Cross Country Linkages and Transmission of Sovereign Risk: Evidence from Global Credit Default Swaps Markets

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Abstract

We examine transmission of sovereign risk between China and other countries due to China's special role in the global value chain. Employing a dynamic approach, we find that China's sovereign risk has strong contagion effects on resource-providing countries, while China is vulnerable to contagion effects from its major importers, suggesting sovereign risk spreads from downstream to upstream along the global supply chain. Cross-country competition effects are clustered by time and region. FDI and portfolio investment also affect sovereign risk transmission via financial account linkages. Spillover effects are affected by country-specific factors, such as economic growth rate, reserves, and country governance.

Keywords: cross country linkages, sovereign risk transmission, contagion and competition effects, China, Credit Default Swaps

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Abstract

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1. Introduction

Over the past several decades, the world's economies have become increasingly connected and integrated in terms of cross-border trade and services, foreign direct investment flows, and international financial transactions. Due to cross-country linkages, sovereign risk of a country could be transmitted to other countries more easily and faster. The sovereign risk transmission could take place in two directions. On the one hand, higher sovereign risk in one country could create ripple effects and increase sovereign risk of other countries due to cross-country linkages. We call these effects "contagion effects." On the other hand, higher sovereign risk in a country may lead to trade or fund reallocation and reduce sovereign risk of competing countries. We refer to these effects as "competition effects." Contagion and competition effects may coexist, and it is ultimately an empirical question to determine which effect dominates in which country and when.

In this paper, we study sovereign risk contagion and competition effects reflected in credit default swaps (CDS) markets between China and 53 countries for the period 2001-2014. We choose China as the anchor country for three reasons. First, China plays an instrumental role in the global value chain. China's importance both as a supplier and, increasingly, as an end user in the global supply chain has grown tremendously. China is the second largest recipient of FDI and one of the top financial investment destinations.[1] At the same time, China also dramatically

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increased its overseas investment to boost its influence abroad.[2] China's unique role in global value chain enables us to examine how sovereign risk is transmitted due to cross-country linkages.

Second, China has experienced exponential growth over the past few decades and has become the world's second-largest economy since 2010.[3] However, extant research mostly focuses on the transmission effect from developed countries such as US to other economies, just as the metaphor goes, "When the US sneezes, the world catches a cold". One novelty of our study is that we provide a new angle of 'reverse transmission' of sovereign risk from an emerging economy to other countries.

Third, China's sovereign risk has wide variations due to uncertainty about Chinese economic and political policies internally, and trade and political friction externally. Therefore, China offers an ideal laboratory to examine how sovereign risk shocks originated from China spill over to other countries.[4] In light of the escalating trade war and investment restrictions between US and China, it is informative to understand the effects of risk transmission initiated by sovereign risk shocks in China.

On the one hand, China could have potentially devasting contagion effects on other countries. China's demand for imported goods has become an important source of growth for its neighbors in Asia and many other countries in the world, because China extensively imports capital equipment, technologies, raw materials and consumer products from countries such as

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[2] "Does China dominate global investment?" 2018 CSIS China Power Project, United Nations Conference on Trade and Development (UNCTAD), https://chinapower.csis.org/china-foreign-direct-investment/ Witt (2019) states that many Chinese MNEs are involved in the current large-scale One Belt One Road initiative partially to serve state interests.

[3] Witt (2019) points out that measured by GDP at PPP, US strength peaked in 1999 with its GDP at 289.4% that of China's. By 2013, China had reached parity, and in 2017, US GDP was down to 83.2% of China's, a decline by 71.3%.

[4] For example, the Chinese stock market crash in July 2015 led to a market selloff in the United States, which was the largest decline in the US stock market since 2008. It also affected multiple economies around the world, including those in countries in Europe, Asia, and Oceania.

Japan, South Korea, Germany, Australia, Chile etc. Changes at the end user point of demand can trigger wide swings upstream. Therefore, we expect that sovereign risk shocks originated from China will spread to its suppliers and countries that rely on China's demand for growth.

On the other hand, a sovereign risk shock in China may lead investors to perceive higher risk in emerging markets and reallocate funds and trades back to developed markets due to "flight to safety". In addition, higher risk in China could benefit competing emerging economies if they have a similar export-oriented economic structure or comparable role in the global supply chain. Both will lead to competition effects.

In the opposite direction, China may suffer from contagion effects from other countries. China started to be part of the global supply chains after its opening up in the late 1970s and gradually came to be known as the "world factory" over the past several decades. China is the largest source of exports to the Eurozone countries and the United States. If economic recessions in these countries lead to lower demand for exports, China will be adversely affected. On the other hand, competition effects can arise if China benefits from higher risk in a country that is a major Chinese competitor in terms of trade, FDI, or fund flows.

In this paper, we are interested in answering the following questions: (1) Does China's sovereign risk have a contagion effect or competition effect on sovereign risk in other countries? (2) Are there structural changes in the relationships between China and other countries' sovereign risk? (3) What are economic and financial channels for contagion or competition effects?

We use the prices of sovereign credit default swaps (CDS henceforth) as the measure of sovereign risk that incorporates forward-looking market information. Sovereign CDS is one of the most commonly used indicators of the market's perception of the financial stability of a

country (Annaert et al., 2013).[5] It is a relatively liquid credit derivative instrument widely used for hedging country credit risk and also for speculative and arbitrage reasons (Fontana and Scheicher, 2011). The price of CDS depends on the probability of sovereign default and, conditional on default, the expected recovery value of a country's sovereign bond.[6]

One novel nature of our study is that we use a time-varying Granger causality test to analyze dynamic risk transmissions in the sovereign CDS markets. Prior studies of causality usually assume that the existence and direction remain constant. However, the cross-country causal links are expected to be stronger when the market is more volatile, for example, during the 2008 financial crisis and the European sovereign debt crisis. Moreover, there could be regime shifting because of China's transition and its implications for international business (Child and Tse 2001), and the evolving economic and political role of China in the world. Ignoring structural shifts or instability may yield misleading results. The dynamic approach allows us to overcome parameter nonconstancy and avoid pretesting bias.

Given the long time period and a wide range of countries, we find that sovereign risk transmissions are time varying and rather complex. Specifically, we observe some interesting patterns. First, China's CDS spreads have stronger contagion effects on both its Asian neighbors and resource suppliers almost over the whole sample period, including South American countries (Chile, Peru, and Brazil), the Middle East countries (Qatar, Iraq, United Arab Emirates), and Oceania countries (New Zealand and Australia). It suggests that sovereign risk in China is transmitted to Asian countries due to geographic, economic, and strategic reasons and also from

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[5] The market for CDS contracts increased eight folded since 2004 and the gross market value of CDS notional principals was worth about 12 trillion USD in 2016 according to Bank for International Settlements (2017).
[6] Using a similar measure of sovereign spread, calculated as the difference between the yield on a bond issued by a developing country in US dollars and a US Treasury bond of similar maturity, Bekaert et al. (2014) argue that the variation in the sovereign spreads reflect not only economic and financial risk, but also political risk.

downstream to upstream through the supply chain to countries that exports energy and raw materials to China (oil, coal, copper, aluminum, iron ore, zinc, soybeans, etc.)

Second, competition effects of China on other countries are mainly clustered in 2008 and 2011. For example, China has competition effects on almost all eurozone countries in 2011, and on US in 2005-2006, 2008, and 2011.

Third, in terms of the impact of other countries on China, contagion effects dominate after the 2008 financial crisis, while competition effects largely dominate before the crisis. Exports to foreign countries have driven China's economic growth. However, after the global recession in 2008, US imports from China declined significantly, followed by the Eurozone countries during the 2010-2011 Sovereign Debt Crisis. China was affected by considerably more episodes of contagion effects than competition effects since 2008, showing that China is hurt by slowing economic growth and thereby lower demand for China's exports by countries in North America and Europe. Notably, Asian competitors of China, including Japan, Singapore, and Thailand, have strong competition effects on China after the crisis.

Fourth, significant Granger-causality relationships are clustered in several sub-periods with higher sovereign risk and market volatility. These sub-periods correspond to higher financial and economic risk and greater market volatility in China or around the world, indicating that our findings are not statistical artifacts but related to real economic changes. During the 2008 financial crisis and 2011 European sovereign debt crisis, we find that Chinese sovereign risk is subject to contagion effects from many countries, and in the reverse direction, China has significant contagion and competition effects on many countries around the world in the crisis periods.

The lead-lag relationships in the sovereign CDS market may only reflect temporal ordering, rather than causality in the real economic sense (Granger & Newbold, 1977, p. 225). To explore underlying fundamental reasons, we use a Probit model to further support our interpretation of Granger-causality test results. Overall, the regression results confirm that trade linkage, FDI, and international fund flows are important drivers of sovereign contagion and competition effects.

We find that China has a stronger contagion effect on countries with a greater percentage of exports to East Asian countries. Moreover, China is subject to a stronger contagion effect from countries with more imports from China. The above two results combined confirm that sovereign risk spills over along the supply chain from customers (importers) to suppliers (exporters).

FDI and portfolio investment also affect contagion effects and competition effects across countries. China has stronger contagion effects and weaker competition effects for a country if China has more FDI outflows or portfolio investments in the country, reflecting the impact of closer financial account linkages across countries.

Moreover, economic growth, reserves, and country governance are among the major determinants of contagion and competition effects. When China's economic growth is stronger, it is more likely to have stronger contagion effects on other countries and less likely to be affected by competition effect of other countries. Similarly, if a country has a higher level of reserves, it can better stand external shocks from China. If a country has better country governance, it will impose a stronger contagion effect on China.

The main contribution is the exhaustive nature of our study of contagion and competition effects in the sovereign CDS market based on an analysis of an extensive data in a general

framework. There is a vast literature on cross-country linkage. However, earlier studies focus more on developed economies than on emerging economies and on equity markets rather than on credit markets. Recent studies examining spillover effects across sovereign CDS are mostly confined to European countries.[7] Very few studies have been conducted on China's evolving role in its interaction with other countries in terms of sovereign risk. Analyzing the contagion and competition effects has important implications for investors and policymakers to understand global interdependence and risk transfer across countries.

This paper proceeds as follows. Section 2 provides a brief literature review. Section 3 describes data and the empirical methodology. Section 4 reports the empirical results of time-varying bootstrap Granger-causality tests. Section 5 further explores sources of causal links using a Probit model. Section 6 concludes.

