Country risk and volatility of stock returns: Panel-GARCH evidence for the Latin America´s major five

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November 2014

Abstract:

This paper studies the link between country risk –measured by a country composite risk index as well as individual measures of economic, financial and political risk– and Volatility of Stock Market returns. We use monthly data for the five major Latin American markets, over the period January 1993 to December 2013 and model Stock return volatility as a panel-GARCH process. We find significant and persistent volatility patterns for Stock market returns as well as high, positive and highly significant cross-correlation among these Stock markets. We also find strong support for the hypothesis that higher country risk increases stock market volatility.

JEL Classification: C23, F00, G15

Keywords: Country risk, stock market volatility, panel-GARCH models

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1. Introduction

Emerging markets are becoming the hub of investment for individual as well as institutional investors, particularly over the past decade. Higher expected returns and higher volatility is associated with emerging markets. Harvey (1995) and Claessens, Dasgupta and Glen (1995) explore the mean and volatility patterns of returns in emerging markets and find that both components are higher in these markets relative to the developed world. Political risk is an important factor when making international investment decisions, particularly when investing in emerging markets. Bekaert and Harvey (2002) point out the higher role of politics in emerging markets. Political events such as change of government, political violence and so on can adversely change the value of investment portfolio. The risk associated with the political uncertainty affects the business environment and is considered as systematic risk.

Research on political risk points out that political news affect financial markets. In particular, stock markets respond more to new information regarding political decisions that may affect domestic and foreign policy. As such, market efficiency requires that stock markets absorb news and political trends into stock prices in anticipation of outcomes of political uncertainty. According to the Political Risk Services International Country Risk Guide (ICRG), along with the gradual opening of capital markets in developing countries, investments into emerging markets totalled more than US$1.5 trillion over the past decade. However, they were exposed to considerable greater degrees of political risks in comparison with developed markets.

Political risk is defined in various ways in the literature. Howell and Chaddick (1994) define political risk as the "possibility that political decisions, events, or conditions in a country, including those that might be referred to as social, will affect the business environment such that investors will lose money or have a reduced profit margin". The reaction of the stock exchange depends on the political news. Prices should increase if the news lead to upward revision of investor's expectation and similarly it can lead to downward movements if the investors respond to news in the opposite way. Researchers use different ways to approach political events and use them to test against stock market's volatility. Soultanaeva (2008) uses political news as a proxy for political risk and finds that there is a weak relationship between political risk and stock market volatility.

The purpose of our study is to investigate to what extent political risk affects the financial stock markets in a panel of the top five Latin American markets. We use a monthly data set on stock returns as well as political, economic, financial and composite risk indexes for these Latin American countries. This study differs from the prior research in three important ways. First of all, to the best of our knowledge, this is the first paper that investigates the relationship between the stock return volatility and country risk in Latin American's top equity markets. Second, this study is also the first to use a panel-GARCH model to empirically examine the effects of political risk on volatility of these markets. Further, this research also highlights the issue of inter-market dependencies and integration across the Latin American emerging markets.

The organization of this study is as follows. Section 2 summarises the relevant literature on the effect of political risk on the stock exchange. Section 3 presents the Panel-GARCH econometric model of financial returns and volatility including risk components as well as the main hypotheses to be tested. Section 4 describes the data. The empirical findings are discussed in Section 5. Finally, the main conclusions are presented in Section 6.

2. Literature Review

In the literature we find two main measures of political risk. One uses the political events such as elections, change of cabinets or political conflicts, etc., as a proxy for political risk. The empirical literature on stock exchange behaviour has focused on the link between stock prices and political risk, as for example in Chan and Wei (1996). More recently, Beaulieu, Cosset and Essaddam (2006) investigated the short run effect of the 30 October 1995 Quebec referendum on the common stock returns of Quebec firms. Their results show that the uncertainty surrounding the referendum outcome had an impact on stock returns of Quebec firms. An important strand of the literature uses political news as a proxy for political risk (Kim and Mei 2001; Fong and Koh 2002; Beaulieu et al 2006; Zach 2003; Suleman 2012).

