Financial Liberalisation and Financial Market Development: The Case of Tunisia

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Abstract: Financial systems in developing countries are generally characterized by under-developed financial markets; they are dominated by commercial banks. This was the case of Tunisia, which, by adopting financial reforms, sought to make a dynamic financial market in order to insure a transition from credit to market economy. In this context, it appears useful to evaluate and quantify the impact of the adopted reforms on the development of Tunisian financial market. Studies that have tried to explore this subject are generally rare. They have all resorted to compare some indicators of financial market development before and after the introduction of reforms.

Within the framework of this paper, we suggest using intervention models in order to quantify (measure) the importance and the nature (transitory or permanent) of the effects of each adopted reform.

1. Introduction

Since 1987, Tunisian authorities, convinced by arguments which show that liberalization can stimulate economic development and by the successful experiences of many countries whose economic growth was rapid, have adopted a strategy of financial and economic reforms. The overall objective of these reforms was to create a market-based economy directed by private sector, while keeping more and more open to international trade and capital. The Tunisian financial system has witnessed since 1987 many structural and conjectural changements following the adoption of many financial reforms. The objective was to switch from a debt-economy toward a capital-market economy. Before 1987, Tunisian financial system was characterized by under-developed financial markets and was also dominated by commercial banks. Therefore, by adopting financial reforms, Tunisian authorities sought to make a dynamic financial market.

In this context, it will be useful to evaluate and quantify the impact of the adopted reforms on the development of Tunisian financial market. Studies that have tried to explore this subject are generally rare. They have all resorted to compare certain indicators of financial market development before and after the introduction of reforms (Jbeli and Enders (1997), Osei (1998), Zamiti (1998)). Nevertheless, such a procedure does not permit to measure separately the importance and the nature of the effects of each adopted reform.

In our case and in order to detect the impact of the adopted reforms on Tunisian financial market development, we suggest using intervention models introduced by Box and Tiao (1975). The reason behind using these models was to measure the importance and the nature of changes brought about by a known event on a process. More specifically, we use these models in order to measure the impact of new financial reforms on the evolution of certain variables reflecting financial market development. Intervention analysis permits to:

- Isolate the impact of a well-determined reform
- Decompose the impact of a reform into two constituent parts: one that measures the long-term effect and a second one that measures the short-term impact. These models enable us therefore to study the nature of shocks (transitory or permanent)

This paper will be divided as follows. We start first by a theoretical and empirical literature review related to the effects of financial liberalization. This will be subject matter of the next section. The third section is dedicated to the presentation of the methodology and the variables used in our study. Finally, and before developing intervention models in the fifth section, a descriptive analysis of different indicators of financial market development will be presented at the fourth section.

2. Theoretical and Empirical Foundations of Financial Liberalization

A great deal of works is interested in studying the effects of financial liberalization. McKinnon (1973) and Shaw (1973) assert that financial liberalization, by increasing real interest rates, favors growth of financial saving and increases potentialities of credits for investors. Consequently, investment, that plays an important role in the economic growth process, will increase.

Other works (Fry (1996), Stulz (1997), Henry (2000), Ranciere (2006), Waliuallah (2010), ...) assert that financial liberalization, while favoring the development of new means of direct financing, develops financial markets and make them more dynamic. A liberalized financial structure allows, in fact, to offer a range of financial assets that could stimulate saving, encourage firms to be quoted so as to benefit from foreign financing and increase transactions on financial markets since the exchanged shares are more and more increasing. Moreover, development of financial markets may assure a better resource-allocation. This will positively affect economic growth of the country. Nevertheless, financial liberalization might have negative effects on the soundness of financial system. Fry (1996) asserts, in fact, that financial liberalization risks causing a transaction multiplication on financial markets that has no direct relation with the production and international financial exchanges. In this way, "speculative bubbles" can appear: value of stocks and money increases while the economic situation of the concerned countries does not justify such a price take-off.

Furthermore, financial liberalization can engender a systemic crisis risk. That is why, many works are interested in the relation between financial liberalization and bank system soundness. Weinstein and Yafeh (1998), Henry (2000), Gurben, et al. (2002) and Ranciere, et al. (2006) suggested that financial liberalization can divert clients toward market financing. This might have positive consequences on the firms' performance. However, the greatest freedom of action provided

to banks after financial liberalization can encourage them to a high level of risk taking. Since competence related to the control of borrowers and the management of risky borrowings can be acquired only progressively, the risk of bank insolvency and generally the risk of systemic crisis might be higher for the recently-liberalized financial systems.

Financial liberalization, deregulation and opening of financial systems on the exterior create, therefore, a new environment to financial institutions. They might lead to a better capital allocation in the country. They can also menace banks solvency, putting in danger the financial system in general and the bank system in specific.

Empirically, many works were interested in the study of the impact of financial liberalization. At first, studies were mainly interested in the macro-economic effects of financial liberalization. After that, and with the aim of determining canals of transmission between financial liberalization and economic growth, studies were interested in the impact of financial liberalization on the financial sector development as well as on the functioning of non-financial firms.

