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Exploring the nexus between Stock prices and Macroeconomic shocks: Panel VAR approach

Riadh El abed
University of Tunis El Manar (FSEG Tunis)

Abstract

This study seeks to examine the interaction between interest rates, monetary aggregate (M1), exchange rates, inflation, foreign direct investment and stock market returns in two emerging countries, namely Mexico and Brazil. The study determines the response of stock returns to a shock in each of these macroeconomic variables. A Panel VAR approach is used to establish the relationship between stock returns and the macroeconomic variables. Empirical results of the regression model reveal that foreign direct investment shows a significant relationship with stock returns. IRF observation shows that for emerging countries the interest rate, the inflation rate and the FDI response on stock prices is positive and significant over the short run and long run. However, exchange rates respond negatively and significantly to stock prices during a short period. We note that the monetary aggregate response to stock prices is negative and significant during a long period.

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Contact: Riadh El abed - riadh.abed@gmail.com.
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1. Introduction

In emerging and developed countries, investors have a great interest in discovering variables that may help forecast stock prices. Policymakers pay attention to the situation of the stock market that can be regarded as a leading indicator of future macroeconomic activity. The interaction between macroeconomic variables and stock market has been subjected to serious economic research. In theory, the stock market plays a prominent role in shaping countries' economic and political development.

In economic theory, there is no unified opinion on the relationship between stock returns and inflation. Fisher (1930) argues that inflation causes an increase in the nominal stock return. Bodie (1976) suggest that stock investment acts as an effective hedge against inflation. Moreover, some authors argument the presence of negative relationship between inflation and stock prices. An increase in inflation will result in high money supply. When the money in circulation decreases, demand remaining the same nominal interest rate will rise. An increase in discount rate will result in a decrease in stock prices. Inflation is measured in term of GDP deflator and consumer price index (CPI). Some authors using consumer price index to measure inflation rate. CPI measures changes in the prices of basket of consumer goods in a given time period.

A negative relationship between inflation and stock prices is discussed in the literature because an inflation rate increase is accompanied by a lower expected earnings growth and higher required real yields. A theoretical explanation was given by the literature concerning the negative relation between inflation and stock market prices. The objective of the central banks is the stability of prices, thus they control for the inflation level. Inflation indicator increase (decrease) (Consumer Price Index for example) causes a rise (decline) in the anticipated real inflation. Pearce and Roley (1985) show that this is a political restrictive sign by the central bank. So the inflation rate level increase involves a restrictive monetary policy, allowing increasing future cash-flows discount rate but do not act directly on the latter.

The relationship between money supply and stock prices is documented by many studies. Increased nominal money supply results in a portfolio rebalancing. An increase in demand for equity shares will result in a rise in stock prices. Bernanke and Kuttner (2005) suggest that a rise in the discount rate decreases the present value of the future cash flows on the investment and results in a drop in the stock prices. In this study, we use M1 as a proxy for money supply which is considered as narrow money which consists of currency plus demand deposits.

Interaction between the foreign exchange market and the stock market is analyzed through two theoretical approaches: the "stock oriented" approach (e.g. Branson, 1983; Frankel, 1983) and the "flow oriented" approach (e.g. Dornbush and Fisher, 1980). In the first approach, the foreign exchange rate is determined by the demand and supply of financial assets such as equities and bonds. In the second approach, the exchange rate is determined by a country's current account balance or trade balance. Flow oriented models provides a positive interaction between stock price and foreign exchange rate.

In the literature, a positive relationship between stock prices and exchange rates may result from a real interest rate disturbance; as the real interest rate rises, the exchange rate appreciates and the capital inflow increases (Wu, 2000).

In the literature, it is suggested that macroeconomic fundamentals act on stock market prices. Asprem (1989) demonstrates that interest rate variations have considerable impact on the discount rate through their effects on the risk free nominal rate. Consequently, when the interest rate increases investors incur capital losses and leave the equity market. Interest rates exercise an impact on firms' operations. Indeed, any interest rate increase causes capital loss amplification. Consequently the firm has to exercise the labor force to generate higher yields in a high interest rate environment. Otherwise, interest expenditure related to inflation destroys profits. If the interest rates increase so much that the firm cannot pay off its debt, the survival of the company will be endangered. In this case, investors will ask for an even higher risk premium."

The national currency appreciation results from increased foreign investors' return denominated in national currency and hence its FDI attractiveness.", When national currency is devalued, exports increase and the company's profit and revenue will rise, so its stock market value will increase." "So, by this logic, an interest rate increase leads to both national currency appreciation and lower equity prices.

The empirical evidence on the stock price – macroeconomic variable relationships has been document by numerous studies. For example, Spyrou (2004) examined the interaction between stock return and inflation for 10 selected emerging markets. For Mexico, he found that the relationship was insignificant during 1989M1–1995M12, 1989M1–2000M8, and 1995M12–2000M6. Husain (2006) examine the causal relationship stock market prices and Pakistani real sector by using annual data from 1960 to 2004. He found a causal relation between variables with several econometric techniques such as ECM, Engle and Granger cointegration, and the unit root tests. These researches indicate the presence of long-run relationship between the stock prices and real sector variables.

