African Review of Economics and Finance | ISSN 2042-1478 | Volume 10 | Issue 1 | June 2018

Impact of exchange rate volatility on exports: The case of Morocco

Younesse El Menyari

Department of Economics, Chouaib Doukkali University, Polydisciplinary Faculty of El Jadida, R.N. N°1 El haouziya, BP 356, 24000 El Jadida, Morocco.
Email: youness.elmenyari@gmail.com

Abstract

This study analyes the impact of exchange rate volatility on Moroccan exports using cointegration and the vector error correction model (VECM) for the period 1998:Q1-2014:Q4. The results obtained are mixed and vary according to the measuring procedure of the volatility that has been used. Our estimates indicate a significant and positive effect of the standard deviation of the moving average of the logarithm of real effective exchange rate on exports of goods and services, while the exchange rate measure determined from EGARCH modeling is negative and statistically highly significant. In addition, the analysis of general impulse response functions (GIRF) shows that exchange rate volatility has a persistent negative effect on real exports. This article recommends the measures that will further encourage exports and facilitate the transition to a flexible exchange rate regime.

Keywords: Exchange volatility; Exports; VECM; EGARCH; GIRF; Morocco.

1. Introduction

Since the collapse of the Bretton Woods system of fixed exchange rates in 1973, exchange rate volatility and its impact on international trade have been a major concern for the government and have sparked much debate among economists. The intuition behind these concerns is that exchange rate volatility would increase transaction costs and thus reduce gains in international trade (see Hooper and Kohl-Hagen, 1978; Cushman, 1983).

Similarly, most macroeconomic studies that seek to measure the effects of exchange rate volatility on trade or even growth (Vieira et al., 2013; Alagidede and Ibrahim, 2017) have not achieved clear results and generally have a modest or insignificant effect. In addition, some studies have found a negative interaction between currency risk and exports (Chowdhury, 1993; Arize *et al*., 2000; Wang and Barrett, 2007; Chit *et al*., 2010; Panda and Mohanty, 2015). Other authors reached the conclusion that they had a positive and significant relationship (Koray and Lastrapes, 1989; Viaene and Vries; 1992; Butt, 2013).

Within this framework, our work aims to contribute to the existing debate on the impact of exchange rate volatility on international trade by studying the case of developing countries and especially Morocco. Thus, it should be emphasised that the exchange rate is today at the heart of economic debates in Morocco, following the process of adopting a new exchange rate regime. Unlike Tunisia, which opted for a flexible exchange rate regime in 1994, the Moroccan monetary authorities have maintained the choice since 1973 to anchor its currency on a basket of foreign currencies. The weightings of the selected currencies were disclosed to the public in the report of Bank Al-Maghrib (2015). The euro is weighted 60 per cent and dollar 40 per cent. Now in order to improve an external competitivity, they are opting for a transition to a more flexible external exchange rate.

However, this flexibility generates uncertainty and increases the risks of investing for economic operators. For this, it is necessary to manage volatility correctly to avoid a distortion of exchange rate that may penalize the competitiveness of exports.

The contribution of the study is to fill a gap in the literature on the impact of the volatility exchange rate, as most empirical studies on the exchange rate in Morocco have focused on the determinants of the exchange rate of balance and extent of misalignment (for instance: Bouoiyour *et al*., 2004; Bouzahzah and Bachar, 2014). Nevertheless, the effect of exchange rate volatility has

not been sufficiently studied. In addition, the Moroccan economy is currently experiencing a sharp decline in foreign exchange reserves due to the growing trade deficit (Bank Al-Maghreb, 2017). Therefore, understanding the impact of exchange rate volatility would help guide appropriate foreign exchange policies that can promote exports, competitiveness and attract foreign sources of finance such as foreing direct investment (FDI), remittances and development of tourism demand. It is, therefore, interesting to clarify, and understand the exchange rate of the Moroccan currency and its effects of volatility on the performance of exports of goods and services.

The base of this study is to examine the impact of exchange rate volatility on Moroccan exports using cointegration and VEC modeling. Its purpose is to draw the necessary lessons for the case of Morocco because of the existence of the specific characteristics of each economy. Results show that unforeseen changes in exchange rates have a negative impact on the profits made and therefore reduce the volume of trade. It is also observed that foreign income has a greater effect on real exports than exchange rate volatility.

The rest of this study is structured as follows: The second section presents the literature review. Section three, is devoted to examine the exchange rate policy and export structure in Morocco. Section four presents the econometric methodology framework and data source. Section five discusses the empirical results and policy implications. Finally, section six summarizes the main conclusions of the study.

2. Literature review

The relationship between exchange rate variability and exports is essentially based on the behavior of exporters operating in a global economy characterized by significant exchange rate fluctuations. In this volatile environment, companies are potentially exposed to currency risk that can ultimately affect their performance. They can then choose to adjust by reducing their involvement in the global markets, thus negatively affecting the volume of foreign trade. When we examine the literature on this relationship, we quickly find that researchers have focused their efforts on empirical verification and much less on modeling. The basic model that inspired all this empirical work is that of Hooper and Kohl-Hagen (1978).

The model developed by Hooper and Kohl-Hagen is a model of export supply and import demand that incorporates exchange rate risk and analyses its impact

on prices and equilibrium quantities of goods traded on the international market. These authors concluded that an increase in foreign exchange risk will reduce the value of exchanges, because most commercial contracts are not for immediate delivery of goods, and are denominated in the currency of either the importer or the exporter. Unforeseen changes in exchange rates have a negative impact on the profits made and therefore reduce the volume of exchanges.

De Grauwe (1988) advance the argument that if exporters are sufficiently risk-averse, then an increase in exchange rate instability results in an increase in the anticipated marginal use of export earnings, which serves to encourage exporters to increase their exports in order to maximise their revenues.

Other theoretical models of hysteresis in international trade (see Baldwin and Krugman, 1989) have shown that the increase in the uncertainty of the high volatility of the exchange rate can also influence foreign trade. Specially if a significant irreversible costs are involved in the international transactions (advertising, setting up of sales networks and after-sales service). However, it is difficult to identify how trade will be affected.

Viaene and De Vries (1987) develop an intertemporal model under uncertainty where the exporter sells all its products on the international market and buys imported inputs in a fixed proportion of its production. Without assuming this exporter's behavior in the face of currency risk, the model takes into account the existence of credit and currency billing practices. It also distinguishes between economies where foreign exchange markets are well developed and those without a futures market. Their theoretical results indicate that there is no clear relationship between exchange rate variability and international trade in developed economies. A negative relationship is, however, predicted in the case of developing countries characterized by a lack of a future markets. In summary, despite some interesting modeling elements, their model does not generate new conclusions on the question.

