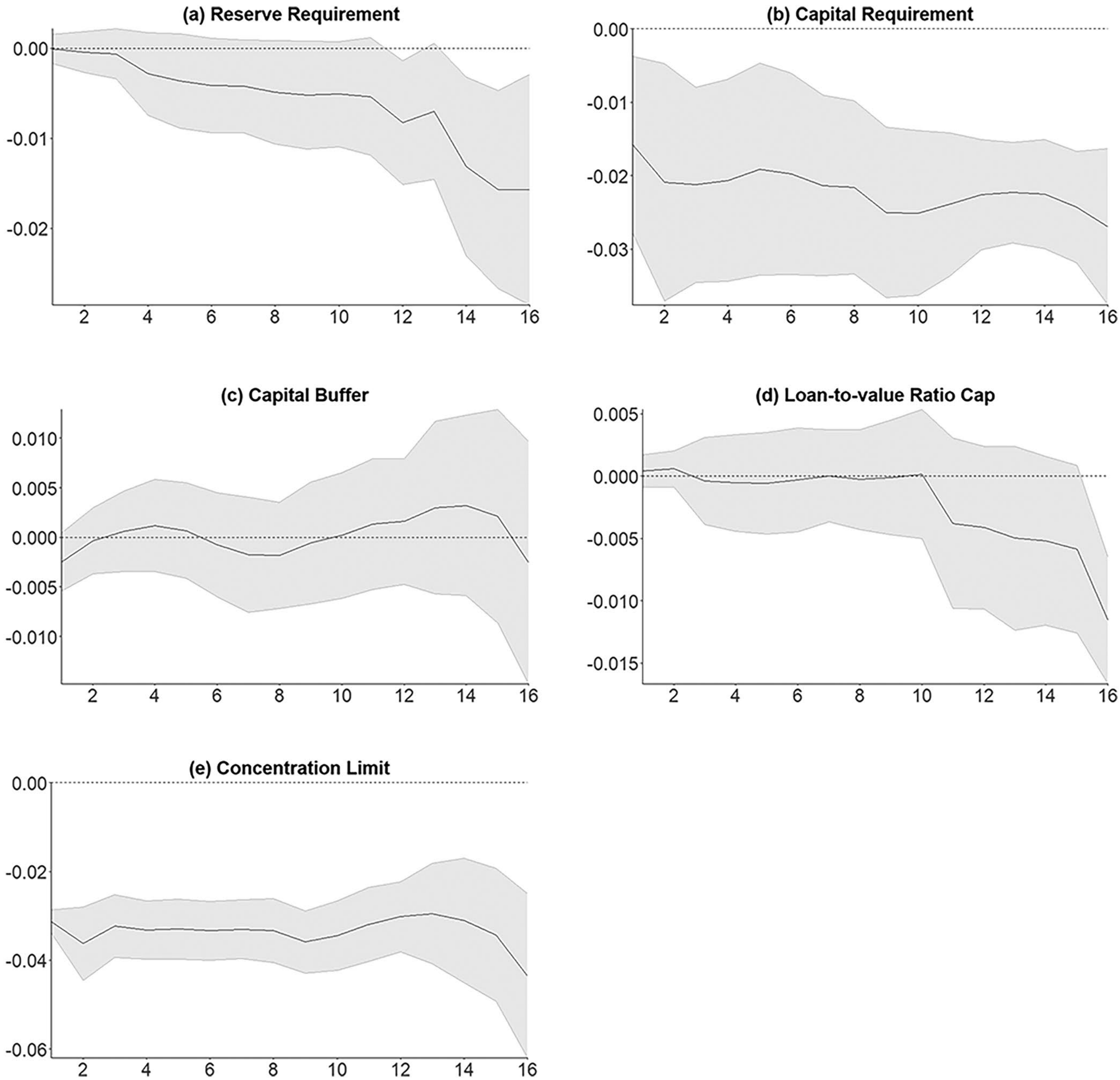


**FIGURE 11** | Response of connectedness, shocked by prudential policies. Subfigures (a–e) present the responses of connectedness to shocks from reserve requirement, capital requirement, capital buffer, loan-to-value ratio cap, and concentration limit, respectively. The black line shows the parameter $\beta^h$ for quarters 1–16, estimated by linear panel local projection in Equation (6). The light grey shaded area denotes the 90% confidence interval around the point estimate, constructed from Driscoll and Kraay's (1998) standard errors. *Source:* Authors' own calculation.

significance emerges only after 14 quarters. This suggests a more gradual transmission mechanism, possibly reflecting implementation lags or delayed balance sheet adjustments. In contrast, capital buffers and loan-to-value ratio caps do not produce statistically significant responses, though loan-to-value ratio caps exhibit a sharper drop with larger effect sizes from the 10 quarters onward.