Abugri (2008) use a VAR model to analyze the effect of macroeconomic variables on stock prices for four Latin American countries. For Mexico, the stock return is negatively affected by the U.S. Treasury bill rate, industrial production, money supply, domestic interest rate and the exchange rate. Moreover, the stock return is positively affected by the MSCI world stock index. In the other hand, Adam and Tweneboah (2008) used Johansen's Multivariate cointegration approach for Ghana and analyzed the interaction between some economic indicators and stock prices by selecting the period from 1991 to 2006. The findings of Impulse Response Function (IRF) demonstrated that Foreign Direct Investment and interest rate were the major estimators of the stock index in Ghana.

Rahman, et al., (2009) used the VAR/VECM framework and explored the interaction between selected macroeconomic variables and stock prices for the case of Malaysia. They found that changes in the Malaysian stock market index do form a cointegrating relationship with changes in interest rates, exchange rate, money supply, reserves and industrial production index. Aloui and Jammazi (2009) combine a wavelet analysis and markov regime-switching models (MS-VAR) and prove that the stock market reaction of three developed countries like France, Japan and UK to shocks affecting oil prices is asymmetric. In US, Odusami (2009) shows that oil price unexpected shocks have an asymmetric and non linear impact on stock returns.

More recently, Mohd Hussin, et al., (2012) using the VECM methodology to examine the relationship between the development of Islamic stock market and macroeconomic variables in Malaysia. Their findings showed that Islamic stock price is negatively related with exchange rates and money supply and significantly and positively related with Consumer Price Index and Industrial production Index.

In the other hand, Pierdzioch and Kizys (2012) compared the linkages between the stock markets in three NAFTA countries, namely, the U.S., Mexico and Canada based on the fundamentals and speculative bubbles. They showed that the fundamentals have stronger effects on stock prices than the speculative bubbles. P.Bhannu Sirresha (2013) uses a linear regression technique and investigates the effect of selected macroeconomic factors on the movements of the Indian stock market, Nifty including gold and silver prices. He found an interdependent relationship between the returns on stock, gold commodities and silver commodities.

Yu Hsing (2014) explored the interaction between the Estonian stock market and some macroeconomic factors and found that the index is positively affected by real gross domestic product, the debt to GDP ratio and the stock market index in Germany. However, the index is negatively associated with interest rates for borrowing, the expected rate of inflation, domestic lending and the exchange rate.

Cyrus M, Kirwa L (2015), using co-integration and vector autoregressive techniques, investigated the dynamic relationship between major macroeconomic variables in Kenya and stock prices. Positive relationships were found between the Nairobi share prices (NSE), Treasury bill rate (TBR) and exchange rate. However, the authors found a negative relationship between the consumer price index (CPI) and NSE performance.

This study examines the relationship between stock price and macroeconomic variables in two emerging countries namely, Mexico and Brazil. It also analyses the theoretical relationships that exist between stock market volatility and macroeconomic variables for the period ranging from 1995 to 2015.

2. Econometric methodology

2.1. Panel VAR Modeling

The VAR models are often used in finance and in Applied Economics. In VAR models, all variables are considered to be endogenous and interdependent, at the same time in a dynamic or static sense. Furthermore, exogenous variables may be included in the VAR modeling structure (see Ramey and Shapiro, 1998).

We have X_t a vector of endogenous variables with (nx1) dimension. The VAR model of X_t is as follows:

$$X_t = A_0(t) + A(L)X_{t-1} + \varepsilon_t \quad (1)$$

where $\varepsilon_t \sim iid(0, \Sigma_\varepsilon)$

A(L) is a lag polynomial and iid means independent and identically distributed. Restrictions are generally imposed on the Aj matrix coefficients to delimit the Xt variance and ensuring the existing of $A(L)^{-1}$. Often, the equation (1) is decomposed to its short run and long run components. (Beveridge and Nelson (1981) and Blanchard and Quah (1989), among others).

Noting that $A_0(t)$ includes all the data deterministic components. Thus, the specification (1) can include constants, seasonal dummy variables and time varying determinist polynomial.

A modification of the equation (1) allows to the n variables Xt to be a linear function of an exogenous variables set Yt (predetermined). In this case, the VAR model is rewritten as follows:

$$X_t = A_0(t) + A(L)X_{t-1} + F(L)Y_t + \varepsilon_t \quad (2)$$

Such a modified structural VAR or VARX was described by Ocampo and Rodriguez (2011) and used in their analysis by, for example, by Cushman and Zha (1997) of the monetary policy effects in Canada.

VAR models with a finite order and fixed coefficients described by the equation (1) could be derived by several ways. The first standard way is by using of Wold theorem (Canova, 2007) and supposing the linearity, time invariance and the irreversibility of the resulting moving average representation. Under these assumptions, there exists a VAR(∞) representation for every vector of variables Xt. To truncate the VAR model infinite dimension and use a (p) order VAR finite and weak, in the empirical analysis, we suppose that the Xt-j contribution in the explanation of Xt is weak when j is high.