On the other hand, researches such as Franke (1986) show a different approach and a very interesting avenue of research. First, Franke proposes a long-term dynamic model (based on optimal control theory) that determines an optimal commercial strategy for the exporter. Risk aversion is excluded; in this case, the firm adjusts the volume of its exchanges according to the level of the exchange rate. International trade is modeled here as an option, i.e. an opportunity for the firm to enter a foreign market when the operation is profitable and exit when it is no longer profitable. In a context of imperfect competition, these entry / exit decisions are expensive so the firm will only use this option occasionally.

Inspired by the financial literature where the value of the option of a foreign exchange increases with the exchange rate risk, it shows that international trade can be stimulated by greater exchange rate volatility, a result opposing the one in the model of Hooper and Kohl-Hagen.

It should be emphasized that the economic underpinnings of the relationship between exchange rate variability and international trade are not solely related to the degree of risk aversion of the exporter. This hypothesis suggests a negative relationship but other assumptions can generate a positive relationship. The significance of this relationship remains an essentially empirical question.

On the empirical plan, a growing body of research has highlighted the relationship between exchange rate variability and exports in both developed and developing countries. However, although more and more work is now focusing on this issue, we have seen that there was no consensus on this issue in the empirical literature. The latter does not appear homogeneous in the results as well as in the methods used and the used measures of exchange rate variability.

Klein and Shambaugh (2006), using panel data techniques, examined the relationship between exchange rate volatility and foreign trade for a very large sample of 181 countries, covering the period 1973-1999. They concluded that the volatility of the exchange rate positively affects trade. In a recent study, Butt (2013) investigated the relationship between exchange rate volatility and exports in eight developed countries (Australia, Canada, Japan, Korea, New Zealand, Norway, Sweden, and the United Kingdom), between 1991: Q3 to 2011: Q4. It showed the existence of a significant and a positive relationship between exchange rate volatility and exports.

Arize *et al*., (2003) examined, in the context of an error-correction model, the effects of exchange rate volatility on trade flows in ten developing countries over the quarterly period 1973-96. The results of the study indicate that a rise in exchange rate volatility has a negative impact on short and long term export demand in most of the countries studied. Aliyu (2010) showed that exchange rate volatility has a negative effect on long term non-oil export flows in Nigeria while in the short term there is a positive relationship. Bouoiyour and Selmi (2014) used GARCH modeling, to study the link between nominal and real effective exchange rate volatility and exports for the case of Morocco and Tunisia over the quarterly period (1996-2009). The results showed that the link is negative and statistically significant for the case of Morocco, while it was positive in Tunisia.

Other researchers have failed to find a significant relationship, like in the case of Boug and Fagereng (2010). The latter examined the causality between exchange rate volatility and Norwegian exports, using VAR modeling. The results show that there is no link between these two variables.

At the end of this analysis, we will remember that the empirical literature, through the different approaches presented, provides inconclusive results in the analysis of the relationship between exchange rate fluctuations and exports. Indeed, no consensus was found on the effects of exchange rate variability on international trade flows. In general, empirical studies have not really shown a significant link between exchange rate volatility and volume of international trade.

It should be noted that the economic effects of exchange rate fluctuations differ significantly between countries and regions. One of the reasons for these regional differences is that real exchange rates are very volatile in many developing countries, often because of unsustainable and erratic macroeconomic policies in the past. This raises an important political question for countries seeking to promote growth and development through greater outward orientation. If the effects of exchange rate volatility on trades are negative and economically significant, then any set of (policy) measures to improve outward orientation and promote international trade should include specific measures that stabilize the real exchange rate over time.

Similarly, the heterogeneity of the results obtained in the empirical literature may also be due, in part, to the negative effect of a uniform definition or means of calculating volatility.

In summary, the same theoretical ambiguity is present in many of the empirical publications. Therefore, we believe that the relationship between exchange rate volatility and exports is undetermined from an analytical point of view. For this reason, the direction and scope of the impact of exchange rate uncertainty on Moroccan exports must be empirically investigated before meaningful conclusions can be drawn. The comprehension the direction and scope of the impact of exchange rate volatility on Morocco's trade is undoubtedly an important issue in the regime change process.

3. Exchange policy and structure of exports in Morocco

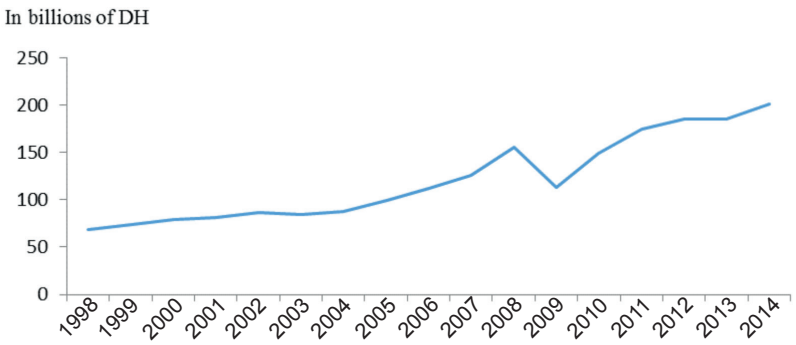
Since the collapse of the Bretton Woods fixed exchange rate system in 1973 and the adoption of the second amendment to the IMF's articles of agreement, member countries are free to adopt the exchange rate regime of their choice, a

fixed or flexible regime or an intermediate solution. However, the transition to more flexible exchange rate regimes has been the general trend characterizing the evolution of exchange rate regimes in developing countries. The fixed rates fell from almost 87 per cent in 1975 to almost 50 per cent in 1996 (Caramazza and Jahangir, 1998). Like other developing countries, Morocco has been encouraged to switch to a flexible exchange rate regime since July 2017. Before, the exchange rate regime adopted by Morocco is an intermediate regime. The rating system is based on a basket defining the Dirham. Indeed, the exchange rate regime, or the determination of the external value of the Dirham, is based on the mechanism of a basket composed of the main international currencies whose weighting coefficients are determined in principle by the geographical distribution of Morocco's foreign trade. The purpose of this multi-monetary peg is to minimize the impact of parity changes in these currencies, since they record fluctuations in different directions. The basket of currencies is composed mainly and solely of the euro (60 per cent) and the dollar (40 per cent).

On the other hand, trade liberalization since the late 1990s and Morocco's growing integration into the European Union has required structural economic reforms to adapt to market realities. As a result, the structure of Moroccan exports has changed considerably between 1998 and 2014.

First, the value of Moroccan merchandise exports has grown steadily, from 68.6 billion dirhams in 1998 to 200.8 billion dirhams in 2014. The growth rate of exports was greater during the period 2009-2014, which was of 12.2 per cent against 8.5 per cent between 1998 and 2008.

