Do Financial Flows raise or reduce Economic growth Volatility? Some Lessons from Moroccan case

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Abstract
The purpose of the paper is twofold. Firstly, it attempts to analyze accurately the volatility of economic growth and financial flows (i.e. remittances and FDI) in the case of Morocco. Secondly, it tries to address the possible effects of these financial flows on the economic growth. We provide evidence that remittances are less volatile than FDI in terms of duration of persistence, intensity of shock and the "volatility clustering". Furthermore, remittances can smooth the volatility of growth, while FDI flows sustain and aggravate it. Altruistic foundations, counter-cyclicality and concentration of remittances in Europe have been advanced as elements of explanation of these outcomes. Similarly, foreign investors seeking only profits have a pro-cyclical behavior and are greatly sensitive to economic conditions in the country of origin.

Keywords: Economic growth volatility; Remittances; FDI; GARCH models.

1. Introduction

When the external funding sources dry up because of the financial crisis of 2007, Morocco, like many developing countries, cannot thrive without migrants' remittances. These are the most important source of external financing, much higher than foreign direct investments (FDI). In 2007, for example, remittance flows represented 734% of development aid, 145% of foreign direct investment and 9% of GDP (Bouoiyour, 2013). Despite the severe restrictions on international migration flows, remittances have become a critically important to many emigration countries. The result of 2007 crisis, whose consequences continue to threaten the economies of immigration countries, was a substantial drop of worldwide migration. Indeed, the slowdown in economic activity in the host countries resulted in a deeper jobs crisis and thus a sharp reduction of migration for work in these countries. However, despite the crisis, remittances from Moroccans living abroad have shown tremendous resilience, unlike other financial flows like FDI which tend to rise during favorable economic conditions and fall in bad times (crisis, natural disasters…). In actual fact, policymakers consider remittances as a relatively stable source of foreign exchange and a tool that can relax the household's budget constraints, and thus encourage households in developing countries to invest in the human capital of children. If we consider the case of Morocco, many studies have attempted to highlight their role in improving the welfare of the beneficiary families (Bouoiyour and Miftah 2014 a), in raising the level of human capital (Bouoiyour and Miftah (2014 b) and Bouoiyour et al. (2014)) and in reducing poverty (Bouoiyour and Miftah, 2014 a). Similarly, some studies have shown their impact on productivity growth through exchange rate and their counter-cyclicality (Makhouf, 2013). However, migration and remittances can also have negative effects on the country of origin. Accordingly, Bouoiyour and Miftah (2014 a) provide evidence that remittances exacerbate inequalities. Similarly, the problem of "moral hazard" may exist. This question has been studied by several researchers (Chami et al. (2003), for example), but no study has addressed the issue in the case of Morocco. It evokes the appearance of a form of disincentives in work closely related to the receipt of international transfers. In other words, remittances decrease the work effort and families who receive them seek employment with less effort. This may prompt a decrease in productivity (e.g. in agricultural plots) and ultimately a reduction in economic growth.

Beyond the purely economic effects, international migration and its corollary remittances have important social, human and cultural dimensions. Some empirical studies on Moroccan case show the importance of migration in the transmission of values, the acquisition of human capital and the rise of individual aspirations. It is also noteworthy that despite its role, especially economic in his native country, the Moroccan migrant became an agent of social, economic and demographic transformations. He contributes to changes in the consumer habits and in the behavior of his community of origin. His lifestyle and wealth promote wellness aspirations and change the parental perceptions of costs and benefits of children and therefore the family choices (Courbage, 1996). A study conducted in rural areas ("Douars" or villages in the region of Meknès[1]) showed that literacy and the acquisition of a certain level of education were not, for the women interviewed for

[1] PhD dissertation in Economics presented and defended by Muriel Sajoux Ben Seddik in September 2001 at the University of Pau.

this study, prior to the moderation and to the control of their fertility (Sajoux Ben Seddik, 2001); they have adopted an implicit strategy for socio-economic improvement, manifested by controlling their fertility. This means that the migration can have an important role in the inflection of fertility via the content of messages conveyed by the migrant. Thus, migration may play a substantial role of "cultural relay" and follows the population dynamic of the country which cannot be attributed solely to socio-economic changes. The status of the child is also modified by the migration. To this we can add that the wives who were left alone their migrant husbands are found invested new responsibilities regarding household management. This leads to certain emancipation, another potential source of fertility decline. Another no less important research deals with the experience of "strawberry harvest" in Huelva in Spain of women from rural Morocco. The study of Arab (2011) showed that circular migration of Moroccans during short periods (for "strawberry harvest" for example) can have a significant impact on the lifestyle of female migrants and their relationship with their family and friends. In some cases, migration brings, in fact, a change in the traditional role of women based solely on reproduction and motherhood. Becoming the main funder of the family and sometimes the head of household, migrant women take a certain influence on their husband. This constant is not specific to Moroccan women who migrate to Spain, it is also found for the case of Dominican and Filipino women. Another survey was conducted in the South of Morocco (Sidi Ifni) by Boufraioua (2011). It showed that the migration of fathers has a substantial impact on the process of entering adulthood of children and in their access to highly skilled jobs (i.e. the children of migrant Moroccans have easier access to the labor markets rather than non-migrant workers). The author concluded that the economic capital of fathers has a direct and intense impact on the life trajectories of their children.

As mentioned above, we invoke the importance of remittances in the macro-economic equilibrium of Morocco on the one hand and their relative importance in explaining national welfare on the other hand. However, it is striking to observe the lack of studies that have focused on the impact of financial flows (remittances and FDI) on economic growth volatility. This issue is particularly important for a country like Morocco sharply characterized by its persistent instability of economic growth. Indeed, it is common knowledge that the Moroccan growth is highly dependent on weather conditions, despite the drastic efforts pursued by governments to effectively mitigate this phenomenon. It is therefore very important for policymakers to rely on a stable and predictable source of external funding. Even FDI and remittance flows are expected to be the more stable components of capital flows, FDI tend in reality to be unstable and highly dependent on the economic situation of their recipient country, while remittances appear to react slightly. The purpose of this paper is to assess accurately this assertion, with special reference to Moroccan case.

To this end, the remainder of the article proceeds as follows: Section 2 presents a literature survey on the relationship between financial flows and economic growth. Section 3 depicts the Moroccan international migration and remittance characteristics. Section 4 recalls the concept of volatility while trying to properly and briefly outline various specifications of conditional volatility (i.e. several GARCH extensions). In section 5, we apply these models to determine the volatility of GDP, remittances and FDI. Then (in the same section), we regress GDP volatility on financial flows (remittances and FDI). Additionally, we re-estimate the focal relationship by incorporating other control variables and using "naïve models" to

check the robustness of our findings. Section 6 discusses our results and offers some lessons and economic implications to help advisers in their decision-making and to enhance readers'informations. Section 7 concludes.

2. Relationship between international financial flows and economic growth: Review of the literature

A number of studies have focused on the link between international financial flows (FDI and remittances) and economic growth in developing countries. First of all, we take a close look at the growth effects of FDI before revising the literature that addresses migrants' remittances. Several studies have shown that the FDI can - under certain conditions- affect the economic growth (Borensztein et al. (1998), Keller and Yeaple (2003), and Görg and Strobl (2004)). Their effects include both the increase of available capital as well as the benefit of externalities in the form of technology transfers and spillovers (e.g., multinationals acting with a more advanced levels of managerial and innovative capacity and production techniques). In addition, it seems that the presence of multinationals can create a competitive pressures as multinationals compete with local firms, which leads to the exit of some domestic firms and forces the others to improve their efficiency and productivity. In fact, the effect of MNCs on productivity of host country firms is ambiguous and depends on certain conditions. More generally, the effect of FDI on growth is not automatic and depends substantially on the characteristics of their recipient country (trade openness, per capita income, sufficiently developed financial markets, etc), the industry-specific factors and the nature of the FDI in question (Alfaro et al. (2010) and Hermes and Lensink (2003)). As mentioned by Borensztein et al. (1998), the FDI accelerates economic growth of the host economy, but this requires sufficient absorptive capability of the advanced technologies; for this, host country must have a minimum threshold stock of human capital. Alfaro and Charlton (2007) have analyzed the role of the quality of FDI in economic growth and confirmed that the positive effect of FDI flows on growth is increasing appreciably if one acknowledges the quality of foreign investment based on objective qualitative industry characteristics such as the average skill intensity and reliance on external capital. Using a panel VAR model type, Choe (2003) shows that there is a two-way causation between FDI and growth, but the effects are rather more apparent from growth to FDI than from FDI to growth.