The Panel VAR models have the same structure of standards VAR models, when all the variables are supposed to be endogenous and interdependent, but a cross-sectional is added to the VAR representation.

If Xt is the amplified version of xi,t , the n variables for every individual I (i=1, .., n), meaning $x_t = (x_{1t}, x_{2t}, \dots x_{nt})'$. The index i is generic and can indicate countries, sectors, markets, banks or a combination among them. Then, the Panel VAR model is given by the following equation:

$$x_{it} = A_{0i}(t) + A_i(L)X_{it-1} + \varepsilon_{it}, \quad \forall i = 1, \dots, n; t = 1, \dots, T \tag{3}$$

Where ε_{it} is an (nx1) vector of the errors terms; $A_{0i}(t)$ and A_i can depending from the cross-sectional component i. When a Panel VARX is considered, the representation is:

$$x_{it} = A_{0i}(t) + A_i(L)X_{it-1} + F_i(L)Y_{it} + \varepsilon_{it} \tag{4}$$

Where $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{nt})' \sim iid(0, \Sigma)$, F_{ij} are n x m matrix for every lag $j = 1, \dots, q$ and Y_t is a vector of exogenous variables common for all the i individuals.

A simple inspection of the equations (3) and (4) suggests that a Panel VAR had three main characteristics. First, the lags of all the endogenous variables for all the individuals enter into the model for the individual i. this characteristic is called "dynamic interdependency". Second, the errors ε_{it} are generally correlated through the individuals i and this characteristic is called "static interdependency". Third, the shocks ε_{it} constant, slope and variance are specific to the individual. This characteristic is called "cross-sectional heterogeneity".

These characteristics allow distinguishing a Panel VAR model, typically used in macroeconomic studies from Panel VAR model used in microeconomic studies. (Eakin and al. 1988 ; Vidangos, 2009 ; Benetrix and Lane, 2009 and Beetsma and Giuliadori, 2011 ; among others).

2.2. Unit root tests for Panel data

2.2.1. Im, Pesaran et Shin Test (2003)

Im and al. (1997) propose t-bar statistic based on the mean of individual ADF statistics to investigate the Panel data unit root assumption. The authors claim that their t-bar statistic has a more precise size and higher power than the data Panel unit root test of Levin and Lim (1993), taking into account residuals heterogeneity and serial correlation through groups. For a sample of n observed groups over a period t, the unit root regression of the conventional ADF test data Panel is given by:

$$\Delta Y_{it} = \alpha_i + \beta_i Y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta Y_{it-j} + \varepsilon_{it} \quad \forall i = 1 \dots n \;\; \text{and} \;\; \forall t = 1, \dots, T \tag{5}$$

Where Y_{it} is the study variable for the country i during the period t. Δ denotes the first difference operator. ;α_i, β_i and γ_{ij} are the coefficients to be estimated and ε_{it} is the error term. Im and al. (1997) propose to test the null assumption of data Panel unit root as follows:

$$\begin{cases} H_0: \beta_i = 0 \; \forall i \\ H_1: \beta_i < 0 \; \forall i = 1,2, \dots, N_1 \text{ et } \forall i = N_1 + 1, N_2 + 2, \dots, N \end{cases}$$

The equation relative to the alternative assumption allows to the coefficient β_i to differ from groups and is more general than the homogenous alternative assumption such: $\beta_i = \beta < 0 \; \forall \, i$. Im and al. (1997) propose a standard t-bar statistic ($\psi_{\bar{t}}$) given by:

$$\psi_{\bar{t}} = \frac{\sqrt{n}\{\bar{t}_{nT} - (1/n) \sum_{i=1}^{n} E[t_{i,T}(p_i, 0) | \beta_i = 0]}{\sqrt{1/n \sum_{i=1}^{n} Var[t_{i,T}(p_i, 0) | \beta_i = 0]}} \tag{6}$$

Where $\bar{t}_{nT} = \frac{1}{N} \sum_{i=1}^{n} t_{i,T}\,(p_i,\ \beta_i)$ and $t_{i,T}(p_i,\ \beta_i)$ is the individual t statistic to test the null assumption $\beta_i = 0 \forall$ i. Noting that: $E\left[t_{i,T}(p_i, 0) | \beta_i = 0\right]$et $Var\left[t_{i,T}(p_i, 0) | \beta_i = 0\right]$ are reported in table (2) of Im and al. (1997). Since $\left[t_{i,T}(p_i, 0) | \beta_i = 0\right]$and $Var\left[t_{i,T}(p_i, 0) | \beta_i = 0\right]$ vary when ADF regression lag length vary. In practice, we use the same lag length in all the individual ADF regressions. Under the null assumption, the standardized statistic $\psi_{\bar{t}}$ is asymptotically standard distributed ($\psi_{\bar{t}} \sim N(0,1)$).