Figure 1: Evolution of Moroccan Exports



Source: Author's calculations based on exchange office data

At the sectoral level, the share of made-up clothing and agricultural products fell from 35.5 per cent and 22.8 per cent respectively in 1998 to 13.9 per cent and 19.5 per cent in 2014. In contrast, transportation grew strongly, from 8.8 per cent in 1998 to 29.2 per cent in 2014, due in particular to the remarkable rise in exports from the automotive sector. Likewise, shares of the extractive industries and chemicals products strengthened, accounting respectively for 12.8 per cent and 16.6 per cent of exports in 2014, against 11.7 per cent and 12.6 per cent in 1998, thanks to the dynamism of exports phosphates and derivatives.

Thus, it appears that the structure of Moroccan exports has undergone a significant change in favor of high value added emerging industrial sectors (such as automotive, electrical, and electronic); at a time when so called traditional sectors are shrinking (clothing, agricultural products). This transformation is explained, in particular, by the orientation of Moroccan industry towards the new global trades, which has generated an increase in exports of products such as wires and cables for electricity whose share has increased by 1.7 per cent to 10.4 per cent between 1998 and 2014, and the emergence of new products such as passenger cars and aircraft and related equipment and parts thereof, which exports reached 9.6 per cent and 1.6 per cent respectively of the total sales of Morocco. In the case of the main agricultural and the sea exported, they decreased in the same period. In particular, crustaceans and molluscs and fruits accounted for respectively for 3.1 per cent and 2.5 per cent of Morocco's total exports in 2014 compared with 6.3 per cent and 4.2 per cent in 1998. Phosphate exports also showed decline (4.1 per cent after 6.4 per cent in 1998). Similarly, clothing sales saw their share decline in Moroccan exports, particularly men's textile garments, except knitted garments, which rose from 11.2 per cent to 2.2 per cent between 1998 and 2014 (Ministry of Economy and Finance, 2015).

We will try, in what follows, to evaluate the crucial role that the exchange rate policy can play in the improvement of the Moroccan exports.

4. Empirical study

4.1. Empirical specification

There are many researches on the impact of exchange rate volatility on exports. The empirical specification adopted for this work is close to that estimated in several empirical studies (Vergil, 2002; Achy and Sekkat, 2003; Sadikov *et al*., 2004; Rey, 2006; Égert and Zumaquero, 2007; Erdal and Banu, 2015). It is presented as follows:

$$LnY_t = \alpha LnREER_t + \beta LnGDP_t + \gamma LnVOL_t + \varepsilon_t \quad (1)$$

Where:

LnY: represents the logarithm of the real export volume. Source: Exchange Office.

LnREER: is the logarithm of the relative price: ratio of the consumer price index of the country of destination and origin adjusted to the nominal exchange rate, source: IFS, HCP.

LnGDP: represents the log of the real GDP of the main partner countries, notably European, Source: Eurostat.

LnVOL: this is the logarithm of the volatility of the exchange rate. Note that the nominal exchange rate is less volatile than the real exchange rate (see: Bouoiyour and Selmi, 2014) , we concentrate in this study on the analysis of real exchange rate volatility. We take two measures of exchange rate volatility: moving average standard deviation taken into account in model 1 (M1) and EGARCH model introduced in model 2 (M2) (see below the measure of volatility).

ε is the error term.

Thus, economic theory suggests that the increase in real foreign income increases the volume of real exports. In addition, relative prices affect business choices, either to produce for the domestic market or to export. Therefore, the expected signs of α and β are respectively positive and negative. Exchange rate volatility in the actual export demand function may affect the volume of exports either positively or negatively.

It should be noted that the empirical specification also includes a DUM08 *dummy* variable reflecting the impact of the financial crisis on Moroccan exports.

The data covers the quarterly period from 1998 to 2014. It should be noted that all variables have been transformed into logarithms.

The method used in this work is that of VECM. It makes it possible to simultaneously illustrate the short-term and long-term dynamics between the variables when it leads to an error correction model.

4.2. The measure of volatility

Multiple work on exchange rate volatility does not provide consensus on how to measure this volatility. The most frequently used measure of exchange rate volatility is the Moving Average Standard Deviation, which is calculated as follows:

$$h_t = \left[(m^{-1}) \sum_{i=1}^{m} (lne_{t+i+1} - lne_{t+i-2})^2 \right]^{1/2} \quad (2)$$

Where *m* is the order of the mean of the moving standard deviation, and *e* is the real effective exchange rate. *Ln*: represents the natural logarithm.

However, this measurement approach may ignore information about the stochastic exchange rate process that is generated (Jansen, 1989).

The second measure is to use ARCH / GARCH approaches that have the advantage of releasing the expected values of exchange rates (McKenzie, 1999). That said, as pointed out by Meese and Rogoff (1983), there are inherent problems with exchange rate forecasts. Therefore, this study adopts the approach followed in the majority of the work done on this subject, using as a reference a measure of the observed variability of exchange rates. EGARCH estimates are included as a second measure of volatility. Thus, by deriving the residuals from an underlying process. If r_t is equal to $\ln(\frac{e_t}{e_{t-1}})$ we have $r_t = \mu + \varepsilon_t$ with μ the conditional average on the past information (ψ_{t-1}). For the set of information ψ, the standard GARCH (p, q) process is given by $\varepsilon_t / \psi_{t-1} \sim N(O, h_t)$ with the autoregressive variance specified as:

$$h_t = \delta_0 + \sum_{i=1}^{q} \alpha_i . \epsilon_{t-1}^2 + \sum_{j=1}^{q} \beta_j . h_{t-1} \quad (3)$$

Where $s = \sqrt{h}$ represents the standard deviation, that is to say the volatility. $\delta_0 > 0, \alpha \geq 0, \beta \geq 0$ Are imposed to ensure the conditional variance (h_t) is positive.

It should be noted that two undesirable features of the GARCH models may appear: an integrated conditional variance and non-normal standardized residues (Hsieh, 1989). Since the GARCH models (1,1) applied to the exchange rates have a particularly strong persistence in the conditional variance.

To give an answer to the two problems mentioned, another density on errors can be proposed, as the asymmetric GARCH-type conditional variance can be considered (Nelson, 1991; Higgins and Bera, 1992). Hsieh (1989) shows that the exponential GARCH is a better fit to the exchange rate series than the simple GARCH (p,q). The exponential GARCH model makes the logarithm of the conditional variance dependent on that of the previous period, shocks standardized in (t-1) and the difference between the absolute value of the standardized shocks and their expectation in (t-1).

$$\ln h_t = \delta_0 + \sum_{i=1}^{q} \alpha_i \left(\emptyset Z_{t-i} + \gamma(|Z_{t-i}| - E|Z_{t-i}|) \right) + \sum_{i=1}^{q} \beta_j . h_{t-1} \quad (4)$$

Where $Z_{t-i} = \frac{\epsilon_{t-i}^2}{\sqrt{h_{t-i}}}$ represents the standardized error.