## 4.5 | Discussion of Empirical Results

While the aggregate analysis indicates that tighter prudential policy tends to reduce sovereign vulnerability over time, the disaggregated results reveal substantial variation across instruments in both the magnitude and timing of their effects. To shed light on these heterogeneous responses, Table 1 summarises the results of all local projections and offers a comparative assessment, drawing on the patterns observed in Figures 8 and 9.

Given that the spread is defined as the difference between 10- and 1-year government bond yields, commonly referred to as the term spread, it allows us to infer the relative changes in short- and long-term yields in response to each prudential policy change. For example, if the Spread LTR (the response of spread in long-term horizon) is positive and yield LTR (the response of yields in long-term horizon) is negative, then the short-term

**TABLE 1** | Summary of empirical results and comparisons.

| | Spread STR | Yield STR | Spread LTR | Yield LTR | Short-term yield STR | Long-term yield STR | Short-term yield LTR | Long-term yield LTR | Sovereign vulnerability STR | Sovereign vulnerability LTR |
|---|---|---|---|---|---|---|---|---|---|---|
| Reserve requirements | Insignificant | Insignificant | Positive | Positive | Insignificant | Insignificant | Unknown | Positive | Insignificant | Negative |
| Capital requirement | Negative | Insignificant | Positive | Negative | Positive | Negative | Negative | Unknown | Negative | Negative |
| Capital buffer | Positive | Negative | Negative | Negative | Negative | Unknown | Unknown | Negative | Insignificant | Insignificant |
| Loan-to-value ratio cap | Negative | Positive | Positive | Positive | Positive | Unknown | Unknown | Positive | Insignificant | Negative |
| Concentration limit | Insignificant | Negative | Positive | Negative | Negative | Negative | Negative | Unknown | Negative | Negative |

*Note:* This table summarises empirical findings and aligns the estimated impacts of prudential policy shocks on bond yields with their effects on sovereign vulnerability, in both the short and long term. The orange panel presents results derived from Figures 8 and 9. Given that the spread is defined as the difference between 10- and 1-year government bond yields, we infer the relative movements of short- and long-term yields in response to each prudential instrument, as shown in the blue panel. The green panel reports the results from Figure 11. STR denotes the short-term response to the prudential policies, while the LTR denotes the long-term response. Text colour indicates the degree of consistency between changes in yields and corresponding changes in sovereign vulnerability over different horizons. The rationale for this matching is grounded in the context of ASEAN countries, where sovereign bonds typically carry lower credit ratings than those of global or regional benchmark markets. In such settings, a decline in yields is generally interpreted as a sign of improved market stability and reduced sovereign vulnerability, whereas an increase in yields reflects heightened risk premia and concerns over debt sustainability. Red font indicates a match between changes in short-term yields and short-term sovereign vulnerability, green font reflects a match in the long term, while blue font indicates the unmatched response.

*Source:* Authors' own calculation.

yield LTR (the response of short-term yields in long-term horizon) must be negative.[6]

In the context of ASEAN countries, where sovereign bonds generally carry lower credit ratings than those of global or regional benchmark markets, a decline in yields is typically interpreted as a signal of improved market stability and reduced sovereign risk, reflecting diminished concerns over credit sustainability. We use this theoretical relationship to guide the font colour coding in Table 1. Specifically, for each prudential policy shock, if the responses of yield and connectedness move in the same direction, consistent with the theoretical prediction, the corresponding font is coloured red for short-term responses (STR) and green for long-term responses (LTR). Otherwise, the font is coloured blue to indicate a lack of directional consistency. In Section 4.4 we find that two instruments, capital requirements and concentration limits, consistently produce the most pronounced effects in mitigating sovereign vulnerability. From the red and green fonts, we find these pronounced effects are associated with declining yields at both the short and long ends of the maturity spectrum, indicating a broad-based reduction in risk perceptions following their implementation. We interpret the decline in yields following prudential shocks primarily as a reflection of improved market confidence and reduced financial uncertainty, which has been found across all prudential instruments, to varying degrees.

