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PAPER

How do flexibility reforms reshape market behavior? A comparative study from the MENA region

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Abstract This study investigates the impact of flexibility reforms on the foreign exchange market in various countries with intermediary regimes. Using the case of three MENA countries with different flexibilization processes, we conducted a comparative study using GARCH and FIGARCH models to exhibit various market behavior changes. Our main results are that flexibilization reforms increase market volatility and sensitivity to endogenous shocks, especially in countries with challenging economic contexts during the transition. On the other hand, the flexibility reforms contribute to market development, allowing it to have more leeway in adjusting prices accordingly with the offer and demand. Finally, we presented the policy implications of this study and some propositions for future research. This study's conclusions will help monetary authorities and market participants prepare efficiently for the flexibilization process and avoid various risks linked to this transition.

Keywords: exchange rate, forex market, flexibility, volatility.

JEL Classification: F31, F37.

1. Introduction

Foreign exchange market behavior is an essential research subject as it impacts various parts of the economy, such as trade, public finance, and inflation. Therefore, its study became a significant economic subject after the gold standard collapsed in the 1970s, with most research papers focusing on floating rates due to the high availability of

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DATA and their essential role in the international economy. However, as of 2018, more than two-thirds of the world's countries are still adopting a de facto fixed regime or had transited to an intermediary one as part of their flexibilization process (IMF, 2019). The growing globalization and international trade interconnections urged those countries to introduce more flexibility in their exchange rate regimes to increase their integration in the global economy and improve competitiveness. Therefore, a road map is essential for those countries to navigate this transition and ensure its success. Unfortunately, the literature lacks such an empirical framework that can provide information about market behavior changes in the aftermath of a flexibilization process. Studies such as (Abdalla, 2012), (Selmia, Bouoiyour, & Ayachi, 2012), (Bouoiyour & Selmi, 2014), and (Azzouzi & Bousselhami, 2019) investigated the market volatility in this type of exchange regime. However, they failed to exhibit the impact of these flexibility reforms on market behavior as they used continuous periods of study. To address this problematic situation, we will conduct comparative research of three MENA Countries using subdivided study periods and GARCH/FIGARCH models to investigate how the flexibilization process reshapes forex market behavior.

Our article will start with a literature review in section 2, followed in section 3 by a brief presentation of the three MENA countries' exchange regimes. We will then expose our data and the theoretical framework in section 4 and then the empirical findings in section 5. Finally, we will end this article with a conclusion and some policy implications in section 6.

2. Literature Review

Since the 1970s, studies such as (Ishiyama, 1975) discussed the pros and cons of having fixed or flexible exchange rates. The author concluded that fixed exchange rates could be beneficial for small economies if they favored a soft peg composed of various currencies. (Flood & Hodrick, 1986) slightly diverge from this vision. They showed that fixed regimes might be useful in the short run, but introducing more flexibility is inevitable to preserve stability in the long run. (Gerlach, 1988) argued through his analysis of exchange rate behaviors in OECD countries that those flexibility reforms increased exchange rate volatility. (Rose A. K., 1996) found similar results in his study of the EMS reforms introduced in the aftermath of 1992's speculative attacks. The same vision is also shared by (Kocenda & Valachy, 2006) in their study of exchange rate volatility in Višegrad countries during the transition to flexible regimes.

However, (Hausmann, Gavin, Pages-Serra, & Stein, 2000) advocated that the results of flexibility reforms are not universal; they depend on the country's economic structure and ability to defend its currency against speculative attacks. The author also exhibited the role of central bank interventions in containing exchange rate volatility, especially in a period of crisis. Those findings are corroborated by (Rose A. K., 2011), who confirmed that flexible and fixed rates regime's success depended on the country's monetary policy. In other words, the introduction of the same flexibility reforms into countries with the same economic structure will not necessarily yield the same results.

As we can see, the literature addressing the impact of the flexibilization process on market behavior is quite limited and contain various contrasting results. Thus, our original contribution will be to investigate those fallouts empirically through a comparative study of three MENA countries (Morocco, Tunisia, and Kuwait), which have initiated significant flexibilization processes in recent years.