We can notice here that there is no constraint of positivity which weighs on the coefficients because the equation of the variance is expressed in log.

This model has two advantages in comparison to the standard GARCH model. While the GARCH model postulates that only the amplitude has an impact on the conditional variance and not the sign of the past residues, the EGARCH model allows an asymmetric response of the conditional variance to the positive or negative shocks of the residuals of the previous period. In other words, it allows the volatility to react differently according to the sign of shocks.

When the coefficient *Ø* is negative, the conditional volatility may increase in the event of negative shocks and fall in the opposite case. The effect "amplitude" is understood by the difference between the absolute value of the standardized residues and its expectation. The second advantage of the EGARCH model is that the unconditional variance is finite when $\beta_j < 1$. In general, the ARCH / GARCH approach implies that exporter behavior is determined by the process that generates the variance in the model. It also implies that the subjects on the market act rationally and know the parameters of the process.

4.3. Methodology

Our analysis begins by processing data to find the order of integration of the variables. This is necessary to determine the number of times a series must be differenced to attain stationarity (Ibrahim and Musah, 2014). For this, the tests used in this study are the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. Indeed, the ADF and PP tests, although based on the simple Dickey-Fuller statistic. The ADF test takes into account the possible autocorrelation of the residues, while the PP test takes into account the heteroscedasticity of residues. The estimated ADF test takes the following equation:

$$\Delta X_t = \alpha + \beta_t + \rho X_{t-1} + \sum_{i=1}^{q} \delta_i \Delta X_{t-i} + \mu_t \qquad (5)$$

With X_t the level variable; t the trend; μ is the error term; Δ is the sign of the first difference; q is optimal delay, estimated according to the information criteria of Akaike and Schwartz. We test the null hypothesis, H_0:ρ = 0 that is, the series is non-stationary, against the alternative hypothesis, H_0:ρ < 0 that is, the series is stationary.

However, if the results of the ADF and PP tests are in opposition, we adopt the DF-GLS test, proposed by Elliott, Rothenberg, and Stock (1996), which is generally considered more powerful, as confirmation or invalidation of the results obtained.

It should be emphasized that determination of the order of integration of the series studied serves to estimate cointegration relations on variables of the same order. It allows to study the long-term relationships between the variables. Therefore, the second step is to analyze the existence of a cointegration relationship between our variables.

We used in this work Johansen's cointegration test (1988, 1991) which allows us to determine the number of long-term equilibrium relationships between integrated variables of the same order. This test uses two statistics to determine the number of cointegrating vectors r:

– The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors given by:

$\text{Trace} = -T\sum_{i=r+1}^{n} \ln(1-\lambda_t)$ where T is the sample size and λ_t is the t:the largest canonical correlation.

– The maximum eigenvalue test tests the null hypothesis of *r* cointegrating vectors against the alternative hypothesis of *r +1* cointegrating vectors:

$$\lambda_{max} = -T\ln(1-\lambda_t)$$

The asymptotic distributions of these two statistics are nonstandard. Asymptotic critical values were tabulated by Osterwald-Lenum. After establishing cointegration, the study proceeds with the estimation of the next VECM, which allows to model jointly short-term and long-term dynamics. For this, if the variables are of the same order of integration and cointegrate, we can estimate the vector model with error correction (VECM) following:

$$\Delta LnY_t = \alpha\Delta\ln GDP_t + \beta\Delta\ln REER_t + \gamma\Delta\ln VOL_t + DUM + \varphi(LnY_{t-1} + \phi_1 LnGDP_{t-1} + \phi_2 LnREER_{t-1} + \phi_3 lnVOL_{t-1}) + \varepsilon_t \quad (6)$$

With the following expected signs:

$\alpha > 0$, $\beta < 0$, $\gamma > 0$ or < 0; $\phi_1 < 0$, $\phi_2 > 0$, $\phi_3 < 0$ or > 0. Δ : is the delay operator.

The equation allows to integrate the short and the long term. Indeed, the term "φ" is the restoring force towards the long-term target value given by the cointegration relation. This parameter represents important implications for the dynamics of the system. The negative sign of the estimated speed of the adjustment coefficients indicates the convergence towards the long-term equilibrium. Indeed, the higher the coefficient value of the error correction term, the stronger the response of the variables. The weaker it is, the longer it takes to return to equilibrium. The export demand equation also includes another variable dummy (DUM08) that could influence Moroccan exports (notably the

2008 financial crisis). However, the choice of the specification was determined by econometric considerations, including the statistical nature of the different series used.

5. Results and discussions

5.1. Study of stationary series

The Figure 2 in the appendix highlight the non-stationary of the series studied. On the other hand, the results of the unit root tests for the different time series are presented in Table 1 and 2. The stationary tests (Dickey and Fuller as Phillips-Perron) conclude that there is a unit root in the stochastic process generating the four studied series (lnY, LnREER, lnGDP, lnVOL). In addition, the first differences of these series are all stationary. We then assume that all of these variables are integrated order 1, which leads us to look at whether there is a cointegration relationship between the variables.

Since the series are all integrated of the same order, we test, in what follows, the number of cointegration relationships using the tests proposed by Johansen and Juselius (1990).

Table 1: ADF Test

	Level			**First Difference**		
	With intercept and trend	With intercept	None	With intercept and trend	With intercept	None
Variable	t-Statistic	t-Statistic	t-Statistic	t-Statistic	t-Statistic	t-Statistic
LnY	-2.61390	-1.59379	-0.34990	-8.65841***	-8.73234***	-8.76956***
LnREER	-2.50837	-1.12157	-1.28490	-6.79141***	-6.74056***	-6.69639***
LnGDP	-1.64723	-0.89942	4.15290	-4.09264***	-12.7766***	-4.35843***
LnVOL (SD)	-2.02411	-1.84740	0.01385	-4.60903***	-7.13105***	-4.65064***
LnVOL (EGARCH)	-2.66643	-1.69325	-1.7418*	-3.83218***	-3.78797***	-3.02439***

Notes: The optimal lag is determined from the Schwarz information criterion (SC). *** significant at 1%; **significant at 5%; *significant at 10%.

Table 2: PP Test

	Level			First Difference		
	With intercept and trend	With intercept	None	With intercept and trend	With intercept	None
Variable	t-Statistic	t-Statistic	t-Statistic	t-Statistic	t-Statistic	t-Statistic
LnY	-3.33477*	-2.68345*	-0.47228	-18.7175***	-18.5487***	-26.5081***
LnREER	-2.50837	-1.17955	-1.29733	-6.73848***	-6.68575***	-6.59872***
LnGDP	-2.54975	0.09265	9.08164	-14.2182***	-14.0949***	-11.8583***
LnVOL (SD)			-0.78269	-20.5612***	-20.3632***	-13.5420***
LnVOL (EGARCH)	-3.11714	-2.21809	-2.23428*	-6.33512***	-6.30736***	-6.40112***

Notes: The optimal lag is determined from the Schwarz information criterion (SC). *** significant at 1%; **significant at 5%; *significant at 10%.