Papers interested in the effects of financial liberalization on financial sector development can be grouped into two sets:
- Those that try to study the effects of the financial liberalization on financial market-development.
- Works that try to study the effects of the financial liberalization on banks performance.

Studies that try to explore the financial liberalization-financial market development relation are generally rare. They have resorted to the simple time-based comparisons ("before after" analysis) that consist in studying some indicators of financial market development before and after financial liberalization.

Demirgüç-Kunt and Levine (1995) collected and compared a set of indicators of financial market-development related to 41 developed and developing countries in the period 1986-1993. Having described each used indicator, the paper then examined the relation between these different indicators of financial-market development, as well as the relation between these indicators and the different measures of financial intermediation development. The used indicators of financial market-development are related to:

1- The size of financial market measured by the (stock market capitalization/G.D.P) ratio [G.D.P : Gross Domestic Product];
2- Its liquidity measured by two ratios (transaction-volume/stock market capitalization) and (transaction-volume/G.D.P);
3-   Its volatility measured by the standard deviation of market output during 12 months;
4- Its concentration measured by the ratio (stock market capitalization of the 10 largest firms/global stock market capitalization), and
5- Its regulation measured by the regulation and institutional indicators constructed by the I.F.C. (International Finance Corporation).

Analyzing these different indicators for 41 developed and developing countries, authors have noticed that:
- the development of financial markets differs from one country to another
- The different indicators are significantly correlated. This suggests that different indicators capture different aspects of financial market development. Liquidity ratios are, in fact, positively correlated, financial market size is positively correlated with its liquidity and negatively correlated with its volatility; market-size and liquidity are negatively correlated with its concentration. Finally, countries that have well-developed regulation system tend to have large and liquid financial markets

In his research paper, Osei (1998) tried to compare the following indicators of financial market development over time:

- Stock market capitalization
- Transaction-volume
- Rotation-ratio of stocks and shares on the Stock Exchange
- The (stock market capitalization/G.D.P) ratio
- The (transaction-volume/G.D.P) ratio

He finds out that financial liberalization has favored the development of Ghana Stock and Shares Exchange. In fact, following reforms adoption, these indicators have experienced a significant increase.

Applying time series data of Malaysia from 1960 to 2001, James, et al. (2007) conduct cointegration and causality tests to assess the finance-growth link by taking the real interest rate and financial repression into account. The empirical evidence suggests that financial liberalization, through removing the repressionist policies, has a favorable effect in stimulating financial sector development and that financial depth and economic development are positively related.

3. Methodology and Variables

3.1 Methodology: Univaried and Multivaried Intervention Models

Box and Tiao (1975) provided a general strategy to model the effects of interventions on a univaried A.R.I.M.A (Auto-Regressive Integrated Moving Average) process. The suggested model is the following

$$Y_t = f(\delta, \omega, \zeta, t) + N_t \qquad (1)$$

Where, Y_t : a time series (Y_t is observed);
- $f(\pm, \omega, \geq, t)$: a function of parameters $\pm$, ω, of an exogenous variable $\geq$ and of time;
- $N_t = Y_t - f(\pm, \omega, \geq, t)$: the series without intervention.

The function $f(\pm, \omega, \geq, t)$ here describes the effects (measured by $\pm$, ω) of the exogenous variable ($\geq$) on the Y_t variable at each (t) instant.

To take into consideration the effect of a time intervention at t=T, exogenous variable should be replaced by an auxiliary variable $\geq_t^T$. According to Box and Tiao, the effect of an intervention on the Y_t variable can be represented by the following dynamic model:

$$f(\delta, \omega, \zeta, t) = \frac{\omega_s(B).B^b}{\delta_r(B)}.\zeta_t^T \qquad (2)$$

- $\omega_s(B) = \omega_0 - \omega_1 B - ... - \omega_s B^s$, the parameters of $\omega_s(B)$ represent the initial intervention effects;
- $\pm_r(B) = 1 - \pm_1 B - ... -\pm_r B^r$: represents the behavior of the permanent intervention effect;
- B: delay operator;
- b: a parameter that represents the delay between Y_t and $\geq_t^T$ variables, that is the time-lag between the intervention and its impact.

The series N_t is represented by a stationary A.R.I.M.A. (p, d, q) model such as:

$$\phi_p(B).\nabla^d.N_t = \theta_q(B).a_t \qquad (3)$$

By substituting (2) and (3) in (1), we obtain the following intervention model:

$$Y_t = \frac{\omega_s(B).B^b}{\delta_r(B)}.\zeta_t^T + \frac{\theta_q(B)}{\phi_p(B).\nabla^d}.a_t \qquad (4)$$

The intervention variable can be either a step-intervention or a pulse-intervention variable.

A step-intervention variable is defined as:

$S_t^T = 1$ si $t \geq T$; Otherwise, $S_t^T = 0$.

This variable is designed to assess the effect, on Y_t, of a phenomenon starting at date T (For example: change of regulation).

And, a pulse-intervention variable is defined by:

$S_t^T = 1$ si $t = T$; Otherwise, $S_t^T = 0$.