The second issue we address is the short and long term effects of remittances on the macro economy of recipient countries. There seems to be a strong relationship between migrants' remittances and economic growth, although this relationship is highly heterogeneous across countries. In fact, in the short-run, remittances received by home countries allow them to strengthen their foreign exchange reserves which can serve as a tool to adjust the macro-economy and therefore affect their macroeconomic equilibrium and GDP growth. From this approach, several studies regarding the impact of remittances on consumption, investment and imports have shown that remittances can influence GDP and marginal propensity to import (El-Sakka and Mcnabb (1999) and Glytsos (2002)). Using Keynesian type econometric model with a dynamic perspective, and data from five Mediterranean countries, Glytsos (2002) has investigated the effects of

remittances on consumption, investment, imports and output and found a rather unstable situation in all countries, with fluctuating positive and negative effects of remittances on growth. He argues that the good done to growth by rising remittances is not as great as the bad done by falling remittances. In other words, in the case of Jordan, Egypt and Morocco, the author argues that the elasticities of induced negative growth rates of output with respect to falling remittances are much higher compared to the corresponding elasticities with respect to rising remittances. On their side, Rao and Hassan (2009) explained the effects of remittances on growth by using the Solow growth model and the GMM panel data estimation method. The study distinguished between the indirect and direct growth effects of remittances and found that migrant remittances seem to have positive but minor effect on growth[2]. Other studies reveal that remittance receipts may have a negative impact on economic growth through the effect of the "Dutch disease", which could result from the reduction of the competitiveness of the tradable sector after an appreciation of the real exchange rate. Amuedo-Dorantes and Pozo (2004) have tested the impact of remittances on the real exchange rate using a panel of 13 Latin American and Caribbean countries. Their analysis provides insight into the possible effects of remittances on exports via real effective exchange rate, showing that remittances have the potential to inflict economic costs on the export sector of receiving countries by reducing its international competitiveness. Another strand of literature has focused more directly on the relationship between investment and remittances. Woodruff and Zenteno (2004) estimate that more than 40% of the capital invested in microenterprises in urban Mexico is associated with migrants' remittances. Other studies put in evidence that return migration can increase investment in some developing countries like Egypt (McCormick and Wahba, 2003) and Tunisia (Mesnard, 2004). Specifically, they find that in countries where access to credit is a major obstacle for entrepreneurship, return migration has highlighted the propensity of returnees to take up self-employment but also the positive impact of accumulated savings on the decision to become self-employed. About the relationship between international remittances and financial sector development, Aggarwal et al. (2006) have found that remittance inflows can promote financial development in developing countries and therefore enhance growth. Besides stimulating capital accumulation and rapid economic growth, remittances could facilitate the financing of investments in human capital and health as well (Mansuri (2006) and Valero-Gil (2008)).

Finally, we take a close look at the stabilizing role played by remittances and FDI at the macroeconomic level. Given the apparent relationship between remittances/FDI and economic growth, it seems reasonable to think that remittances/FDI can influence macroeconomic fluctuations in recipient countries. As mentioned above, there is not universal agreement about the positive association between remittances or FDI inflows and economic growth. In the case of remittances, Chami et al. (2005) have explained this outcome by the fact that the causes and the effects of remittances remain separate. Many studies, above all at the microeconomic level, showed that migrants' remittances can play an insurance role

[2] There are seven channels through which remittances may have indirect growth effects: the output growth volatility, the exchange rate which depreciates when it increases, the investment rate, the development of the financial sector which is proxied by the ratio of M2 to GDP, the inflation rate, the ratio of foreign direct investment to GDP and the ratio of current government expenditure to GDP.

during times of economic crisis. Migrants transfer because they are concerned about the consumption of their families of origin; they look to improve the welfare of their families, i.e., altruistic motivations of remittances (Lucas and Stark, 1985). In addition, according to the New Economics of Labour Migration (NELM), migration is a collective decision making at the household level, which seeks to revenue maximization and especially to economic risks minimization, i.e. insurance motivations of remittances (Taylor and Martin, 2001). In other words, migrants can play a major role in mitigating vulnerability to shocks highlighting the counter-cyclical behavior of remittances. The shocks that hit low-income countries include for example natural disasters and economic crisis. Ratha (2003) realized that "Migrants may increase remittances in times of economic hardship, especially in low-income countries where their families may depend significantly on remittances as a source of income and may live at close to subsistence levels". Moreover, Chami et al. (2005) have found that remittances have a negative correlation with GDP growth. They argue that remittances have a tendency to move counter-cyclically with the GDP in recipient countries. Ebeck and Combes (2012) studying the macroeconomic impacts of natural disasters on the output growth volatility, indicate that the effect of natural disasters disappears for a remittance ratio above 8% of GDP, while remittances aggravate the destabilizing effects of natural disasters when they exceed 17% of GDP. A study by Bouhga-Hagbe (2006) finds a negative correlation between the two variables, which provides evidence that altruistic motivations can partly be behind remittances to Egypt, Jordan, Morocco, Pakistan, and Tunisia in recent years. Altruism can be captured by a negative long-run correlation between remittances and agricultural GDP (this is used as an indicator of economic hardship in the home country). Other external inflows like official development aid are of great need and could significantly mitigate the vulnerability of low-income countries to economic shocks. In this vein, Guillaumont and Le Goff (2010) present a comparative analysis of the stabilizing effect of ODA and migrant remittances. They showed that remittances appear to be stabilizing in more cases than official aid. Neagu and Schiff (2009) compared the stability, cyclicality and stabilizing impacts of ODA, FDI and remittances over the period 1980-2007 including a sample of 116 developing countries. The authors suggest that it is necessary to examine counter-cyclicality separately from the stabilizing impact, as the former does not seem to always imply the latter. They found that ODA is more stable than remittances in 73% of the considered countries which in turn are more stable than FDI in 72% of them. In terms of cyclicality, the results indicate that remittances are pro-cyclical, FDI more pro-cyclical, and ODA counter-cyclical. Finally, ODA has a stabilizing impact in 56% of the studied countries, while remittances and FDI have no effect in most of them (around 80% and 90%, respectively).

3. International migration and remittance characteristics: Moroccan context

According to the World Bank estimates, in 2011, remittances to developing countries have reached $ 373 billion and over $500 billion worldwide. These flows have been rising steadily for many years in developing countries to become as important as direct investment flows and much higher than the amount of official development assistance. In some countries, migrants' remittances represent more

than 20% of GDP (the example of Tajikistan). The size of remittance flows is undoubtedly much more significant than official estimates that underestimate the real levels of remittance flowing back to the origin countries because they only include those remittances which come back through official means. In the case of Morocco, migrants' remittances play a significant role in national economy as well, since a representative number of Moroccans have migrated internationally (10% of total population); the majority of them live in Europe. Remittances flows have been considered one of the major sources of foreign currency. According to World Bank data, Morocco has received $ 7.2 billion in 2011, about 7.24% of its Gross Domestic Product (GDP). As a result of the current global economic crisis, remittance flows have decreased for all regions of the world. In Morocco, while volumes have declined in 2008 and 2009, it is not possible to observe a phenomenon of collapse. For this country, the stability of remittance flows is an important policy issue that is relevant for the analysis of its external and internal vulnerabilities.

Table 1 provides a summary of the movement in the most substantial element of the Moroccan balance of payments as a share of GDP. As a percentage of GDP, remittances are larger than foreign direct investment. Together with tourism, migrants' remittances represent the country's major source of foreign currency receipts.

At the international level, at over 6.5 billion US$ in 2012, they placed Morocco as the 15th largest recipient of remittances in developing countries. In 2012, the country continued to depend on these external flows which provided an essential financial support to its balance of payments and had a significant impact in its GDP. With respect to economic growth, the World Bank show that over the period 1980-2010, growth in Morocco averaged about 4 percent. Morocco's economy has been performing relatively well with an average growth rate of 5% over the past few years, despite the slowdown in world growth (GDP records 4.7% in 2013 compared to 2.7% in 2012 and 5% in 2011) thanks to a favorable domestic demand and good agricultural results (AfDB-OECD-UNDP, 2014). A sectoral analysis of the real GDP showed that the share of agriculture in total Morocco's GDP stood at 14.58% in 2012 (this share of agriculture has remained roughly constant over the past years).