However, we will note an exception, particularly with regard to the volatility of the REER calculated from the mobile standard deviation lnVOL (SD), the results given by the various tests are not all concordant and do not allow to decide on the stationarity of this variable. In order to refine these initial results, we have re-tested the LnVOL (SD) using the DF-GLS test. It shows that the variable is well integrated of order 1 (*Statistics > Critical value*).

5.2. Study of cointegration relationships

The study of cointegration makes it possible to test the existence of a stable long-term relationship between non-stationary and integrated variables of the same order I(1). There are several tests of cointegration, the most general being Johansen's. Whatever the test chosen, it has significance only on long non-stationary series. It should be noted that the appropriate delay count is based on the Schawrtz-Bayesian criteria (SBC) and the Akaike Information Criterion (AIC).

The results are presented in Tables 3 and 4. These tests analyze the possibility that one or more cointegration relationships exist between the real exports and the fundamentals used in the model. This is to test the null hypothesis that there is no cointegration. The results indicate that the null hypothesis (at most) $r = 0$ (for the test of the trace) or exactly $r = 0$ (for the test of the maximum eigenvalue) is rejected at the threshold of 1% in the model 1 and 5% in model 2. These results from the fact that the values calculated from these two statistics

are higher than the critical values associated with them. On the other hand, the null hypothesis that there are at most 1 or more cointegration relationships cannot be rejected at the 1% threshold because the two Johansen test statistics are below the critical values associated with them. Johansen's two cointegration tests therefore confirm the existence of a single cointegration relationship.

Table 3: Johansen Cointegration Test (Model 1)

Maximum rank/no. of cointegrating equations	**Trace Tests**	**Critical values 95% (Trace)**	**Maximum Eignevalue (Max)**	**Critical value 95% (Max)**
0	64.41900	47.85613***	35.67889	27.58434***
1	28.74011	29.79707	16.63283	21.13162
2	12.10728	15.49471	7.607992	14.26460
3	4.499288	3.841466	4.499288	3.841466

Notes: *** significant at 1%; **significant at 5%.

Table 4: Johansen Cointegration Test (Model 2)

Maximum rank/no. of cointegrating equations	**Trace Tests**	**Critical values 95% (Trace)**	**Maximum Eignevalue (Max)**	**Critical value 95% (Max)**
0	42.01824	40.17493**	24.65742	24.15921**
1	17.36082	24.27596	12.74823	17.79730
2	4.612594	12.32090	4.609203	11.22480
3	0.003391	4.129906	0.003391	4.129906

Notes: *** significant at 1%; **significant at 5%

5.3. Diagnostic tests

It should be noted that several diagnostic tests were performed to verify the robustness of our results. The dynamics of the different estimated equations seem to have good statistical properties. Thus, to test the presence of a possible autocorrelation of the residues, we implemented the Ljung-Box (Q) test. This test has the advantage of testing the autocorrelation at all delays and not only at the first delay as does the Durbin Watson test. The probability of testing on Ljung Box's Q statistic remained above the 5% threshold on the first 12 offsets

of the series. Therefore, the Ljung Box Q statistic indicates that the residues from each equation are white noises. In addition, we implemented the Jarque-Bera test to ensure that the residues were normally distributed and therefore the coefficient tests were valid. In Table 5, we report the p-value associated with the Jarque-Bera statistic. A *p-value* greater than 0.05 indicates that the residuals are normally distributed, which is not the case in our estimation. We reject the hypothesis of normality with regard to residues, which is non-Gaussian white noise. The result of the LM test attached, for a $p = 12$ order, does not reveal the existence of autocorrelation of the residuals of the dynamic equations. Moreover, these residues are homoscedastic with regard to the White test.

Table 5: Dagnostic Tests

	Model (1)	**Model (2)**
Ljung-Box	27.234	25.063
(P-value)	0.506	0.624
Autocorrelation:Test LM(12)	20.68537	10.98297
(P-value)	0.1909	0.8105
Normality Test: JB-Test	17.99382	52.77064
(P-value)	0.0213	0.0000
Hetero White: Test Chi-sq	240.2607	369.0848
(P-value)	0.9034	0.2316
Portmanteau Test	199.0372	146.1186
(P-value)	0.0113	0.3666

Notes: Model (1) without mean of the mobile standard deviation; Model (2) without EGARCH model.

5.4. Analysis of results

The study of the relationship between exchange rate volatility and exports is the major concern of our work. This relationship has grown remarkably in the various studies; however, the question of whether such an influence is negative or positive remains a controversial subject. The determination of this impact is important and has considerable implications for economic policy. We will present an estimate of export demand incorporating both short-term and long-term adjustments. The estimates lead to the following results:

TABLE 6: SHORT-RUN VECTOR ERROR CORRECTION MODEL

Variable	**Model (1)**	**Model (2)**
Ec (-1)	-0.037153*** [-2.73684]	-0.311906*** [-3.73774]
LnY(-1)	-0.596991*** [-6.00790]	-0.411707*** [-3.53073]
LnY(-2)	-0.428069*** [-4.17823]	-0.267344*** [-2.16397]
LnY(-3)	-0.290125*** [-2.82522]	-0.203530*** [-1.71351]
LnREER(-1)	1.316676 [1.58478]	-0.042674*** [-2.89357]
LnREER(-2)	0.257521 [0.32060]	-0.027857 [-1.08810]
LnREER(-3)	-0.064130 [-0.07936]	-0.062653*** [-2.37595]
LnGDP(-1)	0.111652 [0.20690]	-1.930718*** [-2.85545]
LnGDP(-2)	1.232409** [2.07549]	-0.597343 [-0.97876]
LnGDP(-3)	-0.355928 [-0.65032]	-0.774328 [-1.33984]
LnVOL(-1)	-0.013608** [-1.97927]	0.091612 [0.86990]
LnVOL(-2)	-0.002765* [-1.95538]	0.107899 [0.88515]
LnVOL(-3)	-0.002765 [-0.67166]	0.262525*** [2.32024]
DUM08	-0.439102*** [-6.21097]	-0.443994*** [-6.36589]
R-squared	0.752940	0.783026
Adj. R-squared	0.687394	0.699195
SSR	0.187009	0.163377
Log likelihood	93.92854	96.12949
AIC	-2.537414	-2.520306
SIC	-2.061162	-1.902751
F-statistic	11.48713	9.340544

Notes: In Model 1 the measure of volatility used is Moving average standard deviation (STDEV). In Model 2 (M2) the measure of volatility used is EGARCH.