Im and al. (1997) used a Monte Carlo simulation and find best performance of finite samples for the statistic $\psi_{\bar{t}}$ compared to the Levin and Lin test (1993). If the variables are characterized by common trends, the individual ADF regression errors could be simultaneously correlated. The error term ε_{it} is supposed to be composed by two random components:

$$\varepsilon_{it} = \theta_t + \vartheta_{it} \tag{7}$$

With θ_t a common specific individual and stationary effect taking into account one dependence degree between groups. ϑ_{it}represents an idiosyncratic (specific) random effect independently distributed between groups. According to Im and al. (1997) simultaneous correlations of errors from individual ADF regressions can affect the critical values and the power of data Panel unit root tests.

2.2.2. Madalla and Wu Test (1999)

The Fisher test P_{λ} developed by Madalla and Wu (1999) enhanced the P-values of ρ_i from the ADF regression for each one of the n ADF regressions for ρ_i issued from the following equation :

$$\Delta Y_{it} = \alpha_i + \beta_i Y_{it-1} + \sum_{j=1}^{p_i} \gamma_{ij}\, \Delta Y_{it-j} + \varepsilon_{it} \forall\ i = 1 \ldots n \text{ and } \forall\ t = 1, \ldots, T \tag{8}$$

The Madella and Wu (1999) test is non parametric and is based on the Fisher's work (1932). Furthermore, this test is similar to the Im and al. (2003) test because it takes into account the different first order autoregression correlations and has the same assumptions (null and alternative) in the estimation procedure. The Fisher test statistic ($P(\lambda)$) is given as follow:

$$P(\lambda) = -2 \sum_{i=1}^{n} \ln(\pi_i) \tag{9}$$

Where π_i is the test statistic P-value for the individual i. The Fisher test statistic $P(\lambda)$ follows a $\chi^2(2n)$ statistic low. Maddala and Wu (1999) show that the Fisher test type has a more precise size and higher power comparing to the test of Levin and Lim (1993). The Fisher test advantage is that it allows the use of the different lags in the individual ADF regressions, although the Im and al. (2003) test requires the same individual regressions lag length.

According to Banergie (1999) and Maddala and Wu (1999), the Fisher test is very useful in practice since it reduces bias caused by the optimal lag selection procedure. Furthermore, there are three other statistics used to test the null assumption stipulating that each Panel contains unit roots.

$$Z = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \Phi^{-1}(p_i) \rightarrow N(0,1) \tag{10}$$

Where $\Phi^{-1}(.)$ the inverse of the standard normal function distribution.

$$L^* = \sqrt{\frac{3(5N+4)}{\pi^2 N(5N+2)}} \sum_{i=1}^{N} \ln\left(\frac{p_i}{1-p_i}\right) \rightarrow t(5n+4) \tag{11}$$

Under the null assumption, if $T \rightarrow \infty$ then by $N \rightarrow \infty$, the statistic P tends towards infinity. Thus, Choi (2001a) proposed a modified χ^2 statistic, noted P_m, which converges to a standard normal distribution ((N(0,1)).

$$P_m = -\frac{1}{\sqrt{N}} \sum_{i=1}^{N} [\ln(p_i) + 1] \rightarrow N(0,1) \tag{12}$$

3. Data and preliminary analyses

In this paper, we study the interaction links between the stock returns and macroeconomic variables. We estimate a VAR model with Panel data context to study the shock effects of every macroeconomic fundamentals on stock returns while considering two emerging countries namely, Mexico and Brazil. Economically, Brazil had the eleventh largest investment fund industry in the world, with USD $731 billion in assets under management, excluding funds of funds, the equivalent of 2% of the world value at the end of the third quarter of 2015. Stock funds accounted for 5.7% of assets under management in Brazil. In addition Stock funds are the main vehicle available for individual Brazilians to invest in stocks. Understanding the macroeconomic factors that may influence the returns of stock portfolios such as stock funds will possibly bring about relevant decision-making aspects for asset managers and investors.

The selection of Mexico is important because it has had a close economic relationship with the U.S. since the passage of the NAFTA in 1994 and partly because it is the second largest country in Latin America. In addition the stock market index in Mexico has risen above the pre-crisis level in recent months, it is interesting to examine the potential impacts of macroeconomic and global variables on stock market performance in Mexico.

We consider the raw nominal exchange rates series, market prices and macroeconomic fundamentals with quarterly frequency (81 observations) from 1995:Q1 to 2015:Q1.

Table 1 and 2 report Maddala and Wu (1999) and Im and al. (2003) unit root results. For the two tests, null hypothesis rejection indicates that the tested variables are stationary.

In our empirical analysis, we adopt the model with original and demeaned data to eliminate the contemporary effects that may affect the unit root in individual regressions. For the IPS test, the common lag is chosen on the basis of SBIC criterion. For the Fisher test, the lag size is chosen with the SBIC criterion and is equal to individual ADF regressions. First, we apply the IPS test and Fisher test on the original series. Tables (1) present Panel data unit root tests of the original series. We report four statistics of the IPS test: t-bar, t-tilde-bar, Z-t-bar and W-t-bar based on the ADF statistics.