The second measure of political risk is the rating provided by the rating agencies such as Standard and Poor's, Moody's, Euromoney, Institutional Investor, Economist Intelligence Unit, and the International Country Risk Guide, which analyse qualitative and quantitative information regarding alternative measures of political, economic and financial risks and

incorporate into the risk index. These agencies provide ratings which reflect the risk inherent in a country using a reliable method of risk assessment. In the literature we find several researchers (e.g., Erb et al. 1995; Diamonte et al. 1996; Bilson et al. 2002) that used ratings such as ICRG (International Country Risk Guide) and IICCR (Institutional Investor Country Credit Rating) as proxies for political risk.

Cosset and Suret (1995) evaluate the benefits of international portfolio diversification into politically risky countries. They used monthly data on political risk ratings and stock returns for a sample of thirty-six countries from April 1982 to December 1991. They used monthly political risk ratings by Political Risk Services as measures of perceived political risk. Their empirical findings suggested that diversification among politically risky countries improves the risk-return characteristics of optimal portfolios. However, the most striking benefit of the inclusion of politically risky countries in an international portfolio is the reduction in overall portfolio risk.

Erb, Harvey and Viskanta (1996) explored five measures of country risk. Three political risk, economic risk, and financial risk-are from Political Risk Services' International Country Risk Guide (ICRG). The ICRG also reports a measure of composite risk, which is a simple function of the three base indexes. The fifth measure is Institutional Investor's (II) country credit ratings (CCR). The information content of these indexes was examined in a number of ways. Initially it was investigated whether the risk indexes contain information about future expected returns. Their analysis focused on 117 countries for which all of the five risk indexes were available for the period from January 1984 to July 1995. They conducted time-series/cross-sectional analysis linking these risk measures to future expected returns. Their results suggest that the country-risk measures are correlated with future equity returns. In addition, such measures are highly correlated with equity valuation measures.

Bilson, Brailsforda and Hooper (2002) extend the literature with two main contributions. First, they present a model of return variation that incorporates political risk after taking into account both global and local influences on returns. Second, the impact of political risk is considered both at the individual country and the aggregated portfolio levels. They employ monthly data over the period 1985–1997 for a sample of 17 emerging markets and 18 developed markets. For the political risk proxy, they use monthly Political Risk data from International Country Risk Guide. The authors find evidence that there is some political risk

exposure in emerging markets that is different to any exposure in developed markets, which has implications for asset pricing and portfolio decisions in these markets. Second, a large number of international investors use specialised international mutual funds as their investment vehicle to gain access to emerging markets (in contrast to direct foreign share ownership). Hence, these investors are exposed to the 'risk' of the emerging markets portfolio. In this sense, any exposure of emerging markets at the aggregate portfolio level will be borne by such investors. Indeed, they show that exposure to political risk at the aggregate level may well exist. Third, there is indirect but suggestive evidence that political risk is related to levels of capital market integration. This possibility opens an avenue for future research.

Hassan, Maroney, El-Sady and Telfah (2003) explore three related issues –stock market volatility, predictability and portfolio diversification– in the context of 10 emerging markets in the Middle East and Africa (MEAF). They examined the effects of local factors (using the country's credit rating of political, financial and economic risk) on volatility and predictability of the stock return in emerging markets. This study explicitly incorporates political, financial and economic risks into asset pricing models in these markets. Monthly data was collected from Emerging Markets Database (EMDB) and country's credit ratings International Country Risk Guide (ICRG) of the Political Risk Services Inc. Their results show that shocks in the political, financial and/or economic ratings shift the volatility parameters in the MEAF emerging markets. The results and conclusions are, however, interpreted with caution since five out of ten countries have only 3 years of data.