In recent years, to reduce the volatility of real GDP growth and diversify its economy, Morocco has encouraged high value added production sectors such as telecommunications, financial and insurance activities and tourism. New industries, such as aeronautics and vehicle manufacture, are now increasingly important sectors and potential sources of both jobs and innovation in the country.

Table 1. The main elements of the Moroccan balance of payments (as percentage of GDP)

	1990-94	1995-99	2000-04	2005-12	2011	2012
Current account balance	-1.6	-0.8	2.4	-4.3	-8.1	-9.8
Travel credits	3.9	4.2	6.5	7.8	7.4	6.9
Spending of investment income	4.3	3.5	2.6	2.4	2.9	3
Remittances	7	5.9	8.2	8.4	8	7.5
Foreign direct investment			3.4	4.2	3.2	3.5
Inv. and private debt flows to Morocco	1.5	2.5	4.1	4.8	3.8	3.7

Source: Division of financial research and perspective (2013).

4. The relationship between GDP volatility and financial flows: Methodological framework

The main aim of this paper is twofold: Firstly, we try to determine the optimal model able to appropriately capture the volatility of Moroccan GDP growth and that of financial flows (remittances and foreign direct investment). Secondly, to model the volatility of GDP growth based on various explanatory variables including particularly remittances and *FDI*. Economic theory assumes that these last two variables act oppositely on the volatility of economic growth. Our objective in the following is therefore to check whether remittances smooth economic growth, and if *FDI* accentuate the volatility of growth for the case of Morocco. The obtained results may have important economic implications and may be very useful for policymakers.

4.1. GARCH models and the volatility of GDP, Remittances and FDI

Economic agents act in an uncertain economic environment where the volatility of commodity prices increases continuously, aggravating then the probability of risk' occurrence. Obviously, the risk is heavily correlated to instantaneous variability of asset returns or more accurately to volatility. It seems therefore of utmost importance to determine an appropriate econometric technique to capture properly the unobservable process. At this stage, we should be cautious in choosing the best volatility measurement.

The conventional models (standard deviation, moving average deviation, among others) consider the distribution of asset returns as stable, implying that economic agents formulate their expectations at the same way over time. It is of course well known that this assertion is far from reality, since during periods of great agitation (adverse changes, crisis, political tensions and sudden shocks, among others), the variance-covariance of returns may be very volatile. As a result, "the naïve models" or the standard specifications are unable to detect effectively the conditional volatility process and to account for transitory and permanent components, persistence of volatility clustering, reaction to shocks and weight between tranquil and turbulent periods. The GARCH-type modeling (General Autoregressive Conditional Heteroskedasticity) has been and continuous to be very

valuable tool in financial economics after the pioneering study of Engle (1982). The latter was among the first to model the conditional variance of time series. Bollerslev (1986) has generalized then the work of Engle (1982). Other extensions followed, Nelson (1991), Bollerslev et al. (1993), Zakoin (1994), Bollerslev et al. (2008), Bauwens and Storti (2008), Bouoiyour and Selmi (2014), among others. Statistically, financial markets data seem distinguished during "volatility clustering" in which time series show periods of high volatility and periods of low one. In fact, time-varying is more common than constant volatility. In that context, GARCH extensions are considered more appropriate to define volatility (Bollerslev et al. 1993). These models are efficient for describing the volatility of the conditional variance by taking into account the characteristics of series using the past errors in estimates.

Because choosing an optimal model among various GARCH specifications seems useful and most convenient, we use here different extensions in order to determine the best model able to effectively capture the conditional process of remittances (*REM*), foreign direct investments (*FDI)* and economic growth (*GDP*). Since no single measure of volatility has dominated the existing empirical literature, the more parsimonious techniques able to clearly and appropriately depict the volatile behaviors of the focal variables may be selected using standard criteria such as the Akaike information criterion (AIC), the Bayesian (BIC) and Hannan-Quinn information criteria (HQ). Some loss functions are also been applied including root mean square error (RMSE), mean absolute error (MAE) and bias proportion (BP). These criteria are sufficient to judge the quality of estimation, because they allow to determine the optimal model in terms of historical evaluation (AIC, BIC, HQ) and in terms of forecasting performance (RMSE, MAE, BP).

Hence, it is crucial to recall initially that standard GARCH model initiated by Engle (1982) and generalized by Bollerslev (1986) assume that the conditional variance follows an ARMA process. It allows a representation of the autoregressive conditional variance process. It may be expressed as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_j \sigma_{t-j}^2 \qquad (1)$$

Where α_i, β_i and ω are the parameters to estimate.

Subsequently, we have showed an intense evolution of GARCH extensions (Tong (1990), Nelson (1991), Ding et al. (1993) and Zakoin (1994), Bauwens and Storti (2008), etc…).These may be linear or nonlinear, symmetrical or asymmetrical. While such analyses accurately analyze the excessive volatility of financial variables, they do not account for asymmetry (the sign of innovations) and nonlinearity. The symmetrical and linear modeling imposes the same sign of parameters over time. However, the focal variable may change intensely from one state to another, highlighting the very prime need to consider switching regime and leverage effect. Table-A.1 reports the GARCH specifications used in our study.

4.2. Modeling the economic growth volatility

Several researches have focused on analyzing the interaction dynamic between economic growth and financial flows or more precisely on the importance of financial development in reducing volatility and mitigating their possible detrimental effects. Easterly et al. (2000) put in evidence that this nexus is more complex than it may appears and that it seems crucial to account for nonlinearity when assessing this relationship. It is indeed low when the financial sector is well developed. In addition, Caballero (2000) argues that a sizeable macroeconomic volatility may be substantially attributed to the weak of financial system and the lack of financial openness. Nevertheless, another strand of literature including Stiglitz (2000) reveals that financial openness may be pro-cyclical and may play a destabilizing role in the concerned country, indicating therefore the issue controversy. Indeed, deeper connection with international financial markets may have harmful effects on each economy when it exceeds the country's capacity to effectively absorb external shocks, especially when the country in question is highly concentrated on inherently volatile products like agriculture, industrial inputs, among others (Bouoiyour and Selmi, 2014). Intuitively, the vulnerability of the economy to the negative socks can be mitigated by a powerful public sector and good governance. Hence, the institutional quality may have a pulling role on lessening the excessive macroeconomic volatility (Rodrik (1998) and Acemogluet al. (2003)).

In the present study, we will focus on the roles of remittances and FDI in explaining the volatility of economic growth. We must initially point out that they have controversial influences. Normally, financial flows are closely linked to the economies where capital intensity is high. They are pro-cyclical and volatile (Jackman et al. 2010) and Neagu and Schiff (2009)). However, other empirical studies reveal that remittances are stable and countercyclical (Bugamelli and Paterno, 2008).

Our main aim in this research is to re-explore the empirical connection between financial flows (remittances and FDI) and economic growth, by incorporating control variables including domestic credits and openness. To this end, we carry out several volatility' specifications. In addition and unlike several previous studies on the focal issue that use only "naïve models" such as standard deviation and moving average deviation to capture the process of volatility (for instance, Neagu and Schiff (2009), and Chami et al. (2009, 2010), among others), in this paper we use both "naïve techniques" and "sophisticated models on the conditional volatility basis" to ensure the robustness of the obtained findings.

As mentioned at the outset, the existing literature suggests different factors as main drivers of economic growth instability. This study disentangles the short-run dynamic between *GDP* volatility, remittances to *GDP* ratio and *FDI* to *GDP* ratio, by incorporating other variables supposed to have a pulling role in explaining excessive growth volatility. The model to estimate may be expressed as follows:

$$y_t = a_0 + a_1 x_{1t} + \alpha_2 x_{2t} + a_3 x_{3t} + a_4 x_{4t} + a_5 x_{5t} + \alpha_6 x_{6t} + \varepsilon_t \quad (2)$$

Where y_t is the volatility of GDP (in real terms); x_1 and x_2 represent the variables of interest, namely, remittances and *FDI* respectively. The rest of time series are the

control variables. So, x_3 denotes the lagged GDP of one period (x_4 is the squared lagged GDP); x_5 are the credits to the economy divided by GDP; x_6 denotes the openness (exports and imports to GDP ratio); ε_t is the error term to be white noise.

