CHAPTER 5

Modelling dependence between tourism demand and exchange rate using copula-based GARCH model

This chapter is developed from the original paper "Modelling dependence between tourism demand and exchange rate using copula-based GARCH model" by Tang et al. (2014). This paper was accepted by journal of Current Issue in Tourism. This paper is in the appendix B.

Abstract

This paper investigates dependence between tourism demand and exchange rate, using the case of China, and from a new perspective by using copula-GARCH models. The empirical results show that the volatility of exchange rate is not a determinant factor in fluctuation of China's inbound tourism demand from the countries being studied. Furthermore, only Russia exhibit risk adverse behavior with extreme SUR depreciation, or CNY appreciation associated with a extreme decline in arrivals. Third, introducing the tail dependence and dynamic dependence between growth rates of tourism demand and exchange rate add much to the explanatory ability of the model. The findings of this study have important implications for destination manager and travel agent as it helps to understand the impact of exchange rates on China inbound tourism demand and provide a complementary academic approach on evaluating the role of exchange rates in international tourism demand model.

5.1 Introduction

By continued development, expansion and diversification, tourism has become one of the world's largest and faster-growing economic sectors in the past few decades. International tourist arrivals reached a record of 1,035 million in 2012 (39 million more than in 2011), (World Tourism Barometer-Advance Release, January 2013). According to Tourism Towards 2030, international tourist arrivals worldwide will reach 1.8 billion by 2030. Tourism is one of the most important driving forces of socio-economic development, through export revenues, the creation of jobs and enterprises, and infrastructure development to promote socio-economic progress. UNWTO Headlights (2012) reports that tourism contributes 5% to the worldwide gross domestic product (GDP), and the tourism revenue could be over one-fourth of GDP in some developing countries and small islands. This information highlights that continuous growth of tourism will bring tremendous business opportunities, and thus, tourism market competition could become increasingly fierce.

Webber (2001) points out that tourism is one particular commodity, which is likely to be affected by the exchange rate volatility. Fluctuating exchange rates induce two different effects on the international tourism. First, exchange rate fluctuations may affect international tourist destination choice (Webber, 2001; Akar, 2012), as tourists tend to choose countries in which the exchange rate is more favorable (Wang et al, 2008). The second effect is that the variations of exchange rates are likely to alter visitors' intended length of stay and expenditure. When the destination's currency depreciates, international tourists have more money to spend, and thus, may prolong the length of stay and increase spending (Crouch, 1993). It is, therefore, interesting to study the dependence between exchange rates and international tourism demand.

Based on the motivations discussed above, this study aims to examine the dependence between tourism demand and exchange rates from a new perspective by using several copula-GARCH models. The conditional dependence of the standardized residuals describe show the variations in the exchange rate (destination country's currency with source country's currency) affect the international tourist arrivals from source country to destination country. As far as the authors are aware, no previous empirical paper studied dependence or co-movement between tourism demand and exchange rate and, by extension, no research on the asymmetry of that relation has been done. In order to fill in the gap in literature, this paper introduces both static and dynamic copula-GARCH models in this study. This methodological approach allows the paper to examine the static and dynamic dependence between tourism demand and exchange rate based on monthly data of the top six countries in terms of the number of tourist arrivals to China. This chapter represents three main contributions. First, it captures the static and time-varying dependence between tourism arrivals and exchange rates, and investigates the asymmetric and symmetric dependence between these variables. The second contribution is to capture the tail dependence between growth rate of tourist arrivals and exchange rate. Third, there are no previous empirical papers studying dependence or co-movement between tourism demand and exchange rate, this paper will fill this gap.

5.2 Data Description

This study uses the case of China because China has become one of the most important tourism destinations in the world tourism. According to World Tourism Organization (UNWTO 2012), China is the third (3.4% worldwide market share) and fourth (5.86% worldwide market share) in inbound tourism arrivals and receipts in the world, respectively. The empirical analysis of dependence is applied to monthly data of tourism arrivals to China from South Korea, Japan, Russia, USA, Malaysia, and Singapore and the corresponding exchange rates from January 1994 to December 2011. The exchange rate is defined as the amount of CNY per unit of foreign currency. Hence, a rise of the exchange rate, infers a depreciation of the CNY or an appreciation of the other currency.

The choice of the six countries is justified as those are the top countries in terms of the number of tourist arrivals to China, these source countries counting for the vast majority of China inbound tourism. The monthly data of tourist arrivals are obtained from the National Bureau of Statistic of China, and the exchange rates are obtained from International Financial Statistics of the Federal Reserve Board. Figure 5-1 plots the monthly series of China inbound tourist arrivals from the six leading source countries. The figure exhibits that China inbound tourist arrivals increase over time in general, although it falls sharply around 2003 due to SARS, and the sub-prime crisis in 2008 and 2009. The figure also displays clear seasonal and cyclical movements. To measure the general trend of each series, seasonality is eliminated by employing X-12 ARIMA method. Then, a logarithmic transformation of the data is applied to stabilize the increase of their volatility over time. Thereafter, this paper uses $r_{1,t} = \mathrm{Ln}(Y_t/Y_{t-1})$ and $r_{2,t} = \mathrm{Ln}(P_t/P_{t-1})$ to measure the growth rates of the monthly tourist arrivals and their exchange rates, respectively, in which Y_t and P_t are the seasonal adjusted tourist arrival and exchange rate at month t. The growth rates of the tourist arrivals and exchange rates are plotted in Figures 5.2 and 5.3, respectively. The figures suggest that there are conditional variance processes in the data, and thus, the GARCH model is appropriate for analyzing the growth rate of both tourist arrivals and their exchange rate.

