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Short Communication

What drives the dependence between the Chinese and global stock markets?

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Abstract: By applying time-varying copulas and panel regression analysis, this study investigates the dependence between the Chinese and eleven international stock markets, as well as its determinants during the period 2002-2018. Our results indicate that the dependence magnitude between the Chinese stock market and major international markets varies with region. Furthermore, the dependence is negatively driven by both economic policy uncertainty differentials and interest rate differentials while positively affected by the global financial crisis and trade interdependence. Our findings are of great importance to international investors and policymakers.

Keywords: dependence, determinants, time-varying copulas, panel regression analysis, economic policy uncertainty, global financial crisis

JEL codes: D80, F36, G01

1. Introduction

The economic and trade exchanges between China and major economies, as well as their financial markets, have become increasingly close since China joined the WTO. The nature and origins of dependence between stock markets have attracted considerable attention from academics, investment professionals, and government regulators. To date, the presence of stock market dependence and its concrete form has been the focus of numerous studies (Wongswan, 2006; Quinn and Voth, 2008), but few studies provide the theoretical and empirical underpinning of possible driving forces behind such dependence. In this paper, we apply time-varying copulas to measure the dependence between the Chinese and eleven international stock markets while investigating its determinants through panel regression analysis.

This study contributes to the literature in the following aspects. First, we use a unique sample focusing on the stock market dependence between China and major economies, which extends the current literature in developed countries. For example, Quin and Voth (2008) examine a dataset of 16 developed countries, which do not include China. However, with the rapid development of the Chinese economy, the Chinese stock market has been the second largest one around the world, whose dependence and impact on other international markets cannot be neglected.

Second, this study diverges from previous studies in employing time-varying copulas proposed by Patton (2006) to measure market dependence, which provides a better fit of nonlinear and time-varying dependence than traditional methods such as the linear correlation used by Tavares (2009) and the dynamic conditional correlation of Engle (2002). Further, by modeling flexibly the appropriate marginal distributions and copulas, we avoid choosing incorrect model specifications. The dependence magnitude between

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the Chinese stock market and major international markets is found to vary with regions obviously.

Finally, and most importantly, our panel regression results indicate that economic policy uncertainty differentials are negatively related to stock market dependence between China and major economies, which extends the work of Baker et al. (2016) and others by linking economic policy uncertainty with market dependence. Consistent with Johnson and Soenen (2002), our results suggest a negative effect of interest rate differentials on dependence. Moreover, the positive effects of the global financial crisis and trade interdependence on stock market dependence are in line with Pretorius (2002) and Paramati et al. (2016) but in contrast with Vithessonthi and Kumarasinghe (2016) that report insignificant impacts.

The remainder of this paper is organized as follows. Section 2 describes the data, variables, and methods. Section 3 reports the empirical results. Section 4 concludes the study.

2. Data, Variables, and Methods

The market returns are computed as the log-returns multiplied by 100 for our sample: China's SSEC, Hong Kong's HSI, the United States's SP500, Japan's N225, Korea's KOSPI, Australia's SP200, the United Kingdom's FTSE100, France's CAC40, Germany's DAX 30, Brazil's BVSP, Russia's RTS and India's SSEX30 after China joined the WTO (December 11, 2001). Table A.1 in the Online Appendix reports the summary statistics of the market returns. To obtain pairwise dependence coefficients of market returns for eleven country pairs, we implement a two-stage method to perform time-varying copulas (see Appendix B in the Online Appendix for details).

We take monthly averages of daily pairwise dependence coefficients as the dependent variable (denoted as DEP) to investigate underlying determinants using a panel regression framework. The description of explanatory variables is presented in Table 1.

Table 1. Determinants of the pairwise dependence.

Variable	Abbreviation	Description
Panel A: Economic policy uncertainty differentials		
Economic policy uncertainty differentials	EPU	The absolute difference of log of economic policy uncertainty indices between country pairs
Panel B: Financial crisis		
Global financial crisis	GFC	A dummy variable that takes the value of one during the global financial crisis periods (March 2007-May 2008) and zero otherwise
Panel C: Macroeconomic conditions		
Interest rate differentials	IR	The absolute difference of one-year treasury bill rates
Trade interdependence	TRADE	The sum of the value of imports and exports from China to other economies as a proportion of China's GDP
Economic growth differentials	EG	The absolute difference in GDP growth rates
Inflation rate differentials	INF	The absolute difference in the inflation rates
Exchange rate growth	ERG	Percentage change in the bilateral exchange rates of foreign currencies in terms of the Chinese Yuan
Monetary policy growth differentials	MPG	The absolute difference in M2 to GDP ratios
Panel D: Market performance		
Market development growth differentials	MDG	The absolute difference in the total value of stock traded to GDP
Market volatility differentials	VOL	The absolute difference of standard deviations of market returns

Note: This table describes potential variables that determine the pairwise stock market dependence, separated into four categories: economic policy uncertainty differentials, financial crisis, macroeconomic conditions, and market performance. We obtain economic policy uncertainty indices from http://www.policyuncertainty.com and others from the WIND financial database. A

quadratic interpolation method is employed to obtain the monthly data of GDP. TRADE, EG, INF, and MPG are seasonally adjusted using the Census X12 method.

The descriptive statistics are presented in Table A.2 in the Online Appendix. Following Carrieri et al. (2007), a series of tests is conducted to determine the appropriate specification for the panel models (see Table A.3 in the Online Appendix). We find that the two-way fixed effects model is the appropriate model for our empirical analysis, which is defined as:

$$DEP_{it} = \beta_0 + \beta_1 EPU_{it} + \beta_2 GFC_{it} + \beta_3 IR_{it} + \beta_4 TRADE_{it} + \beta_5 EG_{it} + \beta_6 INF_{it} + \beta_1 ERG_{it} + \beta_8 MPG_{it} \beta_9 MDG_{it} \beta_{10} VOL_{it} + \mu_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where i represents cross-sections, t represents time periods, μ_i denotes the cross-section, γ_t captures the period fixed effects, and ε_{it} is a random disturbance effect.