5. Main findings and discussion

5.1. Preliminary analysis

Before measuring the volatility of *GDP*, remittances and *FDI* and estimating the relationship between them, we start by a preliminary analysis of these focal variables. Using quarterly data spanning between 2000 and 2009 (the chosen period of study is due to the availability of data) collected from Econstats™ and exchange office of Morocco. The descriptive statistics are reported in Table 2. It is clear that the Jarque-Bera test rejects the null hypothesis of a Gaussian distribution of *GDP* returns and those of *FDI* (we obtain high values for GDP (8.7401) and for FDI (14.9316), while it accepts it for the case of remittances returns. *GDP* and *FDI* returns show a negative asymmetry (skewness), and thus admitting a symmetrical distribution is plausible for the two countries in question, inversely for remittances (positive asymmetry). Kurtosis is greater than 3 for all variables under consideration (except remittances), indicating that the distribution of each series is flatter than the Gaussian distribution.

Table 2. descriptive statistics

	r_{GDP}	r_{REM}	r_{FDI}
Mean	-2.48E-05	-0.006094	-0.025771
Median	0.001442	-0.012378	0.017499
Maximum	0.104484	0.371875	2.837132
Minimum	-0.118370	-0.375297	-3.123113
Std. Dev.	0.042136	0.185237	0.967503
Skewness	-0.072678	0.282753	-0.235811
Kurtosis	4.325246	2.610268	6.034487
Jarque-Bera	8.740164	0.746839	14.93169

Notes: $r_t = \log(S_t) - \log(S_{t-1})$. S_t denotes *GDP*, remittances and *FDI* returns, respectively.

To be more effective in our investigation, we can also test the autocorrelations and the occurrence of asymmetry on conditional volatility in the three considered time series. Simple diagnostic can be used to see whether there we should account for asymmetry when analyzing the focal series is the correlation between squared returns and lagged returns (i.e. $corr(r^2, r_{t-1})$). A negative value of the correlation coefficient implies the existence of potential leverage effect. The results of autocorrelation, ARCH and leverage effects tests are summarized in Table 3. The findings from DW test imply that there is no evidence of autocorrelation in the mean equation of all time series under consideration. It is also clear that all the

variables indicate significant evidence of the ARCH effect, implying that the mean equation did not adequately capture volatility for concerned countries, hence it seems not necessary to estimate the GARCH models based on this mean equation. We also clearly note that the correlations between the squared returns and lagged returns have negative values for *GDP* and remittances and positive for *FDI*. This indicates the presence of asymmetric effects for the first variables and its absence for the third one.

Table 3. Test of leverage effect on conditional volatility

	DW test (r_{t-1})	ARCH LM test (r_{t-1})	$\rho(r^2, r_{t-1})$
GDP	1.93	27.34*** [0.0000]	-0.6093
REM	1.87	22.18*** [0.0000]	-0.2115
FDI	1.89	22.69*** [0.0000]	0.3844

As mentioned in section 4, to choose the best model, we will use standard criteria such as the Akaike, the Bayesian and the Hannan-Quinn criterion. These criteria evaluate the models based on the history of volatility[3]. To have good performance in forecasting, we should use the forecast error. The latter is calculated as the difference between the observed and predicted values. We can calculate a loss function based on the Root Mean Square Error, the Mean Absolute Error and the bias proportion[4] to compare the performance of different models for prediction (Koksal, 2009). The model with the minimum loss function is assumed to be the optimal one.

[3] For more details about the formula of these different criteria, you can refer to Bouoiyour et al. (2012).

Akaike information criterion : *-2log (vraisemblance) + 2k*
Bayesian information criterion : *-2log (vraisemblance) + log(N).k*
Hannan-Quinn information criterion: *-2log (vraisemblance) + 2k.log (log(N))*

Where *k* the degree of freedom and *N* is the number of observations.

[4] The formulas of the different loss functions are as follows:

Mean Square Error : $$MSE = \frac{1}{n}\sum_{i=1}^{n}(\sigma_i - h_t)^2$$

Root Mean Square Error : $$RMSE = [\frac{1}{n}\sum_{i=1}^{n}|\sigma_i - h_t|^2]^{1/2}$$

Bias proportion: $$BP = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{\sigma_i - h_r}{\sigma_i}\right|$$

5.2. Volatility of GDP, remittances and FDI: Results via optimal GARCH model

5.2.1. GDP

Whatever the criterion of historical evaluation (AIC, BIC, HQ) or the criterion of the loss function (RMSE, MAE, BP), the optimal model is the T-GARCH (Threshold-GARCH) initially proposed by Tong (1990) and extended by Zakoin (1994) which takes into account both asymmetry and nonlinearity in the process of volatility. It is expressed as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} (\alpha_i |\varepsilon_{t-i}| + \gamma_i |\varepsilon_{t\_i}^{+}|) + \sum_{i=1}^{p} \beta_j \sigma_{t-j} \qquad (3)$$

Where α_i, β_i and ω and γ are the parameters to estimate.

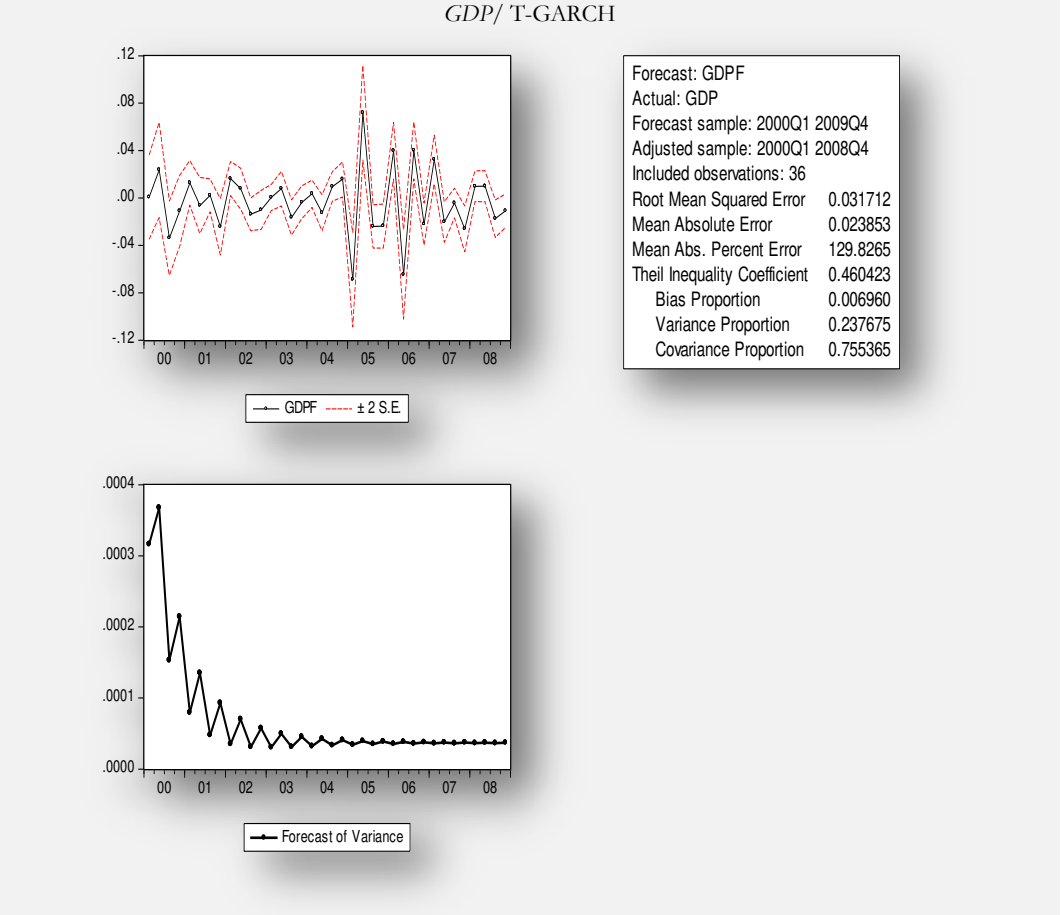
The main results of estimates are reported in Table 4. The volatility appears persistent and tends towards long memory process since $\alpha + \beta + 0{,}5\gamma = 1.07$ (not far from 1). The asymmetrical effect is positive and statistically significant implying that the effect of bad news on the conditional variance is stronger than that of good news. Indeed, the degree of asymmetry ($\frac{\alpha + \gamma}{\alpha}$), which measures the relative influence of bad news on volatility seems important in our case (it amounts 0.9214). Additionally, the intensity of negative shocks ($-\alpha + \gamma = 1.46$) is more intense than that of positive shocks ($\alpha + \gamma = 0.88$). It is also well seen from Figure 1 that the Moroccan *GDP* tends to stabilize. More precisely, the variance of *GDP* decreases from one year to another. This result may be owing to the fact that the sharp de-correlation between the GDP and the climatic conditions in the last years tends to limit the volatility of the variance.