In additional, the descriptive statistics of monthly growth rates of tourist arrival and exchange rates are given in Table 5.1. The results show that the mean of South Korea (+0.0055), CNY/USD (-0.0027), CNY/MYR (-0.0034) and CNY/SGD (-0.0023) growth rates pass the 0.1 significant levels, which show these four series are significant in mean. The third column of Table 5.1 shows that most of the series are significant and skew to the left, except CNY/JPY (+0.5711) and CNY/SGD (+0.3805) which are significant skew to the right. All series are significantly greater than 3 in kurtosis, inferring that all series are fat-tailed and sharp in their peaks. In addition, the normality hypothesis for all series is rejected at the 5% significant level based on the results of the JB test. All these result show all series do not follow normal distribution and support the use of the skewed-t distribution in our study.

Since it is necessary for the series to be stationary to conduct the GARCH analysis, the results of augmented Dickey-Fuller (ADF, Dickey and Fuller, 1979) ,the augmented Dickey-Fuller generalized least squares (ADF-GLS test, Elliott, Rothenberg, and Stock ,1996) and Zivot-Andrews (ZA, Zivot and Andrews,1992) unit root tests are displayed in Table 5.2. The results suggest that most of the logarithmic ($\mathrm{Ln}(\mathrm{Y_t})$and $\mathrm{Ln}(\mathrm{P_t})$) of the data contain unit roots while their growth rates ($\mathrm{r}_{1,\mathrm{t}} = \mathrm{Ln}(\mathrm{Y_t}/\mathrm{Y_{t-1}})$ and $\mathrm{r}_{2,\mathrm{t}} = \mathrm{Ln}(\mathrm{P_t}/\mathrm{P_{t-1}})$) are stationary. Hence, the test results suggest that the use of growth rates in this analysis is appropriate.

5.3 Empirical result

5.3.1 Results of the marginal models

The empirical analysis starts with the estimation of the ARMA (p, q)—GARCH (1,1) models by using the maximum likelihood estimation method and by considering different combinations of the values of the parameters p and $q$ranging from zero to a maximum of two lags. In addition, Akaike information criterion is adopted to select the most suitable models. Table 5.3 reports the parameters of ARMA (p, q)—GARCH (1,1) for growth rates of tourist arrivals from the six source countries and Table 4 reports parameters of ARMA (p, q)- GARCH (1,1) the growth rates of their exchange rates.

ARMA (0,1)—GARCH (1,1) specification is proven to be the best model for South Korea, Japan, and Malaysia, while ARMA (1,1)—GARCH (1,1) is more appropriate for Russia, USA, and Singapore. The results for the growth rates of tourist arrivals shown in Table 5.4 indicate that the estimate of the ARCH coefficient, α_s, is significant for all series except Russia, with South Korea attaining the highest value of 0.8279. On the other hand, the estimate of the GARCH coefficient, β_s, is not significant for South Korea and Japan, with Russia attaining the highest value of 0.9889. These results imply that there is short run persistency of shocks on tourist arrivals in all series except Russia and long run persistence in Russia, the USA, Malaysia, and Japan. The results of the conditional variance equations are $\widehat{\alpha} + \widehat{\beta} = 0.9990$ and 0.9408 for USA and Singapore, respectively, inferring that the volatilities of these two series are highly persistent. In general, the skewness parameter ξ_s and the degrees of freedom $\lambda_s$in the skewed-t distribution for all the series are significant, suggesting that the error terms are not normal and applying the Skew-t distribution is suitable. This is consistent with the evidence reported in Table 5.1.

In addition, Table 5.4 exhibits the results for the growth rates of the exchange rates. The best model for all the series is ARMA (1,1)—GARCH (1,1) specification. The estimate of the GARCH coefficient, β_s, is significant in all series, while the estimates of the ARCH coefficient, α_s, are insignificant only for CNY/KRW and CNY/JPY. This information shows that an exchange rate growth rate shock has long run persistence in all series, while a shock to the growth rate of CNY/SUR, CNY/USD, CNY/MYR, and CNY/SGD has short run persistence. The conditional variance equations for almost all the series are nearly 1, except the exchange rate of CNY/KRW, inferring that the volatilities of these series are highly persistent. Furthermore, the skewness parameter ξ_s and the degrees of freedom λ_s are strongly significant, suggesting that the error terms are not normal and applying the Skew-t distribution is suitable. The results are also is consistent with the evidence report in Table 5.1.

The marginal distribution must be uniform (0, 1), otherwise the copula model may be mis-specified. Hence, the crucial step is to test the marginal distribution. Following Patton (2006) this paper uses two steps for this purpose. First, Ljung-Box (LB) test is used to examine the serial independence. Secondly, the Kolmogorow-Smirnov (KS) test is used to test whether the marginal distribution is uniform (0, 1). The result of LB and KS test summary in Table 5.5, which show all series are not rejected at the 5% significance level, which prove these are not mis-specified. Hence, the copula model can correctly capture the dependence between the growth rates of the tourist arrivals and the exchange rates.