3. Exchange rate regime in the studied countries

3.1 Morocco

The Moroccan dirham was anchored to various major currencies through time. Starting with French Franc (FFR) right after the independence, then a multi-currency basket anchor since the 1970s, the Moroccan dirham was always in a fixed exchange regime. That said, in June 1996, the Moroccan foreign exchange market was created, and banks got the power to trade foreign currencies without the central bank acting as the middle man. Also, a narrow fluctuation band of ±0.3% was established to allow flexibility in a market characterized by strict capital control.

After the Asian crisis and the internet bubble burst, the U.S. Dollar raised sharply against the dirham forcing the Moroccan authorities to a 5% devaluation of the local currency in 2001. This devaluation took the form of a change in the peg composition (80% EUR and 20% USD). After the Euro debt crisis in 2011, the growing gap between American and European economies pushed the U.S. dollar higher against the Euro and the dirham. The Moroccan monetary authorities then changed the basket composition again to preserve local exports' competitiveness, moving ratios to 60% EUR and 40% USD. After a turbulent second semester in 2017 on the local market, the Moroccan authorities initiated a flexibilization process in 2018. The main reforms were the widening of fluctuation bands to ±2.5%, suppressing central banks' intervention on the local market, and creating a Market Maker statute for banks to auto-regulate the local market liquidity. In March 2020, as COVID19 economic fallouts started to impact the Moroccan economy, monetary authority widened the fluctuation bands to ±5% to help absorb those shocks.

3.2 Tunisia

After its independence, Tunisia adopted a rigid anchor to the FFR before switching to a basket anchor composed of major world currencies in the 1980s. The local foreign exchange market started in 1992 with a central bank massively intervening daily. After the Jasmine revolution in 2011, the country's economy presented a 1.9% contraction for the first time in Tunisia's modern history. This problematic context forced the central bank to seek loans from the IMF, who strongly advised that the central bank reduce its interventions to let the market reflect the dinar's real value. Those recommendations pushed monetary authorities to initiate a flexibilization process in 2015. The local currency lost roughly half of its value in the following years due to the challenging economic conditions and the weak foreign exchange reserves. Tunisia has a "Crawling Peg" de facto regime, even though the central bank officially declares adopting a managed floating (IMF, 2019).

3.3 Kuwait

Kuwait's exchange rate was anchored to a basket of major currencies until 2003. The country adopted a rigid anchor to the U.S. Dollar (USD 1 = KWD 0.29963), as did many Gulf Cooperation Council (GCC) efforts as part of their steps toward monetary union. After the U.S. dollar's critical depreciation in 2006, Kuwait's central bank re-established a soft peg regime with fluctuation bands of ±3.5% and initiated a flexibilization process. Even though the composition of the country's peg basket is not disclosed, studies such as (Jen & Bindelli, 2008) and (Saidi, Scacciavillani, & Ali, 2008) confirm that U.S. Dollar is predominant in the peg basket due to the importance of oil exports in the country's economy.

4. Data and methodology

4.1 Data

To ensure our data integrity, we used daily closing exchange rates against the U.S. Dollar published by the studied counties' central banks. We split our data into two samples to exhibit the impacts of flexibilization reforms on the forex market. We listed the details of the different study periods in Table 1. We adopted a discontinued study period for Kuwait as the country went through a fixed hard peg regime between 2003 and 2006.

Table 1. The details of studied Periods

Studied country	Before flexibility reforms	After flexibility reforms
	P1	P2
Morocco	04/25/2001 – 01/12/2018	01/15/2018 – 12/31/2019
Tunisia	03/08/2006 - 12/31/2014	01/01/2015 - 12/31/2019
Kuwait	01/04/2000 - 12/31/2002	01/01/2007 - 12/31/2019

To ensure the stationarity needed for GARCH and FIGARCH models, we will use the daily logarithmic yields instead of level data in our modeling. We define daily logarithmic yields as follow:

$$Y_t = \log(S_t) - \log(S_{t-1}) \tag{1}$$

With S_t, the closing exchange rate of the day *t*.