Table 4. GDP volatility' parameters and persistence

Dependent variable: (r_t)	
Mean Equation	
C	-0.0028* (-2.0316)
r_{t-1}	-0.6325*** (-3.7151)
Variance Equation	
ω	2.05E-05 (0.1249)
α	-0.2924* (-1.8592)
β	0.2944* (1.8174)
γ	1.1756*** (3.7377)
Duration of persistence: $\alpha + \beta + 0{,}5\gamma$	1.0104
ARCH and GARCH effects: $\alpha + \beta$	0.0020
Leverage effect: γ	1.1756
Intensity of negative shock: $-\alpha + \gamma$	1.4680
Intensity of positive shock: $\alpha + \gamma$	0.8832

Notes: ω : The reaction of conditional variance; a : ARCH effect; β : GARCH effect; γ : Leverage effect

Figure 1. Volatility of GDP using optimal GARCH model



5.2.2. Financial flows

a. Remittances

The best model chosen by combining the results from information criteria and loss functions for remittances is the CMT-GARCH model recently used by Bouoiyour and Selmi (2014) that consider multiple threshold orders, weight between high and low volatility, leverage effect and that decomposes the process of volatility into a long-run time varying trend and short-run deviations from trend (Table A.2). This model is written as following:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta(\omega + (\alpha + \gamma I_{(\varepsilon_{t-2}>0)})\varepsilon_{t-2}^2 + \beta\sigma_{t-2}^2) \quad (4)$$

Where α_i, β_i and ω and γ are the parameters to estimate.

Table 5 provides more details about the estimated parameters. We show that the leverage effect is insignificant for *REM* (Equation-1), indicating that neither the bad news nor the good news have any impact on the conditional volatility. In addition, the intensity of both negative and positive shocks is seemingly low for *REM* (they amount respectively $-\alpha + \gamma = -0.02$ and $\alpha + \gamma = 0.20$). The persistence of conditional volatility $(\alpha + \beta + 0.5\gamma)$ amounts 0.27. It appears low (i.e. not

persistent since the duration of persistence is less than 1). Intuitively, the common characteristic of financial returns "volatility clustering" may be defined as the succession of periods when returns change slightly (i.e. tranquil periods) and others where changes in returns are sharply large (i.e. turbulent periods). For our cases of study and particularly for *REM*, we clearly show that the sum of a and β is lower, implying the absence of "volatility clustering" for this time series.

b. FDI

Using several information criteria and loss functions, we show that for *FDI* the optimal model is the T-GARCH, which accounts for nonlinearity (switching regime) and asymmetry (leverage effect) in the process of conditional volatility. The formula of this specification is already mentioned above (section 5.2.1). Table 5 reports the estimated parameters. We show that the leverage effect is positive and significant for *FDI* (Equation-2), indicating that bad news have more impact than good news. In addition, the intensity of negative and positive shocks is strong for *FDI* (1.21 and 0.69, respectively). The duration of persistence $(\alpha + \beta + 0.5\gamma)$ amounts 1.23, implying to some extent, that *FDI* tends to follow a long memory process (more accurately, it follows an "explosive process" since the duration of persistence exceeds 1), the sum of ARCH and GARCH effects is higher for *FDI*, indicating the presence of an excessive succession of tranquil (slight changes) and turbulent periods (wide changes).

Summing up, we find that it is crucial when assessing the instability of *REM* and *FDI* to account for asymmetry and nonlinearity (i.e. the volatility of remittances has been determined through CMT-GARCH and that of FDI has been measured via T-GARCH that considers both possible asymmetrical and nonlinear effects). The duration of persistence and the ARCH and GARCH effects are not the same for the two variables of interest. They appear much more important for FDI. Overall, remittances behave better than FDI (considering the conditional volatility characteristics). Figure 1 confirms the more volatile and persistent behavior of foreign direct investments, *i.e. FDI* volatility takes more time to dissipate than that of *REM*.

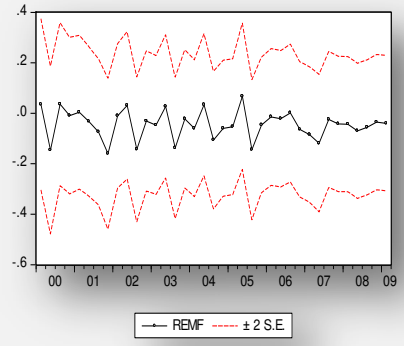
Table 5. Financial flows volatilities' parameters and persistence

Dependent variable: (r_t)		
	(1)	(2)
	REM	*FDI*
Mean Equation		
C	-0.0416 (-0.2795)	-0.0468*** (-3.6597)
r_{t-1}	-0.4534*** (-6.6107)	-0.3037** (-2.3446)
Variance Equation		
ω	0.5929** (2.7142)	0.0048 (1.4836)
α	0.1145 (0.0086)	-0.2597 (-1.4628)
β	0.1128** (2.3706)	1.0122*** (8.1525)
γ	0.0944 (1.0826)	0.9593* (1.7784)
Duration of persistence: $\alpha + \beta + 0{,}5\gamma$	0.2745	1.2325
ARCH and GARCH effects: $\alpha + \beta$	0.2253	0.7525
Leverage effect: γ	0.0944	0.9593
Intensity of negative shock: $-\alpha + \gamma$	-0.0201	1.2190
Intensity of positive shock: $\alpha + \gamma$	0.2089	0.6996

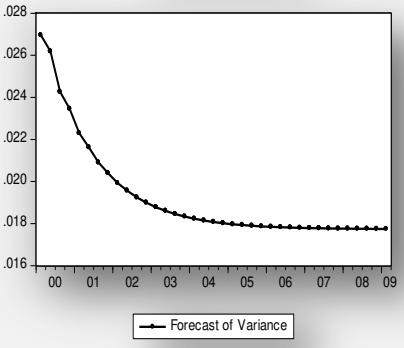
Notes: ω : The reaction of conditional variance; a : ARCH effect; β : GARCH effect; γ : Leverage effect .

Figure 2. Volatility of financial flows using optimal GARCH model

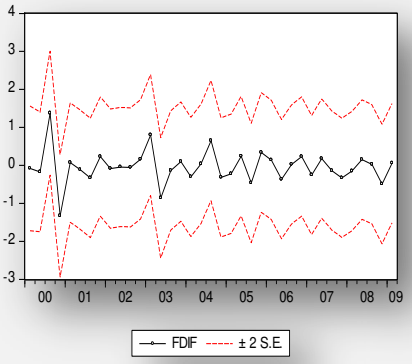
REM/ CMT-GARCH



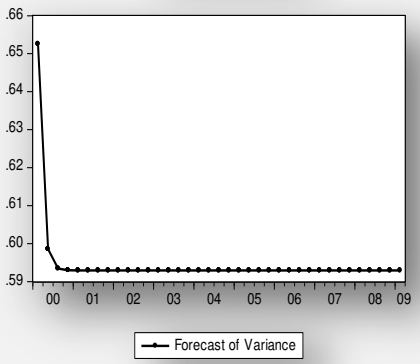
Forecast: REMF	
Actual: REM	
Forecast sample: 2000Q1 2009Q4	
Adjusted sample: 2000Q1 2009Q1	
Included observations: 37	
Root Mean Squared Error	0.177767
Mean Absolute Error	0.138107
Mean Abs. Percent Error	547.0888
Theil Inequality Coefficient	0.690980
Bias Proportion	0.048728
Variance Proportion	0.526167
Covariance Proportion	0.425105



FDI/T-GARCH



Forecast: FDIF	
Actual: FDI	
Forecast sample: 2000Q1 2009Q4	
Adjusted sample: 2000Q1 2009Q1	
Included observations: 37	
Root Mean Squared Error	0.854788
Mean Absolute Error	0.626933
Mean Abs. Percent Error	176.9830
Theil Inequality Coefficient	0.608568
Bias Proportion	0.000432
Variance Proportion	0.386304
Covariance Proportion	0.613264



After determining the volatility of GDP and comparing the instability of *REM* to that of *FDI*, it is time to address whether financial flows raise or reduce economic growth volatility. To do so, we use the optimal GARCH model that links the returns of GDP with financial flows (Equation-1, Table 6) and additional explanatory variables (Equation-2, Table 6) that can be able to capture appropriately the process of conditional variance. The first best model specification chosen among various GARCH extensions (Table A.3) seems asymmetrical (AP-GARCH), while the second one considers both the switching regime and the leverage effect (CMT-GARCH). The AP-GARCH model can be expressed as following:

$$\sigma_t^{\varphi} = \omega + \sum_{i=1}^{q} \alpha_i (|\varepsilon_{t-i}| + \gamma_i \varepsilon_{t-i})^{\varphi} + \sum_{i=1}^{p} \beta_j \sigma_{t-j}^{\varphi} \quad (5)$$

Where α_i, β_i and ω and γ are the parameters to estimate.