Moreover, we report four statistics of the Fisher test: P, Z, L* and Pm. From these tables, we note that the unit root null assumption can be rejected in most series at a 1%, 5% and 10% significant level.

Second, we use demeaned data to reduce contemporaneous correlation and then apply IPS and Fisher tests to demeaned data series. Im and al. (2003) suggest that error contemporaneous correlations from individual ADF regressions can affect Panel data unit root tests power. Tables (2) present Panel data unit root tests of demeaned series. Using the IPS test statistics, we can reject the unit root null assumption at a 1%, 5% and 10% significant level. Furthermore, using the Fisher test statistics, we can reject also the unit root null assumption at 5% significant level.

4. Empirical results

We follow the Panel VAR approach which combines the classical VAR approach and the Panel data approach. The model to be estimated is the following:

$$SP_{i,t} = \alpha_0 + \alpha_1 LnSP_{i,t-1} + \alpha_2 FDI_{i,t-1} + \alpha_3 ER_{i,t-1} + \alpha_4 Ln(CPI)_{i,t-1} + \alpha_5 LnM1_{i,t-1} + \alpha_6 (IR)_{i,t-1} + \varepsilon_{i,t} \quad (13)$$

With $i = 1, \dots, n = 2\ ;\ t = 1995Q1, \dots, 2015Q1$.

The description and measurement of variables is explained in table 3 as shown.

Table 3. Definition and measurements of variables

Type	Variable	Variable Transformation and Measure
Dependent variable	Stock return	$R_t = LnP_t - Ln\, P_{t-1}$
Independent variables	Foreign Direct investment	FDI
	Nominal exchange rate	ER
	Inflation	Ln (CPI)
	Money supply	Ln(M1)
	Interest rate	IR

We transformed some variable in (Ln) if series are I (1) or not stationary.

The Panel VAR model estimations are done with STATA 12 software because of its performance in Panel data based studies. Empirical model estimation results are represented by the equation (13) and reported in the tables below.

This analysis objective is consists in determine the optimum number of lags (p) of the on level model. For the dependent variable, the optimal lag choice needs an identification model. Brooks (2002) suggests the existence of two ways to select the optimal lag. The first way, is based on the data frequency (daily data, intraday …) here the optimal lag choice is not evident. The second way applies the information criteria. In fact, there exist three criteria such as the AIC (1974), the SBIC and the HQIC (1978) criteria. In our empirical approach, we often adopt the SBIC criteria to identify the optimal lag length because it requires a more severe penalty AIC criterion. By referring to the SBIC criteria, obtained optimal lag is in the order of one for the two groups of emerging and developed countries. Table (4) allow the choice of the optimal lag.

Table1. Original data for emerging countries

Variables	Fisher-type tests: Fisher-ADF statistic P	Z	L*	Pm	Fisher-PP statistic P	Z	L*	Pm	IPS test t-bar	t-tilde-bar	Z-t-tilde-bar	W-t-bar
stock price	7.8196	-1.2985	-1.3303	1.3504	1.9992	1.0225	1.0892	-0.7074	-0.8364	-0.8238	1.1551	1.1263
(p-value)	(0.0984)	(0.0971)	(0.1023)	(0.0884)	(0.7359)	(0.8467)	(0.8528)	(0.7603)	(0.8760)	(0.8760)	(0.8760)	(0.8700)
stock return	81.7876	-8.4183	-16.5934	27.5021	115.8892	-10.138	-23.512	39.5588	-8.355	-6.0615	-7.8779	-10.7463
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
IDE	107.888	-9.802	-21.8887	36.7299	130.1848	-10.8604	-26.4123	44.6131	-8.9766	-6.3268	-8.3332	-8.6966
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
exchange rate	25.8251	-4.1506	-5.2373	7.7163	13.9251	-2.6312	-2.7966	3.5091	-3.1399	-2.977	-2.5574	-3.441
(p-value)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0075)	(0.0043)	(0.0071)	(0.0002)	(0.0053)	(0.0053)	(0.0053)	(0.0003)
interest rate	9.1542	-1.6585	-1.6983	1.8223	2.3714	0.3542	0.3376	-0.5758	-1.274	-1.2631	0.3977	0.7793
(p-value)	(0.0574)	(0.0486)	(0.0558)	(0.0342)	(0.0678)	(0.0384)	(0.0297)	(0.0176)	(0.6546)	(0.6546)	(0.6546)	(0.7821)
M1	0.5578	3.3521	4.7417	-1.217	0.0022	3.0556	4.0023	-1.4134	6.5877	4.7324	10.7352	6.8906
(p-value)	(0.9676)	(0.9996)	(0.9998)	(0.8882)	(1.0000)	(0.9989)	(0.9985)	(0.9212)	(1.0000)	(1.0000)	(1.0000)	(1.0000)
Ln(M1)	25.1809	-3.7298	-5.0674	7.4886	74.1904	-6.0195	-14.8776	24.8161	-63.392	-5.4202	-6.7719	-99.6748
(p-value)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
IPC	16.324	-2.9621	-3.2907	4.3572	8.6715	-1.3959	-1.4835	1.6516	-2.2935	-2.21	-1.235	-1.448
(p-value)	(0.1026)	(0.1015)	(0.1027)	(0.0000)	(0.1699)	(0.1814)	(0.1801)	(0.1493)	(0.1084)	(0.1084)	(0.1084)	(0.0738)
Ln(IPC)	77.9595	-8.1896	-15.8167	26.1486	105.1789	-9.6706	-21.3391	35.7722	-7.9129	-5.9165	-7.6278	-10.5297
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: The t-tilde-bar ($\mathbf{\tilde{t} - bar_{NT}}$) statistic is similar to the t-bar($\mathbf{t - bar_{NT}}$), statistic except a different error variance estimator of the Dickey-Fuller regression is used. A standardised version of the statistic t-tilde-bar is $\mathbf{-t - tilde - bar(Z_{\tilde{t}-bar})}$. In presence of serial correlation, Dickey-Fuller regression is augmented as follow : $\mathbf{\Delta y_{it} = \phi_i y_{i,t-1} + z'_{it}\gamma_i + \sum_{j=1}^{p} \Delta y_{i,t-j} + \epsilon_{i,t}}$ where $\mathbf{p}$ is the number of lags. Im et al. (2003) propose thus another statistic noted $\mathbf{W_{t-bar}}$ which follows an asymptotical standard normal distribution when $\mathbf{T} \rightarrow \infty$ followed by $\mathbf{N} \rightarrow \infty$.