First, the error correction model shows a coefficient significantly different at zero and negative for the long-term relationship. These results confirm the validity of a long-run equilibrium relationship between real export volume, exchange rate volatility, real GDP and relative price. Second, the change in quarterly real exports attributed to the imbalance between actual levels and equilibrium is measured by the absolute values of the EC term of each equation. This coefficient varies between 0.03 and 0.33 in the two estimated models. There is considerable variation in the speed of adjustment depending on the measure of volatility used. This implies that the adjustment of export volumes to changes in the explanatory variables can take 2 quarters if the exchange rate's EGARCH volatility measure is held. This indicates the existence of market forces in the export market that function to restore to the long term equilibrium after a short term disruption.

The coefficients of the term error correction indicate that the rate of adjustment in the models estimated with a volatility variable measured by STDEV is low. These results indicate that the adjustment of real exports in the explanatory variables may take some time to return to equilibrium, or 23 quarters. This means that market forces in the export market are slowly restoring the balance.

In the short term, the results are not all in line with expectations. First, we find that the export is negatively impacted by their previous values regardless of the number of delays; the estimation coefficients are statistically significant.

The volume of real exports is also negatively associated with exchange rate volatility (STDEV) in Model 1, which is in line with expectations, the coefficients are significant in the majority of cases, but are not significant in Model 2.

In addition, foreign income has a positive and significant effect for the second lag in Model 1, while contrary to expectations; foreign income has a negative short term effect in Model 2. In addition, relative prices have an impact. Negative and significant in most cases in Model 2.

Overall, the specification of the short term dynamics of the export equation is not satisfactory. Some elasticity's do not have the expected sign and / or are not significant (the volatility of the real effective exchange rate by the EGARCH model). However, the estimation of long-term relationships between variables was favored over the specification of short term dynamics. Indeed, the signs of the coefficients of the long term relationship are statistically very significant.

Table 7: Log-run Estimated Coefficients

Variable	Model (1)	Model (2)
LnREER	-6.464231*** [3.98639]	+0.124586*** [-5.84204]
Ln GDP	+2.651894*** [-4.75473]	+4.058267*** [-3.64955]
Ln VOL	+0.556156*** [-6.14097]	- 0.558002*** [6.06609]
Constant		68.5859

Notes: Model (1): Model without constant and without trend. Model (2): Model with constant and without trend. In Model 1 the measure of volatility used is Moving average standard deviation. In Model 2 (M2) the measure of volatility used is EGARCH.

In the long term, the impact of exchange rate volatility differs depending on the measure taken into account. Indeed, the volatility of the real effective exchange rate by the moving standard deviation is associated with a positive impact on Moroccan exports. This result can be explained by the fact that this measure of volatility does not take into account information on the stochastic exchange rate process that is generated (Jansen, 1989). In parallel, the volatility measured by the EGARCH model negatively affects exports. Indeed, unforeseen changes in exchange rates have a negative impact on the profits made and therefore reduce the volume of trade. This result is consistent with the traditional theory of international trade that the negative relationship between exchange rate volatility and trade is based on risk aversion (Clark, 1973; Hooper and Kohl-Hagen, 1978).

The elasticity of real income relative to exports is a determining variable in the two estimated models. Indeed, a 1% increase in real GDP would increase the real volume of exports from 2.65% to 4.05%.

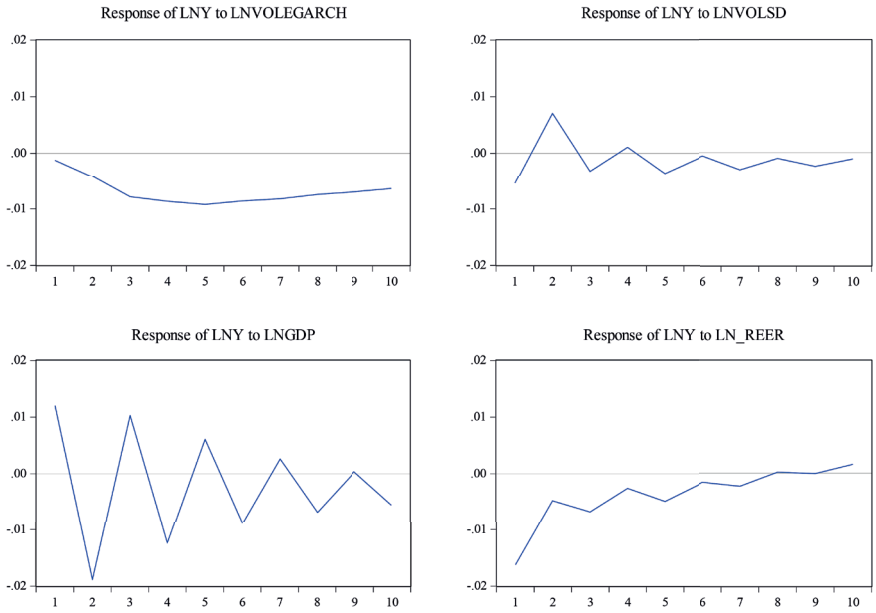
In addition, relative prices have a negative and statistically significant long-run coefficient in Model 1, which is consistent with economic theory. While they appeared with a positive sign in the Model 2.

5.5. Generalized Impulse-Response Functions and Variance Decomposition Analysis

In addition to analyzing both long and short-run relationships by using the cointegration method and vector error correction (VEC) model, we use

Generalized Impulse Response Functions (GIRF) as proposed by Koop, Pesaran and Potter (1996) and Pesaran and Shin (1998) to analyze the impact of exchange rate volatility shocks and other determinants on Moroccan exports.

FIGURE 3: RESPONSE TO GENERALIZED ONE S.D. INNOVATIONS



The analysis of the generalized impulse response functions (Figure 3) shows that exchange rate volatility has a persistent negative effect on real exports (with the exception of period 2 and 4 for the volatility measured by the Moving Average Standard Deviation), foreign income has an unpredictable effect and the relative price variable has an overall negative effect. The choice of the method for estimating impulse response functions is a delicate point. The best known of these methods is the decomposition of Cholesky. However, this has the disadvantage of offering results that can be extremely sensitive to the order of variables in the vector of endogenous variables. The use of generalized impulse response functions GIRF makes it possible to circumvent this difficulty.