2. Related Literature

The current era is characterized by strengthened interactions among financial markets and increased capital mobility globally. Interdependence in financial markets arises because of multiple and complex economic and noneconomic factors. Earlier studies of CDS focus on cross-market interdependence for corporations in CDS, bond, and equity markets (e.g., Forte and Pena, 2009; Fung et al. 2008; Norden and Weber, 2009) and contagion and competition effects across firms and financial institutions (e.g., Jorion and Zhang 2007, 2009; Yang and Zhou, 2013). The relationships among sovereign CDS market, bond market, and equity market within a country have been explored (Eyssell et al. 2013; Fontana and Scheicher, 2016).

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[7] An incomplete list includes Ait-Sahalia et al. (2014), Beirne&Fratzscher (2013), Benzoni et al. (2015), Brutti&Saurffe (2015), and Caporin et al. (2013).

A growing literature on sovereign CDS markets centers on determinants of CDS spreads, in particular, the question of whether sovereign credit spreads are determined by global or country-specific risk factors. The general consensus is that US and European regional factors play a dominant role in determining sovereign CDS spreads. For most of the time prior to the financial crisis, the empirical evidence suggested that global risk factors, particularly US risk factors, were the primary determinants of sovereign credit risk. These risk factors include US financial risk factors, such as changes in the volatility index (VIX) or macroeconomic factors (e.g., Longstaff et al. 2011; Pan &Singleton 2008). In addition, Fender et al. (2012) show that eurozone financial market factors are significant in determining 12 emerging market CDS spreads dynamics during the 2008 financial crisis period.

Market integration in an international context has increased significantly over the years. Economic globalization and financial integration also transfer risk from domestic markets to the international market. It was documented that pairs of countries with stronger international trade linkages tend to have more tightly correlated business cycles (e.g., Frankel and Rose, 1998). Considerable evidence of stock market interdependence exists and becomes important as the degree of economic interaction among countries increases (e.g., Berbenand Jansen, 2005). However, earlier studies focus more on developed countries than emerging economies and more on equity markets than credit markets. A number of studies examine the interdependence relationship among European countries. Doukas (1989) investigates the adjustment of spreads in the syndicated Euro-credit market to shocks in the sovereign borrowers' creditworthiness, and finds contagion effects that noncountry-specific risk factors systematically influence country-specific spreads. Bartram et al. (2007) show that market dependence within the Eurozone increased after the introduction of the common currency only for large equity markets, such as in

France, Germany, Italy, the Netherlands, and Spain. The UK and Sweden, but not other European countries outside the eurozone, exhibit an increase in equity market co-movement. Yang (2005) examines government bond markets in five industrialized countries (the United States, Japan, Germany, UK, and Canada) and shows that no long-run relationship exists during the period 1986–2000. More broadly, Boubaker et al. (2016) assesses the contagion between the US equity market and selected developed and emerging stock markets over the period from 2005 to 2014, providing significant evidence of contagion effects after the global financial crisis.

The 2011 European sovereign debt crisis attracted a lot of attention to spillover effects in sovereign CDS markets, including studies by Ait-Sahalia et al. (2014), Beirne and Fratzscher (2013), Benzoni et al. (2015), Brutti and Saurffe (2015), Caporin et al. (2018), Pragidis et al. (2015). Broto and Perez-Quiros (2015) find that since the onset of the European sovereign debt crisis, contagion has played a non-negligible role in countries on the periphery of Europe, which confirms the existence of significant financial linkage among these economies. Wu et al. (2016) find that sovereign credit risk first spreads rapidly within regions, then builds up globally via protracted risk spillovers. Risk spillovers are determined by global and regional risk factors.

As emerging economies are more deeply integrated with the global economy, it is more likely that financial shocks in emerging economies can have reverse spillover effects on other emerging and even advanced economies. Boyrie and Pavlova (2016) examine the interactions in sovereign CDS markets in the BRICS and MIST (Mexico, Indonesia, South Korea, and Turkey) countries for the period 2010–2014. They find significant spillover effects in these two groups of emerging markets. They show that global financial market factors are important drivers of BRICS and MIST sovereign CDS spread variability and the European debt crisis showing significant influence on emerging markets sovereign spreads. Brazil and Mexico contribute the

largest net directional spillover on the other emerging markets. Kang and Suh (2015) find that emerging market financial instability in 2013-2014 reduces portfolio fund flows to advanced economies and increases their sovereign CDS premia, indicating a significant increase in the influence of emerging markets in the global financial network.

Taking a broader view, Wang and Moore (2012) use a dynamic conditional correlation from a multivariate GARCH model to examine correlation between 38 emerging and developed sovereign CDS markets during the 2008 financial crisis. They find stronger integration after the collapse of Lehman Brothers in 2008, in particular, for developed markets. For both developed and emerging markets, declining US interest rates are found to be the main driving factor behind the higher level of correlation, suggesting that the CDS markets were heavily driven by the world's largest economy when the crisis reached its peak. Different from their study, we examine intertemporal relationships rather than contemporary relationships.

Although China has become the second-largest economy in the world, few studies examine the presence and dynamics of linkage between China's sovereign risk and that of other countries. Child and Tse (2001) study the institutional change as the central and most consequential contextual aspect of China's transition, and the relevance of key characteristics of China's emergent institutions for international business practice. Our sample period, spanning several crises, allows us to discover time variations in China's sovereign risk and cross-country linkages. Moreover, earlier studies mostly focus on negative spillover effects (contagion effects). We contribute to the literature by assessing both contagion and competition effects and transmission of sovereign risk via cross-country linkages.

3. Data and Empirical Methods

3.1. Sovereign CDS Data

Sovereign credit default swap (CDS) is the most popular derivative security for managing sovereign debt exposure. A sovereign CDS is an OTC contract that offers insurance against sovereign default. The protection buyer pays a fixed premium, called the CDS spread, to the seller until the time of the credit event or until the maturity date of the CDS, whichever is first. If the credit event occurs prior to maturity, the protection seller pays compensation to the protection buyer. By design, the CDS spread is an ideal measure of probability of sovereign default, or more broadly, the country's financial stability. The sovereign CDS market is often more liquid than the corresponding sovereign bond market (Longstaff et al., 2011).

Our sovereign CDS spread data comes from the MarkIt Group, which provides comprehensive coverage for corporate, financial, and sovereign reference entities around the world. This database is widely used for research on CDSs. Because CDSs are over-the-counter contracts, their maturities are negotiable; they range from a few months to 10 years or more, although five years is the most common horizon. In this paper, we use only five-year spreads because these contracts are the most liquid and constitute over 85% of the CDS market. To maintain uniformity in contracts, we only keep CDS quotations for senior unsecured debt with a modified restructuring (MR) clause. For each day, reference entities in our dataset could have several CDS spread quotations, denominated in different major currencies, for example, USD, EUR, JPY, and GBP. Because the quotation in USD usually has the longest history, to maintain the uniformity and time-series consistency of data, we filter the data based on whether the currency is USD.

We use monthly data from 2001 to 2014. The monthly data should reflect the main trend and change in sovereign risk while avoiding noise and inactivity in daily data.[8] Our sample

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[8] The daily sovereign CDS data at daily frequency are less active.

contains 54 countries, including ten countries in Asia, 12 countries in the eurozone, 13 non-eurozone European countries, three countries in North America, four countries in Central America and the Caribbean, four countries in South America, six countries in the Middle East, and two countries in Oceania.

Table 1 presents summary statistics of sovereign CDS spreads for our sample countries and number of monthly observations. The mean value of CDS spreads in China is 63 basis points (bps), ranging from 9.9 bps to 231.5bps. The wide variation in China's CDS spreads enables us to examine the sovereign risk transmission originated from China. The mean of Ukraine's CDS spread is the highest (871.5bps), while the mean of Norway's CDS spread is the lowest (14.3bps). CDS spreads across countries vary widely, with much wider CDS spreads in emerging markets than in developed economies. Specific countries also have wide time-series variation, given that our sample spans several crisis periods between 2001 and 2014.

Figure 1 plots examples of sovereign CDS spreads. Several observations are noteworthy. First, most countries experienced spikes in sovereign CDS spreads during the 2008 global crisis and the 2011 European sovereign debt crisis. Second, the jumps in CDS spreads during the 2011 crisis are greater than those in the 2008 crisis in eurozone countries, while it is the opposite for most other countries. Non-eurozone European countries were less affected by the 2011 crisis. Third, emerging economies in North and South America also saw higher CDS spreads in the 2002-2003 period (e.g., Mexico, Chile, Brazil), likely due to the debt crisis in Argentina.

To test for stationarity in the time series of CDS spreads, we conduct a unit-root analysis using an augmented Dickey-Fuller (ADF) test for each country. The lag length is selected using the Akaike information criterion (AIC). The results of unit-root tests for all countries are available upon request. The ADF test rejects the null hypothesis of non-stationarity for Vietnam,

Dominica, Chile, Brazil, Lebanon, Sweden, and Mexico. CDS spreads in these countries are stationary in their levels, that is, I(0). For China and all other countries, ADF test statistics show that CDS spreads are stationary in the first difference, that is, I(1). So, we employ a VAR in first-differences for CDS spreads.

3.2. Empirical Methods

In this paper, we employ Granger-causality tests and apply them to a bivariate VAR model to find the causal relationship in the sovereign CDS spreads between China and other countries. The test statistics used in our Granger-causality tests are the likelihood ratios. We use the residual-based (RB) bootstrap technique in Balcilaret al., (2010), which is robust to small sample size and pretesting bias. The excellent performance of the RB method over standard asymptotic tests has been confirmed in a number of Monte Carlo simulation studies (Hacker and Hatemi-J, 2006; Mantalos, 2000; Mantalos and Shukur, 1998; Shukur and Mantalos, 2000). Particularly, Shukur and Mantalos (2000) show that the RB-based modified-LR test exhibit relatively better power and size properties, even in small samples. Hence, we carry out the RB-based modified-LR statistic to examine causality between CDS spreads in China-country pairs.

In order to demonstrate the RB-based modified-LR causality test, we consider the bivariate VAR (p) process as follows:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \phi_{10} \\ \phi_{20} \end{bmatrix} + \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (1)$$

where y_{1t} and y_{2t} indicate the sovereign CDS spreads of China and the other country, respectively.

$\phi_{ij}(L) = \sum_{k=1}^{p+1} \phi_{ij,k} L^k$, $i, j = 1,2$ and L is the lag operator defined as $L^k x_t = x_{t-k}$. $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$ is a white

noise process with zero mean and covariance matrix Σ. The optimal lag length p is determined by the Schwarz information criterion (SIC).