The results are summarized in Table 6. We find that remittances play a stabilizing role. Indeed, the remittances (*REM)* have a negative and significant effect on the dependent variable and then reduce the volatility of growth in Morocco. It is also well notable that *FDI* have a positive impact on the volatility of Moroccan economic growth. In other words, the foreign direct investments accentuate the *GDP* instability, inversely to remittances. Nevertheless, this outcome worthy indicates the opposite behavior of the two financial flows, confirming therefore the previous assessment of conditional volatility of remittances and *FDI*.

It is also notable that *openness* has a positive and significant impact on the volatility of Moroccan GDP, but this effect seems minor. More precisely, an increase by 10% in *openness* leads to an increase in the instability of GDP by 0.41%. This means that openness, as practiced in Morocco, may be considered as an element that sustains and thus accentuates the volatility of economic growth. Obviously, Morocco is specialized in exporting products distinguished during low technological and innovative content. Likewise, imports are concentrated mainly in raw materials characterized by high uncertainty and question of great speculative attacks. This result is inconsistent with Bouoiyour (2008), arguing that openness can have a negative impact on growth. As for the variable relative to *Credits*, it reduces certainly the volatility.

Table 6. Optimal GARCH model: Estimation of the link between economic growth volatility and financial flows

Dependent variable: (r_t)		
	(1)	(2)
	AP-GARCH	CMT-GARCH
Mean Equation		
C	0.0729 (1.0676)	92.372*** (18.6354)
REM/GDP	-0.0352* (-1.7215)	-0.0293* (-1.8840)
FDI/GDP	0.00676* (1.6784)	0.0252* (1.7459)
GDP(t-1)	-	-15.244*** (-10.2840)
GDP(t-1)²	-	0.6632*** (17.5896)
Credits	-	-0.4082*** (-6.5070)
Openness	-	0.0416* (1.7544)
Variance Equation		
ω	3.00E-05 (0.9984)	0.0001** (2.7791)
α	-0.0683 (-0.9227)	0.7191* (1.1460)
β	0.9925 (0.3588)	0.2114 (0.3239)
γ	1.0580*** (4.2153)	-0.0224 (-0.0088)

Notes: ω *:* The reaction of conditional variance; a : ARCH effect; β : GARCH effect; γ : Leverage effect .

5.3. Robustness

The above outcomes reveal that remittances can mitigate the instability of GDP, while *FDI* may accentuate it. To effectively verify the robustness of this evidence, we performed several estimates of the link between economic growth volatility and financial flows (*REM* and *FDI*) by incorporating control variables that may have potential roles in explaining the volatile GDP behavior (*lagged GDP, squared lagged GDP, credits, openness*) based on different "naïve models" (standard deviation, moving average deviation and absolute average deviation) and GARCH extensions (linear, nonlinear, symmetrical and asymmetrical). Details about the different estimates are reported in Table A.3 and Table A.4. Comparing these findings with those of the optimal specification, we notice that the effect of financial flows on the volatility of Moroccan economic growth is sharply robust.

The main results reported in Table 6 (Equations-1 and 2) indicate that the remittances have a negative and significant impact on the focal variable, whereas the influence of FDI appears positive and statistically significant. These findings do not change substantially among the different followed GARCH models (Table A.5), when adding the control variables (Table A.6) or when moving from the application of "sophisticated techniques" (Tables A.5 and A.6) to the use of "naïve models" (Table A.7), reinforcing thus their robustness.

We can therefore confirm that remittances play a stabilizing role on Moroccan economic growth, while *FDI* acts as destabilizing element. These outcomes may have important economic implications. They may be very useful for policymakers, advisers and practitioners in properly and appropriately achieving their decisions-making.

6. Economic implications

One of the main roles of policymakers is to ensure a credible budget and to allow reliable budget forecasts to be made in good time. However, these can only be achieved if actual conditions do not change or change marginally. In the present paper, we have shown that FDI seems highly volatile compared to remittances. This assertion which is valid whatever the criterion used (leverage effect, intensity of shocks and persistence of conditional volatility, etc) is of utmost importance for a country like Morocco characterized by its unstable growth. This instability is largely due to weather conditions (long periods of drought followed by heavy rainfall). Despite the drastic efforts regularly pursued by Moroccan governments, the relationship between climate and economic growth appears continuously substantial and becomes increasingly tenuous. It must be said in that context that the agricultural sector remains important component of national wealth. Even agricultural value added amounts less than 20% of the national wealth for several years ago, almost the half of Moroccan population lives in rural areas today (48% of total population). Similarly, the share of food industry in total manufacturing industries is not negligible (24% more precisely, see MEDISCO (2008)). To this, we must add the possible induced effects of drought on the country (including a decreasing of the moral of households or consumers and the waiting times and then productivity losses for business leaders of food industry, etc.). In other words, agriculture weight in national

wealth is much more than it appears (14-16% of GDP). This shows the interest of the obtained results, including the fact that migrants' remittances mitigate the volatility of growth, while FDI accentuates it. Given the volatility of the Moroccan growth, this result seems fundamental and implies that remittances play "a smoothing role" on the variability of the Moroccan economic growth. This may limit any sizeable variation of consumption, and maintain balanced and fixed income of households. In other words, from a macroeconomic point of view, migrants' remittances can lessen the effects of internal exogenous shocks (drought, for example) and external ones (crisis and sudden short-run disturbances, for instance). We can detect from this finding that remittances are mainly due to altruistic reasons (decisions of migrants who have still a link with their family members stayed in their origin country and support them in case of problems like illness, crisis, drought or special events), unlike FDI which is expected to depend on solely profit of foreign investors. Considering the current economic crisis, we notice that remittances have decreased by 7.95% while FDI fell by 12.7% over the period that spans between 2007 and 2008. Thereafter and particularly during the period 2008-2009, remittances have dropped by 2.38% and then stabilized, while FDI have heavily declined by 20.11% and 37.05% thereafter (particularly in 2009-2010).

Remarkably, the bulk of remittances goes into consumption increases the domestic demand and leads to the stabilization of demand in the case of exogenous shock. Additionally, the diversification of Moroccan economic allows it to absorb important transferred amounts. Finally, it should be noted that much of remittances goes to the real estate industry and this has been for several years[7]. This phenomenon related to real estate speculation doesn't win Morocco recently and the impact of remittances on the sector would be very beneficial for the country which has a cheap labor and available inputs (cement, sand ...) in sufficient quantity. However, despite the positive impact of remittances, it stills limited, because of the weaker absorption capacity and assets in terms of investment opportunity. If migrants have strongly invested in building, it is primarily because it is the only market offering. Then, it is the only sector where the risks are limited. Finally, it is an investment that, for many migrants, is a culmination after many years of effort and sacrifice in their host countries. Given the above elements, the authorities should establish a clear and credible policy to redirect remittances to more productive sectors. Since remittances are done over several years, they have also large time to effectively anticipate these flows. Certainly the FDI flows are important and their recent evolution seems encouraging, despite the crisis and the "Arab Spring", but their externalities (spillovers) are almost non-existent because of their concentration in sectors with low capital intensity.

At this stage, we can argue that today Morocco has won a first round. Thanks to the efforts of authorities, this country has succeeded to attract remittances of its nationals living abroad, while developing a safe and stable financial system. It remains a second round to be won by the drainage of considerable funds into productive and innovative investment projects. This is still far from being met today, despite the great efforts pursued and the proactive measures implemented by the authorities responsible for migration affairs. This is true for FDI as the incentives are needed from public authorities towards the sectors producing value added.

7. Conclusion

The present research was focused on addressing the degree of variability of the main financial flows (i.e, remittances and *FDI*) on the one hand and to see whether these flows play a substantial role in explaining economic growth instability on the other hand, with special reference to Moroccan case.

The results show that it seems of utmost importance when assessing the volatilities of *GDP*, remittances and *FDI* to account for asymmetry and nonlinearity. The remittances behave better than *FDI* in terms of the duration of persistence, intensity of negative and positive shocks, leverage effect and "volatility clustering" (i.e. the sum of ARCH and GARCH effects). This implies that remittances are more stable than *FDI*.