3. Empirical Results

Since the pairwise dependence coefficients are confirmed to be time-varying, three types of time-varying copulas are employed to characterize them. The optimal copulas and summary statistics for dependence coefficients are displayed in Table 2.

Table 2. Optimal copulas and descriptive statistics of the time-varying dependence coefficients.

Country pair	Optimal copula	Mean	Max.	Min.	Std. dev.
SSEC-HSI	time-varying Student's t	0.4194	0.6858	-0.2584	0.1261
SSEC-SP500	time-varying rotated Gumbel	1.0549	1.2787	1.0001	0.0290
		[0.0956]	[0.1282]	[0.0437]	[0.0090]
SSEC-N225	time-varying rotated Gumbel	1.1543	1.4659	1.0108	0.0434
		[0.2315]	[0.4546]	[0.0540]	[0.0476]
SSEC-KOSPI	time-varying Student's t	0.2644	0.5689	-0.1058	0.0987
SSEC-SP200	time-varying Student's t	0.2166	0.4188	-0.1047	0.0775
SSEC-FTSE100	time-varying rotated Gumbel	1.0965	1.2223	1.0323	0.0265
		[0.1424]	[0.2481]	[0.0032]	[0.0535]
SSEC-CAC40	time-varying rotated Gumbel	1.0845	1.1644	1.0477	0.0161
		[0.1286]	[0.2132]	[0.0171]	[0.0384]
SSEC-DAX30	time-varying rotated Gumbel	1.0814	1.1855	1.0383	0.0201
		[0.1173]	[0.1573]	[0.0869]	[0.0063]
SSEC-BVSP	time-varying Student's t	0.1418	0.1801	0.0910	0.0084
SSEC-RTS	time-varying Student's t	0.1709	0.3005	-0.0076	0.0574
SSEC-SSEX30	time-varying normal	0.1968	0.3635	-0.0229	0.0611
		[0.1929]	[0.2784]	[0.1174]	[0.0265]

Note: This table presents the optimal copulas for country pairs and summary statistics for corresponding dependence coefficients. The results of the dependence coefficients obtained using time-varying Student's t copula are in square brackets for comparison's sake, whose range is [-1,1]. The abbreviations of market indices refer to Section 2. The sample period spans from December 11, 2001, to December 31, 2018.

As we observe, time-varying Student's t copula is the optimal model for describing the dependence between China's SSEC and most indices, including Hong Kong's HSI, Korea's KOSPI, Australia's SP200, Brazil's BVSP, and Russia's RTS, while time-varying rotated Gumbel copula for other pairs except SSEC-SSEX30. Our results indicate that the dependence magnitude between Chinese and major international stock markets varies with regions obviously, from large to small: Asia-Pacific (Hong Kong, Korea, Japan, Australia), BRIC (India, Russia, Brazil), and Euramerican (the United Kingdom, France, Germany, the United States).

Table 3 presents the panel regression results, which demonstrate that the larger absolute difference in economic policy uncertainty between China and other economies would decrease their stock market dependence. A possible channel works in the following

way. One country with heightened economic policy uncertainty experiences greater stock market volatility and lower investment rates, thereby triggering a cycle of falling asset prices (Baker et al., 2016). Our results also point towards a negative effect of interest rates differentials on market dependence, providing evidence consistent with Johnson and Soenen (2002). They argue that a greater differential in interest rates would reduce comovements between the Japanese and twelve Asian equity markets.

Table 3. Estimated results for the two-way fixed effects model.

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Mod. 6	Mod. 7	Mod. 8
EPU	-0.014				-0.012	-0.013	-0.013	-0.013
	(0.005)				(0.004)	(0.005)	(0.004)	(0.004)
GFC		0.030			0.026	0.028	0.026	0.026
		(0.009)			(0.007)	(0.008)	(0.007)	(0.008)
IR			-0.004		-0.004		-0.005	-0.004
			(0.001)		(0.001)		(0.001)	(0.001)
TRADE				0.006	0.004**		0.004	0.003
				(0.002)	(0.002)		(0.002)	(0.002)
EG							0.001	0.001
							(0.001)	(0.001)
INF							0.005	0.005
							(0.005)	(0.005)
ERG							-0.001	-0.001
							(0.002)	(0.001)
MPG							0.001	0.001
							(0.001)	(0.001)
MDG								-0.000
								(0.000)
VOL								0.000
								(0.000)

Note: This table presents the results of panel regression specifications which include country and month fixed effects. The abbreviations of variables refer to Table 1. Robust standard errors clustered at the country level are reported in parentheses. ***, ** and * indicates the statistical significance level at 1%, 5% and 10%, respectively. The sample period spans from January 2002 to December 2018, except China-Brazil and China-India which start in January 2006 and February 2003, respectively.

4. Conclusion

Using a panel sample of China and eleven developed and emerging economies over the period of January 2002 to December 2018, this paper employs three types of time-varying copulas and the two-way fixed effects model to investigate the evolvement of pairwise stock market dependence and the potential factors that can determine it. We demonstrate that the dependence magnitude between the Chinese stock market and major international markets varies with regions obviously, from large to small in order: Asia-Pacific, BRIC, and Euramerican markets. Furthermore, panel regression analysis demonstrates that economic policy uncertainty differentials, global financial crisis, interest rate differentials, and trade interdependence are significant determinants. Our findings are of great significance to international portfolio construction and risk management.

Supplementary Materials: Online Appendix is available from the authors.

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