5.3.2 Copula estimates of dependence

The results for the static copulas report in panel A of Table 5.6 in which the dependence parameter is assumed to be constant over time. Examining the symmetric copulas in thepanel A of Table 5.6, for the dependence parameters in the Gaussian, Student-t and Frank copulas are positive in South Korea-CNY/KRW, Russia-CNY/SUR, USA-CNY/USD and Singapore-CNY/SGD pairs and negative in Japan-CNY/JPY and Malaysia-CNY/MYR pairs, but all dependence are weak and not significant. The dependence varied across pairs of growth rates of tourist arrival and exchange rate. The degree of freedom for Student-t copula is lower in Russia-CNY/SUR pair, which suggests that only Russia-CNY/SUR have tail dependence. In the Plackett copula, the result is consist with result of Gaussian, Student-t and Frank copulas, while all the dependence parameters τ are significantly. In order to study the asymmetric dependence, Gumbel copula is applied to capture the right tail dependence and the Clayton copula to capture the left tail dependence. Note that there are no estimates of the dependence τ for Japan and Malaysia. This shows that there is not right tail dependence λ_U for Japan and Malaysia. The dependence parameters in Gumbel copula are significant in South Korea-CNY/KRW, Russia-CNY/SUR, USA-CNY/USD and Singapore-CNY/SGD pairs. The right tail dependence values for the Gumbel copula, $\lambda_U = 2 - 2^{1/\tau}$, are 0.0369 for South Korea-CNY/KRW, 0.0339 for Russia-CNY/SUR, 0.0781 for USA-CNY/USD, and 0.0188 for Singapore-SGD, respectively. Only the estimate for Russia is significant at 10% in Clayton copula, which shows that between Russia and CNY/SYR have a left tail dependence, $\lambda_L = 2^{-1/\tau}$, the values is

0.0033. Panel B of Table 5.6 reports the results of the application of the dynamic copula function based on the GARCH model. According to AIC criterion, the dynamic of the dependence parameter can improve the performance of the static copula for Japan-CNY/JPY, USA-CNY/USD, Malaysia-CNY/MYR and Singapore-CNY/SGD pairs in dynamic Gaussian copula. While the static Clayton is the best performer for South Korean-CNY/KRW and Russia-CNY/SUR.

Overall, the results from the copulas could draw the following interesting conclusions: 1) The growth rates of inbound tourism demand and exchange rates are weak negative correlated for Japan and Malaysia and weak positive correlated for all other countries, but the coefficients of correlations are not statistically significantly. 2) There are not extreme dependence Japan-CNY/JPY, USA-CNY/USD, Malaysia-CNY/MYR and Singapore-CNY/SGD pairs, which imply extreme movements of CNY/JPY, CNY/USD, CNY/MYRand CNY/SGD, do not cause extreme movements of Japan, USA, Malaysia and Singapore outbound tourism demand to China, respectively. 3) There are lower tail dependence in Korean-CNY/KRW and Russia-CNY/SURpairs, but the lower tail dependence is not significant and near zero in Korean-CNY/KRW pair. The significant lower tail dependence for Russia-CNY/SUR weak support that when the currency of tourists from south Russia depreciates, or CNY appreciates, tourists from Russia are less willing to choose China as their traveling destination. 4) The static Clayton for the South Korea-KRW/CNY and Russia-CNY/SUR and the dynamic Gaussian copula for Japan-JPY/CNY, USA-CNY/USD, Malaysia-MYR/CNY and Singapore-CNY/SGD perform better than the other models, which infer that introducing the tail dependence for South Korea-KRW/CNY and Russia-CNY/SUR and dynamic dependence for the remainder four pairs between growth rates of tourism demand and exchange rate add much to the explanatory ability of the model.

In order to get a better picture of the time-varying evolution, this paper plots the dynamic dependence parameter estimates between tourist arrivals and exchange rate growth rates over the sample period generated from GARCH-copula model in Figures 5.4a and 5.4b. In addition, to check whether the estimates are significant, this paper plots the 10% significant level in the figures 5.5. It can be observed that growth rates of tourist arrivals from different source countries and the related exchange rate have different conditional dependence structure. Interesting results from the figures of dynamic copula can be summarized as: 1) The conditional correlation of the tourist arrivals for different source countries with their corresponding exchange rate growth rates varies over time. 2) It is significantly positive in some periods, significantly negative in other periods, and not significant in some other time periods. 3) The dynamic dependence analysis infers that the conditional correlation drop and even change from positive to negative during financial risk, such as 1997 Asian Financial Crisis and 2008 World Financial Crisis.

5.3.3 Goodness-of-Fit for copula and comparisons

The last section of the empirical part of the paper presents the Goodness-of-Fit (GOF) tests to prove that the copula can fit well to the variables. The paper follows the approach recommended by Genest, Remillard and Beaudoin's (2009) by estimating the p-values of the bivariate Goodness-of-Fit for different copulas and exhibits it at Table 5.7. These tests reveal that all the growth rates' pairs are significant for all copulas used in our paper at the 5% level, inferring that all the copulas used in this paper can fit all the pairs very well.

5.4 Conclusions

This study examines the dependence between exchange rates and tourism demand from a new perspective by applying the copula-GARCH model. To account for tail independence, tail dependence, time-invariant, and time-variant dependence, abroad family of copulas are applied to model the growth rate of the monthly exchange rate and tourist arrivals to China from the leading six tourism source countries, namely South Korea, Japan, Russia, USA, Malaysia, and Singapore, with a sample size of 216 observations from Jan 1994 to Dec 2011.

The dependence analysis shows that fluctuation of the exchange rate that has a negative effect on tourist arrivals on China from Japan and Malaysia and has a positive effect on tourist arrivals on China from South Korea, Russia, USA, and Singapore, but the coefficient of dependence is not statistically significant. The result indicates that the volatility of exchange rate is not a determinant factor in fluctuation of China's tourism demand from the countries being studied. Second, there are not extreme dependence between Japan-CNY/JPY, USA-CNY/USD, Malaysia-CNY/MYR and Singapore-CNY/SGD pairs, which imply extreme movements of CNY/JPY, CNY/USD, CNY/MYR and CNY/SGD do not cause extreme movements of Japan, USA, Malaysia and Singapore outbound tourism demand to China, respectively. Third, there is weak support suggesting that when the currency of tourists from south Russia extremely depreciates, or CNY appreciates, tourists from Russia may extremely decrease. This suggests risk adverse behaviour of tourists from Russia. Furth, introducing the tail dependence and dynamic dependence between growth rates of tourism demand and exchange rate add much to the explanatory ability of the model.