4.2 Stationarity

Using the ADF test, we test the stationarity of our series during the different study periods. The results listed in Table 2 show that all the yield series are stationary

Table 2. Results of Augmented Dickey-Fuller test for yields series

		P1	P2	Stationarity
Morocco	ADF test result	-75.78103	-65.48713	I(1)
	P-value	0.0000	0.0001	
Tunisia	ADF test result	-63.65650	-32.39048	I(1)
	P-value	0.0000	0.0000	
Kuwait	ADF test result	-18.08693	-52.74752	I(1)
	P-value	0.0000	0.0001	

Graphical analysis

The plot of the USD/MAD closing rates presented in Figure 1 shows no particular trend with a significant number of volatility clusters. This observation is confirmed by the yield's series plot on the same Figure, where volatility clusters are more critical with visible spikes during crisis periods.

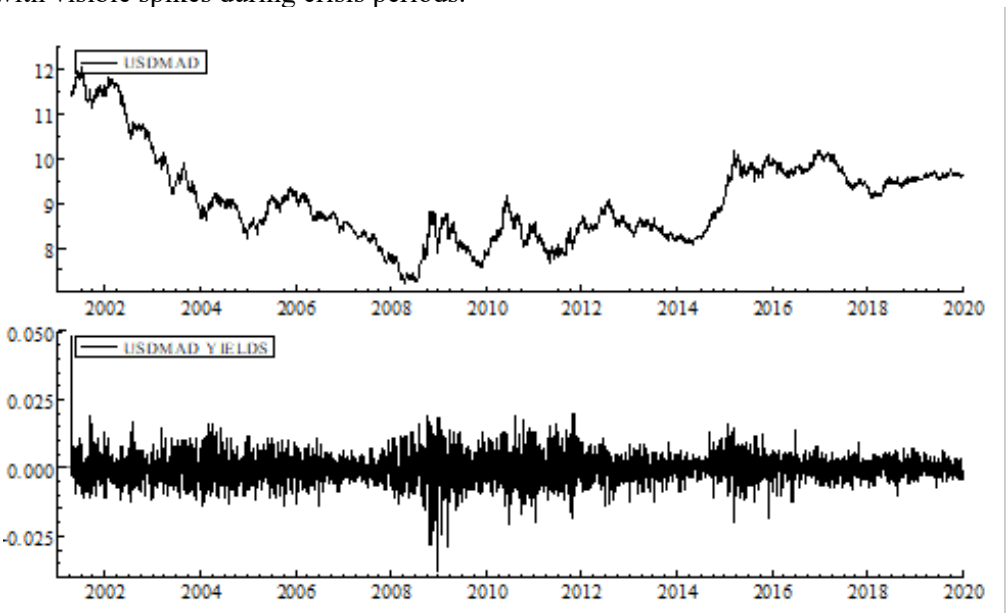

Figure 1. USD/MAD closing rates and yields series

The USD/TND closing rates plotted in Figure 2 show a relatively calm period before 2014 with moderate movements. However, after 2015 we observe a substantial depreciation of the local currency. On the yield graph, we keep significant volatility clusters during crisis periods, as was the case in 2009 and after the initiation of flexibilization reform.