It is reasonable that capital requirements and concentration limits, which directly address solvency and exposure risks, exhibit the most pronounced effects in mitigating sovereign vulnerability. Specifically, capital requirements mandate financial institutions to maintain a minimum ratio of capital to risk-weighted assets. These requirements are designed to enhance the resilience of banks by ensuring they can absorb unexpected losses without jeopardising depositors or triggering broader financial instability (De Jonghe et al. 2020; Oduor et al. 2017; Oyetade et al. 2023). Concentration limits mitigate financial risks by setting a cap on the amount of exposure that an entity, such as a bank or investment portfolio, can have to a single counterparty or a specific category of assets. This policy is designed to prevent excessive concentration of risk in any one area, which could lead to significant losses if that particular counterparty or asset class experiences financial distress. These two tools enhance financial system credibility without generating substantial side effects, thereby reinforcing investor confidence and lowering risk premia.

In contrast, the other three instruments, that is, reserve requirements, capital buffers, and loan-to-value caps, do not produce pronounced responses in our baseline analysis. This muted effect may be attributed to potential offsetting dynamics. For instance, reserve requirements can restrict market liquidity (Argimón et al. 2018),[7] while LTV caps may reduce credit intermediation and signal tighter financial conditions (Cerutti et al. 2016; Claessens and Kose 2013; Wong et al. 2012). While Coman and Lloyd (2022) find that reserve requirements help dampen the spillover of US monetary policy to other economies, our results suggest that their regulatory effect on sovereign vulnerability is relatively limited and statistically imprecise. Federal law sets requirements for the percentage of deposits a bank must keep on reserve, either at the local Federal Reserve Bank or in its vault. During our sample period, the reserve requirements in local currencies were ASEAN's most-used prudential policy, with both easing and tightening changes. It can initially be explained by the increased cost of capital that typically accompanies tighter macroprudential regulations. Incorporating insights into the liquidity regulation dilemma (Monnet and Vari 2023), we can deepen our understanding. Prudential policies, such as higher reserve requirements and capital buffers, lead to higher borrowing costs for banks, which in turn pass these costs onto consumers and businesses in the form of higher interest rates. As the cost of borrowing increases, the overall demand for credit decreases, leading to a reduction in economic activity and investment. In the bond markets, these higher interest rates translate directly into higher yields as new bonds must offer higher returns to attract investors in a higher interest rate environment. This mechanism could be a fundamental way in which prudential policies can drive up bond yields, reflecting the increased cost of capital throughout the economy. These side effects may counteract the intended de-risking benefits of the policies, weakening their transmission to sovereign bond markets.

## 5 | Conclusion

The surge in the interdependence between ASEAN and international markets has raised questions about the relationship between prudential policies and sovereign vulnerability. This study investigates the sovereign vulnerability in four ASEAN markets (Indonesia, Malaysia, the Philippines and Thailand); three regional markets (PRC, India and Japan, abbreviated to regional markets), and three global markets (the EU, the UK and the US, abbreviated to global markets).

We find evidence from the static horizon that domestic connectedness within each ASEAN country dominates the network. Specifically, our study reveals that ASEAN sovereign vulnerability exhibits stronger exposure to global markets than to regional markets. From the results of the topological network, we find that among the ASEAN-4 countries, the two with higher credit ratings, Malaysia and Thailand, act as intermediary channels that link the global market with lower-rated countries. Vulnerability increased during the PRC–US trade war and the COVID-19 pandemic.

This paper examines the impact of prudential policies on the vulnerability of sovereign bonds. An empirical study finds that prudential policies have a long-term effect of reducing the sovereign vulnerability of ASEAN countries. However, the differences between specific prudential instruments are quite noticeable. We find that aggregate prudential policy tightening in the current quarter is associated with a significant reduction in sovereign vulnerability over the longer term, with effects becoming statistically significant approximately seven quarters ahead. Among individual instruments, capital requirements and concentration limits exhibit immediate and statistically significant impacts, with observable reductions in vulnerability emerging as early as one quarter after implementation. At the same time, LTV cap and reserve requirements display a more delayed effect, with a significant decline in connectedness materialising only after approximately 3 years.