Under those circumstances, government policies aimed to reduce tourist arrivals variability do not need to consider the exchange rate fluctuations effect since it is not possible to explain the volatility of tourism arrival on the basis of exchange rate fluctuations. This could be attributed to the purpose of tourists who travel to China. According China National Tourism Administration Statistics, travel for meeting and business, visiting relatives and friends, work and crew and others account for 57.23% in 2012. This indicates shows that most of tourists who travel China are price inelastic; they do not care about the change that the tour price changes due to fluctuations of exchange rate. Chinese tourism demand volatility may be caused by tourist preferences and economic conditions that originate from the tourism source countries, economic and cultural relationships between china and source countries, and promotional activities to China markets. If exchange rates influence tourists from some nations less than others in choosing China as a destination, then other price proxies may have more relevance than exchange rates, or the nature resource’s attractiveness trumps exchange rate considerations. Hence, government and policy maker should diversify tourism products, strengthen tourism infrastructure (such as: hotels, restaurants, transportation and other and other services) and extend the tourism season. Moreover, the government should design the marketing promotion, increase Internet distribution channels, publicity, advertising and promotion. Second, travel agents do not need to worry about the reduction of competitiveness derived from exchange rate fluctuations. While they should design different tour package according traveller preferences, improve the quality of service, offer a diversity of attractions and provide a wide range of competitive tour packages to attract tourist and enhance its competitiveness. Last, this paper provides a complementary academic approach on evaluating the role of exchange rates in international tourism demand model.

Table 5.1 Summary statistics for monthly logarithmic growth rates of tourist arrival and exchange rates

	Mean	SD	Skewness	Kurtosis	Max	Min	JB
South Korea	0.0055 *	0.0485	-1.5751***	17.1537 ***	0.1694	-0.3552	1883.48 ***
CNY/KRW	-0.0035	0.0368	-4.0932***	38.2209***	0.0869	-0.3450	11713.25 ***
Japan	0.0028	0.0490	-1.8804***	27.0292 ***	0.2748	-0.3742	5299.28***
CNY/JPY	-0.0029	0.0272	0.5711***	4.4936***	0.1115	-0.0901	31.67 ***
Russia	0.0069	0.1007	0.3805**	18.5617***	0.6009	-0.5861	2174.58***
CNY/SUR	0.0013	0.0393	-6.7901***	75.9759 ***	0.0889	-0.4405	49359.58***
the USA	0.0032	0.0548	-3.0385***	46.0375 ***	0.3098	-0.5212	16923.66***
CNY/USD	-0.0027***	0.0069	-0.9841***	3.7514**	0.0114	-0.0260	39.76***
Malaysia	0.0037	0.0850	-2.1075***	27.1179***	0.4199	-0.7037	5369.97***
CNY/MYR	-0.0034**	0.0232	-0.1563	23.9615***	0.1580	-0.1488	3937.02***
Singapore	0.0034	0.0667	-1.9659***	38.3263 ***	0.4265	-0.5895	11318.04**
CNY/SGD	-0.0023**	0.0150	0.0369	5.2138***	0.0558	-0.0653	43.95 **

Note: The total number of observations for each series is215. ***, **, and * denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

Table 5.2 Tests of hypotheses of unit-root

Variables	ADF		DF-GLS		ZA	
	Log	Growth rate	Log	Growth rate	Log	Growth rate
South Korea	-1.2075	-12.1463**	0.4537	-2.3744*	-4.1152	-5.0759*
CNY/KRW	-2.7772	-10.2561**	-0.0639	-10.2149**	-2.8775	-5.6882**
Japan	-1.9736	-11.2660**	-0.0763	-13.2626**	-5.0223	-5.6873**
CNY/JPY	-3.7303**	-10.8608**	-0.1158	-4.8343**	-4.4796	-5.0868*
Russia	-1.6282	-13.2456**	0.3745	-2.2955*	-5.5769**	-6.6398**
CNY/SUR	-1.5584	-10.2207**	-1.3327	-4.6624**	-4.1306	-6.4088**
the USA	-0.8884	-11.6289**	-0.0565	-2.1146*	-4.5248	-6.2310**
CNY/USD	-2.5291	-5.0542**	0.9176	-4.6624**	-4.3719	-6.4088**
Malaysia	-0.8582	-11.9389**	-0.0564	-2.7863**	-4.9255	-6.1694**
CNY/MYR	-3.3306**	-11.5559**	0.4192	-4.1877**	-6.7288**	-5.2995*
Singapore	-1.2199	-11.9387**	0.0004	-2.4900**	-5.2781*	-6.2317**
CNY/SGD	-4.5679**	-11.6084**	0.3652	-11.5786**	-4.9897	-5.7795**

Note: Lag orders of ADF, ADF-GLS and ZA tests are determined based on AIC. The ADF critical values for the rejection of the null hypothesis of a unit-root are -3.4626 and -2.8756 for 1% and 5%, respectively. The ADF-GLS critical values for the rejection of the null hypothesis of a unit-root are -2.5759 and -1.9423 for 1% and 5%, respectively. And ZA critical value for the rejection of the null hypothesis of a unit-root is -5.57 and -5.08 for 1% and 5%, respectively. The symbol ** and * denote rejection of the null hypothesis at the 1% and 5% significance levels, respectively.