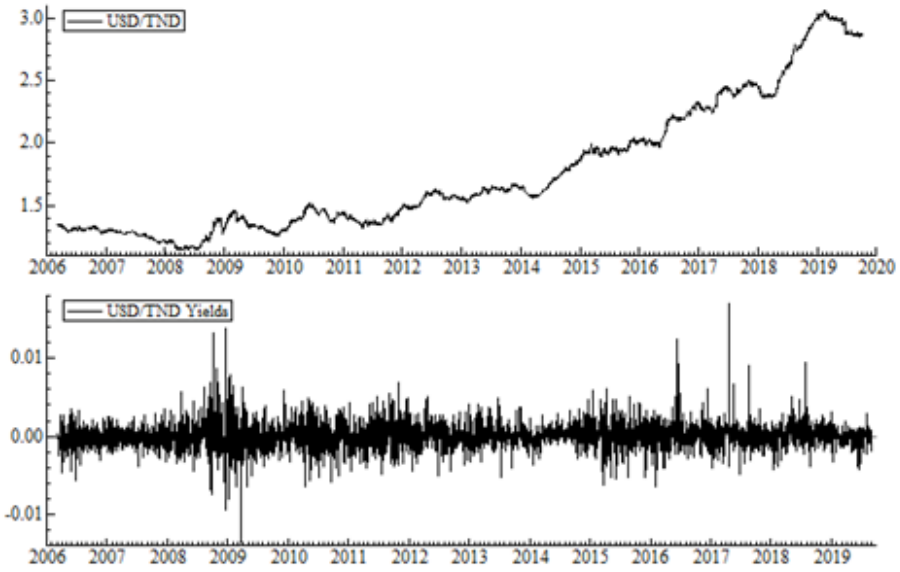

Figure 2. USD/TND closing rates and yields series

The plot of the USD/KWD closing rates in Figure 3 shows the critical difference in movement between our two study periods. We observe a significant increase in fluctuation and volatility clusters after the introduction of flexibility reforms in 2007. Finally, we notice the discontinuity of the yields' series materialized by a relatively constant value between 2003 and 2006.

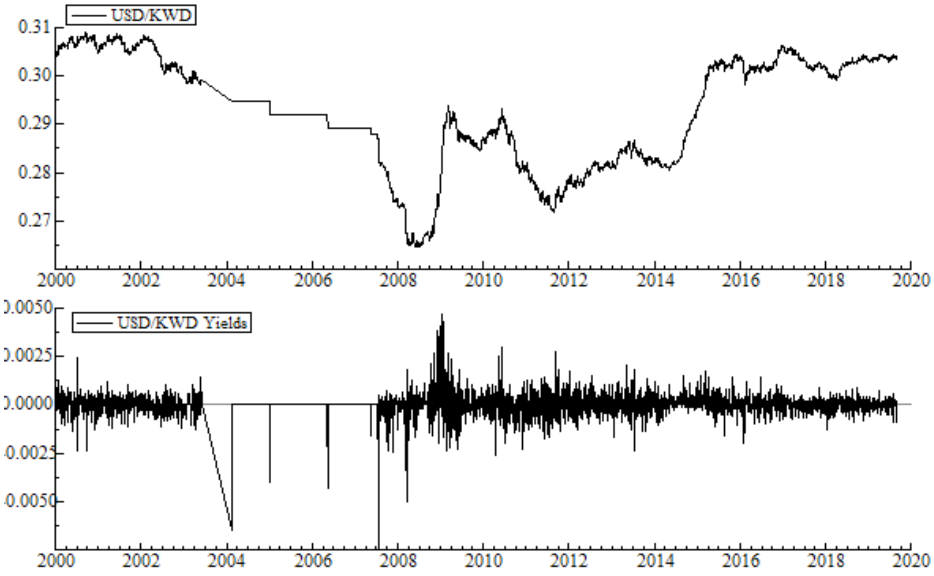

Figure 3. USD/KWD closing rates and series

4.3 Descriptive statistics

The descriptive statistics of the studied series listed in Table 3 show that the yields are leptokurtic on all the periods, which means that their movements are significantly different from those predicted by the ordinary law. We also notice that the series are negatively skewed for Morocco and Kuwait while being positively skewed for Tunisia.

Table 3. Descriptive statistics of yields series

	Morocco		Tunisia		Kuwait	
	P1	**P2**	**P1**	**P2**	**P1**	**P2**
Mean	1.01E-05	7.42E-05	6.12E-05	0.000161	-6.60E-06	7.65E-06
Median	0.000000	0.000156	0.000000	0.000141	0.000000	0.000000
Maximum	0.048537	0.007418	0.013783	0.016883	0.001281	0.004660
Minimum	-0.049676	-0.010336	-0.013627	-0.006480	-0.001356	-0.007483
Std. Dev.	0.004977	0.002553	0.001851	0.001724	0.000395	0.000559
Skewness	-0.097538	-0.187992	0.250914	1.326274	-0.294034	-0.505474
Kurtosis	8.978139	3.469956	8.290703	14.82727	3.871509	24.53023
Jarque-Bera	8405.917	7.259554	2656.054	7168.489	27.86407	53425.88
Probability	0.000000	0.026522	0.000000	0.000000	0.000001	0.000000