Based on Eq. (1), the null hypothesis that China's CDS does not Granger cause the other country's CDS is tested for the full sample by imposing the restriction, $\phi_{21,k} = \mathbf{O}$ for $k = 1,2,....., p$. Similarly, the null hypothesis that a country's CDS does not Granger cause China's CDS is tested by imposing the restriction, $\phi_{12,k} = \mathbf{O}$ for $k = 1,2,....., p$. The causality tests in this paper relied upon RB-based *p*-values and modified-LR statistics. If the first null hypothesis, $\phi_{21,k} = \mathbf{O}$ for $k = 1,2,....., p$, is rejected, then there is a significant causality running from China's CDS to the other country's CDS. This means that China's sovereign risk can predict the other country's sovereign risk. Similarly, if the second null hypothesis, $\phi_{12,k} = \mathbf{O}$ for $k = 1,2,....., p$ is rejected, then the other country's CDS leads China's CDS.

Because China's inter-linkage with the rest of the world has evolved over our sample period, we expect to find time-varying causal links between two CDS spread series over subperiods. One may split samples and use dummy variables in the estimation to identify structural breaks. However, this technique imposes a disadvantage of pretesting bias because of the arbitrary choice of structural breakpoints. In order to overcome this bias, we rely on the bootstrap rolling-window estimation. The rolling-window technique is based on fixed-size subsamples rolling sequentially from the beginning to the end of the full sample.[9] The VAR model and the bootstrap causality tests are applied for each subsample. This procedure allows the system to accommodate the subsample instability issue in a convenient way (Balcilaret al., 2010).

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[9]For technical details of the bootstrap test, see Balcilar et al. (2010), appendix.

Specifically, given a fixed-size rolling window including l observations, the full sample is converted to a sequence of $T-l$ subsamples, that is, $\tau-l+1$, $\tau-l$, ..., T for $\tau= l, l+1, ..., T$. The RB-based modified-LR causality test is then applied to each subsample. The causality in CDS spreads across countries is identified by calculating the bootstrap p-values of LR-statistic rolling through T-l subsamples. Moreover, the magnitude of the effect is also measured in this study. The impact of China's CDS spreads on CDS spreads in other countries is defined as the average of the entire bootstrap estimates deriving from the formula $N_b^{-1}\sum_{k-1}^{p}\hat{\phi}_{21,k}^{*}$, with N_b representing the number of bootstrap repetitions; similarly, the impact of CDS spreads in other countries on China's CDS spread is obtained from the formula $N_b^{-1}\sum_{k-1}^{p}\hat{\phi}_{12,k}^{*}$. Both $\hat{\phi}_{12,k}^{*}$ and $\hat{\phi}_{21,k}^{*}$ are bootstrap estimates from the VAR models in Eq.(1). We also calculate the 90 percent confidence intervals, where the lower and upper limits equal the 5th and 95th quantiles of each of the $\hat{\phi}_{12,k}^{*}$ and $\hat{\phi}_{21,k}^{*}$ respectively (Balcilar et al., 2010).

In this study, we choose a window size l of 24 months. Small intervals provide a more detailed transition in the presence of multiple structural changes because it maximizes the total number of rolling regressions. However, a larger window size with a higher degree of freedom may improve the precision of parameter estimates. Based on their Monte Carlo simulations, Pesaran and Timmerman (2005) show that the bias in autoregressive (AR) parameters is minimized with a window size as low as 20 when there are frequent breaks. The issue of estimate accuracy is addressed by the bootstrap technique employed in the rolling estimation.

4. Results

4.1. Full Sample Causality Relationships

We start by conducting Granger causality tests in the VAR framework for the full sample period. Results in Table 2 show that we can reject the null hypothesis that China's CDS spread does not Granger cause that of the other country for 20 economies (Hong Kong, Japan, Philippines, Singapore, Thailand, Mexico, Dominica, Jamaica, Chile, Panama, Peru, United Arab Emirates, Israel, Iraq, Qatar, Bulgaria, Romania, Ukraine, Australia, and New Zealand). As expected, China has spillover effects on most Asian countries and resource suppliers in North and South America, the Middle East, and Oceania. Conversely, we can reject the null hypothesis that an economy's CDS spread does not Granger cause China's CDS spreads for 17 countries (Hong Kong, Japan, Thailand, Belgium, Finland, France, Germany, Ireland, Italy, Portugal, Slovakia, Croatia, Czech Republic, Poland, Russia, Australia, and New Zealand). Therefore, 8 out of 12 European countries in our sample have spillover effects on China. Significant causality relationships are justified by the fact that these economies are among China's top trading partners.

The full sample results confirm intricate cross-country causal links. However, the full sample analysis hides the evolving nature of the cross-country relationships during the past two decades, which experienced ever-increasing interdependence and competition. Moreover, we suspect that causality relationships of sovereign risk exist between China and some countries for certain periods but not the full sample. Therefore, we use the bootstrapped rolling-window approach to identify subperiods when significant causal effects exist.

4.2. Examples of Subsample Causality Relationships

We conduct the bootstrapped rolling-window estimation for Chinese sovereign CDS spreads with the CDS spreads of the other 53 countries in the sample. Figure 2 illustrates

selected examples in which significant causality relationships in subperiods are discovered. We choose two representative countries for illustration purposes (the United States and Japan). The bootstrap p-values and the magnitude of the effect are plotted in Figures 2-1 to 2-6, respectively. Panels (a-1) and (b-1) in these figures show the bootstrap p-values. The null hypothesis that $y1$ (China CDS spread) does not cause $y2$ is rejected when the p-values are below the horizontal red line showing a less than 10% significance level.

Panels (a-1) and (b-1) in Figure 2-1 show the causality relationships from China to the United States and from the United States to China, respectively. We identify the period as having a significant causality relationship if the p-value is lower than 10%. Panels (a-2) and (b-2) show the signs and magnitudes of the causality relationships from China to the United States and from the United States to China, respectively. Figure 2-1 shows that the null hypothesis of China's CDS does not Granger-cause CDS of the United States is rejected at the 10% significance level during the periods December 2005–May 2006, February 2008, and April–July 2011. The impact is negative, suggesting that the competition effect dominates from China to the United States during these periods. China has significant contagion effects (positive sign) on the United States only during June–August 2008. In the reverse direction, the null hypothesis of CDS of the United States does not Granger-cause China's CDS is rejected for the periods November 2006– June 2007, January–March 2008, and January–July 2011. The impact is positive, indicating a contagion effect from the United States to China in these periods.

In the case of China/Japan, China's impact on Japan is positive and significant in June– October 2006, December 2006–February 2007, July–September 2007, December 2007, and May–December 2008, suggesting contagion effects during these periods. The reverse impact from Japan to China is positive and significant in November 2007–March 2008, when the

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contagion effect dominates, and negative and significant in October–November 2008, April

2009–March 2011, and May–July2012, when the competition effect dominates. Evidently, there

are complex and time-varying relationships between China and other countries.

4.3. Causality Relationship between China and Other Countries

To uncover the pattern of contagion and competition effects while saving space, we

summarize our main findings on significant causality relationships between China and other

countries in Table 3.[10] Panels A and B show contagion effects and competition effects,

respectively. Several observations are noteworthy. First, we observe substantially more

observations of contagion effects than competition effects. Contagion effects are relatively weak

before the subprime loan crisis, reflecting China's limited influence during the earlier period.

China's contagion effects became stronger after the subprime loan crisis. This trend shows

escalating influence of China's sovereign risk on the world over the sample period. Growth in

China slowed markedly after 2013, casting a shadow over prospects for the global economy.

This could explain strong ripple effects over a wide range of countries during the 2013-2014

period.

Second, China has contagion effects on many Asian neighboring economies, including

Hong Kong, Thailand, Singapore, Indonesia, and the Philippines. This can be attributed not only

to economic and trade linkage but also political and military factors. In addition, China has

contagion effects on many resource-supplying countries in the Middle East (Iraq, United Arab

Emirates, and Qatar), Oceania (New Zealand and Australia), and South America (Chile and

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[10] All detailed results as reported in Figure 2 are available from the authors upon request.

Peru) over the sample period. This is consistent with the notion that risk from China (as customers) is transmitted to these countries (as resource suppliers) along the supply chain.

China rose from an insignificant market to account for more than half the global demand in some commodities. China consumes a great deal of raw materials, such as copper, iron ore, aluminum, zinc, coal, and oil. China's oil imports account for about 14.4% of the world total, imports of iron account for 57.7%, copper ore for 31%, and soybeans for 57.7% in 2016. The main countries exporting oil to China include Russia and countries in the Middle East. Australia and Brazil are major exporters of iron to China. Copper is imported mainly from Chile and Peru. The United States and Brazil are major exporters of soybeans. China's consumption of commodities and raw materials is very important to countries with abundant natural resources.

Because it had a country-wide economic slowdown, China initiated economic structural reforms away from export production and infrastructure buildup in 2013 and is now focusing more on boosting internal consumption. These reforms negatively affect resource-supplying countries because of a reduction in the derived demand for their output. As expected, we observe many cases of contagion effects from China to other countries, particularly on resource-supplying countries in 2013 and 2014. This suggests that sovereign risk captured by CDS spreads spills over from customers to suppliers along the supply chain. This finding is consistent with Hertzel et al. (2008), Chen et al. (2016) and Huang and Kim (2019) that spillover effects occur more frequently from customers to suppliers rather than the other way around.

In addition to trade, FDI and lending are among other channels that could transmit sovereign risk. For example, South American countries are a highly desirable investment destination for China. Chinese banks have provided loans toward infrastructure in South American countries. China also leads in the world in mergers and acquisitions in the region.

Chinese investment in Asia and Oceania has risen steadily from \$5.68 billion in 2005 to \$38.01 billion in 2017. Australia has been the second largest recipient country of Chinese FDI after US. China's need for energy fuels outbound Chinese energy FDI, concentrated in Southeast Asia and Middle East region. One example is CNPC's 2009 deal to service the Rumaila oil field in Iraq for \$5.59 billion. [11]

An increase in sovereign risk in China, which may lead to a decline in China's imports, outward FDI, lending or M&A activities, will negatively affect sovereign risk of these countries. This can explain why China has predominantly contagion effects on the sovereign risk of the resource-abundant countries over almost the entire sample period.

Third, Panel B shows that competition effects are clustered during the 2008 financial crisis and the 2011 European sovereign debt crisis. For example, during the 2011 European sovereign debt crisis, competition effects from China dominate in 11 eurozone countries, four other European countries, four Asian countries, four North American countries, two South American countries, and two Middle Eastern countries. Specifically, we find that China has competition effects on the United States in during the two recent crises. Competition effects imply that China's sovereign risk is inversely related to sovereign risk of other countries in the subsequent period. The competition effects may arise from shifting of goods and services flow across export-competing and/or FDI-competing countries, or portfolio rebalancing across countries. Our results suggest that China remains a country that could help reduce portfolio risk and achieve global diversification effect during the crisis periods.