Table 5.3 Results of the ARMA-GARCH model for the growth rates of tourism demands

	South Korea	Japan	Russia	the USA	Malaysia	Singapore
$\boldsymbol{C_s}$	0.0072***	0.0035**	0.0039**	0.0031***	0.0034***	0.0037***
	(0.0019)	(0.0015)	(0.0020)	(0.0010)	(0.0015)	(0.0010)
$\boldsymbol{\phi_{s,1}}$			0.6773***			
			(0.0715)			
$\boldsymbol{\theta_{s,1}}$	-0.1726**	-0.2529***	-0.8634***	-0.5602**	-0.5698***	-0.6147***
	(0.0761)	(0.0789)	(0.0673)	(0.2294)	(0.0636)	(0.1325)
$\boldsymbol{\omega_s}$	0.0009***	0.0005*		0.0004*	0.0005*	0.0004**
	(0.0003)	(0.0003)		(0.0002)	(0.0003)	(0.0002)
$\boldsymbol{\alpha_s}$	0.8279**	0.6217*		0.6099*	0.2885*	0.5346*
	(0.3275)	(0.3503)		(0.3389)	(0.1438)	(0.2958)
$\boldsymbol{\beta_s}$			0.9889***	0.3891**	0.1438***	0.4061**
			(0.0095)	(0.1669)	(0.1187)	(0.1786)
$\boldsymbol{\xi_s}$	1.0420***	1.0959***	0.9206***	0.9318***	0.8296***	0.9026***
	(0.0979)	(0.0985)	(0.0838)	(0.0822)	(0.0884)	(0.0970)
$\boldsymbol{\lambda_s}$	3.7186***	3.0871***	2.3696***	2.7539***	3.7981***	3.4895***
	(1.0602)	(0.7853)	(0.2788)	(0.5337)	(0.9216)	(0.8964)

Notes: The table shows the estimates and their standard errors (in parentheses) for the parameters of the marginal distribution model defined in equations (1) and (2).The lags p and qare selected by using the AIC criterion for different combinations of values ranging from 0 to 2. ***, ** and * denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

Table 5.4 Results of the ARMA-GARCH model for the growth rates of the exchange rates

	CNY/KRW	CNY/JPY	CNY/SUR	CNY/USD	CNY/MYR	CNY/SGD
$\boldsymbol{c_s}$			0.0040*			
			(0.0021)			
$\boldsymbol{\phi_{s,1}}$		0.3606*	0.5632***	0.9217***	0.7025***	-0.3552*
		(0.2045)	(0.0851)	(0.0472)	(0.3044)	(0.1910)
$\boldsymbol{\theta_{s,1}}$	0.3940***			-0.3627*		0.6158***
	(0.1276)			(0.1656)		(0.1577)
$\boldsymbol{\omega_s}$	0.0001*		0.0000*		0.0000**	0.0000**
	(0.0000)		(0.0000)		(0.0000)	(0.0000)
$\boldsymbol{\alpha_s}$			0.4337***	0.1869**	0.4760***	0.2335**
			(0.1563)	(0.0882)	(0.1042)	(0.1082)
$\boldsymbol{\beta_s}$	0.7830***	0.9931***	0.5653***	0.8057***	0.5230***	0.5486***
	(0.1514)	(0.0244)	(0.0899)	(0.0725)	(0.0756)	(0.1676)
$\boldsymbol{\xi_s}$	0.7646***	1.2398***	0.8800***	0.9874***	1.1304***	1.1369***
	(0.1842)	(0.1225)	(0.0746)	(0.0987)	(0.0731)	(0.1156)
$\boldsymbol{\lambda_s}$			3.3462***		4.0098***	
			(0.6269)		(0.8372)	

Notes: The table shows the maximum likelihood estimates and standard errors (in parentheses) for the parameters of the marginal distribution model defined in equations (1) and (2). The lags p and qare selected by using the AIC for different combinations of values ranging from 0 to 2. ***, **, and * denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

Table 5.5 Tests for the skewed-t marginal distribution models

	First moment LB test	Second moment LB test	Third moment LB test	Fourth moment LB test	K-S test
South Korea	0.5402	0.5376	0.1020	0.3776	0.8114
Japan	0.3955	0.8774	0.2725	0.6188	0.5830
Russia	0.3223	0.2513	0.2082	0.2619	0.9749
USA	0.1122	0.2930	0.1751	0.0528	0.7258
Malaysia	0.7049	0.7642	0.5150	0.5496	0.8974
Singapore	0.2035	0.8705	0.4805	0.9618	0.9579
CNY/KRW	0.0910	0.6596	0.0761	0.7888	0.7990
CNY/JPY	0.2223	0.3298	0.1193	0.3661	0.8796
CNY/SUR	0.9926	0.7823	0.6720	0.8380	0.6895
CNY/USD	0.1331	0.3634	0.2295	0.3156	0.4679
CNY/MYR	0.1216	0.6565	0.3779	0.6324	0.0560
CNY/SGD	0.2249	0.3911	0.3482	0.2821	0.7587

Note: This table reports the *p*-values from Ljung-Box (LB) tests for serial independence of the first four moments of the variables u or v. Regress $(u_t - \bar{u})^k and\ (v_t - \bar{v})^k$on the first 5 lags of the variables for k=1, 2, 3, 4. In addition, the *p*-values of the Kolmogorow-Smirnov (KS) tests for the adequacy of the distribution model are presented.