4.4 ARCH AND GARCH models

(Engle, 1982) introduced the ARCH model (Autoregressive conditional heteroskedasticity) as part of its analysis of the United Kingdom's variance of inflation. We can express an ARCH model of order q in the following form:

$$r_t = \mu + y_t \tag{2}$$

$$y_t = \varepsilon_t + \sigma_t \tag{3}$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i y_{t-i}^2, \alpha_i > 0 \; \forall i \in \{0, \ldots, q\} \tag{4}$$

$y_t \left| \psi_{t-1} \sim N(0, \sigma_t^2) \right.$

y_t: The error terms of the mean equation
r_t: Logarithmic yields at the moment t
μ_t: An average of the logarithmic yield
ε_t: Gaussian process i.i.d such that (White noise)
σ_t: The volatility of the asset
$\psi_{(t-1)}$: Information available in t-1
α_0 is usually considered as the minimum volatility and α_i the impact of past shocks. Although the ARCH model is easy to estimate, it remains constrained due to the difficulty of determining the q order and the non-negativity constraint of the α_i parameters. To address this problem (Bollerslev, 1986) introduces GARCH (Generalized ARCH), which adopted a similar generalization to the extension of the A.R. (p) model

to ARMA (p, q) model. The introduction of an autoregressive term β_i characterizes the GARCH model. This parameter represents the impact of past volatilities.

We express the conditional volatility in the GARCH model as follows:
with p and q positive integer

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i y_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \qquad (5)$$
$$\alpha_i > 0 \ \forall i \in \{0,\ldots,q\}, \beta_j \geq 0 \ \forall i \in \{1,\ldots,p\}$$

4.5 FIGARCH model

The FIGARCH model (Fractionally integrated generalized autoregressive conditional heteroskedasticity) was first introduced (Baillie, Boi|erslev, & Mikkelsen, 1996) to study the presence of long memory in DEM/USD exchange rates between 1979 and 1992. This model was developed as the authors saw that the IGARCH model might be too restrictive as it may yield infinite volatility, which contradicts the observed dynamics of financial series.

The FIGARCH(1,d,1) is defined as Follow:

$$\begin{cases} r_t = \mu + \rho r_{t-1} + y_t, \ y_t \left| \psi_t \sim D(0, \sigma_t^2) \right. \\ \sigma_t^2 = \alpha_0 + \left\{ 1 - \left[1 - \beta_1 L \right]^{-1} (1 - \varphi_1 L)[1 - L]^d \right\} y_t^2 \end{cases} \qquad (6)$$

Where:
μ: An average of the logarithmic yield
y_t: The error terms of the mean equation
ψ_t: Information available in t
d: The fractional integration parameter comprised between 0 and 1, which model long memory behavior and the slow decay of volatility shocks
L: The lag operator
$D(.,.)$: The conditional distribution

5. Empirical finding

Table 4. Results of GARCH (1,1) Model

	Morocco		**Tunisia**		**Kuwait**	
	P1	**P2**	**P1**	**P2**	**P1**	**P2**
$\alpha_t 10^6$	0.015919	0.018133	0.010651	0.018102	0.008524	0.005709
	[0.03540]	[0.02240]	[0.07800]	[0.07130]	[0.04500]	[0.03760]
α_1	0.030808	0.048852	0.032893	0.063559	0.021367	0.039413
	[0.00000]	[0.00000]	[0.00000]	[0.00000]	[0.21200]	[0.00330]
β_1	0.965262	0.947930	0.963969	0.931512	0.966896	0.949972
	[0.00000]	[0.00000]	[0.00000]	[0.00000]	[0.00000]	[0.00000]
$\alpha_1+\beta_1$	0.996070	0.996780	0.996860	0.995070	0.988260	0.989380

	Morocco		Tunisia		Kuwait	
	P1	P2	P1	P2	P1	P2
Log-likelihood	20337.10	29113.60	11241.10	17031.47	9241.080	17023.57
Unconditional Volatility 10^6	4.049920	5.634550	3.394000	4.672850	0.726309	1.937835

The GARCH (1,1) results presented in Table 4 exhibit surprising lower volatility in Kuwait's case than Morocco and Tunisia over both periods. The USD/KWD closing rates plotted in Figure 3, and the conditional volatility presented in Figure 6 confirm this observation as we notice relatively small changes through our study period. Those subtle movements resulted from Kuwaiti dinar's limited use in international trade, as 80% of its oil exports are settled in U.S. dollars. The low volatility also limits the Kuwaiti dinar's use in speculative trading as the profits are meager, making it a non-attractive asset for speculative trading.