Olmeda and Sotelsek (2009) analyse one aspect of political fragility in Latin America and its incidence on the stock market. They tried to determine how news related to terrorism affect the volatility level of the Colombian stock market. They used data on the Colombian stock market index from MSCI for the period of Jan 1, 1996 to Apr 31, 2008, as well as compiled records of news related to terrorism. The database used in their paper includes more than 500 news items related to terrorism. Their results suggest that this kind of news does not affect the risk level faced by investors. A possible explanation is that terrorism in Colombia, though dramatic, is considered a variable that does not condition economic activity.

3. Econometric Methodology

Here we specify the econometric model as well as the empirical strategy that will be followed in this paper. We consider the following modified version of the panel-GARCH model proposed by Cermeño and Grier (2006). Let $\mathbf{u}_t$, $t = 1, \cdots, T$, be the *N*-dimensional vector of disturbances from a dynamic panel data model, with typical element: [2]

$$u_{i,t} = r_{i,t} - \mu_i - \beta_1 r_{i,t-1} - \cdots - \beta_p r_{i,t-p} - \tau\, \sigma_{i,t}\,, \qquad (1)$$

for $i = 1, \cdots, N$. That is, the stock return $(r_{i,t})$ is modeled as a stationary panel $AR(p)$ process, for which we need to assume that all the characteristic roots of the polynomial $(1 - \beta_1 L - \cdots \beta_p L^p) = 0$ lay outside the unit circle. Both, $\mu_i, i = 1, \cdots, N$ and $\beta_h, h = 1, \cdots, p$ are parameters. The parameter τ measures the GARCH-in-mean effect. We assume that the vector $\mathbf{u}_t$ follows a multivariate-normal distribution with zero mean and variance-covariance matrix $\mathbf{\Omega}_t$ with the following typical diagonal element:

$$\sigma_{i,t}^2 = \alpha_i + \delta\sigma_{i,t-1}^2 + \gamma u_{i,t-1}^2 + \xi\, I_t u_{i,t-1}^2 + \varphi R_{i,t}\,;\; i = 1, \cdots, N \qquad (2)$$

Equation (2) specifies a GARCH (1, 1) process for each stock return in the panel.[3] The effect of Country Risk on the conditional volatility is given by the parameter φ. The asymmetric effect of past shocks on current volatility is captured by the parameter ξ. The indicator variable I_t takes on the value of 1 if $u_{i,t-1}^2 < 0$ and zero otherwise. The introduction of this type of indicator variable was proposed by Glosten, Jagannathan and Runkle (2003) in a time series context.

The off-diagonal elements of $\mathbf{\Omega}_t$ represent the co-variances for each pair of markets and can be similarly modelled as:[4]

$$\sigma_{ij,t} = \rho_{ij}\left(\sigma_{i,t}\sigma_{j,t}\right) \quad i \neq j \qquad (3)$$

Preliminary testing has led us to a $AR(1)$ model without specific effects for the mean equation, as follows:

$$r_{i,t} = \mu + \beta_1 r_{i,t-1} + \tau\, \sigma_{i,t} + u_{i,t} \qquad (4)$$

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[2] See Baltagi (2005) for a comprehensive review of key aspects in the panel data literature.

[3] Although the conditional variance is assumed to follow a common dynamics it is not equal across countries because shocks are different. Also, each variance has a country-specific intercept given by α_i which guarantees that even unconditionally the variances will differ across countries.

[4] This covariance structure is similar to the constant conditional correlation (CCC) multivariate GARCH model proposed by Bollerslev (1990). See Bauwens, Laurent and Rombouts (2006) for a useful survey on Multivariate GARCH models.

Therefore, the relevant equations of the panel-GARCH model are given by (4), (2) and (3). Our main hypothesis is that$\varphi > 0$, that is, a higher country risk (an increase in the risk index) will increase the volatility of the Stock market return. Also, based on abundant evidence from the financial time series literature, we expect that higher risk levels are related to higher returns ($\tau > 0$) and that negative shocks to these markets produce higher increases in volatility than positive shocks ($\xi > 0$).