Table 5.6 Result of the static and dynamic copula—GARCH model

	South Korea CNY/KRW	Japan CNY/JPY	Russia CNY/SUR	the USA CNY/USD	Malaysia CNY/MYR	Singapore CNY/SGD
Panel A : static copula						
Gaussian Copula						
$\boldsymbol{\rho}$	0.0776	-0.0187	0.0807	0.0727	-0.0089	0.0127
	(0.0611)	(0.0700)	(0.0580)	(0.060)	(0.0632)	(0.0646)
AIC	0.6655	1.9186	0.4396	0.7688	1.9778	1.9660
Student-t Copula						
$\boldsymbol{\rho}$	0.05720	-0.0070	0.0313	0.0660	-0.0202	0.0272
	(0.0923)	(0.0863)	(0.0800)	(0.0831)	(0.0820)	(0.0817)
$\boldsymbol{T}$	21.8268	100.0000**	7.1064	12.3822	100.0000**	11.5134
	(36.1734)	(7.0711)	(5.3924)	(10.2795)	(7.7011)	(11.8836)
AIC	1.4854	10.0960	-3.2081	2.8192	14.9278	2.8530
Frank Copula						
$\boldsymbol{\tau}$	0.2799	-0.0831	0.1581	0.4876	-0.1199	0.2462
	(0.4076)	(0.4054)	(0.4026)	(0.4050)	(0.4047)	(0.4032)
AIC	1.5260	1.9586	1.8497	0.5740	1.9029	1.6547
Plackeet Copula						
$\boldsymbol{\tau}$	1.1498***	0.9591***	1.0833***	1.2759***	0.9445***	1.1359***
	(0.2334)	(0.1944)	(0.2176)	(0.2582)	(0.0191)	(0.2293)
AIC	1.5271	1.9584	1.8477	0.5725	1.9076	1.6426
Gumbel Copula						
$\boldsymbol{\tau}$	1.0276***	_	1.0253***	1.0557***	_	1.0138***
	(0.0385)		(0.0391)	(0.0450)		(0.0434)
AIC	1.4624		1.5452	0.5121		1.9063
Clayton Copula						
$\boldsymbol{\tau}$	0.0125	_	0.1214*	0.0476	0.0118	0.0102
	(0.0895)		(0.0632)	(0.0564)	(0.0558)	(0.0701)
AIC	**-2.0849**		**-3.2367**	1.1890	1.9467	1.9745
Panel B: dynamic copula						
Dynamic Gaussian copula						
$\boldsymbol{\alpha_c}$	0.0022	-0.0003	0.0020	0.0393	-0.0025	0.0054**
	(0.0755)	(0.0022)	(0.0011)	(0.0440)	(0.0467)	(0.0016)
$\boldsymbol{\beta_c}$	0.9964***	0.9721***	0.9950***	0.3321	0.9856***	0.9345***
	(0.2647)	(0.0309)	(0.3359)	(0.3719)	(0.0414)	(0.2037)
$\boldsymbol{\gamma_c}$	-0.4942	-0.7649**	-0.4799*	-2.0905**	-0.6803**	-1.2466***
	(0.3675)	(0.3587)	(0.2702)	(0.7172)	(0.1277)	(0.3045)
$\boldsymbol{AIC}$	0.0624	**1.2784**	1.6552	**-3.1908**	**0.9017**	**-4.6250**

Note: This table reports the estimates of static and dynamic copula parameters defined in equations (3)-(9) and their corresponding standard errors (in brackets) for several copula specifications for each pair of growth rates of the tourist arrivals and exchange rates.***, **, and * denote rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

Table 5.7 Goodness-of-fit tests for the copula model

	Gaussian Copula	Student-t Copula	Gumbel Copula	Clayton Copula	Placket Copula	Frank Copula
South Korea and CNY/KRW	0.6558	0.2722	0.5410	0.7238	0.5519	0.5549
Japan and CNY/JPY	0.9915	0.9898	0.9935	0.9056	0.9975	0.9965
Russia and CNY/SUR	0.3171	0.6648	0.3022	0.3641	0.2592	0.2493
USA and CNY/USD	0.1500	0.1568	0.2823	0.0986	0.2139	0.1352
Malaysia and CNY/MYR	0.3931	0.2103	0.3911	0.5290	0.2632	0.2532
Singapore and CNY/SGD	0.3102	0.7177	0.7028	0.4378	0.7907	0.7328

Note: We report the *p*-value from the Goodness of fit tests. A *p*-value less than 0.05 indicate a rejection of the null hypothesis that the model is well specified.