The second observation is the significant climb in volatility after the flexibilization process in the three countries. This rise is exceptionally substantial in Kuwait's case, where the volatility increased almost three-time after the introduction of flexibility reforms. This finding corroborates those of (Gerlach, 1988), (Rose A. K., 1996) and (Kocenda & Valachy, 2006) concerning the increase of volatility after switching to a more flexible regime. In the case of the studied countries, this growing volatility resulted mainly from the change in the central banks' role. They limited their interventions considerably and started acting exclusively as a liquidity provider. This behavior change allowed prices to fluctuate more aggressively within the fluctuation bands to reflect offer and demand in the domestic exchange market.

The third observation is the increasing impact of shocks after introducing flexibility reforms in all the studied countries, especially in Tunisia, where this impact doubled from one period to another. Moreover, the plot of USD/TND conditional volatility presented in Figure 5 shows more frequent spikes after 2015 than those observed during the first period. (Beinea, Laurent, & Lecourt, 2003) and (Katusiime & Agbola, 2018) argued that central banks' public interventions significantly reduce shocks' impacts. Therefore, as the Tunisian central bank limited its interventions as part of the flexibilization reform, the domestic forex market became more sensitive to shocks. Those shocks are mainly endogenous and related to liquidity as capital control and flexible regime offset the impacts of external shocks as shown by (Glick & Wihlborg, 1990), (Edwardsa & Yeyati, 2005), and (Edwards & Rigobon, 2009).

Similar results are noticed in the case of Morocco with a lesser amplitude due to two main factors. The first one is that the Moroccan central bank role was always a liquidity provider and had only intervened a few times on the domestic forex market during the significant financial crisis, as was the case in 2008. The second one is the relatively stable context in which the flexibilization reform was initiated in Morocco compared to Tunisia, where the economy was struggling deeply with political instability and crushing external debt.

The last observation is the drop in past volatilities impact in the second period for all the studied countries, which implies that the growing flexibility allowed the

local market to absorb external shocks using price adjustment accordingly to offer and demand. We frequently observe this phenomenon in the Moroccan exchange market as local banks adjust their prices within fluctuation bands to absorb intraday volatility. Furthermore, the plot of USD/MAD conditional volatility presented in Figure 4 corroborates this finding as we observe a sharp decrease in volatility clusters after the introduction of flexibility reforms in 2018.