This is designed to assess the effect, on Y_t, of a phenomenon taking place only at date T (For example: strike).

In general, if we suppose that the series Y_t is submitted to "k" interventions that take place at dates $t = T_1, T_2... T_k$ with $T_1 < T_2 <... < T_k$, thus, the general intervention model is the following:

$$Y_t = \frac{\omega_s^1(B).B^{b1}}{\delta_r^1(B)}.\zeta_t^{T1} + \frac{\omega_s^2(B).B^{b2}}{\delta_r^2(B)}.\zeta_t^{T2} +...+ \frac{\omega_s^k(B).B^{bk}}{\delta_r^k(B)}.\zeta_t^{Tk} + \frac{\theta_q(B)}{\phi_p(B).\nabla^d}.a_t \quad (5)$$

It has to be noted that:

- The "without intervention" series N_t is supposed to be generated by a stationary process; And,

- In the intervention model, we suppose that there are no other exogenous variables that affect the Y_t variable.

Interventions can affect many time series. The effect of interventions can differ from one series to another. In order to modelize simultaneously these effects, Abraham (1980) has generalized the results of Box and Tiao(1975) on multiple series. His model presents the effects of K events that take place at the dates $t = T_1, T_2...T_k$ and that affect endogenous variable-vector Z_t.

$$\boldsymbol{Z_t = R(B).I_t + N_t} \quad (6)$$

Model (6) comprises two different components: a determinist component that describes the intervention and its impact, and a stochastic component.

- Initially, it is difficult to identify a model for the stochastic term N_t since it is affected by the effects of interventions. So, the first step consists in the identification of an ARIMA (p, q) model for Z_t vector using the (T-1) observations related to each Z_{it} series (T indicates the date of the first intervention).

- The second step is the estimation of the model as it was identified above

- The exogenous intervention component of the model cannot be identified using rigorous statistic techniques. This portion is generally identified using time series graphs.

- The last step consists in estimating intervention model. After having estimated the model and the "without intervention" series, the general model becomes :

$$Z_t = R(B).I_t + \hat{\phi}_p^{-1}(B).\hat{\theta}_q(B).a_t \quad (7)$$

$$\Leftrightarrow Y_t = \varphi(B).I_{t(7)} + a \quad (8)$$

$$\text{With } Y_t = \hat{\phi}_p(B).\hat{\theta}_q^{-1}(B).Z_t$$

$$\text{and } \varphi(B) = \hat{\phi}_p(B).\hat{\theta}_q^{-1}(B).R(B)$$

The model (8) can be estimated by the maximum likelihood method or by non-linear least squares method.

3.2 Presentation of Endogenous and Intervention Variables

In our case, intervention variables are the adopted financial reforms. Endogenous variables are the indicators of the Tunisian financial market development.

3.2.1 Intervention variables

Intervention variables are the adopted financial reforms as presented in table (1). The date of each reform corresponds to the date of intervention.

Table 1. Intervention variables

Intervention-dates	**Introduced reforms**
(S_0) January 1987	Interest-rate liberalization
(S_1) January 1988	- Adoption of prudential norms - Reorganization of the monetary market - Deletion of the preliminary authorization and the rediscount agreement
(S_2) April-May 1989	- Revision of the B.V.M.T. status - Institution of a currency-monetary market *- **Opening of the monetary market to a largest number of operators***
(S_3) January 1993	- Current dinar convertibility decision - Exoneration of benefits on stocks and shares - Promotion of investment firms and recasting of their legal framework
(S_4) end 1994- begining 1995	- Privatization of the B.V.M.T. - Conditionning the daily variation of each stock price by the realization of a minimal transaction-volume of 50000 dinars
(S_5) February 1996	- Lower minimal transaction-volume per session to 30000 dinars then to 5000 dinars
(S_6) November 1996	- New system of electronic quotation - Deletion of rediscount even for priority sectors - Creation of the Tunisian Central Depository of securities and the manager of the system settlement/delivery (S.T.I.CO.DE.VA.M : Société Tunisienne Interprofessionnelle de COmpensation et de DEpôt des VAleurs Mobilières). It guarantees safety, efficiency and security of transactions.

Table 1above suggests the following remarks:
- The described interventions are step-intervention variables and not pulse-intervention variables since they are meant to explain a phenomenon that starts at a date "T" and not a phenomenon that takes place just at the date "T".
- Since financial liberalization in Tunisia is progressive, the used intervention dates are the dates of the beginning of each step in the reform process.

3.2.2 Endogenous variables

The endogenous variable-vector Z_t includes development indicators related to:

- The size of financial market measured by (stock-market capitalization/G.D.P) ratio (noted later on "lncap")
- The liquidity of financial market measured by transaction-volume (noted later on "lnvolt") and by the asset-rotation ratio on the Stock exchange market measured by (transaction-volume/stock-market capitalization) ratio (noted later on "lnrot").