These findings underscore the importance of instrument-specific policy design, highlighting that certain prudential tools can deliver timely and measurable reductions in sovereign vulnerability. For policymakers in ASEAN economies, understanding the differential timing and magnitude of each instrument's effect is crucial for effective risk management and crisis prevention. Moreover, the results offer practical insights for both domestic and international investors, illustrating how changes in regulatory frameworks can impact sovereign risk dynamics over various time horizons.


### Acknowledgements

The authors sincerely appreciate the valuable comments and constructive suggestions provided by the editors and anonymous reviewers. Their insightful feedback significantly contributed to improving the quality of this manuscript and facilitated its successful publication. We are also grateful for the feedback received during the Asian Economic Development Conference 2023, jointly organised by the Asian Development Bank (ADB), the Asian Development Bank Institute (ADBI), and the University of Tokyo, where an earlier version of this paper was presented.


### Conflicts of Interest

The authors declare no conflicts of interest.

### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data that support the findings of this study are penly available in 1. Bloomberg at https://doi.org/10.17616/R31NJMZO; 2. Prudential Policy Instruments of Cerutti et al. (2016) at https://www.eugeniocerutti.com/datasets; 3. Twitter-based Uncertainty Indices of Baker et al. (2021) at https://www.policyuncertainty.com/twitter_uncert.html; 4. Geopolitical risk index of Caldara and Iacoviello (2022) at https://www.matteoiacoviello.com/gpr.htm; 5. IMF, Monetary and Financial Statistics at https://data.imf.org/?sk=b83f71e8-61e3-4cf1-8cf3-6d7fe04d0930; 6. Asian Bonds Online at https://asianbondsonline.adb.org/data-portal/

### Endnotes

[1] For many emerging markets and developing economies, the high debt levels built up during a decade of low interest rates have become a particular concern. Some emerging markets face a challenge from the combination of high government debt and large bank holdings of domestic government bonds. See for details: https://www.fsb.org/2023/11/fsb-plenary-meets-in-basel-3/.

[2] They examine various decomposition methods (Demirer et al. 2018; Diebold and Yilmaz 2014; Lanne and Nyberg 2016; Pesaran and Shin 1998). The results of these decomposition methods have different systemic risk and vulnerability rankings, and the measure of Lanne and Nyberg (2016) is found to have more volatile results. In our paper, we select the most commonly used framework of Diebold and Yilmaz (2014) for universality.

[3] Market openness is often measured by indicators such as the Capital Account Openness Index, trade-to-GDP ratios, or external asset and liability positions (Bleaney and Tian 2023; Chinn and Ito 2008; McGrattan 2012; Zhou 2024).

[4] Narrative identification is a strategy based on textual or event records, used to extract exogenous policy shocks. Rather than relying on structural models or statistical properties of the data, it draws on policymakers' statements, announcements, or official documents to determine whether a given policy change can be considered exogenous. Fernández-Gallardo Romero et al. (2023) emphasise two core challenges in identifying exogenous macroprudential policy shocks when analysing their impact on GDP growth: (i) the potential endogeneity of policy actions, which are often implemented in response to macroeconomic conditions, and (ii) anticipation effects arising from delays between policy announcements and implementation. Their analysis focuses on GDP growth as the projection variable, where such concerns are particularly salient due to the intrinsic responsiveness of macroprudential tools to countercyclical economic design.

[5] The effect of the interbank exposure limit is not provided, because this variable is dropped during the panel estimation, due to the insufficient observations.

[6] Given that LY and SY denote the long-term and short-term yields, respectively, the term spread is defined as $\text{Spread} = \text{LY} - \text{SY}$, and the average yield is given by $E(\text{Yield}) = 0.5 \times (\text{LY} + \text{SY})$. This implies the following identities: $\text{LY} = E(\text{Yield}) + 0.5 \times \text{Spread}$, $\text{SY} = E(\text{Yield}) - 0.5 \times \text{Spread}$. Therefore, if the long-term response (LTR) of the spread is positive, while the LTR of the average yield is negative, it must follow that the LTR of the short-term yield is negative.

[7] As stated by Cerutti et al. (2016), the tighter prudential policy in capital buffer always results in an increase of risk weight on real estate credit, consumer credit and other credit (e.g., Non-Deliverable Forward Contracts). The local and foreign sovereign bonds in ASEAN-4 countries are zero-weighted. The increase in risk weight on other assets decreases the capital ratio, and then the banks have to turn to some assets with lower risk, where one option is the sovereign bond market.

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## Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supplementary information.