Table 2. demeaned data for emerging countries

Variables	Fisher-type tests								IPS test			
	Fisher-ADF statistic				Fisher-PP statistic							
	P	Z	L*	Pm	P	Z	L*	Pm	t-bar	t-tilde-bar	Z-t-tilde-bar	W-t-bar
stock price	20.5426	-3.5625	-4.163	5.8487	10.084	-1.9835	-1.9779	2.151	-2.682	-2.5827	-1.8776	-1.9045
(p-value)	(0.0004)	(0.0002)	(0.0005)	(0.0000)	(0.0390)	(0.0237)	(0.0340)	(0.0157)	(0.0302)	(0.0302)	(0.0302)	(0.0284)
stock return	81.2856	-8.3892	-16.4915	27.3246	144.1746	-11.4917	-29.2507	49.5592	-9.7395	-6.5728	-8.7597	-13.5414
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
IDE	104.7765	-9.6609	-21.2574	35.6299	119.9204	-10.4016	-24.3299	40.984	-8.5435	-6.1798	-8.0797	-10.6728
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
exchange rate	19.7806	-3.4666	-4.0074	5.5793	12.784	-2.4608	-2.5598	3.1056	-3.13	-2.9691	-2.5438	-1.4634
(p-value)	(0.0006)	(0.0003)	(0.0006)	(0.0000)	(0.0124)	(0.0069)	(0.0113)	(0.0009)	(0.0055)	(0.0055)	(0.0055)	(0.0717)
interest rate	14.2696	-2.6976	-2.8718	3.6309	3.6412	-0.3495	-0.3209	-0.1268	-1.7208	-1.6998	-0.3553	-0.3196
(p-value)	(0.0065)	(0.0035)	(0.0062)	(0.0001)	(0.4567)	(0.3634)	(0.3765)	(0.5505)	(0.3612)	(0.3612)	(0.3612)	(0.3746)
M1	0.4623	1.7411	1.7039	-1.2508	0.5968	0.2547	0.9852	-1.4142	4.5169	4.0472	9.5538	4.5172
(p-value)	(0.9771)	(0.9592)	(0.9448)	(0.8945)	(1.0000)	(1.0000)	(1.0000)	(0.9214)	(1.0000)	(1.0000)	(1.0000)	(1.0000)
Ln(M1)	18.1863	-3.2587	-3.6811	5.0156	8.6286	-1.6928	-1.6508	1.6365	-2.4058	-2.3357	-1.4524	-2.8342
(p-value)	(0.0011)	(0.0006)	(0.0012)	(0.0000)	(0.0711)	(0.0452)	(0.0452)	(0.0509)	(0.0732)	(0.0732)	(0.0732)	(0.0023)
IPC	10.8548	-2.127	-2.1466	2.4235	3.8797	-0.4353	-0.4004	-0.0425	-1.7764	-1.7527	-0.4465	0.0075
(p-value)	(0.0282)	(0.0167)	(0.0249)	(0.0077)	(0.4225)	(0.3317)	(0.3475)	(0.5170)	(0.3276)	(0.3276)	(0.3276)	(0.5030)
Ln(IPC)	66.3639	-7.4761	-13.4642	22.049	87.1656	-8.724	-17.6845	29.4035	-7.1245	-5.5735	-7.0362	-9.2297
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: The t-tilde-bar ($\tilde{\mathbf{t}} - \mathbf{bar_{NT}}$) statistic is similar to the t-bar($\mathbf{t} - \mathbf{bar_{NT}}$), statistic except a different error variance estimator of the Dickey-Fuller regression is used. A standardised version of the statistic t-tilde-bar is $-\mathbf{t} - \mathbf{tilde} - \mathbf{bar}(\mathbf{Z}_{\tilde{\mathbf{t}}-\mathbf{bar}})$. In presence of serial correlation, Dickey-Fuller regression is augmented as follow : $\Delta \mathbf{y_{it}} = \boldsymbol{\phi}_\mathbf{i} \mathbf{y_{i,t-1}} + \mathbf{z}'_\mathbf{it} \boldsymbol{\gamma}_\mathbf{i} + \sum_{\mathbf{j=1}}^{\mathbf{p}} \Delta \mathbf{y_{i,t-j}} + \boldsymbol{\epsilon}_\mathbf{i,t}$ where $\mathbf{p}$ is the number of lags. Im et al. (2003) propose thus another statistic noted $\mathbf{W_{t-bar}}$ which follows an asymptotical standard normal distribution when $\mathbf{T} \rightarrow \infty$ followed by $\mathbf{N} \rightarrow \infty$.