3.2.3 Study period

Study period stretches out from January 1981 up to January 2007. It takes into consideration monthly data. So, we have 312 observations decomposed in this way: 72 observations (1981-1986) before the date of the first reform and 240 observations (1987-2007) after the first reform. Model was estimated for the period from 1981 to 2004. The two last years (2005 and 2006) was used to calculate forecasts using estimated models.

4. Descriptive Analysis

Within the framework of this section, we try, first, to compare the evolution of financial market development indicators before and after the introduction of reforms. Second, we try to study the relations that may exist between these different indicators.

4.1 Before-after Analysis

The size of financial market, measured by (stock-market capitalization/G.D.P) ratio has clearly increased (cf. Fig. 1). The share of the stock market capitalization in relation to the G.D.P. has, in fact, passed from 4% in 1990 to 23% in 1996. However, this ratio decreased after that (cf. Table 2).
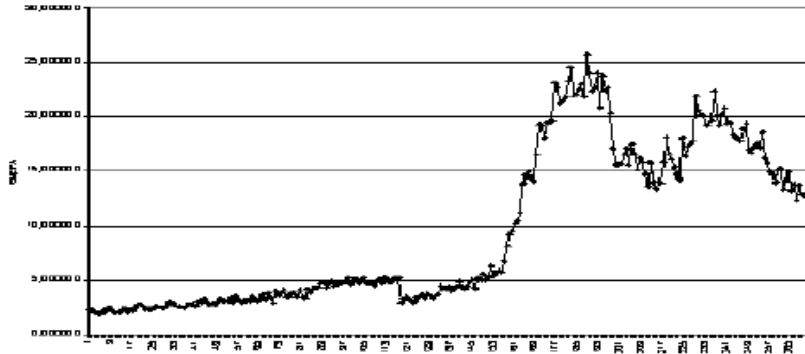

Figure 1. Share of the stock market capitalization in relation to the GDP "Lncap" series

Table 2. Share of the stock-market capitalization in relation to the G.D.P. (in percentage)

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
stock-market capitalization/G.D.P	2.13	2.40	2.62	2.85	3.15	3.14	3.75	4.61	4.88	4.57	3.43	4.41	5.38

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
stock-market capitalization/G.D.P	11.49	20.13	23.15	18.56	15.05	16.46	20.28	18.11	15.5	15.38	15.06

Graphics above representing transaction-volume as well as (transaction-volume/stock-market capitalization) ratio show that, financial market has become more liquid as a result of the introduction of reforms.

However, we have noticed that this increase of ratios was not lasting (cf. fig. 2 and 3). That is why; we can expect interventions (introduced reforms) to have transitory effects and not permanent ones on financial market liquidity.
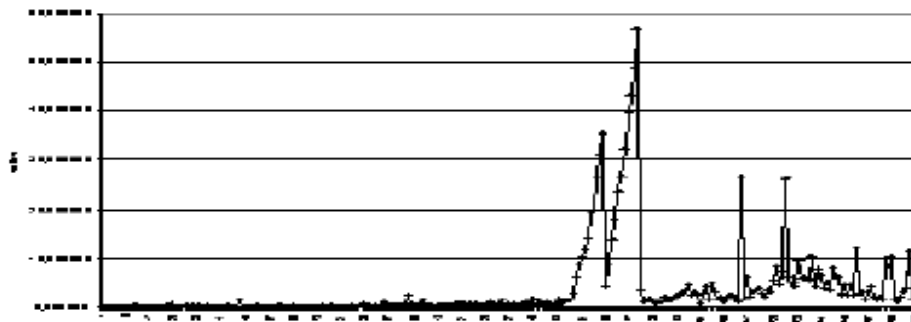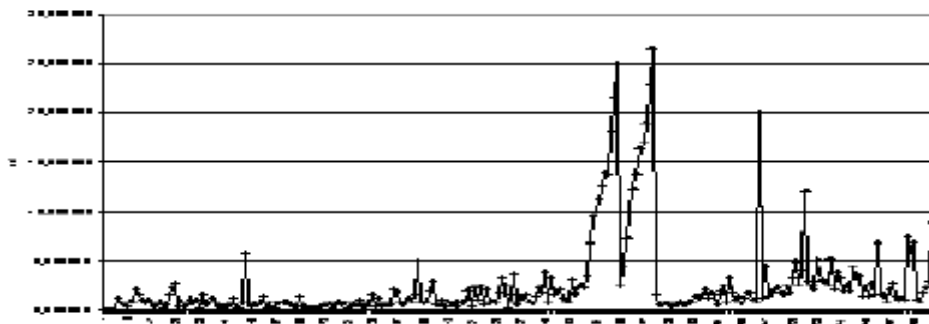

Figure 2. Transaction-volume "Lnvolt" series

Figure 3. Rotation ratio "Lnrot" series

4.2 Relation between Indicators of Tunisian Financial Market Development

Correlation coefficients between different indicators of Tunisian financial market development are significant and positive (cf. Table 3).