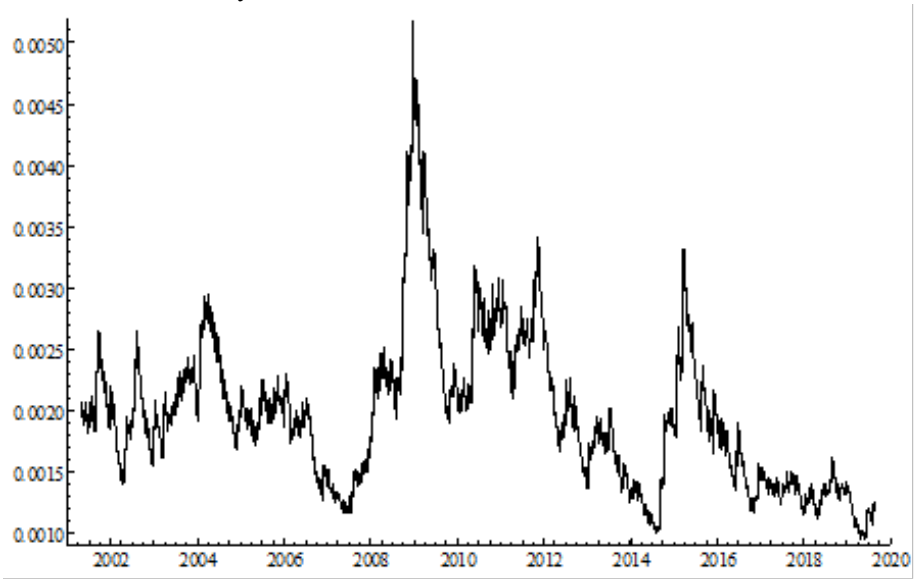

Figure 4. Conditional Volatility of USD/MAD Yields

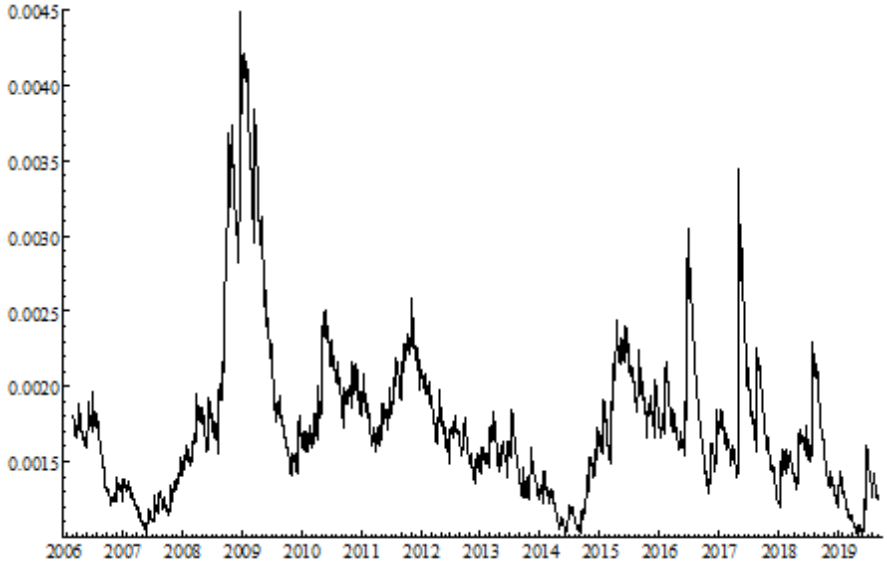

Figure 5. Conditional Volatility of USD/TND Yields

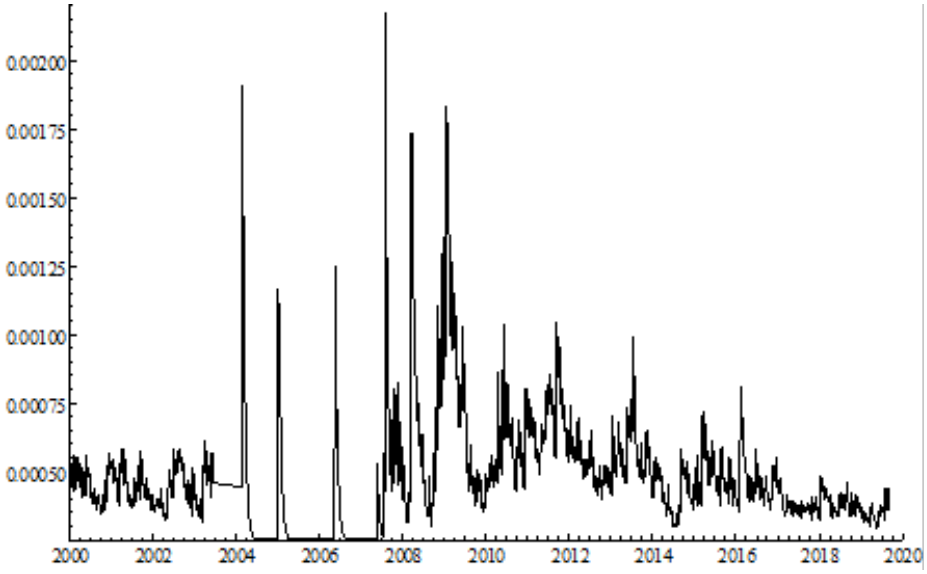

Figure 6. Conditional Volatility of USD/KWD Yields

To further scrutinize the flexibilization process's fallouts, we will investigate the evolution of long-term memory in domestic markets using the FIGARCH model. This analysis will give us more insights regarding local banks' behavior and their sensitivity to historical volatility and the domestic context.