4.4. Causality Relationship between Other Countries and China

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[11] Does China dominate global investment? Source: https://chinapower.csis.org/china-foreign-direct-investment/

Table 4 summarizes countries and time periods of significant contagion and competition effects when information flows from other countries to China. Panel A (B) shows the countries that have contagion (competition) effects on China. These panels indicate the following interesting findings.

First, no cases of contagion effects occur from other countries to China in 2004 and 2005 and there are very few cases in 2006 and 2007 (Panel A). A clustering of contagion effects is largely found during the 2008 global financial crisis and 2011 European sovereign debt crisis. For example, in 2008-2009, many economies have contagion effects on China, including ten eurozone countries, eight non-eurozone countries, the United States, Mexico, Hong Kong, and Japan. China has multiple bilateral and multilateral free trade agreements. The European Union is China's largest trading partner, followed by the United States, member countries in the Association of Southeast Asian Nations (ASEAN) (including Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Cambodia, Lao and Myanmar), Hong Kong, and Japan. Contagion effects of the United States on China due to greater uncertainty about growth prospects and declining demand for Chinese exports are felt during the subprime crisis period (2006-2008) and the European sovereign debt crisis (2011). Similarly, when European sovereign risk was high during the 2011 crisis, China suffered contagion effects from many European countries. In 2011, 11 eurozone countries and seven non-eurozone European countries have negative spillover effects on China. Contagion effects since 2008 likely reflect that China's export-oriented economy and investment activities are hurt by lower demand from these countries.

Second, competition effects from other countries to China are clustered in 2004 and 2005. A dominating competition effect implies that a higher degree of sovereign risk in these

countries leads to lower risk in China. One possible explanation is trade and FDI substitution. China was an export-oriented emerging economy. Higher risk in other countries could benefit China if China is perceived as a more attractive trade and FDI destination. Another channel could be international portfolio rebalancing. Investors who perceive higher risk in one country will move their funds to other countries. Very few cases of competition effects from other countries occur after 2008, with the exception of Asian countries that are strong competitors with China, that is, Japan, Singapore, Thailand, and South Korea. The sovereign risk of these countries inversely affect China's risk.

5. Exploring Sources of Causal Links Using the Probit Model

After identifying the time and direction of significant causality relationships, we explore the possible reasons for the causality relationship between China and other countries. China's impact on other countries could spread through the impacts for exporters, multinational corporations, bond and equity investors, and so on. We use the following Probit model to further investigate the determinants of contagion and competition effects.

$$Significance\_Dummy = \alpha + \sum \gamma_i (Characteristics\_China_i) + \sum \gamma_j (Characteristics\_OtherCountry_j) + \sum \gamma_k (GlobalFactors_k) + \varepsilon$$

The dependent variable is a dummy variable that equals 1 if a significant relationship is detected during a period. The independent variables include cross-country linkages in trade and investments as well as China and the corresponding country's characteristics. Specifically, we consider the linkages between China and a specific country in terms of exports and imports and FDI inflows and outflows, as well as China's portfolio investment inflow and outflow, and GDP growth. In addition, we consider the corresponding country's characteristics including GDP growth, inflation, equity index change, sovereign rating, reserves, and importantly, exports to

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and imports from East Asia countries, which include China. Following the seminar paper of La Porta, Lopez-de-Silanes, Shleifer, & Vishny (1997, 1998), Globerman and Shapiro (2003), and Cumming et al. (2017) that highlight the importance of country-level legal and regulatory institutions in finance and international business such as FDI, we control for an aggregated country governance index[12]. Longstaff et al. (2011) find that global factors are major determinants of sovereign CDS spreads. Bekaert et al. (2014) decompose sovereign spreads to local economic/financial and political risks and global factors. Therefore, we also include global risk factors (VIX), and the 2008 crisis dummy and the 2011 crisis dummy in our model.

Table 5 reports the results of the Probit regression models. Panel A shows the drivers of China's contagion effects on other countries. We find that higher GDP growth in China, more FDI outflows from China to Country i, and more portfolio investment lead to stronger contagion effect on other countries. Importantly, China has a stronger contagion effect on a country with a higher percentage of exports to East Asia (including China). A closer look reveals that the countries with a higher percentage of exports to East Asia mainly include Asian countries and resource providing countries. For example, economies with the percentage of exports to East Asia greater than 20% in 2014 include Hong Kong, Singapore, Australia, South Korea, Thailand, Japan, New Zealand, Chile, Malaysia, Iraq, Indonesia, Brazil, Philippines and Peru. These countries are indeed shown in Panel A of Table 3 as major countries that are subject to China's contagion effects. In other words, if China is a country's main export destination (customer), greater sovereign risk in China is likely to spill over to that country. This is consistent with our expectation that risk spills over along the supply chain upstream from customers to suppliers.

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[12] The country governance index is obtained by averaging six dimensions of governance, including voice and accountability, political stability and the absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.

Furthermore, the corresponding country is less likely to suffer a contagion effect from China if it has greater reserves, which helps the country to buffer the external shocks.

Panel B reports the Probit regression results for China's competition effects on other countries. China has weaker competition effects on other countries when China has a higher portfolio investment outflow. Country i is less likely to benefit from competition effects from China if the country has a greater percentage of exports to East Asian countries or has a higher equity index change. China has stronger competition effects when the global risk indicator (VIX) is higher. This confirms our earlier observation that competition effect is clustered.

Next, we assess the determinants of contagion and competition effect from other countries on China. As shown in Panel C, China is subject to stronger contagion effects from a country if China has more exports to that country. This is consistent with our observation in Table 4 (Panel A) that Eurozone countries have significant contagion effects on China. If the corresponding country has a greater percentage of exports to East Asian countries, China is less likely to suffer contagion effects from that country. The results further confirm our expectation that sovereign risk spills over from the downstream customers to upstream suppliers, but not the other way around. China suffers from greater contagion effects if the country has better country governance, which is generally developed countries. When the VIX is higher, contagion effect from other countries are stronger.

Finally, Panel D reports the results for competition effects of other countries on China. When China has a higher GDP growth rate or more fund flows, China is less likely to be subject to competition effect. When a country has a higher percentage of exports to East Asia, it has stronger competition effects on China. As we discussed earlier, these countries are mainly Asian countries and resource providing countries. China shares many similar characteristics as other

Asian countries, resulting in stronger competition effects. Countries with higher GDP growth in the past decade, which are mostly developing economies, have weaker competition effects on China. In addition, competition effects on China are weaker when the VIX is higher. This is in line with our observation in Table 4 (Panel B) that competition effects on China are clustered before the financial crisis.

Overall, our results suggest that trade linkage, FDI and international fund flows are important drivers of contagion and competition effects. Significant relationships are frequently revealed along the supply chain and via the fund flow channel. China's GDP growth, and the corresponding country's GDP growth, country governance and reserves also play an important role.

6. Conclusion

Global integration, cooperation, and competition have become increasingly important over the past several decades. We aim to shed light on transmission of sovereign risk via economic linkages using China as the anchor country. Due to its special role in the global value chain and the wide variation of its sovereign risk, China provides a fertile ground for testing global contagion and competition effects arising from shocks in China's sovereign risk.

Our study is based on a dynamic approach to capture any possible time-varying relationships. We find complex but interesting patterns both time-wise and cross-sectionally in sovereign risk diffusion between China and other countries. China's sovereign risk has contagion effects on many neighboring Asian countries and on countries in South America, the Middle East, and Oceania that are important resource suppliers. Therefore, sovereign risk in China is transmitted not only due to geographic proximity but also to more distant countries that have

close trade, FDI and financial linkages with China. Competition effects from China are mainly clustered during the 2008 financial crisis and the 2011 European sovereign debt crisis. Identifying competition effects during the crisis can benefit investors who could partially hedge against the crises that affect countries to varying degrees.

In the reverse direction (the impact of other countries on China), we find a shift from earlier dominating competition effects before the 2008 financial crisis to contagion effects after the crisis. Our results demonstrate that significant spillover effect is greater during periods of global economic instability and financial market crisis. China is subject to strong competition effects from major neighboring Asian countries for almost the whole period because they have many similarities.

Moreover, we explore the reasons for sovereign risk spillover effects from the perspectives of global trade, FDI, and portfolio investment. The Probit regression results provide further support for our findings that China has strong contagion effects on its exporters, while countries in Europe and the United States, as the major importers of Chinese goods and services, have strong contagion effects on China. Both are consistent with our expectation that risk spillovers occur along the supply chain from downstream (customers) to upstream (suppliers) even at the country level.

In addition, FDI and portfolio investment are determinants of contagion and competition effects. Contagion effects are stronger while competition effects are weaker if China has more FDI or portfolio investments. We also find that economic growth, reserves, and country governance also affect contagion and competition effects.

Since 2013 China's economy has slowed down from its earlier high levels of growth. Policymakers started to push for economic restructuring and more sustainable growth as China's

low-cost labor edge erodes. As China shifts from an export-led economy to one focused on consumer spending, risk will shift across countries and sectors. Investors need to pay more attention to China's ability to restructure and strengthen its economy internally, and to cope with trade and investment tension with US. Overall, better understanding of intricate cross-country linkages and sovereign risk transmission patterns is important for traders, regulators, and policymakers.

Reference

Ait-Sahalia, Y, R.J. Laeven, and L. Pelizzon (2014). Mutual excitation in eurozone sovereign CDS. *Journal of Econometrics* 183:151-167.

Anneart, J., De Ceuster, M., Van Roy, P and Vespro, C. (2013). What Determines Euro Area Bank CDS Spreads. *Journal of International Money and Finance*. Vol. 32, p. 444-461.

Balcilar, M., Ozdemir, Z.A. and Arslanturk, Y. (2010). Economic growth and energyconsumption causal nexus viewed through a bootstrap rolling window. *Energy Economics,* 32:1398-1410.

Bank for International Settlements. (2017). "BIS Quarterly Review". Available at: http://www.bis.org/publ/qtrpdf/r_qt1703.pdf

Bartram, S.M., S.J. Taylor, and Y. H. Wang (2007). The Euro and European financial market dependence. *Journal of Banking & Finance* 31.5: 1461-1481.

Beirne J, and M. Fratzscher(2013). The pricing of sovereign risk and contagion during the European sovereign debt crisis. *Journal of International Money and Finance* 34:60-82.

Bekaert, G., Harvey, CR., Lundblad, CT. and Siegel, S. (2014). Political Risk Spreads. *Journal of International Business Studies*. Vol. 45, p. 471-493.