Table 3. Correlations between different Indicators of B.V.M.T development

Indicators	Lncap	Lnvolt	Lnrot
Lncap	1.00		
Lnvolt	0.87	1.00	
Lnrot	0.52	0.87	1.00

These correlations suggest that different indicators capture different aspects of financial market development. Furthermore, this table enables us to make the following conclusions:

- Financial market size is positively correlated with liquidity ratios. Then, as the size of financial market increases, it becomes more liquid.
- Capitalization and rotation ratios are correlated. Nevertheless, correlation coefficient is only of 0.52, which implies that financial market size is not the only determinant of its liquidity. Likewise, a small market does not necessarily suffer from a liquidity problem. A small market (with a weak (stock-market capitalization/G.D.P) ratio) can, in fact, have an important ratio of rotation, which reflects an active and liquid market.

5. **Empirical Results and Interpretations**

We have first developed a univaried intervention model for each series. Then, and in order to eliminate cross and contemporary correlations between series, we have developed a multivaried intervention model that allows a joint estimation of equations related to the three series.

5.1 Univaried Models

5.1.1 (Stock-market capitalization/G.D.P) series in logarithm [noted"Lncap"]

-   Identification of a model for the N_t series without interventions

There are two general approaches to testing for stationarity, parametric and nonparametric approaches. Using Parametric ones, According to Bowerman and O'Connell (1979), if a time series is non stationary, then the sample autocorrelation function will neither cut off nor die down quickly, but rather will die down extremely slowly.

Graphic representation as well as autocorrelation functions (Figure 4) showed that the series is not stationary.
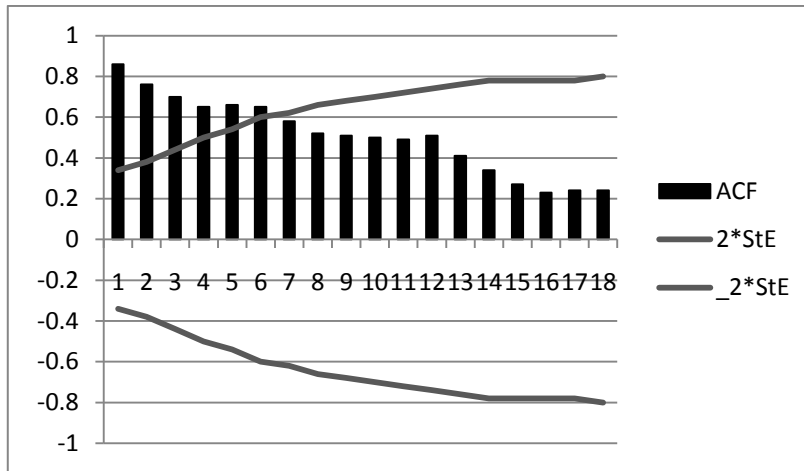

Figure 4. Auto correlation function for "Lncap" series

A differentiation of order (1) was not sufficient. A differentiation of order (12) showed that all autocorrelations were significantly equal to zero (Figure5).
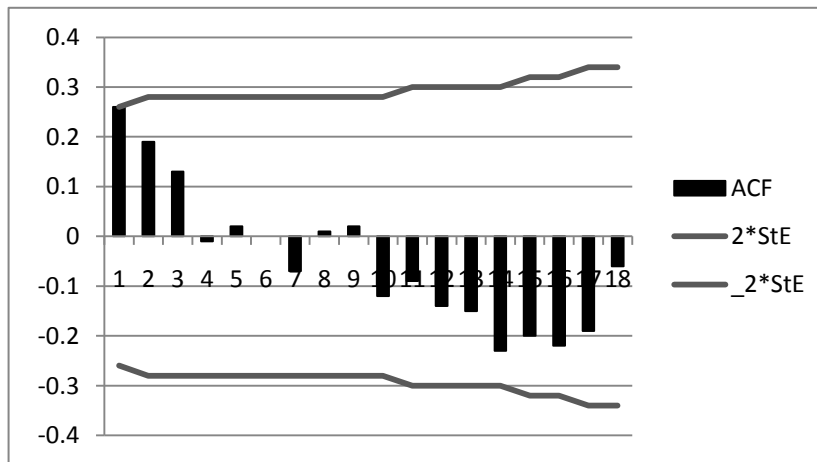

Figure 5. Auto correlation function for "Lncap" series after differentiation of order (12)

Autocorrelations and partial autocorrelation-functions allowed the identification of an ARIMA(1,12,1) model.Estimation of this model showed that coefficient associated with (θ''_t) is not significant. Thus, ARIMA(1,12,0) model was estimated :

$$(1 - B^{12})(1 - 0.2637.B).\ln cap = 0.0703 + \varepsilon_t \quad (9)$$

$$(2.10) \qquad\qquad (5.28)$$

To have a valid model, residuals have to form a white noise. Autocorrelation function of residuals showed that all autocorrelations are significantly null. This model was then valid.

- Study of intervention effects

Estimation of the model (9) identified above for the period following the first, the second as well as the third intervention (S_0, S_1 and S_2) showed that the model remains always valid. In fact, residuals form a white noise. Estimation of this model for the period following the fourth intervention (S_3) showed that the model identified for the period before interventions is not valid. In fact, residuals were auto correlated.