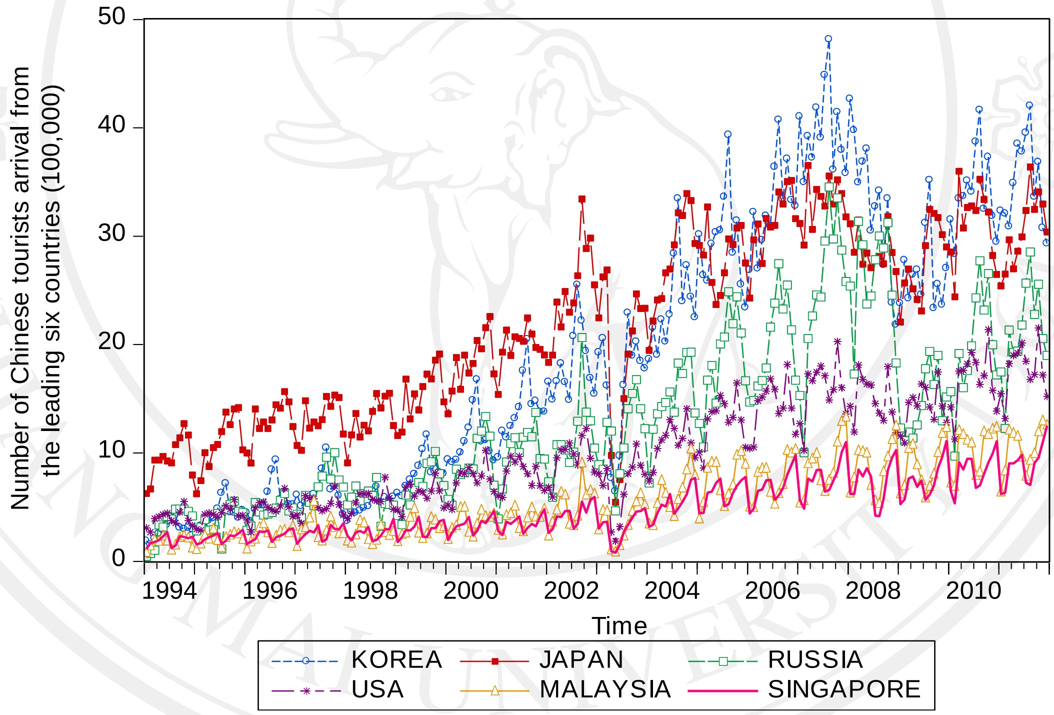

Figure 5.1 China inbound tourist arrival from the leading six countries

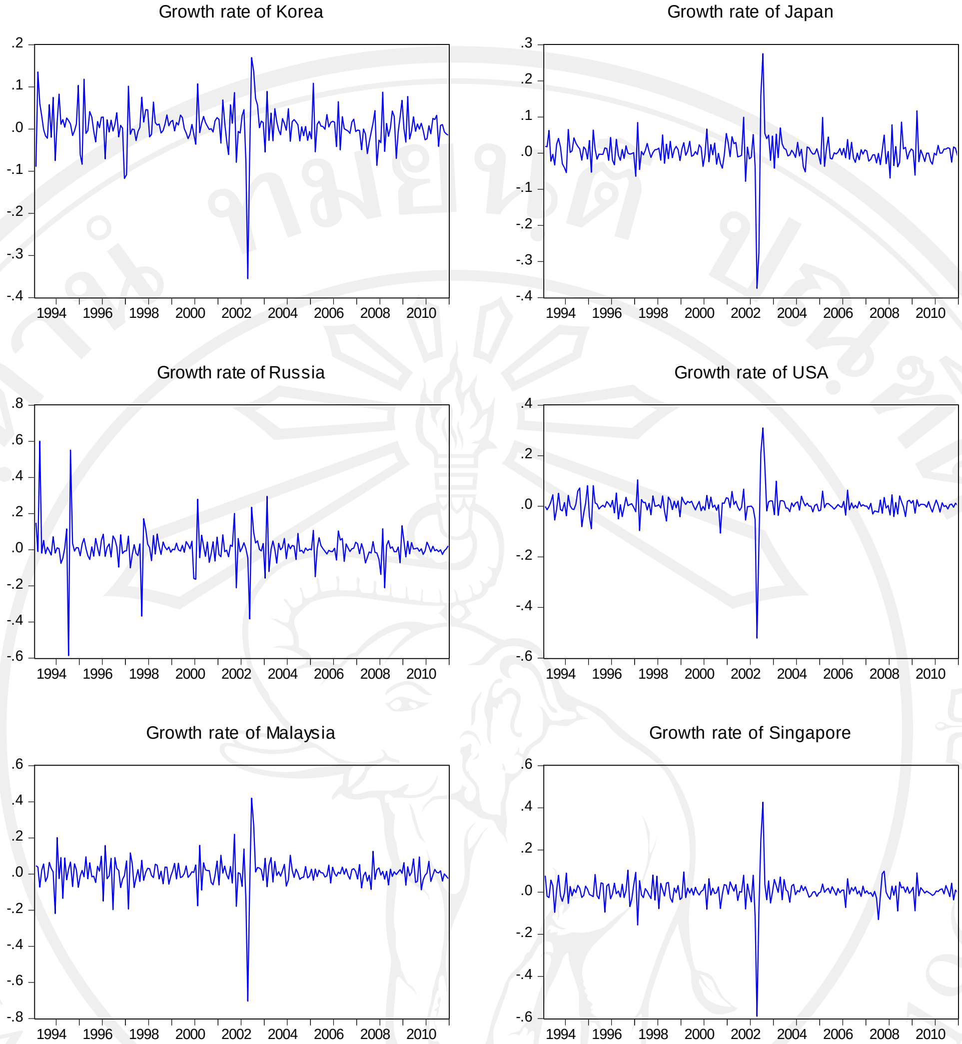

Figure 5.2 Monthlygrowth rates from tourist arrival of the leading six countries

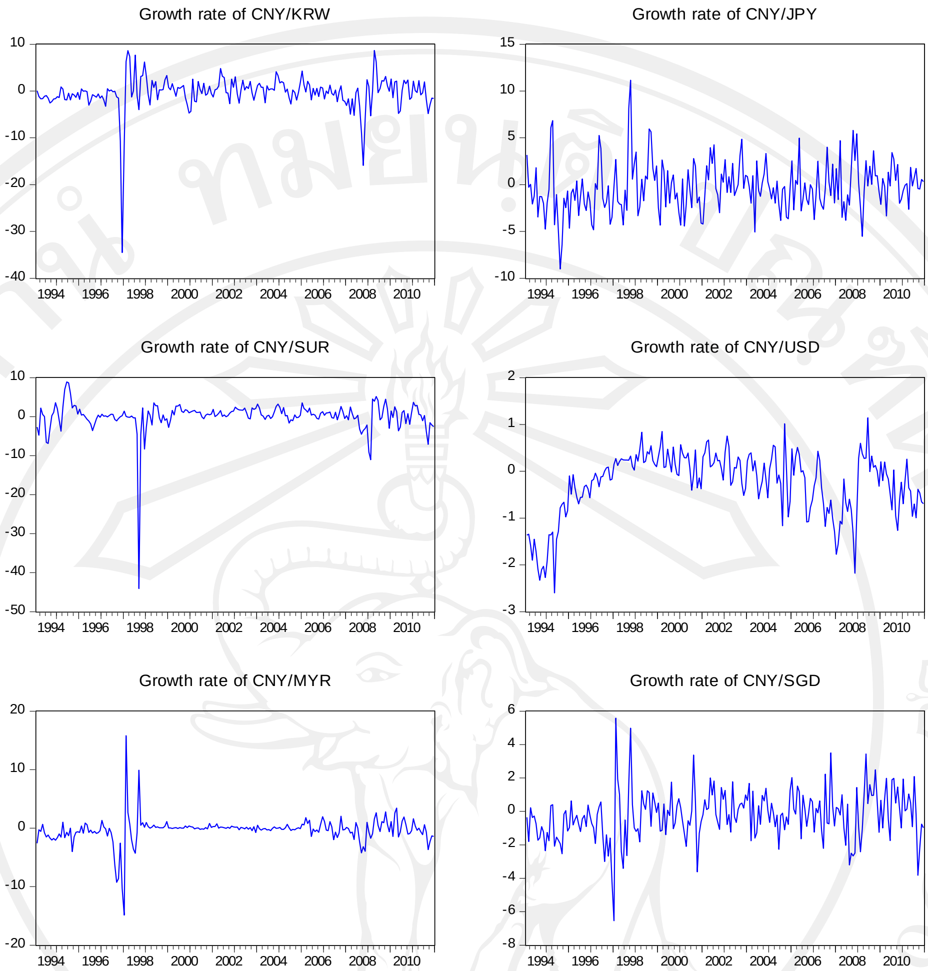

Figure 5.3 Monthly growth rates from exchange rate of the CNY

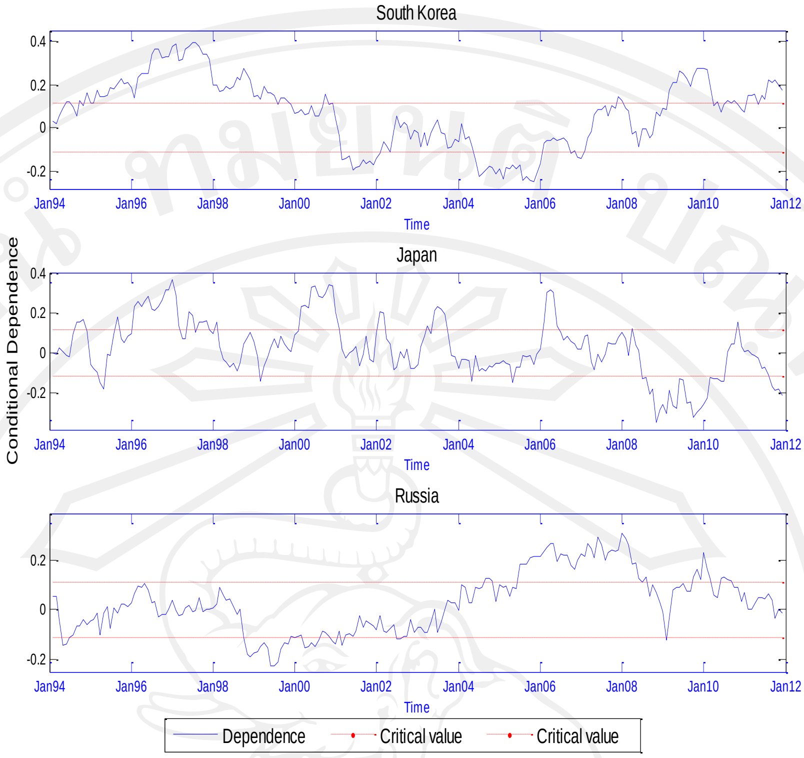