Svestre (2002) indicates that standard econometric techniques such as OLS do not provide efficient parameters estimations in a dynamic model which proposes the lagged dependent variable as explicative variable. Furthermore, the estimation of model with random effects using OLS is not efficient because there is a correlation between individual effects and estimators (Biondi and Toneto, 2008). For this, we propose to estimate with GMM method in system because this method provides solutions to different problems such as simultaneity bias and reverse causality bias.

GMM estimator on system is proposed by Arellano and Bover (1995) and Blundel and Bond (1998). This empirical method assumes that equations in difference are used as variables in level tools. Monte Carlo simulations realized Blundel and Bond (1998) proved that the GMM estimator in system is more efficient than the one in first difference. Table 5 report the estimate results for the VAR model from the six variables.

Table 4. Optimal lag (emerging countries)

Emerging countries								
Lag	**LL**	**LR**	**DL**	**P**	**FPE**	**AIC**	**HQIC**	**SBIC**
0	-13529.8				2.90E+32	91.768	91.798	91.843
1	-11869.6	3320.4	36	0	4.80E+27	80.7564	80.9666*	81.2814*
2	-11836.8	65.503	36	0.002	4.90E+27	80.7785	81.1688	81.7533
3	-11809.7	54.339	36	0.026	5.20E+27	80.8383	81.4088	82.2631
4	-11771.5	76.355	36	0	5.10E+27	80.8236	81.5742	82.6983
5	-11639.3	264.4*	36	0	2.7e+27*	80.1714*	81.1022	82.496

In emerging countries, empirical results indicate that the response of stock returns to the foreign direct investment shock is negative and significant. The response of stock returns to an exchange rate shock is positive and not significant. This finding is consistent with the argument that exchange rate appreciation leads to an increase in stock returns, at least from the international investor's perspective (e.g., Bilson et al., 2001; Pebbles & Wilson, 1996). The response of stock returns to the interest rate is negative and significant, implying that the more nominal interest rates lead to a decrease in market returns. The response of stock returns to the money supply is negative and not significant. This finding is not surprising since an increase in money supply can lead to higher inflation and lower returns. Finally the response of stock returns to consumer price index is negative and not significant. Economically, any decrease in expected level of economic activity should induce a less level of return (Cheung et al., 1997a).

Table5. Empirical results from VAR modeling (emerging countries)

Emerging countries						
response of	response to					
	stock return (t-1)	FDI (t-1)	ER(t-1)	IR (t-1)	Ln M1 (t-1)	Ln IPC (t-1)
stock return (t)	-0.014	0.0087	2.56E-07	3.85E-06	-6.20E-06	0.0001
	[-0.1556]	[0.9609]	[0.3320]	[0.7706]	[-0.5228]	[1.7077]
FDI (t)	-0.7895*	0.0170	1.11E-06	2.01E-07	-0.0002	0.0008*
	[-1.9810]	[0.1492]	[0.5371]	[0.0063]	[-1.7280]	[2.1404]
ER (t)	4163.339	755.1975	0.8195*	0.1821	5.0308*	8.1364*
	[0.5080]	[0.9935]	[11.1305]	[0.3781]	[3.9460]	[2.2816]
IR (t)	-2.46E+02*	-3.30E+01	0.0017	0.9518*	-0.4161*	-0.1319
	[-1.9774]	[-0.9071]	[1.2243]	[35.6128]	[-7.6500]	[-0.4934]
Ln M1 (t)	-23.3147	1.9447	-0.0004*	-0.0025	0.0094*	0.0248
	[-0.9581]	[0.7669]	[-2.1359]	[-1.6489]	[2.0504]	[1.5692]
Ln IPC (t)	-18.677	-28.3053	0.0004	0.0150*	0.0067	0.0878
	[-0.3204]	[-1.6117]	[0.6756]	[2.3775]	[0.3072]	[1.0537]
	N= 162 observations					

