

Subprime Crisis and Financial Contagion: Evidence from Tunisia

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ABSTRACT: The purpose of this paper is to study the subprime crisis while focusing on the phenomenon of financial contagion. Subprime crisis is a crisis that has hit the U.S. mortgage sector and helped to trigger the financial crisis of 2007-2009. In the context of this study, we are interested in exposing the subprime crisis and the contagion first point. The second point will be reserved for the transmission channels of contagion and the third point; we will try to assess the impact of liquidity on the capital market returns. This study shows that the Tunisian financial market does not seem to be very influenced by the subprime crisis. This can be explained by the intrinsic characteristics of the Tunisian market, an underdeveloped market and elemental thing that can make him more or less immune to that crisis.

Keywords: Subprime crisis; financial contagion; intrinsic characteristics; capital market returns; Tunisian market

JEL Classifications: E60; F30; G01; M31

1. Introduction

The international economic scene has been marked in recent years by a strong financial globalization has resulted in changes affecting the operation of finance as a whole. Therefore, financial globalization has contributed to the dramatic growth of international financial transactions, including those of international capital flows. The opening of the country, especially the emerging and developing countries has favored integration into the global economy. This integration is presented as a requirement given that the financial systems of industrialized countries liberalize and participate in an active process of globalization of international finance.

In recent years, a wave of financial crises have arisen and influenced all the country's financial system. We speak, then, of the propagation of shocks of a financial market to other markets. Certainly, it is the phenomenon of financial contagion as a crucial reason: financial globalization or integration of international financial markets.

During the second half of 2007, the debt problems in the U.S. subprime caused disturbances on many segments of the financial system. The effects of this crisis were significant, which is why the mortgage industry at risk is a relatively important is in relation to the size of the financial system and exhibitions were widely scattered due to securitization.

We are interested in this work to study the subprime crisis by trying to answer the following questions:

What are the main determinants involved in the explanation of this crisis? Can we talk about financial contagion during the subprime crisis? What are the propagation mechanisms that result? What are the possible damage of the Tunisian economy and proposed remedies?

To answer these questions we will try to develop three points. In the first we are interested in exposing the subprime crisis and contagion. The second point will be reserved for the transmission channels of contagion and the third point we will try to assess the impact of liquidity on the capital market returns.

2. Literature Review

After the great economic crisis that struck the world in 1929, state intervention in the economic and financial activities was deemed essential. Classical theories and the law of outlets were devoid of any importance. This is the new era of the welfare state and Keynesianism.

In fact, it is after years of independence in developing countries that the role of the state in the process of economic growth has gained further ground: the private sector, considered embryonic and market, which was supposed to have only short-term goals, could not only ensure long-term growth.

In 1973, McKinnon (1973) and Shaw (1973) have submitted their thesis in which they criticized the situation characterized mainly by discouraging savings and a non-optimal allocation of resources. They proposed financial liberalization as a solution to boost financial development and economic growth in the long term. This call had a strong impact both at the state level that major financial institutions (IMF, World Bank). Also, a large wave of internal and external financial liberalization began to settle in developed countries (USA, UK), and to spread later to emerging and developing ones. By the late 70s, a number of Latin American countries (Argentina, Chile, and Uruguay) have implemented a policy of financial liberalization. Countries of South East Asia such as South Korea and Taiwan began to liberalize their financial systems in the early 80s. In particular, the free movement of international capital was seen as a way to collect more savings, more investment and stimulate the subsequent long-term economic growth.

Firstly, according to McKinnon (1973) and then Shaw (1973), the situation of financial repression may discourage savings and reduce the volume of productive capital in the future. Implementation of a policy of financial liberalization can abandon the diet, as bad of financial repression. Where financial repression reflects the intensive intervention of government in the financial and economic activities. In particular, given the important role that banks play in financing the economies of developing countries (which are economies of debt), governments see as a strategic sector. For McKinnon (1973) and Shaw (1973), the setting of interest rates below their equilibrium value aims to:

- Reduce savings (lower bank deposits) in favor of current consumption
- Fix the investment below its optimum level;
- Deterioration in the quality of investments made since banks will be forced to finance projects related to sectors such as low yields or agricultural property.