Other substantial aim of the present research was to go beyond this conclusion and evaluate whether the remittances stabilize Moroccan growth, itself very volatile and if the *FDI* flows act in the opposite direction. Our findings tend to confirm the hypothesis thereby remittances can smooth the volatility of growth, while *FDI* accentuate it. The first outcome may be attributed to altruistic foundations), the counter-cyclical behavior of remittances (Makhlouf, 2013) and the concentration of Moroccans in Europe (80% of total number of migrants) and in France in particular (almost 50%). This concentration allows remittances to be relatively stable (Mouhoub (2010) and Bouoiyour (2013)). The second finding may be owing to the fact that FDI flows depend intensely on the decisions of foreign investors who search a profitable economic environment for their investments. This can explain the heavily sensitivity of these flows to economic conditions. In this sense, FDI are pro-cyclical.

To ensure the robustness of our findings, we have performed several estimates of the relationship between economic growth volatility and financial flows by incorporating control variables as main drivers of GDP instability including domestic credits and openness based on different "naïve models" and several GARCH extensions (linear versus nonlinear and symmetrical versus asymmetrical). These results do not change considerably in terms of signs and magnitude when adding control variables or when applying "naïve models" as volatility' measurements, highlighting their robustness.

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Table A.1. GARCH extensions used in this study

Extensions	linear	nonlinear	symmetrical	Asymmetrical
GARCH-M (GARCH in mean, Bollerslev et al. 1993) $r_t = \mu_t + \varepsilon_t + \lambda\sigma_t^2$	x		x	
C-GARCH (Component GARCH, Ding et al. 1993) $(\sigma_t^2 - \sigma^2) = \alpha(\varepsilon_{t-1}^2 - \sigma^2) + \beta(\sigma_{t-1}^2 - \sigma^2)$	x		x	
I-GARCH (Integrated GARCH, Bollerslev et al. 1993) $\sigma_t^2 = \omega + \varepsilon_{t-1}^2 + \sum_{i=1}^{q}\alpha_i(\varepsilon_{t-i}^2 - \varepsilon_{t-1}^2) + \sum_{i=1}^{p}\beta_j(\sigma_{t-j}^2 - \varepsilon_{t-1}^2)$	x		x	
T-GARCH (Threshold GARCH, Zakoian, 1994) $\sigma_t^2 = \omega + \sum_{i=1}^{q}(\alpha_i\lvert\varepsilon_{t-i}\rvert + \gamma_i\lvert\varepsilon_{t\_i}^{+}\rvert) + \sum_{i=1}^{p}\beta_j\sigma_{t-j}$		x		x
E-GARCH (Exponential GARCH, Nelson, 1991) $\log(\sigma_t^2) = \omega + \sum_{i=1}^{q}(\alpha_i z_{t-i} + \gamma_i(\lvert z_{t-i}\rvert - \sqrt{2/\pi})) + \sum_{i=1}^{p}\beta_j \log($				x
P-GARCH (Power GARCH, Higgins and Bera, 1992) $\sigma_t^{\varphi} = \omega + \sum_{i=1}^{q}\alpha_i\varepsilon_{t-i}^{\varphi} + \sum_{i=1}^{p}\beta_j\sigma_{t-j}^{\varphi}$	x		x	
A-PGARCH (Asymmetric power GARCH, Ding et al., 1993) $\sigma_t^{\varphi} = \omega + \sum_{i=1}^{q}\alpha_i(\lvert\varepsilon_{t-i}\rvert + \gamma_i\varepsilon_{t-i})^{\varphi} + \sum_{i=1}^{p}\beta_j\sigma_{t-j}^{\varphi}$				x
CMT-GARCH (Component with Multiple Thresholds GARCH, Bouoiyour and Selmi, 2014) $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta(\omega + (\alpha + \gamma I_{(\varepsilon_{t-2>0})})\varepsilon_{t-2}^2 + \beta\sigma_{t-2}^2)$		x		X

Notes: σ_t^2 : conditional variance, α_0 : reaction of shock, α_1 : ARCH term, β_1 : GARCH term, ε : error term; I_t: denotes the information set available at time t; z_t: the standardized value of error term where $z_t = \varepsilon_{t-1}/\sigma_{t-1}$; μ : innovation, γ : leverage effect; φ : power parameter.

Table A.2. Volatilities of GDP and financial flows: Optimal models chosen by information criteria and loss functions

GDP						
Models	AIC	BIC	HQ	RMSE	MAE	BP
GARCH	-3.8419	-3.6220	-3.7652	0.0326	0.0247	0.0000
GARCH-M	-3.7812	-3.5173	-3.6891	0.9562	0.3410	0.0127
I-GARCH	-4.2065	-4.0746	-4.1605	0.0316	0.0241	0.0003
C-GARCH	-3.7495	-3.4416	-3.6421	0.0326	0.0247	0.0010
CMT-GARCH	-3.7677	-3.4158	-3.6448	0.0316	0.0239	0.0011
T-GARCH	-3.9209	-3.6130	-3.8134	0.0317	0.0238	0.0069
E-GARCH	-3.8498	-3.5859	-3.7577	0.0238	0.0246	0.0004
P-GARCH	-3.8585	-3.6386	-3.7818	0.0237	0.0248	0.0002
AP-GARCH	-3.8184	-3.5544	-3.7262	0.0323	0.0244	0.0032
REM						
GARCH	2.5109	2.7286	2.5877	0.8606	0.6477	0.0024
GARCH-M	2.5045	2.7657	2.5966	0.8979	0.6621	0.0779
I-GARCH	2.4973	2.7282	2.5887	0.8604	0.6272	0.0021
C-GARCH	2.6189	2.9237	2.7264	0.8607	0.6471	0.0026
CMT-GARCH	2.3269	2.5302	2.3610	0.8547	0.6269	0.0004
T-GARCH	2.3398	2.6010	2.4319	0.8728	0.6350	0.0176
E-GARCH	2.4671	2.7322	2.4964	0.8753	0.6412	0.0029
P-GARCH	2.4934	2.7111	2.5701	0.8625	0.6281	0.0019
AP-GARCH	2.8045	3.1529	2.9273	0.8718	0.6321	0.0042
FDI						
GARCH	-0.3567	-0.3190	-0.4600	0.1759	0.1381	0.0141
GARCH-M	-0.5539	-0.2927	-0.4618	0.1753	0.1476	0.0000
I-GARCH	-0.6892	-0.5586	-0.6432	0.1820	0.1424	0.0016
C-GARCH	-0.5432	-0.2384	-0.4357	0.1750	0.1389	0.0074
CMT-GARCH	-0.2639	0.0843	-0.1411	0.1731	0.1444	0.0000
T-GARCH	-0.7320	-0.4255	-0.6228	0.1717	0.1381	0.0048
E-GARCH	-0.4604	-0.1992	-0.3683	0.1746	0.1395	0.0055
P-GARCH	-0.5915	-0.3738	-0.5148	0.1743	0.1454	0.0040
AP-GARCH	-0.5470	-0.2857	-0.4549	0.1734	0.1426	0.0029

Table A.3. The relationship between GDP volatility and financial flows: Optimal models chosen by information criteria and loss functions

Models	AIC	BIC	HQ	RMSE	MAE	BP
GARCH	-5.097127	-5.757346	-5.382416	0.0740116	0.0557022	0.002016
GARCH-M	-5.10918	-5.780313	-5.426894	0.7353801	0.055616	0.063099
I-GARCH	-5.069519	-5.756502	-5.384496	0.0705528	0.048294	0.001596
C-GARCH	-5.316367	-6.169007	-5.670912	0.0740202	0.038826	0.002236
CMT-GARCH	-4.723607	-5.338722	-4.91088	0.0735042	0.050152	0.000344
T-GARCH	-4.749794	-5.495913	-5.058352	0.0750608	0.051435	0.015136
E-GARCH	-5.008213	-5.764942	-5.192512	0.0715732	0.055143	0.002494
P-GARCH	-5.061602	-5.720421	-5.345808	0.0739162	0.054016	0.001634
AP-GARCH	-5.693135	-5.852619	-5.887841	0.0709748	0.47606	0.001538

Table A.4. The relationship between GDP volatility, financial flows and control variables: Optimal models chosen by information criteria and loss functions