Benzoni L, Collin-Dufresne P, Goldstein R.S, Helwege J. (2015). Modeling credit contagion via the updating of fragile beliefs. *Review of Financial Studies* 28:1960-2008.

Berben, R.P., and W. J. Jansen (2005). Comovement in international equity markets: A sectoral view. *Journal of International Money and Finance* 24.5: 832-857.

Boubaker S, Jouini J, Lahiani A. (2016). Financial contagion between the US and selected developed and emerging countries: The case of the subprime crisis. *The Quarterly Review of Economics and Finance*, 14-28.

Boyrie, Maria E., and Ivelina Pavlova (2016). Dynamic interdependence of sovereign credit default swaps in BRICS and MIST countries. *Applied Economics* 48.7: 563-575.

Broto, Carmen, and Gabriel Perez-Quiros (2015). Disentangling contagion among sovereign CDS spreads during the European debt crisis. *Journal of Empirical Finance* 32: 165-179.

Brutti F and P. Saurffe(2015). Transmission of sovereign risk in the euro crisis. Journal of International Economics, *Journal of International Economics* 97.2: 231-248.

Caporin M, Pelizzon L, Ravazzolo F, Rigobon R. (2018). Measuring sovereign contagion in Europe. *Journal of Financial Stability*, 34, 150-181.

Chen, Long, Gaiyan Zhang and Weina Zhang (2016), Return predictability in the corporate bond market along the supply chain, *Journal of Financial Markets*, 29(June), 66-86.

Child, J. and Tse, D.K. (2001). China's Transition and its Implications for International Business. *Journal of International Business Studies* 32(1), 5-21.

Cumming, D., Filatotchev, I., Knill, A., Reeb, D.M., and Senbet, L. (2017). Law, finance, and the international mobility of corporate governance, *Journal of International Business Studies* 48: 123-147.

Doukas, J. (1989). Syndicated Euro-Credit Sovereign Risk Assessments, Market Efficiency and Contagion Effects. *Journal of International Business Studies*, 20(2), 255-267.

Eyssell, Tom, Hung-gay Fung and Gaiyan Zhang (2013). Determinants and Price Discovery of China Sovereign Credit Default Swaps. *China Economic Review*, Vol. 24, March:1-15.

Fender, I., Hayo, B., & Neuenkirch, M. (2012). Daily pricing of emerging market sovereign CDS before and during the global financial crisis. *Journal of Banking & Finance*, 36(10):2786-2794.

Fontana, A., and M. Scheicher (2016). An analysis of euro area sovereign CDS and their relation with government bonds. *Journal of Banking & Finance* 62, January:126–140.

Forte, S., and J.I. Pena (2009). Credit spreads: An empirical analysis on the informational content of stocks, bonds, and CDS. *Journal of Banking & Finance* 33.11: 2013-2025.

Frankel, J. A. and A. K. Rose (1998). The Endogeneity of the Optimum Currency Area Criteria, *The Economic Journal*, Vol. 108, No. 449 (Jul., 1998), pp. 1009-1025.

Fung, Hung-gay, Greg, Sierra, Jot Yau and Gaiyan Zhang (2008). Are the U.S. Stock Market and Credit Default Swap Market Related? Evidence from the CDX Indices. *Journal of Alternative Investment*, Summer: 43-61.

Globerman, S. & Shapiro, D. (2003). Governance infrastructure and US foreign direct investment, *Journal of International Business Studies*, 34(1), 19-39.

Granger, C. W. J., & Newbold, P. (1977). Forecasting economic time series. Academic Press.

Hacker, R. S., Hatemi-J, A. (2006). Tests for causality between integrated variables based on asymptotic and bootstrap distributions: theory and application. *Applied Economics*, 38: 1489-1500.

Hertzel, Michael G., Zhi Li, Micah S. Officer, and Kimberly J. Rodgers, 2008. Inter-firm linkages and the wealth effects of financial distress along the supply chain. *Journal of Financial Economics* 87, 374-387.

Huang, Q. and Kim, R., (2019), Capital structure decisions along the supply chain: Evidence from import competition. *Journal of International Business Studies,* https://doi.org/10.1057/s41267-019-00225-9

Jorion, Philippe and Gaiyan Zhang (2007). Good and Bad Credit Contagion: Evidence from Credit Default Swaps. *Journal of Financial Economics*, June, 84(3):860-883.

Jorion, Philippe and Gaiyan Zhang (2009).Credit Contagion from Counterparty Risk. *Journal of Finance*, Vol. 64 (October): 2053-2087.

Kang, Hyunju, and Hyunduk Suh(2015). Reverse spillover: Evidence during emerging market financial turmoil in 2013–2014. *Journal of International Financial Markets, Institutions and Money* 38: 97-115.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. 1997. Legal determinants of external finance. *Journal of Finance*, 52, 1131–1150.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. 1998. Law and finance. *Journal of Political Economy*, 106, 1115–1155.

Longstaff, F. A., Pan, J., Pedersen, L. H., and Singleton, K. J. (2011). How Sovereign Is Sovereign Credit Risk? *American Economic Journal: Macroeconomics*, 3(2): 75-103.

Mantalos, P., Shukur, G. (1998). Size and power of the error correction model cointegration test: A bootstrap approach. *Oxford Bulletin of Economics and Statistics*, 60: 249–255.

Mantalos, P. (2000). A graphical investigation of the size and power of the Granger-causalitytests in integrated-cointegrated VAR systems. *Studies in Non-linear Dynamics and Econometrics*, 4:17–33.

Norden, L., and M. Weber (2009). The comovement of credit default swap, bond and stock markets: An empirical analysis. *European financial management* 15.3: 529-562.

Pan, J., and K. J. Singleton (2008). Default and recovery implicit in the term structure of sovereign CDS spreads. *The Journal of Finance*, 63(5):2345-2384.

Pesaran, M. H., Timmermann, A. (2005). Small sample properties of forecasts from autoregressive models under structural breaks. *Journal of Econometrics*, 129: 183-217.

Pragidis, I. C., et al. (2015).Contagion effects during financial crisis: Evidence from the Greek sovereign bonds market. *Journal of Financial Stability* 18: 127-138.

Wang, P., and T. Moore (2012). The integration of the credit default swap markets during the US subprime crisis: Dynamic correlation analysis. *Journal of International Financial Markets, Institutions and Money* 22.1: 1-15.

Witt, M.A. (2019), De-globalization: Theories, predictions, and opportunities for international business research, *Journal of International Business Studies*, https://doi.org/10.1057/s41267-019-00219-7.

Yang, J. (2005). International bond market linkages: a structural VAR analysis. *Journal of International Financial Markets, Institutions and Money* 15.1: 39-54.

Yang, J., and Y. Zhou (2013). Credit Risk Spillovers among Financial Institutions around the Global Credit Crisis: Firm-Level Evidence, *Management Science*, 59.10: 2343-2359.

Wu, E., M. Erdem, E., Kalotychou, and E. Remolona (2016). The anatomy of sovereign risk contagion, *Journal of International Money and Finance*, 69: 264-286.

Figure 1: Plots of sovereign CDS spreads in selected economies (China, U.S., Canada, Japan, Thailand, Germany, France, Italy, no south America country)
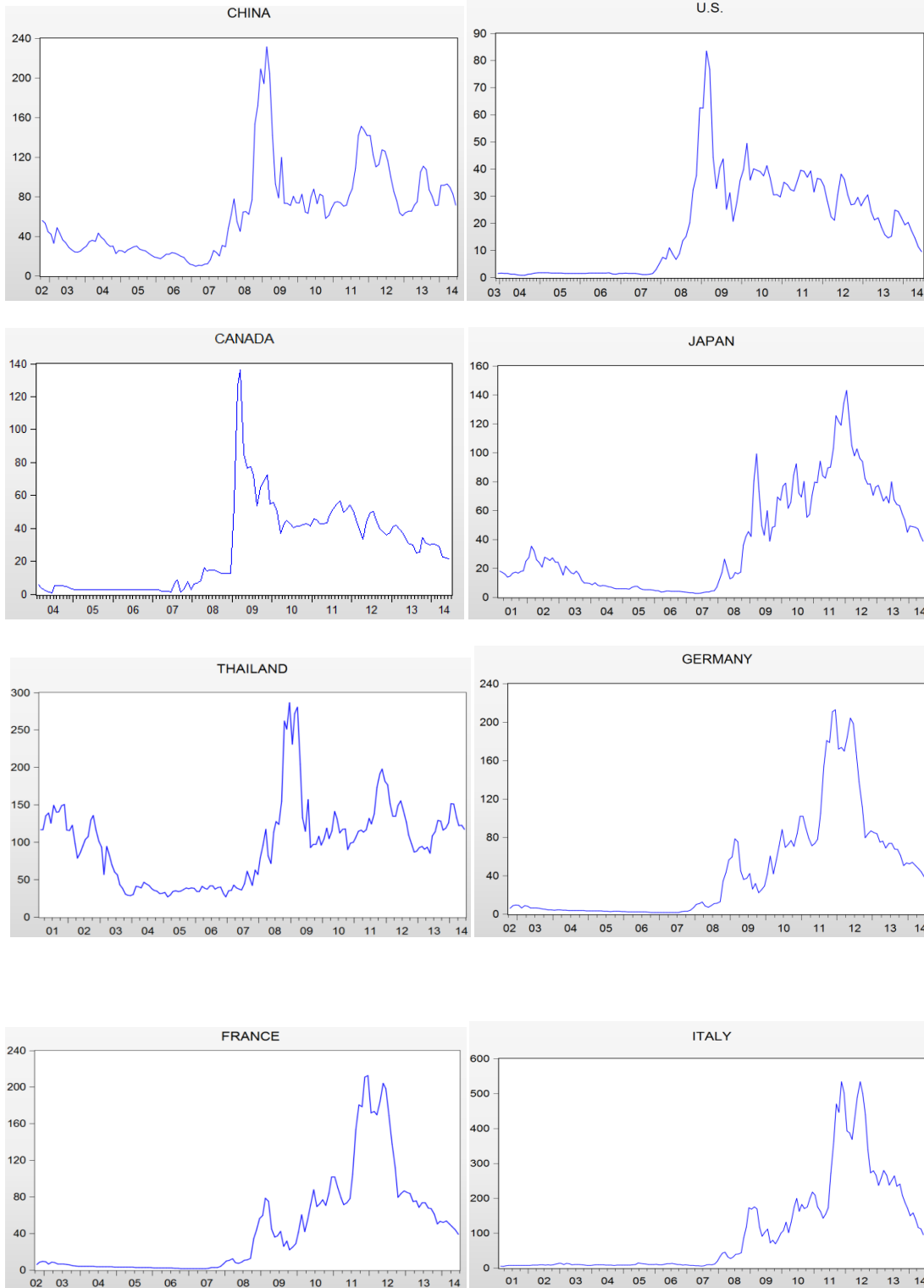
Figure 2: Causality relationship between China and U.S. and between China and Japan.