King and Levine (1993) also state that financial repression increases the cost of financing the investment, thereby reducing the yield of these intermediates. In addition, Roubini and Sala-i-Martin (1992) have shown theoretically and empirically that a liberalized economy grows faster than the economy where financial repression is practiced.

The financial crisis that began in July 2007 was accompanied by a financial crisis a crisis of interbank liquidity and credit crisis (credit crunch: Credit Crunch). This crisis has its origins in the bursting of economic bubbles and the losses of financial institutions including banks caused by the subprime mortgage crisis. The situation worsened in September 2008 with the bankruptcy of several banks that possess important positions in the financial market, causing contagion from one country to another.

Fall scholarships to major international stock markets have experienced at the beginning of 2008 (- 40% on the CAC 40 index, 35% of the Dow Jones) has not passed without influence on the public, analysts specialists, but especially investors. The media, in turn, were, as usual, be the first to call said a similar crisis to the crisis of 1929.

Since 2005, the United States, wages stagnate and rates from the Federal Reserve (FED) increased from 2% to 5.75% thereby increasing the rate of "subprime" loans, which is variable and indexed the rate of the FED. Borrowers increasingly many have thus ceased to pay their monthly payments. Their homes were auctioned that has accentuated the decline already underway property prices. Banks therefore recover homes for sale. But as housing prices fell, banks lose money on sales.

The U.S. housing crisis has turned into financial and banking crisis, itself causing a global economic crisis with risks of a recession in the United States and Europe. In France, growth should be only 1% in 2008 and unemployment figures are very bad. Through all these findings, the question arise how this crisis is localized and restricted to real estate could "contaminate" the entire global finance?

Secondly, Coretti et al., (1999) develop an interpretation of the Asian meltdown focused on moral hazard as the common source of overinvestment, excessive external borrowing, and current account deficits. Then, Dornbush et al., (2000) argue that Specific measures at the national level and

the international financial architecture are necessary to reduce these risks, manage their impact, and recover as efficiently as possible.

3. Transmission Channels of Contagion

Contagion occurs through the propagation of shocks from one country to another, usually in the form of significant losses of capital pressure on the exchange rate, increased interest rates, increased volatility in the exchange rate nominal and real and falling stock values. This contagion appears as an explanatory factor and fatal birth financial crises have hit several countries.

Economists and business leaders are not unanimous on a single definition of contagion. Indeed, Forbes and Rigobon (2002) define contagion as a significant increase links between financial markets due to a specific shock to a country or group of countries. The credit crisis of 2007 would, in fact, a surprise if financial contagion was fueled mainly by the channel defaults.

For, Masson (1999) argued that models that allow only a single equilibrium conditional on the macroeconomic fundamentals are not adequate to capture all forms of contagion, and formulate macro models that admit multiple equilibria and self-fulfilling expectations. Accordingly, Radelet and Sachs (1998) focus on the broad characteristics of recent financial crises in Mexico in 1994-1995, Argentina in 1995, and the five East Asian crisis economies, Indonesia, Korea, Thailand, Malaysia, and the Philippines in 1997 and considers other factors that have contributed to the crisis.

4. Contagion Effect

There are two main factors that have contributed significantly to the subprime contagion, the complexity of the structures on the securitization of these loans and investment strategies with high leverage some of the buyers of these investments, including hedge funds. The first channel of transmission of the subprime crisis lies in the phenomenon of securitization.

Securitization appears as a phenomenon relevant to the distribution of risk: To compensate for the poor quality of loans on which they are backed these securities offered interest rates well above the industry standard. However, it has contributed to the spread of the subprime crisis in the world and it leads to doubt aggravate international investors against securities called mortgage RMBS (Residential Mortgage Backed Securities) on the U.S. residential real estate and claims against the diverse packages called CDO (Collateralized debt Obligations).

The second transmission channel of the crisis consists of investment funds and hedge funds (or hedge funds) which are hedge funds and who themselves purchased receivables titrated. They are characterized by high yields (high yield) due to payment by the borrower of an interest rate higher than the primary market.

When the first failure symptoms appear, solvent financial institutions that hold risky assets in the portfolio have tried to sell quickly to draw the highest liquidation value possible. These institutions then need "money" (cash) to cope with their losses and cover their activities. So they sell these structured products (securities backed by subprime) whose liquidation value decreases as the supply of these products in the financial market increases Third the transmission channel of the crisis is the use of international financial market.