The log-likelihood function for the complete panel is given by:

$$L = -\frac{NT}{2}\log(2\pi) - \frac{1}{2}\sum_{t=1}^{T}\log|\mathbf{\Omega}_t| - \frac{1}{2}\sum_{t=1}^{T}\mathbf{u}_t'\mathbf{\Omega}_t^{-1}\mathbf{u}_t \ . \qquad (5)$$

Estimation of the panel-GARCH model is based on direct maximization of this function, using numerical methods. The variance-covariance matrix of the estimated parameters is approximated by the negative inverse of the Hessian of L evaluated at the ML estimates.

4. Data

4.1 Stock Market Data

The stock market data is obtained from the Thomson DataStream for the selected countries for the period of January 1993 to December 2013. All returns are measured in U.S dollars in order to control for the impact of the exchange rate and domestic inflation (See Bilson et al., 2002). Monthly returns are calculated as follows,

$$R_{i,t} = \ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) * 100$$

Where $R_{i,t}$ is the return of the Stock market in country i at time t. Descriptive statistics of the monthly stock market returns are presented in Table 1.

Table 1: Descriptive statistics of Monthly Returns

	Mean	Std. Dev	Skewness	Kurtosis	Min	Max
Brazil	0.846	12.39	-0.693	5.15	-51.54	37.32
Chile	0.708	7.12	-0.998	6.95	-37.01	18.19
Colombia	0.678	8.14	-0.329	3.39	-28.22	20.76
Mexico	0.686	9.45	-1.523	7.99	-46.08	19.25
Peru	1.21	9.83	-0.607	8.07	-54.41	32.670

We clearly observe that the average return of the Peru Stock market (1.21%) is the highest in the region for the period of study and has a standard deviation of 9.3%.On the other hand, Colombia is the country with a lowest average return. Also, we observe that the return series of all markets, except Ecuador, have a negative skewness and excess kurtosis. This result is not surprising as the distribution of financial returns is usually leptokurtic due to volatility clustering.

Table 2 presents the correlation among the stock markets of the selected Latin American countries. The correlation estimates of these markets is quite important for portfolio managers and international investors since it facilitates the creation of portfolio and hedging strategies to reap the benefit of diversification. As it can be seen, the scope of diversification in these markets is relatively low due to the high correlation among the Brazil, Chile, Mexico and to some degree Peru. However the correlation is relatively low for Colombia which increases the window for some diversification in these stock markets. Appendix 1 displays the political, economic, financial and composite risk rating graph for the sample period. As it can be seen all indexes show considerable variation for all the countries. It is important to notice that the political risk rating is much lower for Venezuela which demonstrates the high level of political risk in the country. Further the variation is also prominent in the economic, financial and composite risk rating for all the countries.

Table 2: Correlation Matrix of Returns

	BRAZIL	**CHILE**	**COLOMBIA**	**MEXICO**	**PERU**
BRAZIL	1				
CHILE	0.645	1			
COLOMBIA	0.389	0.385	1		
MEXICO	0.645	0.602	0.317	1	
PERU	0.550	0.598	0.398	0.554	1

4.2 Measure of Political Risk

Political risk is a qualitative measure and as such needs to be quantified in order to be related to the financial data. A number of institutes such as (Bank of America, Business Environment Risk Intelligence, Economist Intelligence unit, Euromoney, Institutional Investor, Standard and Poor's Rating Group, Political Risk Service: ICGR (International Country Risk Guide),

Political Risk Service: Coplin- O'Leary Ratings system and Moody's Investment Service) offer country by country analysis, however only a few of these agencies or institutes provide quantitative analysis and most of them are constructed on a semi-annual or annual basis.

This study employs political risk indices developed by the international country risk guide (ICRG) and compiled by the PRGS Group. Independently acclaimed and sourced by researchers, the IMF, the World Bank and a host of other international financial institutions, the ICRG has become one of the world's most frequently used resources for evaluating and forecasting international risk. For example Howell and Chaddick (1994) find that PRS indices are more reliable and are able to predict risk better than other major political rick information providers. Hoti (2005) examined the qualitative comparison of country risk rating system used by seven leading agencies and found that PRGS is the best one to forecast the political, financial and economic risk. We used the political risk index as a proxy of political risk variable provided by the Political Risk Service.