We plot dynamic causality relationships using the bootstrap Granger causality test with fixed size rolling subsamples in the bivariate VAR framework. The year is plotted on the *x*-axis, and the bootstrapped p-values on the *y*-axis. Panels (a-1) and (b-1) show the causality relationships from China to other countries and from other countries to China, respectively. The redline is the cutoff for a significant causality relationship if the p-value is lower than 10%. Panels (a-2) and (b-2) illustrates the sign and magnitude of the causality relationships from China to other countries and from other countries to China, respectively. The green and red lines represent the 5th and 95th quantiles respectively.

(a-1) Impact of China on U.S.
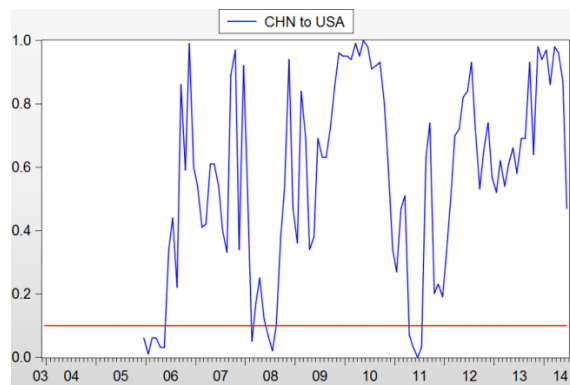
(b-1) Impact of U.S. on China
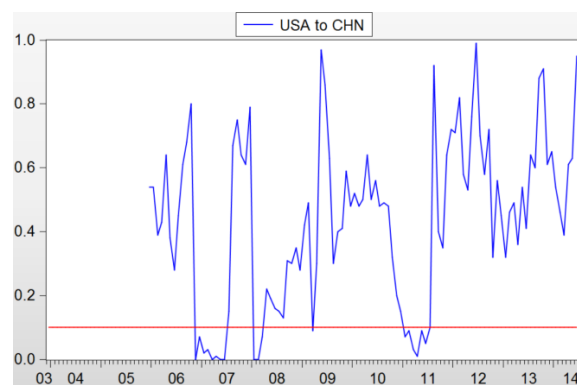
(a-2) Impact of China on U.S.

(b-2) Impact of U.S. on China

Figure 2-1: Time-varying causality relationship between China and U.S.

(a-1) Impact of China on Japan

(b-1) Impact of Japan on China
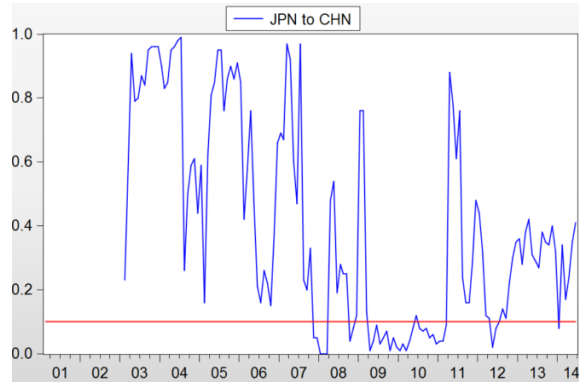
(a-2) Impact of China on Japan
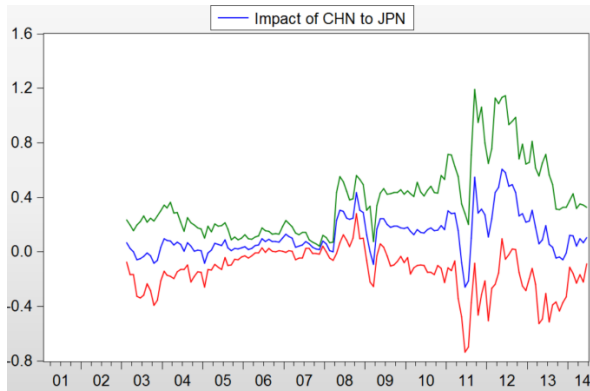
(b-2) Impact of Japan on China
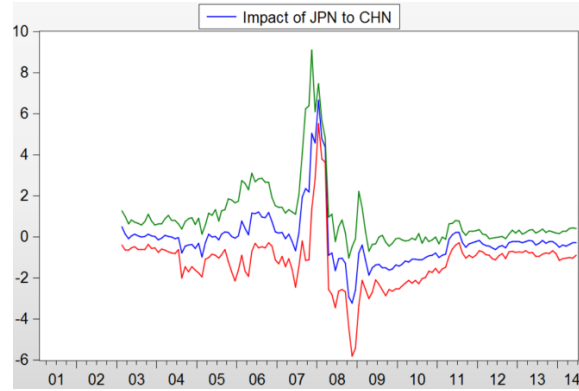
Figure 2-2: Time-varying causality relationship between China and Japan

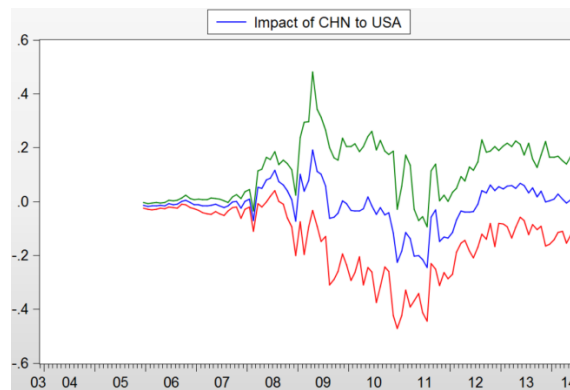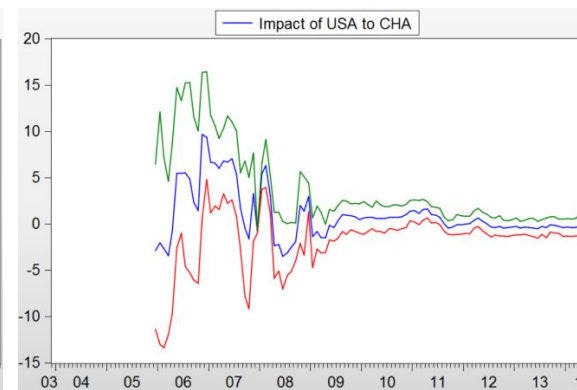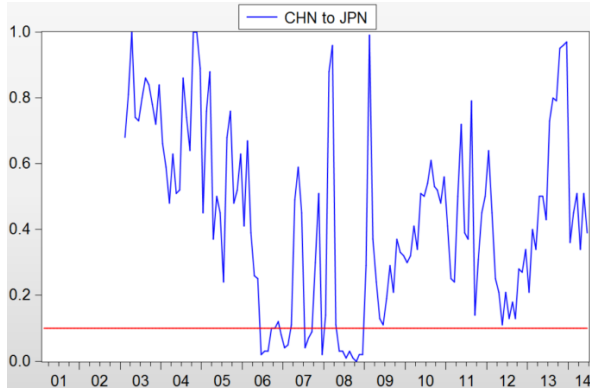| Region	Country	Country Code	N. of monthly obs.	Beginning Month	Mean	Max	Min	Std. Dev.
Table 1: Summary Statistics of Sovereign CDS Spreads of 54 Countries for the Period 2001–2014 by Region.								
Asia	China	CHN	162	200101	63.0	231.5	9.9	42.1
	Hong Kong	HKG	78	200407	34.8	136.8	4.0	32.2
	Indonesia	IDN	126	200401	230.9	793.4	100.9	127.2
	Japan	JPN	162	200101	38.6	143.0	2.6	35.3
	Malaysia	MYS	150	200201	82.4	280.7	13.2	56.6
	Philippines	PHL	160	200103	273.1	618.4	85.3	153.1
	Singapore	SGP	75	200601	33.9	102.5	2.0	27.0
	South Korea	KOR	90	200701	112.3	400.2	14.9	82.6
	Thailand	THA	162	200101	97.4	286.7	27.0	54.9
	Vietnam	VNM	81	200404	231.8	580.3	58.0	129.4
North America	Canada	CAN	126	200401	27.2	136.1	0.9	25.8
	Mexico	MEX	162	200101	141.9	417.8	30.6	82.1
	United States	USA	128	200311	19.0	83.6	0.9	17.8
Central America and Caribbean	Costa Rica	CRI	126	200401	205.0	408.1	62.7	85.0
	Dominica	DOM	126	200401	591.9	2287.8	151.2	524.7
	Jamaica	JAM	126	200401	642.2	1258.4	219.3	220.7
	Panama	PAN	150	200201	195.3	633.9	65.7	123.6
South America	Brazil	BRA	112	200109	496.2	3416.3	14.4	640.6
	Chile	CHL	150	200201	81.0	274.4	12.8	58.2
	Colombia	COL	150	200201	265.3	1257.2	76.0	224.8
	Peru	PER	150	200201	230.2	1003.5	65.8	180.9
Eurozone	Austria	AUT	150	200201	42.7	204.0	1.6	53.6
	Belgium	BEL	162	200101	53.7	360.3	2.1	76.0
	Finland	FIN	138	200301	21.3	84.0	1.1	21.9
	France	FRA	142	200209	44.2	212.8	1.5	54.0
	Germany	DEU	142	200209	24.8	105.3	1.4	26.6
	Greece	GRC	135	200101	686.7	21195.0	5.0	2444.9
	Ireland	IRL	138	200301	172.8	990.7	1.9	241.1
	Italy	ITA	162	200101	103.5	533.9	5.0	134.5
	Portugal	PRT	150	200201	217.1	1343.7	4.1	336.2

	Slovakia	SVK	150	200201	71.7	295.5	5.7	67.7
	Slovenia	SVN	150	200201	98.3	478.7	3.6	123.3
	Spain	ESP	78	200801	212.3	581.9	25.4	138.4
Other Europe	Bulgaria	BGR	162	200101	199.8	610.2	13.8	147.7
	Croatia	HRV	162	200101	192.5	534.9	15.5	139.1
	Czech Republic	CZE	150	200201	56.2	302.2	4.9	52.8
	Iceland	ISL	90	200701	309.5	1037.0	6.1	245.7
	Malta	MLT	114	200501	133.3	417.8	4.9	122.9
	Norway	NOR	129	200310	14.3	53.0	1.3	12.9
	Poland	POL	162	200101	83.9	362.8	8.0	74.1
	Romania	ROU	138	200301	208.5	712.4	17.2	147.8
	Russia	RUS	90	200701	203.2	753.1	39.6	151.0
	Serbia	SRB	90	200701	356.5	754.4	115.9	126.7
	Sweden	SWE	102	200601	34.3	415.0	1.3	47.8
	Turkey	TUR	162	200110	357.7	1180.7	119.4	266.9
	Ukraine	UKR	90	200701	871.5	4401.9	131.2	770.9
Middle East	Syria	SYR	78	200801	95.9	281.4	30.9	52.4
	United Arab Emirates	ARE	162	200101	355.5	1180.7	13.5	281.6
	Israel	ISR	150	200201	100.5	246.7	17.2	57.0
	Iraq	IRQ	102	200601	489.2	806.8	303.7	120.2
	Lebanon	LBN	138	200301	417.3	818.7	205.4	111.0
	Qatar	QAT	150	200201	78.6	318.5	9.5	55.1
Oceania	Australia	AUS	78	200801	55.7	156.6	6.7	27.1
	New Zealand	NZL	114	200501	44.6	199.8	2.5	38.1

Table 2: Granger-causality test for the full sample

We use the following bivariate VAR models to test pairwise Granger-causality relationships between China and the other country. y1 stands for China CDS spread, y2 stands for CDS spread for the country in the first column, and L is the lag operator. The first difference in CDS spreads is used in the VAR models. The study employs the residual based bootstrap technique used by Balcilar et al. (2010). The RB-based modified-LR statistic and p-value is reported.