Table 8: Variance Decomposition for LNY

Period	S.E.	LNY	LNGDP	LN_REER	LNVOL (EGARCH)	LNVOL (SD)
1	0.085545	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.092977	93.15427	6.047861	0.169441	0.090693	0.537733
3	0.097366	92.66735	5.967361	0.156570	0.704101	0.504613
4	0.098976	90.22630	7.649764	0.292102	1.314117	0.517718
5	0.099983	89.30200	7.729035	0.339054	2.121122	0.508785
6	0.100761	87.92879	8.392041	0.439570	2.738475	0.501124
7	0.101170	87.29040	8.374836	0.457032	3.374668	0.503060
8	0.101674	86.47461	8.710173	0.473090	3.842967	0.499164
9	0.101922	86.05485	8.669280	0.470795	4.302166	0.502914
10	0.102290	85.51717	8.863271	0.467495	4.650638	0.501430

The variance decomposition (Table 8) shows, for a horizon of 10 quarters, that the variance of the forecast error of real exports (ln Y) is 85.5% due to its own innovations and for 8.8% to foreign income. From the point of view of this test, it can be concluded that a foreign income shock has a greater impact on real exports than the other determinants. In addition, the volatility of the exchange rate measured by (LnVOL EGARCH) has a small effect on real exports in the early periods, but increases in subsequent periods. Although exchange rate volatility accounted for 0.09% of real exports in the second period, it reached 4.65% in the tenth period.

5.6. Economic policy implications

In the light of the results obtained, the volatility of exchange rates has negative effects on the volume of Moroccan exports; an important mechanism can be invoked to explain this negative impact. Exporters' risk aversion faces greater risk and uncertainty about the profits of their foreign operations, thus reducing their demand and the supply of traded goods. The trade liberalisation policy may be condemned by a variable exchange rate and may precipitate a balance of payments crisis.

In addition, it is important to note that the exchange rate is more volatile in a flexible exchange rate regime since the exchange rate is determined by the supply and demand of foreign exchange on the foreign exchange market. Fluctuations in the real exchange rate affect economic activity, mainly because of the effect they have on the international competitiveness of Moroccan production. Thus,

exchange rate fluctuations have an impact on foreign trade, which subsequently spreads to all sectors of the economy through the change in relative prices between exported products and products destined for the domestic market.

Otherwise, the volatility and instability of the real exchange rate raises an important political issue for a developing country like Morocco, which seeks to promote growth and development through a greater outward orientation. If the effects of exchange rate volatility on trade are negative and significant, then any set of measures to improve the outward orientation and promote international trade, should include specific measures that stabilize the exchange rate real time. Similarly, Morocco needs to have a relatively stable currency to attract capital from foreign investors. Otherwise, the prospect of foreign exchange losses from currency depreciation can deter foreign investors.

It should be noted that the fabric of Moroccan companies is made up 99 per cent of small and medium enterprises (SMEs), which have limited technical and human resources to support their development and do not necessarily reach the critical size to be competitive on the costs (GCME, 2014).

Policymakers will have to support these companies more to improve their international competitiveness. It would therefore be wise to build a long-term export strategy, through the encouragement of innovation to promote the up scaling of more diversified and competitive products and services. In addition, the development of credit markets is crucial to help SMEs overcome the sunk costs of exchange rate volatility. Tax measures for these companies can also be an effective instrument for increasing exports.

In addition, productivity improvement is often achieved through investment in equipment, most of which is imported. It is therefore appropriate for companies to take advantage of periods when the exchange rate is advantageous for investing in production equipment.

The diversification of export markets is crucial for Moroccan companies. Without abandoning the traditional markets, they should consider the possibility of expanding the range of their trading partners, particularly in Africa or America. This diversification helps to minimize the negative impacts of foreign revenue movements on Moroccan exports.

Finally, companies must integrate foreign exchange risk management into their development strategy in order to maximize profits.

6. Conclusion

In this article, we have studied the impact of exchange rate volatility on exports using cointegration and VECM for a quarterly period from 1998 to 2014. As a measure of volatility, we used the estimated variance rate real exchange rate generated by an EGARCH model and the average of the mobile standard deviation. Concerning the relationship between exchange rate variability and exports, the results obtained are mixed and vary according to the measure of variability used. It should be recalled that our estimates indicate a positive and significant impact of the moving average exchange rate standard deviation on exports of goods and services, while the exchange rate measure determined from EGARCH modeling is negative and statistically very significant. Indeed, unforeseen changes in exchange rates have a negative impact on the profits made and therefore reduce the volume of trade. It is also observed that foreign income has a greater effect on real exports than exchange rate volatility. These results show the sensitivity of real Moroccan exports to the economic crises facing European countries. In addition, the analysis of general impulse response functions (GIRF) shows that exchange rate volatility has a persistent negative effect on real exports.

At this point, policymakers should be cautious when considering a transition to a flexible exchange rate regime: without increased diversification of exports, a very low level of uncertainty and speculation, as well as measures to reduce fluctuations in foreign exchange rates exchange, this transition can have a detrimental effect on the country's trade performance.

Biographical Notes

Younesse El Menyari is Assistant Professor of Economics and Finance, Polydisciplinary Faculty of El Jadida (FPJ) and member of Laboratory for Research in Management, Economics and Social Sciences at Chouaib Doukkali University-Morocco. He holds a PhD in applied economics from the University Mohammed V, Faculty of Law, Economic and Social Sciences, Agdal Rabat, Morocco.

Acknowledgements

I am indebted to two anonymous referees who provided excellent comments and suggestions on previous drafts of the article. I am also grateful to Prof. Paul Alagidede, the Editor-in-Chief of this journal, for sharing my enthusiasm for this article.

References

Achy, L., and Sekatt, K. (2003). The european single currency and mena's export to Europe. *Review of Development Economies*, vol 7, pp. 563-582.

Alagidede, P and Ibrahim, M. (2017). On the Causes and Effects of Exchange Rate Volatility on Economic Growth: Evidence from Ghana. *Journal of African Business*, vol 18, pp. 169–193.

Aliyu, R. (2010). Exchange rate volatility and export trade in Nigeria: an empirical investigation. *Applied Financial Economics*, pp.1071–1084.

Arize, A.C., Malindretos, J., and Kasibhatla, K.M. (2003). Does Exchange-Rate Volatility Depress Export Flows: The Case of LDCs. *International Advances in Economics Research*, vol 9, pp. 7-19.

Arize, A.C., Osang, T. and Slottje, Daniel J. (2000). Exchange-Rate Volatility and Foreign Trade: Evidence From Thirteen LDC's. *Journal of Business & Economic Statistics*, vol 18, pp. 10-17.

Baldwin, R., and Krugman P. (1989). Persistent Trade Effects of Large Exchange Rate Shocks. *The Quarterly Journal of Economics*, MIT Press, vol 104, pp. 635–54.

Bank Al- Maghreb (2015). Rapport annuel 2015.

Bank Al- Maghreb (2017). Rapport sur la politique monétaire. N° 45 / 2017.

Boug, P. and Fagereng, A. (2010). Exchange rate volatility and export performance: a cointegrated VAR approach. *Applied Economics*, 42 (7), pp. 851-864.

Bouoiyour, J., Marimoutou V. and Rey, S. (2004), Taux de change réel d'équilibre et politique de change au Maroc: une approche non paramétrique. *Economie Internationale*, vol 97, pp. 81-104.