The following model was then identified and estimated

$$(1 - B^{12})(1 - \phi.B).\ln cap = c + \frac{\omega_3}{1 - \delta_3.B}.(1 - B^{12}).S_3 + \varepsilon_t \quad (10)$$

Table 4 below summarizes results of estimation:

Table 4. Estimation results of intervention model for "Lncap" series

Parameters	values	z-stat.
Cnst	0.0005	0.07
ω_3	0.0134	2.79[**]
δ_3	-0.9276	-29.73[***]
ϕ	0.890	32.01[***]
R ²	0.987	
RSE	0.0933335	

5.1.2 Transaction-volume series in logarithm [noted "Lnvolt"]

- Identification of a model for the N_t series without interventions

Graphic representation as well as autocorrelations and partial autocorrelation functions allowed identifying the following model:

$$(1 - B)(1 - \phi_{12}.B^{12}).\ln volt = (1 - \theta_1.B)(1 - \theta_{12}.B^{12}).\varepsilon_t \quad (11)$$

Estimation of this model provided these results:

$$(1 - B)(1 - 0.7158.B^{12}).\ln volt = (1 - 0.7436.B)(1 - 0.5643.B^{12}).\varepsilon_t \quad (12)$$

$$(5.67) \qquad\qquad (8.50) \qquad (3.52)$$

Estimation residuals were not auto correlated. This proves the validity of the model.

- Study of intervention effects

Estimation of the previously identified model for the period following the first, the second, as well the third intervention (S_0, S_1 and S_2) showed that the model remained always valid. On the contrary, estimation of the model for the period following the fourth intervention showed that the identified model is no longer valid. Residuals were, in fact, auto correlated.

Graphic representation of the series showed that (S_3), (S_4), (S_5) and (S_6) interventions might have an impact on the evolution of the series. This model was then identified and estimated:

$$(1 - B)(1 - \phi_{12}.B^{12}).\ln volt = \omega_3.(1 - B).S_3 + \omega_4.(1 - B).S_4 + \omega_5.(1 - B).S_5 +$$

$$\omega_6.(1 - B).S_6 + (1 - \theta.B)(1 - \theta_{12}.B^{12}).\varepsilon_t \quad (13)$$

Table 5 below sums up estimation results

Table 5. Estimation results of intervention model for "Lnvolt" series

Parameters	Values	z-stat.
ω_3	0.1422	6.94**
ω_4	-0.4026	-8.57**
ω_5	0.5437	6.65**
ω_6	-0.2815	-4.63**
θ_1	0.8135	22.55***
θ_{12}	0.7825	13.45***
ϕ_{12}	0.8071	18.35***
R ²	0.877	

5.1.3 Asset-rotation rate on the "B.V.M.T." in logarithm [noted "Lnrot"]

- Identification of a model for the N_t series without interventions

Graphic representation as well as autocorrelations and partial autocorrelation functions allowed identifying this model:

$$(1-B)(1-\phi_{12}.B^{12})\ln rot = (1-\theta_1.B)(1-\theta_{12}.B^{12}).\varepsilon_t \qquad (14)$$

Estimated model was presented in this way:

$$(1-B)(1-0.7172.B^{12})\ln rot = (1-0.7569.B)(1-0.5710.B^{12}).\varepsilon_t \qquad (15)$$
$$(6.27) \qquad\qquad (8.78) \qquad (3.84)$$

Autocorrelation function of residuals showed that the model is valid.

- Study of interventions effects

Following the same methodology as for transaction-volume series, this model was identified and estimated:

$$(1-B)(1-\phi_{12}.B^{12})\ln rot = \omega_3.(1-B).S_3 + \omega_4.(1-B).S_4 +$$
$$\omega_5.(1-B).S_5 + \omega_6.(1-B).S_6 + \qquad (16)$$
$$(1-\theta_1.B)(1-\theta_{12}.B^{12}).\varepsilon_t$$

Table 6. Estimation results of intervention model for "lnrot" series

Parameters	Values	z-stat.
ω_3	0.0984	5.81**
ω_4	-0.3381	-8.36**
ω_5	0.5630	7.67**
ω_6	-0.3226	-5.96**
θ_1	0.8594	26.03***
θ_{12}	0.7547	11.96***
ϕ_{12}	0.7939	16.49***
R ²	0.621	
RSE	0.633336	

5.2 Multivaried Intervention Model

Financial market-development indicators are correlated. So, the three equations should be jointly estimated in order to eliminate cross and contemporary correlations between series. Joint estimation of the three developed models provided the following results [cf. Table 7 below].