The monthly data for the political, economical, financial and composite risk indices cover the period of January 1993 to December 2013 for the countries in our sample. The ICRG provide four types of indices including political risk (PR), economic risk (ER), financial risk (FR) and composite risk (CR). The PR measure the degree of political uncertainty in a given country. The political risk consists of a total of 100 points which is obtained by adding twelve components of political risk. The maximum rating number of 100 reflects the lowest risk while a score of zero indicates the highest risk. The sub components of PR are government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tension, law and order, ethnic tension, democratic accountability and bureaucracy quality. For the better understanding of the ratings, we minus the rating of each country from 100, so the higher value of the index represents higher political risk in a country.

Table 3: Descriptive statistics of Monthly Political Risk

	Mean	Std. Dev	Skewness	Kurtosis	Min	Max
Brazil	33.68	2.34	0.211	2.47	29.00	40.00
Chile	22.89	3.39	0.349	2.41	17.00	31.00
Colombia	40.68	4.75	0.507	2.67	33.00	54.00
Mexico	29.65	2.91	-0.126	2.33	22.50	37.00
Peru	38.41	3.88	1.39	7.28	27.50	54.00

The Economic Risk Rating (ERR) provides a measure of a country's current economic strengths and weaknesses. The ERR consists of five components which include per capita GDP, real GDP growth rate, inflation, fiscal and current account balances expressed as percentage of GDP. The rating of ERR is between 0 and 50 and a high rating indicates a sound economic conditions where as a low rating demonstrate weak economic conditions in the country. The overall aim of the Financial Risk Rating is to provide a measure of a country's ability to finance its official, commercial, and trade debt obligations. This also consist of five subcomponents like ERR which are external debt as percentage of GDP, foreign debt as percentage of export of goods and services, current accounts as a percent of goods and services, net liquidity in a month, exchange rate stability against US dollar. The FRR fluctuate between 0 and 50, a high rating display a low level of external exposure and vice versa. The Composite risk is the combination of all the three risks (PR, ER and FR) and is calculated as CR = 0.5PR + 0.25ER + 0.25FR. We use the similar like the political risk so the higher value of these indexes represents higher risk.

Table 3 presents the descriptive statistics for the political risk from ICRG. It is noteworthy that Colombia has the highest political risk rating of 40.68 with standard deviations of 4.75. The lowest political risk rating is for Chile, however the standard deviation for this country is also quite high which is due to the uncertainty about the political risk in the country. The difference between minimum and the maximum of the political risk is relatively large for the majority of countries confirming the presence of uncertainty in these markets.

5. Empirical Results

In Table 4 below we present the panel-GARCH estimation results of the key parameters of the model. In the first place, we find strong evidence on GARCH effects as the estimates of δ and γ are statistically significant at the 1% level in all cases. Also, these coefficients add up to less than one in all cases and we can characterize the volatility of Latin American stock market as a stable dynamic process. Second, we find evidence on positive GARCH-in-mean effects in the panel, a result that is consistent with the accepted view that higher risk in this markets implies higher average returns. Third, we also find reasonable evidence that negative shocks to these markets increase volatility of stock returns in a greater extent than positive socks. These asymmetric effects are captured by the parameter ξ which is positive and statistically significant in all cases.