Table 5. Results of FIGARCH (1,d,1) Model

	Morocco		**Tunisia**		**Kuwait**	
	P1	**P2**	**P1**	**P2**	**P1**	**P2**
$\alpha_t 10^6$	0.072742	0.098399	0.007391	0.081850	0.008536	0.007766
	[0.03500]	[0.54390]	[0.1193]	[0.16700]	[0.08980]	[0.03220]
α_1	0.268189	0.465882	0.119975	0.533605	-0.075135	0.033298
	[0.00000]	[0.00090]	[0.07140]	[0.00070]	[0.05490]	[0.03730]
β_1	0.729133	0.698429	0.942504	0.791065	0.858954	0.805884
	[0.00000]	[0.00000]	[0.00000]	[0.00000]	[0.00000]	[0.00000]
d	0.464771	0.258011	0.867777	0.417476	0.931501	0.801295
	[0.00000]	[0.04640]	[0.00000]	[0.03330]	[0.00000]	[0.00000]
Log-likelihood	20230.3	2758.87	10719.6	5814.07	2122.9	17050.3

The results of the FIGARCH (1,d,1) model listed in Table 5 exhibit a clear presence of long memory processes in all the studied exchange rates as suggested by various researchers such as (Cheung, 1993), (Alptekin, 2006), (Caporale & Gil-Alana, 2013)

and (Barkoulas, Barilla, & Wells, 2016). We also observe a high value of Tunisia and Kuwait fractional integration parameters before the flexibilization process initiation compared to Morocco due to different reasons.

For Kuwait, the significant long memory process results from the limited dinar movements and the country's economic stability. This explanation is further confirmed as the fractional integration parameter remained relatively high compared to the other studied countries after introducing flexibility reforms.

On the other hand, Tunisia's robust long memory process results from the central bank's frequent exchange market interventions, which maintained stability through the first period. As a result, domestic market actors always relied on the monetary authorities to absorb external and domestic shocks, explaining the fractional integration parameter's high value during this period. The 51% drop in this parameter during the second period supports our interpretation of the central bank's role in boosting the long memory process.

This decrease in the fractional integration parameter is also significant in Morocco, where the long memory process decreased by roughly 55%. This substantial decline results from market actors becoming less sensitive to historical volatility and its movements after introducing flexibility reforms. As a matter of fact, with the widening of fluctuation bands, market actors gained significant leeway to adjust prices accordingly with domestic liquidity and their anticipations of demand, making them more responsive to monetary policies and the domestic economic context rather than market volatility.

6. Conclusion and discussion

This study investigated the impact of flexibility reforms on the foreign exchange market in various countries with intermediary regimes. We used closing exchange rates from three MENA countries that introduced initiated flexibilization processes in recent years. We then conducted a comparative study using heteroscedastic models to exhibit various market behavior changes.

Our first result is relatively intuitive. The introduction of flexibility reforms amplifies volatility as prices started moving more freely within the fluctuation bands after the limitation of central banks' interventions. This finding corroborates and explains further the results of (Gerlach, 1988), (Rose A. K., 1996) and (Kocenda & Valachy, 2006). The second finding is that the flexibilization process contributes to the rise of shocks' impacts, especially in counties with challenging economic contexts during the transition. The third result is that the domestic forex market acquires a growing capacity to absorb past volatilities and external shocks after introducing flexibility reforms. Furthermore, this increasing leeway allows market actors, especially market marker banks, to adjust prices accordingly with domestic liquidity and their anticipations of demand, which increases their sensitivity to monetary policies and the domestic economic context rather than market volatility. This study's results have significant value for countries planning to initiate a flexibilization process and move toward more advanced steps. Moreover, this research's different conclusions

will help monetary authorities, domestic banks, and corporations develop detailed road maps to face challenges related to domestic market mutations and the various crisis risks linked to this type of process.

Further studies should focus on the flexibilization process steering, crisis detection, and simulation models to help different market actors prepare more efficiently for an imminent transition toward floating.

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