Table 7. Multivaried intervention model

Lncap	value	t-ratio	Lnvolt	value	t-ratio	Lnrot	value	t-ratio
C	-0.020	-0.46	ω_3	0.0348	0.25	ω_3	-0.0029	-0.020
ω_3	0.0104	2.42*	ω_4	-0.2076	-1.09	ω_4	-0.1717	0.91
δ_3	0.9252	25.32***	ω_5	0.4405	1.90*	ω_5	0.4464	1.93*
ϕ	0.9018	47.63***	ω_6	-0.2696	-1.30	ω_6	-0.2752	-1.33
			θ_1	0.1782	5.38**	θ_1	0.1751	5.27**
			θ_{12}	-0.0395	-0.58	θ_{12}	-0.0142	-0.21
			ϕ_{12}	0.3746	4.98**	ϕ_{12}	0.4036	5.51**
R²	0.99		R²	0.80		R²	0.41	

Multivaried model can thus be presented in this way:

$$(1-B^{12})(1-0{,}9018)\ln cap = \frac{0{,}0104.B}{1-0{,}9252.B}(1-B^{12}).S_3 + \varepsilon_t$$

$$(1-B)(1-0{,}3746.B^{12})\ln volt = 0{,}0348.(1-B).S_3 + (-0{,}2076)(1-B).S_4 +$$
$$0{,}4405.(1\text{-}B).S_5 + (-0{,}2696)(1-B).S_6 +$$
$$(1-0{,}1782.B)(1-(-0{,}0395).B^{12}).\varepsilon_t$$

(17)

$$(1-B)(1-0{,}4036.B^{12})\ln rot = 0{,}0029.(1-B).S_3 + (-0{,}1717)(1-B).S_4 +$$
$$0{,}4464.(1\text{-}B).S_5 + (-0{,}2752)(1-B).S_6 +$$
$$(1-0{,}1751.B)(1-(-0{,}0142).B^{12}).\varepsilon_t$$

According to estimation results of the multivaried intervention model, we may notice that:
- Determination coefficients (R²) have increased.
- By eliminating correlation effects between variables, we obtain better forecasts. The calculation of forecast-gap (for the period starting from January 2005 to January 2007), which is designed to compare forecasts provided by multivaried model to those provided by univaried model, permits to remark an improvement in the quality of forecasts.

Table 8. Forecast-gaps with $Forecast\ gap = \dfrac{1}{9}\displaystyle\sum_{i=1}^{9}(observation_i - forecast_i)^2$

	lncap	lnvolt	lnrot
Univaried model	0.06017719	0.67157933	0.53718004
Multivaried model	0.04153033	0.50648535	0.48172749

5.3 Interpretations

5.3.1 Financial market size

The intervention (S_3) has had a positive and significant effect on the series. This effect was both weak and significant (ω_3=0.0104) but was progressive and long-term lasting since (δ_3) is very close to 1.0 (δ_3=0.9252). This reform has, therefore, allowed a progressive increase in the size of Tunisian financial market. Graphic representation of the series confirms this result. The Tunisian financial market has known, in fact, a remarkable growth since 1993. The striking downturn of interest rates on saving books and fiscal exemption of benefits on stocks and shares, associated with the recasting of the legal framework of investment firms have favored the increase of quoted firms on the B.V.M.T., this permitted a progressive increase of the stock market size, as shown by the graphic on the next page.
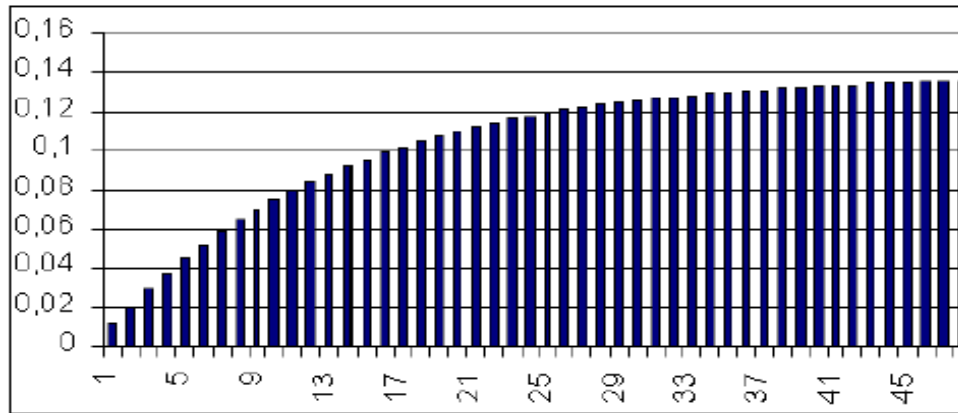
Figure 6. Transitory and permanent effects of reforms on financial market size

5.3.2 Financial market liquidity

The recasting of the Tunisian stock exchange status as well as different measures adopted at the beginning of the 1993 (fiscal encouragements, promotion of investment firms) have made the market more active and liquid.

The effect of (S_3) intervention was positive, weak and for short-term. Transaction-volume has marked a growth from 1993 to 1994. This evolution resulted in a price-inflation which has no relation with reality. Fearing "speculative bubbles", authorities adopted at the beginning of 1995 regulation measures that condition daily variations of stock prices by realizing a minimum transaction-volume. The maximum variation of prices was, in fact, fixed to ±3% in comparison with the medium price of the set of transactions of the previous session provided a minimum transaction-volume of 50000 dinars per session. This reform (S_4) resulted in an important decrease in transaction-volume and, therefore, in the ratio of assets rotation. This was a negative, significant and short-term effect (ω_4= -0.2076). The (S_5) intervention (decrease of the minimum transaction-volume to 5000 dinars per session) had a positive and significant effect.