Models	AIC	BIC	HQ	RMSE	MAE	BP
GARCH	-3.304034	-3.31492	-3.362768	0.151274	0.118766	0.011844
GARCH-M	-3.096802	-3.954532	-3.995549	0.143570	0.123984	0.057984
I-GARCH	-3.461949	-3.537442	-3.56198	0.149786	0.109648	0.01216
C-GARCH	-3.241442	-3.168208	-3.132206	0.1512875	0.087507	0.06364
CMT-GARCH	-3.240222	-3.869272	-3.134528	0.158866	0.128296	0.054066
T-GARCH	-3.371974	-3.926531	-3.279524	0.147662	0.111861	0.04128
E-GARCH	-3.118338	-3.183874	-3.189322	0.141426	0.11997	0.01023
P-GARCH	-3.306734	-3.129196	-3.264071	0.1493751	0.125044	0.034524
AP-GARCH	-3.483824	-3.956784	-3.999436	0.149124	0.122636	0.054056

Table A.5. GARCH models: Estimation of the link between economic growth volatility and financial flows

Dependent variable: (r_t)									
	GARCH	GARCH-M	I-GARCH	C-GARCH	CMT-GARCH	T-GARCH	E-GARCH	P-GARCH	AP-GARCH
Mean Equation									
C	0.03723 (1.4319)	0.0262 (1.5706)	0.1644*** (6.5190)	0.0458 (0.7634)	0.0922 (1.3742)	0.0687 (1.3469)	0.0644* (1.7110)	0.0580 (1.1953)	0.0729 (1.0676)
REM/GDP	-0.0286* (-1.617)	-0.0196 (-0.523)	-0.0986** (-2.6647)	-0.0552 (-0.948)	-0.0433* (-1.6902)	-0.0578* (-1.968)	-0.0691 (-0.316)	-0.0494* (-1.830)	-0.0352* (-1.7215)
FDI/GDP	0.0082* (1.9256)	0.0096* (1.7233)	0.0439*** (4.0031)	0.0040 (0.1750)	0.0234* (1.8925)	0.0117 (1.5234)	0.0084* (1.6230)	0.0083 (0.0678)	0.00676* (1.6784)
Variance Equation									
ω	0.0005* (1.9375)	0.0006* (1.8150)	-	0.0005* (1.8657)	0.0006 (1.2017)	0.0003* (1.6880)	-0.0855* (-1.8523)	0.0232* (1.8133)	3.00E-05 (0.9984)
α	0.3971 (1.2725)	0.6196 (1.3821)	-0.1552*** (-18.3667)	0.6212 (0.4415)	0.5827 (0.3224)	0.7787 (0.8575)	0.8486* (1.6735)	0.5132* (1.6653)	-0.0683 (-0.9227)
β	-0.4641 (-0.7960)	-0.4629* (-1.6825)	1.1552*** (13.6674)	0.3175 (0.2879)	0.1428* (1.9926)	-0.0462* (-1.7066)	-0.1917 (-1.3757)	-0.4566 (-0.7681)	0.9925 (0.3588)
γ	-	-	-	-	0.4982* (1.6096)	-0.1275 (-0.5612)	-0.1256** (-2.1384)	-	1.0580*** (4.2153)

Notes: ω : The reaction of conditional variance; a : ARCH effect; β : GARCH effect; γ : Leverage effec

Table A.6. GARCH models: Estimation of the link between economic growth volatility, financial flows and other control variables

Dependent variable: (r_t)									
	GARCH	GARCH-M	I-GARCH	C-GARCH	CMT-GARCH	T-GARCH	E-GARCH	P-GARCH	AP-GARCH
Mean Equation									
C	92.36*** (14.3140)	95.783*** (23.0247)	92.38** (2.3867)	92.3*** (27.90)	92.372*** (18.6354)	92.2820*** (14.9530)	92.4390*** (8.1778)	92.39*** (8.9007)	92.33*** (6.8479)
REM/GDP	-0.0212 (-0.2040)	-0.0415* (-1.6853)	-0.027* (-1.876)	-0.0286 (-0.782)	-0.0293* (-1.8840)	-0.0348** (-2.6641)	-0.0519* (-1.7785)	-0.054** (-2.355)	-0.0486* (-1.759)
FDI/GDP	0.0457* (1.9461)	0.02215 (0.1850)	0.0224 (0.1850)	0.021** (2.4125)	0.0252* (1.7459)	0.0412 (1.3814)	0.0397 (0.4093)	0.0421 (0.3941)	0.0464* (1.6184)
GDP(t-1)	-15.2*** (-8.8687)	-15.8097 (-8.2200)	-15.2** (-2.361)	-15.24* (-2.110)	-15.24*** (-10.284)	-15.244*** (-16.8401)	-15.239*** (-8.2262)	-15.2*** (-8.226)	-15.2*** (-6.980)
GDP(t-1)²	0.6688** (2.2814)	0.6923*** (10.9402)	0.668** (2.3833)	0.66*** (6.5482)	0.6632*** (17.5896)	0.6692*** (3.3843)	0.6678*** (8.2262)	0.667*** (9.1056)	0.668*** (5.9180)
Credits	-0.42*** (-4.7278)	-0.426*** (-4.5842)	-0.42** (-2.417)	-0.4*** (3.4853)	-0.408*** (-6.5070)	-0.4280*** (-5.2057)	-0.4224*** (-7.3138)	-0.41*** (-6.671)	-0.42*** (-6.690)
Openness	0.02038 (0.3560	0.0516 (1.3594)	0.0442 (0.6005)	0.0407* (1.6820)	0.0416* (1.7544)	0.0035* (1.6176)	0.0553 (1.1308)	0.0531* (1.6211)	0.0412* (1.6544)
Variance Equation									
ω	1.39E-05 (0.4329)	7.49E-05 (1.1820)	-	0.0003* (2.1694)	0.0001** (2.7791)	1.94E-05* (2.0266)	-7.1489 (-0.8120)	0.0270** (2.1167)	0.0236 (1.3189)
α	-0.1612** (-2.1855)	-0.1423 (-1.2518)	0.0561 (0.5176)	0.5000 (0.2916)	0.7191* (1.1460)	0.0014 (0.0316)	-0.6269 (-0.9457)	-0.349*** (-3.6632)	-0.0821 (-0.1967)
β	1.1086*** (10.8037)	0.9192*** (6.7612)	0.9438*** (8.7020)	0.0399* (1.8482)	0.2114 (0.3239)	0.3708** (2.6033)	-0.1223 (-0.2786)	-0.1018 (-0.1832)	-0.0221 (-0.0243)
γ	-	-	-	-	-0.0224 (-0.0088)	0.3867** (2.7453)	0.0281 (0.0241)	-	0.1419* (1.8734)

Notes: ω : The reaction of conditional variance; a : ARCH effect; β : GARCH effect; γ : Leverage effect

Table A.7. "Naïve models": Estimation of the link between economic growth volatility, financial flows and other control variables

Dependent variable: *GDP*						
	SD		*MAD*		*AAD*	
	(1)	(2)	(3)	(4)	(5)	(6)
C	1.8722** (2.5643)	3.0114*** (4.6915)	1.9115*** (3.4782)	2.7539* (1.8654)	2.0142** (2.5601)	3.1579*** (6.0012)
REM/GDP	-0.0067 (-1.1038)	-0.0034 (-1.2155)	0.0054* (1.7213)	0.0037* (1.6822)	-0.0032* (-1.8928)	-0.0031* (-1.6954)
FDI/GDP	0.0135* (1.6912)	0.0125** (2.8810)	0.02218** (2.4569)	0.0154* (1.6017)	0.0195 (1.5436)	-0.0137* (-1.6994)
GDP(t-1)	-	-6.7892*** (-4.5543)	-	-8.0215*** (-6.7119)	-	-6.0732*** (-5.6954)
GDP(t-1)²	-	8.0416* (1.9455)	-	8.7914*** (3.2100)	-	7.1892*** (6.0008)
Credits	-	-0.4356** (-2.7110)	-	-0.3985*** (-3.1254)	-	-0.4013** (-2.8152)
Openness	-	0.0329 (0.8865)	-	0.0350* (1.6628)	-	0.0367 (1.2058)

Notes: *SD*: Standard deviation; *MAD*: Moving average deviation ($VOL = \left[(1/m)\sum_{i=1}^{m}(e_{t+i-1} - e_{t+i-2})^2\right]^{1/2}$); *AAD*: Absolute average deviation ($VOL = \left[(1/n)\sum_{i=1}^{n}(e_i - \overline{e_i})\right]^{1/2}$).