Note: the value between brackets indicates the standard deviation

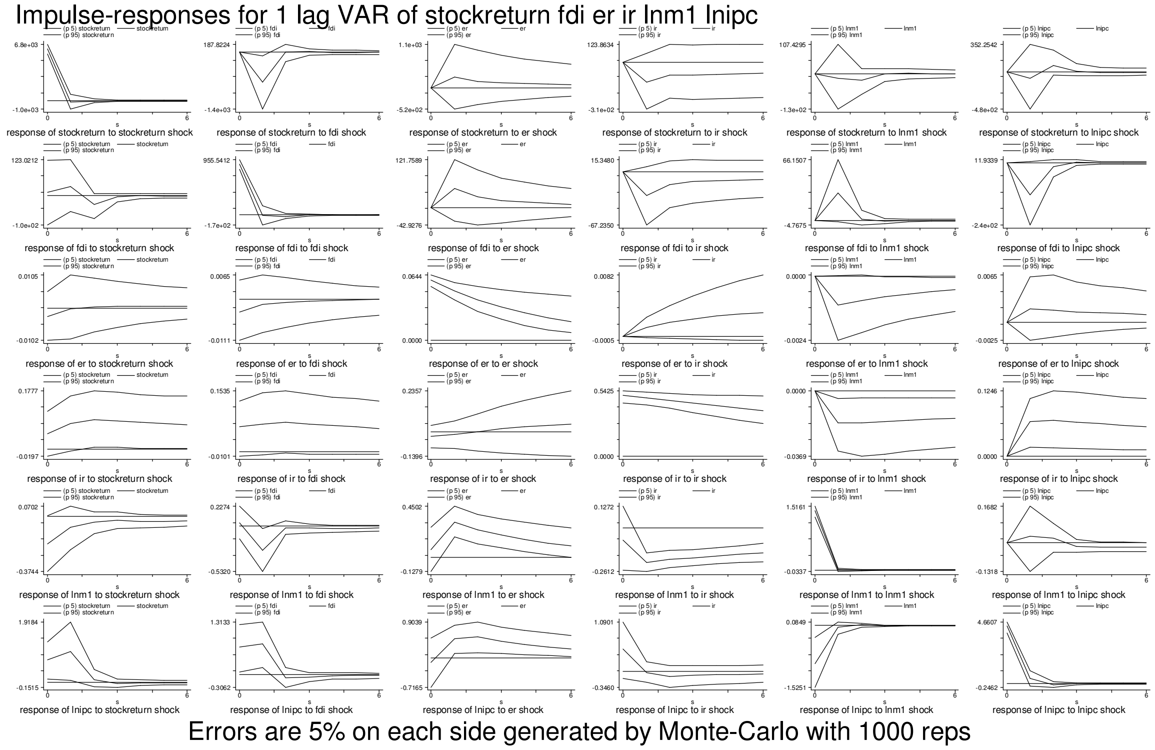

Fig1. IRF (Emerging countries)

5. Conclusion and Policy implications

Exchange rate and stock price volatility occupies a growing presence in financial markets. Macroeconomic variables such as interest rates, inflation indicators, the money supply and the exchange rate have a considerable effect on price fluctuations. In this framework, we tried to model the existing relationships between macroeconomic variables and stock exchange volatility by use of a Panel VAR model." The following sentence does not make sense to me and should be rewritten more clearly: "Estimation results and according to IRF, there is variables movements alternation explained by shocks destabilization relative to emerging countries.

Economically, macroeconomic variables' effects on stock market volatility depend mainly on investors' anticipations explained by arbitrage and also by shock persistence effects." , "In fact, when investors anticipate the interest rate increase, arbitrage to buy domestic securities is favorable." , "An interest rate rise induces an increase of the yields of securities denominated in the national currency." , "The national currency depreciation increases export flows, increases the exporting firms' profit and so raises their stock exchange values.

The theoretical approaches to the determination of the exchange rate, such as the portfolio equilibrium approach, allow a clarification of this link between stock exchange volatility and macroeconomic variables. According to the exchange rate monetary approach, the determination of the exchange rate is driven by the confrontation between the supply and the demand of real cash. Any imbalance in the currency market has an effect on the exchange rate.

Finally, we can say that the continuation and the persistency of the shock on a long time horizon makes favorable the investment in business sectors more oriented to domestic markets because the more the stock market price is volatile, the more risky it is. Investors try to minimize foreign exchange risk. Indeed, the more company is indebted and risky, the more the price is predicted to be volatile: the “indebtedness effect”. The investor is going to ask for a surplus risk premium in order to hedge foreign exchange rate exposure and remunerate the activities which have became more risky. So, the high uncertainty is considered harmful since it puts a brake on investment decisions and generates hedging costs.

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