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} \phi_{10} \\ \phi_{20} \end{bmatrix} + \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

Region	Country Code	H0: y1 (China CDS spread) does not Granger cause y2		H0: y2 does not Granger cause y1 (China CDS Spread)	
		Statistics	*p*-values	Statistics	*p*-values
Asia	HKG	33.7148	0.00***	8.3307	0.08*
	IDN	1.4782	0.34	0.0597	0.82
	JPN	6.6361	0.04**	17.3374	0.01**
	KOR	1.9907	0.34	0.7927	0.59
	MYS	7.8585	0.16	9.5733	0.11
	PHL	4.9356	0.04**	0.4865	0.53
	SGP	25.6981	0.00***	0.6126	0.45
	THA	19.1897	0.00***	22.231	0.01**
	VNM	0.1634	0.69	0.098	0.72
North America	CAN	0.544	0.38	0.1765	0.6
	MEX	7.6415	0.05*	0.0951	0.86
	USA	0.1602	0.75	0.567	0.7
Central America and Caribbean	CRI	0.002	0.97	1.1385	0.37
	DOM	3.3685	0.06*	0.5551	0.42
	JAM	17.1815	0.00***	1.8006	0.23
	PAN	10.4953	0.00***	0.2598	0.62
South America	BRA	0.0139	0.85	0.047	0.81
	CHL	5.1054	0.09*	0.4135	0.46
	COL	2.2246	0.16	0.0741	0.81
	PER	2.8386	0.02**	0.2022	0.63
Eurozone	AUT	1.3048	0.31	4.5973	0.13
	BEL	0.0071	0.95	8.5087	0.01**
	FIN	1.317	0.38	8.5092	0.04**
	FRA	0.4961	0.52	8.4305	0.02**

	DEU	0.4924	0.67	6.7174	0.04**
	GRC	1.9029	0.19	0.0292	0.84
	IRL	0.0025	0.9	3.8745	0.03**
	ITA	0.3164	0.55	8.4895	0.01**
	PRT	0.6066	0.42	1.0571	0.35**
	SVK	1.029	0.49	14.8693	0.01**
	SVN	1.5473	0.27	0.1228	0.81
	ESP	0.4099	0.64	2.8186	0.13
Other Europe	BGR	9.8818	0.02***	2.2237	0.25
	HRV	3.4402	0.25	11.6333	0.05*
	CZE	0.9136	0.58	14.34	0.06*
	MLT	0.2494	0.65	1.2605	0.43
	NOR	0.3451	0.65	3.5106	0.11
	POL	0.0761	0.91	20.2374	0.00***
	ROU	8.7163	0.09*	0.3997	0.73
	RUS	4.9556	0.12	14.7093	0.00***
	SRB	3.1941	0.19	0.0108	0.98
	SWE	3.2261	0.1	0.8528	0.3
	ISL	1.034	0.42	0.2357	0.68
	TUR	0.9876	0.34	0.1248	0.68
	UKR	18.179	0.00***	2.0395	0.23
Middle East	SYR	1.5977	0.36	0.7495	0.42
	UAE	4.1243	0.04**	0.0243	0.89
	ISR	5.5342	0.04**	0.8907	0.41
	IRQ	9.7586	0.00***	1.564	0.24
	LBN	0.3532	0.62	0.4492	0.4
	QAT	8.0654	0.01***	0.2086	0.7
Oceania	NZL	51.1467	0.00***	5.9859	0.06*

*, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 3: Summary of significant contagion and competition effects in the sovereign CDS markets from China to other countries
We summarize significant dynamic causality relationships based on the bootstrap Granger causality test with fixed-size (24 months) rolling subsamples in the bivariate VAR framework. Panels A and B show cases of contagion and competition effects from China, respectively.

Panel A: Contagion Effects											
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Eurozone	SVN(2-4)	IRL(6-12), PRT(1-2, 4)	AUT(9-11), BEL(6-9,11), IRL(1,3-5), ITA(12)	BEL(1-3,8-10), DEU(8), FRA(8-10), ITA(1-5), SVK(1-10), SVN(1-10,12)	AUT(3-9), DEU(1), IRL(12), SVN(2-3,5,7)	AUT(4-5), FIN(4-6), IRL(1)			SVN(3-12)	SVN(1-12), ITA(4,6,10)	ITA(4-6), PRT(6), SVN(1-2), ESP(4-6)
Other Europe			BGR(7-8,10-11), CZE(6-11), HRV(8-11),ROU(8-12),	BGR(1-3), CZE(1-10), HRV(8-10), NOR(8-10), ROU(1-3,8-10)	SWE(12)	SWE(4-7),UKR(4-12)	UKR(1-12)	BGR(9-12), HRV(9-12),ROU(9-12), UKR(1-2,10)	BGR(1-9), HRV(1-7),ROU(1-6,11-12), SRB(7-12), UKR(3-12), ISL(6-7,11-12)	ISL(1-3,5-7,9), ROU(1-5), SRB(1-9), TUR(11-12), UKR(1-9)	NOR(2-5), TUR (1), UKR(1-6)
Asia		THA(2)	HKG(11-12), IDN(5-6), JPN(6-10,12)	HKG(3,5), JPN(1-2, 7-9, 12), PHL(2)	HGK(3), JPN(5-12), SGP(3-12), THA(3)	HGK(5-12), SGP(1-12), THA(5-7)	HGK(1-12), SGP(1-12), THA(10-11), PHL(10-12)	MYS(1-3), IDN(1-3,8-12), PHL(1-4,9-12), SGP(1-3), THA(2)	PHL(1-2), THA(7-12)	IDN(11-12), PHL(10-11), THA(1-11)	IDN(1-2,5-6), PHL(1-3,5-6)
North, Central America and Caribbean			CAN(7-11)	DOM(10-12)	USA(6-8), DOM(3-9,12), JAM(2-3,6-10)	JAM(4-12)	JAM(1-12)	JAM(1-3)		JAM(7-8,11-12), MEX(11-12)	MEX(1-6), JAM(1-6)
South America			CHL(5-12), PAN(6-11)	CHL(1-8), COL(8), PAN(6-8)	BRA(8,11-12), CHL(8)	BRA(1-2)				COL(10-12), PAN(10-12), PER(1,4-5,7,10-12)	COL(1-3), PAN(1-6), PER(1-3), CHL(1-6)
Middle East	ISR(2-3, 7-8,10-12), ARE(12)	ARE(1), ISR(1-2)	QAT(6-12)	ISR(8), LBN(6-8), QAT(1-5, 7-9)	QAT(4-8)	IRQ(7-9,12)	IRQ(1-10,12)	IRQ(10-12)	ARE(2,9,11), LBN(7-12), IRQ(1-12), QAT(7-12)	ARE(1,6,9-10,12), LBN(1-6), IRQ(1-12), QAT(1-7,9,12)	ARE(1), IRQ(1-12), QAT(1-6)
Oceania				NZL(8-12)	NZL(1,3-12)	NZL(1,4-12)	AUS(2-12), NZL(1-12)	AUS(1-3), NZL(1-3, 10-12)	NZL(1-12)	NZL(1-9)	AUS(4-6)

Panel B: Competition Effects

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Eurozone					FRA(5-6), GRC(4-7), ITA(4-7), PRT(2-6)	PRT(8-9, 12), SVN(2)	PRT(1-2)	AUT(4-7), BEL(4-7), FIN(4-6), FRA(9-10), DEU(4-7,10), GRC(6-9), ITA(4-6), PRT(6), SVK(3-4,6-7), SVN(3), ESP(5-11)			
Other Europe			NOR（6-8）		BGR(3-5), POL(1-2), ROU(1-2,4-5)	ROU(8-9)	RUS(11-12)	CZE(3-6), ISL(6), POL(5-7) UKR(5-6)			
Asia					MYS(10-12), THA(11), VNM(6-9)	MYS(1-3), VNM(1-3)		KOR(5-6), MYS(4-7), PHL(5-8), SGP(4-8)			
North, Central America and Caribbean		USA(12)	USA(1-5)	CAN(9-12)	CAN(1), USA(2)			CAN(4-8,12), MEX(4,6-7), USA(4-7), CRI(6-7)	CAN(1-2)		
South America					CHL(1-4)		BRA(11-12)	CHL(6-7), COL(6-7), PER(6-7)			
Middle East					IRQ(2-4)			LBN(6-7), ISR(5-7)			
Oceania											

Table 4: Summary of significant contagion and competition effects in the sovereign CDS markets from other countries to China
We summarize significant dynamic causality relationships based on the bootstrap Granger causality test with fixed size (24 months) rolling subsamples in the bivariate VAR framework. Panels A and B show cases of contagion and competition effects to China, respectively.