Figure 5.4a Conditional dynamic dependence estimates with critical value of 10% between tourist arrival and exchange rate growth rates from South Korea, Japan, and Russia

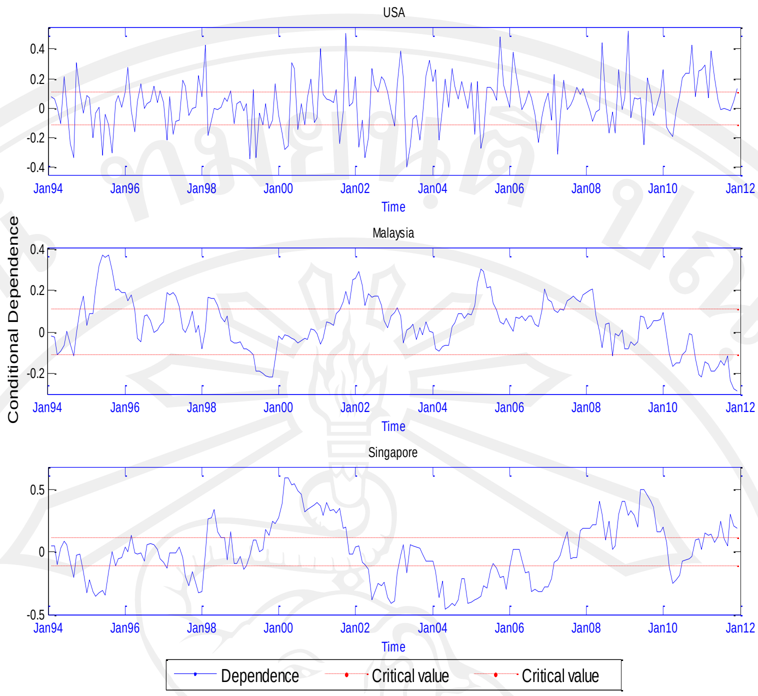

Figure5.4b Conditional dynamic dependence estimates with critical value of 10% between tourist arrival and exchange rate growth rates from USA, Malaysia, and Singapore