Table 4: Panel-GARCH estimates of some key parameters

Risk Index	GARCH (δ)	ARCH (γ)	τ	φ	ξ
Composite					
(1)	0.799***	0.071***	0.178*	0.125***	0.059*
	(0.038)	(0.024)	(0.105)	(0.038)	(0.034)
(2)	0.799***	0.071***	0.178*	0.124***	0.058*
	(0.039)	(0.025)	(0.106)	(0.038)	(0.035)
(3)	0.795***	0.072***	0.178*	0.129***	0.060*
	(0.039)	(0.024)	(0.105)	(0.039)	(0.034)
Economic					
(1)	0.775***	0.068***	0.179*	0.519***	0.074**
	(0.041)	(0.025)	(0.104)	(0.161)	(0.036)
(2)	0.778***	0.069***	0.178*	0.507***	0.071**
	(0.041)	(0.025)	(0.104)	(0.159)	(0.036)
(3)	0.769***	0.069***	0.175*	0.548***	0.074**
	(0.042)	(0.025)	(0.104)	(0.170)	(0.037)
Financial					
(1)	0.796***	0.073***	0.182*	0.188	0.058*
	(0.040)	(0.024)	(0.105)	(0.201)	(0.034)
(2)	0.795***	0.073***	0.183*	0.223	0.058*
	(0.040)	(0.024)	(0.105)	(0.204)	(0.034)
(3)	0.774***	0.075***	0.183*	0.461*	0.063*
	(0.044)	(0.025)	(0.104)	(0.255)	(0.036)
Political					
(1)	0.802***	0.071***	0.174*	0.158***	0.058*
	(0.038)	(0.024)	(0.104)	(0.055)	(0.034)
(2)	0.803***	0.071***	0.174*	0.155***	0.057*
	(0.038)	(0.024)	(0.104)	(0.054)	(0.034)
(3)	0.796***	0.071***	0.174*	0.168***	0.060*
	(0.039)	(0.024)	(0.105)	(0.059)	(0.035)

The panel-GARCH model was estimated by maximum likelihood. Specifications (1), (2) and (3) consider, respectively, the one period lag, current and one period lead of the corresponding risk index. Numbers in parentheses are standard errors and *, **, *** indicate 10, 5 and 1 percent significance levels.

As far as the effect of country risk on volatility of returns, we confirm our hypothesis that higher country risks increases the volatility of stock returns. In practically all cases considered volatility increases in response to higher levels of risk. The only exception is found in the case of the financial risk index, although our estimates are still positive. This result can be interpreted as a beneficial effect of riskiness on stock market volatility.

Finally, it is worthwhile to highlight the finding of relatively high, positive and statistically significant (at the 1 percent level) correlation coefficients among all pairs of countries. These results are shown in Table 5 and are in agreement with the descriptive results shown previously in Table 2. Thus the panel-GARCH model used in this study captures quite well the correlation patterns among markets observed in the data. We find that while in the cases of Brazil, Chile, Mexico and Peru their stock markets are highly connected among each other, with a correlation coefficient of about 0.6, in the case of Colombia this coefficient takes the value of 0.4 approximately.

Table 5: Panel-GARCH estimates of cross-correlations

	BRAZIL	**CHILE**	**COLOMBIA**	**MEXICO**	**PERU**
BRAZIL	1.000	0.630	0.384	0.653	0.568
		0.633	0.386	0.655	0.571
		0.635	0.394	0.659	0.572
CHILE		1.000	0.381	0.601	0.587
			0.388	0.607	0.590
			0.394	0.613	0.593
COLOMBIA			1.000	0.355	0.349
				0.361	0.352
				0.371	0.358
MEXICO				1.000	0.518
					0.524
					0.527
PERU					1.000

The panel-GARCH model was estimated by maximum likelihood. For each pair of countries we report the minimum, average and maximum values of the estimated correlations in the 12 specifications considered. All correlation coefficients are significant at the 1 percent significance levels.

6. Conclusion

This paper investigates the link between Country Risk –measured by a country Composite Risk index as well as Individual measures of Economic, Financial and Political Risk– and Stock Market volatility. We use monthly data for five top emerging Latin American countries, over the period January 1993 to December 2013. Stock return volatility is modeled as a panel-GARCH process. We find significant and persistent volatility patterns for Stock market returns, as well as significant and positive correlation among countries, although Colombia is not as highly connected as the other 4 countries. We find strong support for the hypothesis that higher Country Risk –measured by all the risk indexes considered– increases Stock market volatility in this region.