Bouoiyour, J. and Selmi, R. (2014). Exchange volatility and trade performance in Morocco and Tunisia: what have we learned so far? *Macroeconomics and Finance in Emerging Market Economies*, vol 8, pp. 244-274.

Bouzahzah M. and Bachar R. (2014). Exchange Rate Policy in Morocco and Persistence of Real Exchange Rate Misalignments. *International Journal of Economics and Finance*, vol 4, pp. 122-134.

Butt, H.A. (2013). Effect of Exchange Rate Volatility on Exports: Evidence From Eight Developed Countries. *Journal of Business and Finance*, vol 01, pp. 139–151.

Caramazza, F., Jahangir, A.(1998). Fixed or Flexible? Getting the exchange rate right in the 1990's. *Economic issues* 13. International Monetary Fund, Washington, DC.

Chit, Myint M., Rizov, M. and Willenbocket, D. (2010). Exchange rate volatility and export: new empirical evidence from the emerging East Asian economies. *The World Economy,* vol 33, pp. 239– 263.

Chowdhury, Abdur R. (1993). Does exchange rate volatility depress trade flows? Evidence from Error –correction models. *The Review of Economics and Statistics*, vol 75, pp. 700–706.

Clark, Peter B. (1973). Uncertainty, exchange risk, and the level of international trade. *Western Economic Journal*, vol 11, pp. 302–313.

Cushman, D. O. (1983), The effects of real exchange rate risk on international trade. *Journal of International Economics*, vol 15, pp. 45–63.

De Grauwe, P. (1988). Exchange rate variability and the slowdown in growth of international trade. *IMF Staff Papers*, vol 35, pp. 63–84.

Égert, B. and Morales-Zumaquero, A. (2007). Exchange Rate Regimes, Foreign Exchange Volatility and Export Performance in Central and Eastern Europe: Just Another Blur Project? *William Davidson Institute Working Papers Series wp782*, University of Michigan.

Elliott, G., Rothenberg, T. and Stock J. (1996). Efficient Tests for an Autoregressive Unit Root. *Econometrica*, vol 64, pp. 813–836.

Erdal, D. and Banu, D. (2015). The Dynamic Effect of Exchange Rate Volatility on Turkish Exports: Parsimonious Error-Correction Model Approach. *Panoeconomicus*, vol 62, pp. 429–45.

Franke, G. (1986). Exchange Rate Volatility and International Trade: The Option Approach, *Discussion Paper,* Department of Economics, University of Konstanz, Series II, Nr.12.

General Confederation of Moroccan Enterprises (GCME), (2014). Study on the levers of the competitiveness of Moroccan Companies.

Higgins M. L., Bera A. K. (1992). A Class of Nonlinear Arch Models, *International Economic Review*, vol 33, pp. 137–158.

Hooper, P., Kohlhagen, S. W. (1978). The effects of floating exchange rate uncertainty on the prices and volume. *Journal of International Economics*, vol 8, pp. 483–511.

Hsieh, D. (1989), Modeling Heteroskedasticity in Daily Foreign Exchange Rates. *Journal of Business and Economic Statistics*, vol 7, pp. 307–317.

Ibrahim, M., and Musah, A. (2014). An Econometric Analysis of the Impact of Macroeconomic Fundamentals on Stock Market Returns in Ghana. *Research in Applied Economics*, vol 6, pp. 47–72.

Jansen, D. (1989). Does inflation uncertainty affect output growth? Further evidence. *Fed. Reserve Bank St. Louis Rev*, pp.43–54.

Johansen, S. (1988). Statistical Analysis of Cointegration Vectors. Journal of Economic Dynamics and Control, vol 12, pp. 231–254.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, vol 59, pp. 1551–1580.

Johansen, S. (1995). Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. New York: Oxford University Press.

Johansen, S., and Juselius, K. (1990)/ Maximum Likelihood Estimation and Inference on Cointegration– with Applications to the Demand for Money, *Oxford Bulletin of Economics and Statistics*, vol 52, pp. 169–210.

Klein, M. W., Shambaugh, J. C. (2006). The Nature of Exchange Rate Regimes. Cambridge, Mass. National Bureau of Economic Research.

Koray, F., Lastrapes, W. D. (1989). Real exchange rate volatility and U.S. bilateral trade: A VAR approach. *Review of Economics and Statistics*, vol 71, pp. 708–712.

Koop, G., Pesaran, M.H., Potter, S.M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, vol 74, pp. 119–147.

McKenzie, Michael D. (1999). The Impact of Exchange Rate Volatility on International Trade Flows. *Journal of Economic Surveys*, vol 13, pp.71–106.

Meese, R., and Rogoff, K. (1983). Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample? *Journal of International Economics*, vol 14, pp. 3–24.

Ministry of Economy and Finance, (2015). Non-price competitiveness of Moroccan exports: Outline of product quality in key sectors. DEPF.

Panda, S., and Mohanty, R. K. (2015). Effects of exchange rate volatility on exports: Evidence from India. *Economic Bulletin*, vol 35, pp.305–312.

Pesaran, M. H. and Shin, Y. (1998). Generalized Impulse Response Analysis in Linear Multivariate Models. *Economics Letters*, vol 58, pp. 17–29.

Nelson D.B. (1991). Conditional Heteroscedasticity in Asset Retums: A New Approach. *Ecometrica*, vol 59, pp. 347–370.

Rey, S. (2006). Effective exchange rate volatility and mena countries exports to the EU. *Journal of Economic Development*, vol 31, pp. 23–54.

Sadikov, A. M., Zeng, L., Clark, P. B., Wei, S.-J., and Tamirisa, N. T. (2004). A new look at exchange rate volatility and trade flows. Washington, DC: International Monetary Fund. *IMF Occasional Paper* 235.

Vergil and H. (2002). Exchange rate volatility in turkey and its effect on trade flows. *Journal of Economic and Social Research*, vol 4, pp. 63–79.

Viaene, J. M., de Vries, C. G. (1992). International trade and exchange rate volatility. *European Economic Review*, vol 36, pp. 1311–1321.

Vieira, F.V., Holland M., Silva, C. G., and Bottecchia, L. C. (2013). Growth and exchange rate volatility: A panel data analysis. *Applied Economics*, vol 45, pp. 3733–3741.

Wang, K.L. and Barrett, C.B. (2007). Estimating the effects of exchange rate volatility on export volumes. *Journal of Agricultural and Resource Economics*, vol 32, pp. 225–255.

Appendix

FIGURE 2: EVOLUTION OF REAL EXPORTS (LNY), REAL GDP (LNGDP), REAL EFFECTIVE EXCHANGE RATE (LN_REER) AND THE EXCHANGE RATE VOLATILITY (LNVOL EGARCH, LNVOLSD)