Panel A: Contagion effects											
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Eurozone			IRL(7-12)	IRL(1-3)	AUT(1-2,4), DEU(1-3), IRL (1-3), FRA (1-9), GRC (1-9), ITA (1-9), PRT (1-7, 9), BEL (1-5), SVN (1-3)	GRC (7-11), PRT (4-12), SVK (8-12), SVN (8)	PRT(1), SVK(1-12), SVN(10-12), ESP(2-3,6)	AUT(4-6), FIN(9-12), DEU(4-7,9-12), GRC(7-8), ITA(5-12), PRT(6-8), SVK(1-4,9-11), SVN(1-4,10), ESP(6-7)	AUT(9-10,12), BEL(7-12), FIN(1-12), FRA(2-12), DEU(1-8,10), ITA(1-12), ESP(9-10,12)	AUT(2-5), BEL(1-9,12), FIN(1-8), FRA(1-3), DEU(2-3), ITA(1-5), ESP(1-3,5)	AUT(1-3, 5-6), BEL(1,3-4)
Other European			HRV(2,5-7,11-12), TUR(6-8,11)	HRV(2), ROU(3-7)	BGR (2-4), HRV(1,10), NOR (1-2), POL (2-3), ROU (1-5, 10), SWE (2-3)	CZE(8-12), HRV(1,8-12), POL(8-9), ROU(8-10), RUS(2-3,5-12)	CZE(1,7-8,10-12), HRV(1-7), POL(10-12), RUS(1-12)	CZE(1-5), HRV(4), NOR(10-12), POL(3- 6), RUS(1-3), UKR(4-5)	NOR(1-7,9-10), POL(8-12), SWE(9-12)	POL(1-5)	
Asia			VNM(5-11)	HKG(8,11-12), JPN(11-12)	HKG(1-5), JPN (1-3)			KOR(4), MYS(4-5), PHL(5), SGP(4), THA(4-7)	MYS(3-6)		
North, Central America and Caribbean			CAN(8-10), USA(11-12)	CAN(8-12), USA(1-6)	MEX (6-7), USA (1-3), CRI(4, 5,7,11)	CRI(1-2)		CAN(4-7), USA(1-7)			
South America					BRA(12), CHL(1-5,10), PER(8-12)	BRA(1-4,6-7), PER(2)	BRA(3-7,8-9)				
Middle East			LBN(5-7)		ISR(1-7,10-11), QAT(10-12)	ARE(4,8-10), QAT(1-2)		ISR(4-5)			
Oceania					NZL(1-2)				AUS (8-12)	AUS (1-7)	

Panel B: Competition effects

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Eurozone	BEL(1-11), FRA(10-12), DEU(10-12), GRC(2-12), ITA(1-12), PRT(2-12), SVN(2-12)	AUT(11-12), BEL(1-2), FRA(1-2,10-11), DEU(1-2), GRC(1-2), ITA(1-2), PRT(1-2), SVN(1-2)	AUT(2-4), FIN(11-12), FRA(3-4)	AUT(9-12), BEL(9-11), FIN(1-6), DEU(9-11)							
Other Europe	CZE(2-8,10-12), POL(12)	CZE(1-2), HRV(2), POL(1,3)				UKR(4)		BGR(8-12), HRV(8), ROU(7-12)	BGR(1-7), ROU(1-9)	SRB(9-12)	SRB(1-4)
Asia	MYS(8-12), THA(11-12)	MYS(1), THA(1-2)			SGP (4-9), THA(2-3), JPN(10-11)	JPN(4-12), SGP(4), THA(4-12)	HKG(10-12), JPN(1-5,7-12), THA(2,3,5,10-12)	MYS(1-3), JPN(1-3), THA(1,3)	JPN(5-7), KOR(6), THA(7-12)	THA(1-11)	
North, Central America and Caribbean	MEX(10-12)	MEX(1-2)	CRI(11-12)	CRI(1-2)	DOM (5-6)		JAM(12)	JAM(1-3)			
South America	COL(12), PAN(10-12), PER(11-12)	CHL(1-2), COL(1-2), PAN(1-3), PER(1-2)		CHL(5-6)				CHL(4)			
Middle East	ARE(10-12), ISR(2-12), QAT(2-12)	ARE(1-3,8-12), ISR(1-2), LBN(2), QAT(1-2)	ARE(1-10)		QAT (4-9)			ARE(8-11)	ARE(1-2,4)	ARE(9)	
Oceania				NZL(9-12)	NZL (4-9)			AUS(2-3)			

Table 5: Analysis of determinants of contagion and competition effects using the Probit model. In Panel A, the dependent variable is 1 if there is a significant contagion effect from China and 0 otherwise. In Panel B, the dependent variable is 1 if there is a significant competition effect from China and 0 otherwise. In Panel C, the dependent variable is 1 if there is a significant contagion effect from other country to China and 0 otherwise. In Panel D, the dependent variable is 1 if there is a significant competition effect from another country to China and 0 otherwise. Variable definitions and data sources are reported in the Appendix. *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Determinants of contagion effects from China on other countries

Variable	Estimate	Standard Error	
Intercept	2.6591	1.7613	
Characteristics of China:			
LogFDItoChina	0.0366	0.0413	
LogExpChina	-0.0625	0.0889	
LogImpChina	0.0355	0.0539	
LogFDIfromChina	0.0916	0.0449	**
GDPGrowthChina	0.1229	0.0575	**
PortfolioInflowChina	0.0175	0.0095	**
PortfolioOutflowChina	0.0056	0.0029	*
Characteristics of Country i:			
ExpPctgtoEastAsia	0.026	0.0073	***
GDPGrowth	0.001	0.0214	
Inflation	-0.0361	0.0236	
EquityIndexChange	0.0001	0.0029	
LogSovereignRating	0.066	0.1012	
LogCountryGovernance	-0.0199	0.0811	
LogReserves	-0.2464	0.0733	***
Global factors:			
VIX	-0.0002	0.0156	
Crisis08	0.7665	0.4561	*
Crisis11	0.5008	0.3968	

Panel B: Determinants of competition effects from China on other countries

Variable	Estimate	Standard Error	
Intercept	-2.3387	2.8096	
Characteristics of China:			
LogFDItoChina	0.04	0.0642	
LogExpChina	-0.0988	0.1274	
LogImpChina	0.0657	0.0881	
LogFDIfromChina	0.0989	0.0627	
GDPGrowthChina	-0.0738	0.1144	
PortfolioInflowChina	0.0375	0.0267	
PortfolioOutflowChina	-0.013	0.0075	*
Characteristics of Country i:			
ExpPctgtoEastAsia	-0.0321	0.0124	***
GDPGrowth	0.0021	0.0295	
Inflation	-0.0104	0.0284	
EquityIndexChange	-0.0104	0.0046	**
LogSovereignRating	0.1083	0.1389	
LogCountryGovernance	0.1405	0.1135	
LogReserves	0.0535	0.1028	
Global factors:			
VIX	0.0679	0.0238	***
Crisis08	-0.9129	0.7905	
Crisis11	0.2769	0.7882	

Panel C: Determinants of contagion effects from other countries on China

Variable	Estimate	Standard Error	
Intercept	-3.8195	1.9321	*
Characteristics of China:			
LogFDItoChina	-0.0325	0.0461	
LogExpChina	0.2104	0.1008	**
LogImpChina	-0.024	0.0637	
LogFDIfromChina	-0.0422	0.0451	
GDPGrowthChina	-0.0423	0.0685	
PortfolioInflowChina	-0.009	0.0115	
PortfolioOutflowChina	-0.0054	0.0036	
Characteristics of Country i:			
ExpPctgtoEastAsia	-0.0193	0.008	**
GDPGrowth	-0.0522	0.0253	
Inflation	-0.0313	0.0279	
EquityIndexChange	-0.0047	0.0032	
LogSovereignRating	0.045	0.1026	
LogCountryGovernance	0.1771	0.093	*
LogReserves	0.0787	0.0757	
Global factors:			
VIX	0.0272	0.016	*
Crisis08	0.3741	0.4931	
Crisis11	0.4348	0.4271	

Panel D: Determinants of competition effects from other countries on China

Variable	Estimate	Standard Error	
Intercept	2.8783	2.3897	
Characteristics of China:			
LogFDItoChina	-0.0525	0.058	
LogExpChina	-0.1242	0.1205	
LogImpChina	0.0089	0.0689	
LogFDIfromChina	0.0303	0.0568	
GDPGrowthChina	-0.1614	0.0814	*
PortfolioInflowChina	-0.084	0.0187	***
PortfolioOutflowChina	-0.0181	0.0055	***
Characteristics of Country i:			
ExpPctgtoEastAsia	0.028	0.0092	***
GDPGrowth	-0.0622	0.0329	*
Inflation	-0.0601	0.0309	
EquityIndexChange	-0.0004	0.0038	
LogSovereignRating	-0.1929	0.1185	
LogCountryGovernance	-0.0772	0.1003	
LogReserves	0.1066	0.0992	
Global factors:			
VIX	-0.0451	0.0223	**
Crisis08	-0.897	0.6983	
Crisis11	-1.5775	0.618	**

Appendix

Variable name	Definition	Data Source
LogFDItoChina	Natural logarithm of Country i's FDI to China	National Bureau of Statistics of China, http://www.stats.gov.cn
LogExpChina	Natural logarithm of exports of China to Country i	National Bureau of Statistics of China, http://www.stats.gov.cn
LogImpChina	Natural logarithm of imports of China from Country i	National Bureau of Statistics of China, http://www.stats.gov.cn
LogFDIfromChina	Natural logarithm of FDI from China to Country i	National Bureau of Statistics of China, http://www.stats.gov.cn
GDPGrowthChina	China's GDP growth rate	World Development Indicator (WDI database)
PortfolioInflowChina	China's total equity investment net inflow in a given year	World Development Indicator (WDI database)
PortfoliooutflowChina	China's total portfolio investment outflow in a given year	World Development Indicator (WDI database)
ExpPctgtoEastasia	Percentage of Country I's merchadise exports to low and middle income East Asian countries	World Development Indicator (WDI database)
GDPGrowth	Country i's GDP growth rate	World Development Indicator (WDI database)
Inflation	Country i's inflation rate	World Development Indicator (WDI database)
EquityIndex	Country i's equity index	World Development Indicator (WDI database)
LogSovereignRating	Natural logarithm of Standard and Poor's ratings on long-term sovereign bonds for Country i. The ratings are converted to numerical scores from 1 to 6 (corresponding to B to AAA). A value of 0 is assigned to countries without ratings information.	Bloomberg

LogCountryGovernance	Natural logarithm of Country i's aggregated governance index, by averaging six dimensions of governance, including voice and accountability, political stability and the absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. A higher value of the index corresponds to higher quality of governance.	Worldwide Governance Indicators (www.govindicators.org)
LogReserve	Natural logarithm of Country i's total reserves with gold	World Development Indicator (WDI database)
VIX	VIX index	CBOE.com
Crisis08	2008 global financial crisis dummy	constructed
Crisis11	2011 European sovereign debt crisis dummy	constructed