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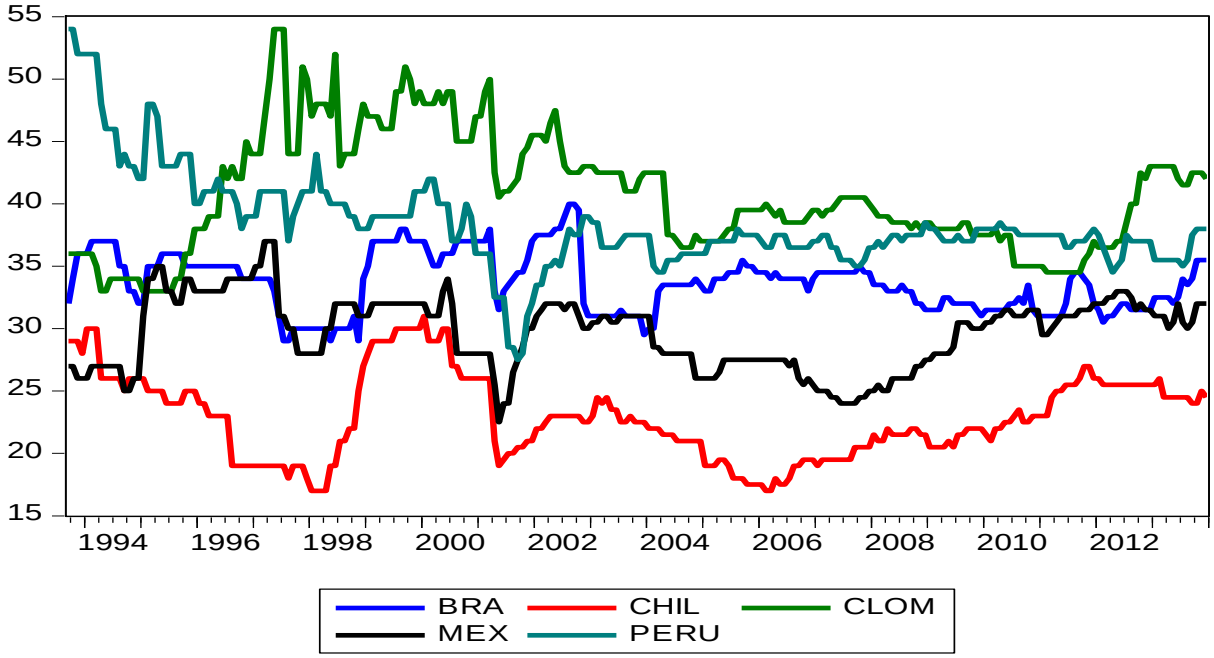
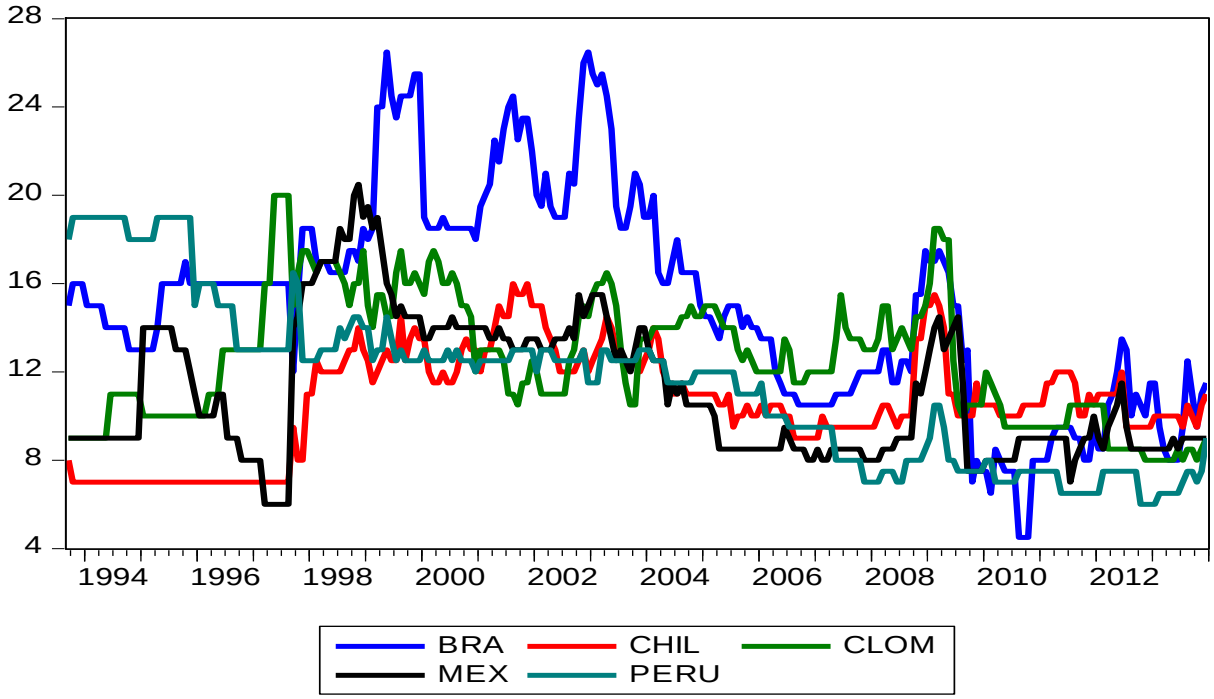
Appendix 1