New reforms adopted during 1996 and at early 1997 had permitted, in fact, a significant increase of asset-rotation ratio on the B.V.M.T. The creation of the S.T.I.CO.DE.VA.M combined to the 1996 installation of a new system of electronic quotation was likely to ensure a high level of transaction-transparency that restores the trust of savers.

Finally, it has to be noted that the adopted financial reforms have had transitory (short-term) effects and not permanent effects on financial market liquidity. In fact, as a result of each reform, transaction-volume as well as rotation ratios vary. Nevertheless, the answer is not lasting and the effect of this reform disappears quickly. This seems to reflect operators who are not mature enough, susceptible to any change. This may be a source of financial market fragility.

6. Conclusion

Financial reforms have had a significant impact on the development and the dynamism of Tunisian financial market. Indicators related to size and liquidity of financial market have clearly increased during the period (1993-1998). The effects of reforms on financial market size were lasting, whereas its effects on liquidity were transitory. Then, it seems that, following the adoption of financial reforms, the number of quoted firms increased but the market has not known a lasting revival of its activity and liquidity (as measured by transaction-volume and asset-rotation ratio). This joins the idea that the size of financial market is not the only determinant of its liquidity. This can be due to the lack of reliable data about firms and to the lack of transparency in terms of stock

information. This can yield a lack of confidence from savers whose participation in the stock exchange market would be low.

Furthermore, we note that since 1999, there has been a progressive decrease in the size of financial market. This can be due to the slow rhythm of privatization process of firms, to the lack of transparency in terms of stock information, and to the small number of private firms making their entry in the stock exchange.

References:
[1] Abraham, B. (1980), "Intervention analysis and multiple time series", *Biometrika*, 67, 1: 73-78.
[2] Bowerman, B. L., and O'Connell, R. T. (1979), *Time Series and Forecasting*, North Scituate, Massachusetts: Duxbury Press.
[3] Box, G.E.P. and Tiao, G.C. (1975), "Intervention analysis with applications to economic and environmental problems",*Journal of the American Statistical Association*, 70: 70-79.
[4] Craigwell R., Greenidge K. and Williams M. (2007), *Aspects of Financial Liberalization and Capital Market Development in the Caribbean*, Central Bank of Barbados, p. 263.
[5] Demirgüç-Kunt A. and Levine R. (1995), "Stock market development and financial intermediaries: stylized facts", *World Bank Policy Research Working Paper* No.1462.
[6] Demirgüç-Kunt, A. and Levine R. (2001), "Bank-based and Market-based financial Systems: Cross-Country Comparisons", In: Demirgüç-Kunt, Asli and Ross Levine (Eds.): *Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development*, Cambridge, MA: MIT Press.
[7] Fry, M.J. (1996), "In Favor of financial liberalization", *University of Birmingham Discussion Paper* No.96-24.
[8] Gurben, W. C, Koo, J. and Moore, R. (2002), "When does financial liberalization make banks risky? An empirical examination of Argentina, Canada and Mexico", *Center for Latin American Economics*, Working Paper No.399, Dallas-fed.
[9] Henry, P.B. (2000), "Stock market liberalization, economic reform and emerging market equity prices", *Journal of Finance*, 55, 2: 529-564.
[10] James B. Ang, Warwick J. McKibbin (2007), "Financial liberalization, financial sector development and growth: Evidence from Malaysia", *Journal of Development Economics*, 84, 1: 215-233.
[11] Jbeli, A. and Enders, K. (1997), "Financial sector reform in Algeria, Morocco and Tunisia: a preliminary assessment", *F.M.I. Working Paper* No.97/81.
[12] McKinnon, R.I. (1973), *Money and Capital in Economic Development*, Washington, D.C. : Brookings Institution.
[13] Osei, K. A. (1998), "Analysis of factors affecting the development of an emerging capital market: the case of the Ghana Stock Exchange", *AERC Research paper* No.76.
[14] Ranciere, R., Tornell, A. and Westermann, F. (2006), "Decomposing the effects of Financial liberalization: crises vs. Growth", *Journal of Banking and Finance*, 30: 3331–3348.
[15] Shaw, E.S. (1973), *Financial Deepening in Economic Development*, New York : Oxford University Press.
[16] Stulz, R. M. (1997), "International portfolio flows and security markets", *Charles A. Dice Center for Research in Financial Economics*, Working Paper No.97-12.
[17] Waliullah (2010), "Financial Liberalization and Stock Market Behavior in an Emerging Market– A Case Study of Pakistan", *International Journal of Business and Social Science*, 3: 75-86.
[18] Weinstein, D. E. and Yafeh Y. (1998), "On the costs of a bank centered financial system: evidence from the changing main bank relations in Japan", *Journal of finance*, 53(2): 635-672.
[19] Zamiti, M. (1998), "Les réformes du secteur financier en Tunisie : description et évaluation", *CETAI Research Paper*(Centre des Etudes en Administration Internationale: CETAI) No.04.