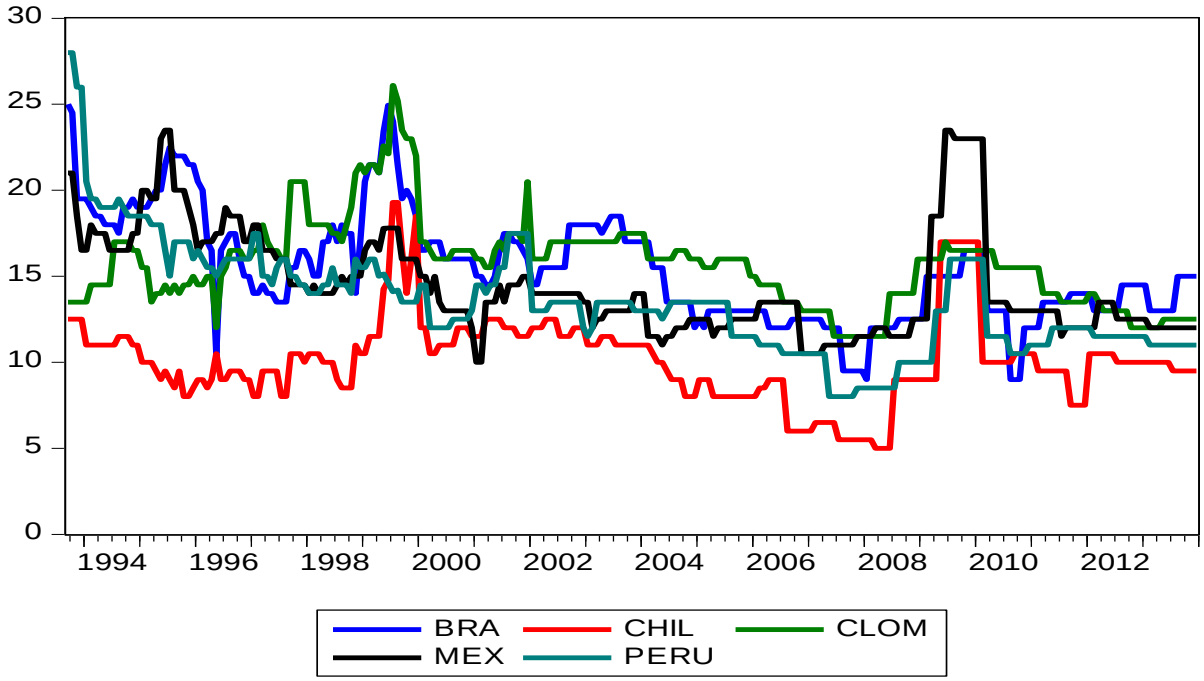
Political Risk



Financial Risk



Economic Risk



Composite Risk