For Billio and Pelizzon (2003), contribute to discuss different methods proposed in the literature to analyse the propagation mechanism of a crisis and to verify the presence of contagion.

5. Empirical Studies of the Subprime Crisis and Contagion

In what follows we intend to focus on the role of liquidity in explaining the evolution dynamics of stock exchange indices of major advanced economies and that of Tunisia. Then test for contagion during the U.S. mortgage crisis called "subprime". Therefore, we study the aspects of modeling yields indices to test the transmission and average variance shocks.

We use daily returns of stock indices based on seven countries, namely the United States, France, Britain, Germany, Japan, South Korea and Tunisia during the period 2007 to 2009. We will present the evolution of different indices 2007, 2008 and 2009 to study the impact of the financial crisis on the different markets.

In this context, Flood and Garber (1984) constructs a pair of linear examples to study the collapse time of a fixed exchange-rate regime and propose two examples; the first is a perfect-foresight, continuous-time model which allows calculation of the exact collapse time and the tracking of reserves. Then the second example is a discrete time, stochastic model which yields an endogenous probability distribution over the collapse time and produces a forward discount of the exchange rate.

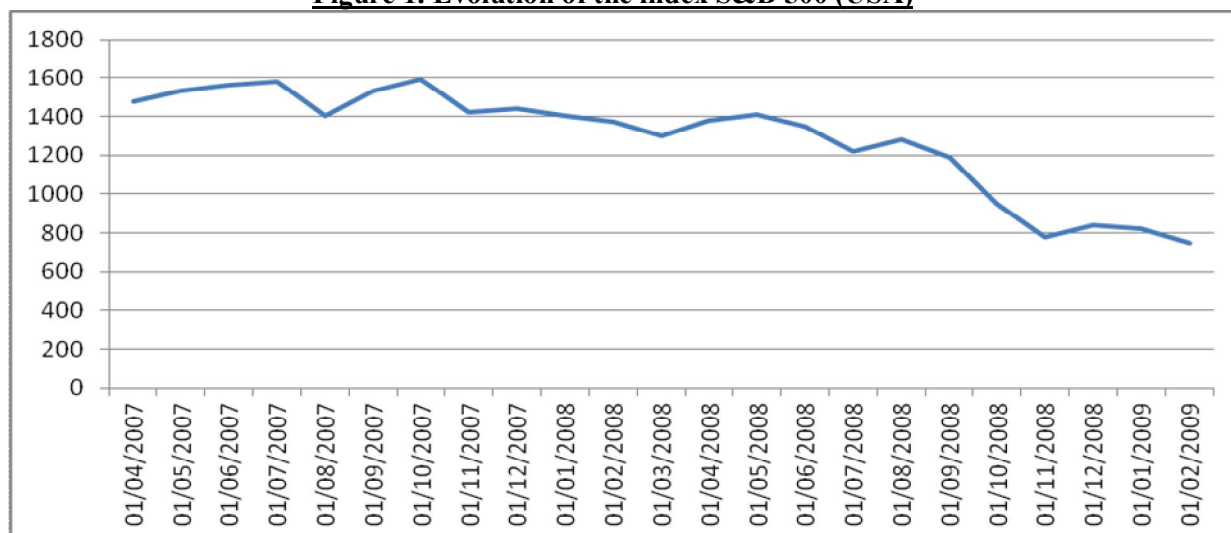
Then Glick and Rose (1999) suggests that patterns of international trade are important in understanding how currency crises spread, above and beyond any macroeconomic phenomena and conclude that trade linkages help explain cross-country correlations in exchange market pressure during crisis episodes, even after controlling for macroeconomic factors.

Yet, Kaminsky and Reinhart (1999) try the subject of balance-of-payments crises that has come to the forefront of academic and policy discussions and they lead by causal relationship from banking to balance-of-payments crises, the macroeconomic that characterize these episodes point to common causes.

While, Kodres and Pritsker (1998) develop a multiple asset rational expectations model of asset prices to explain financial market contagion, although he explains the fact of the pattern and severity of financial contagion are depends on markets' sensitivities to shared macroeconomic risk factors, and on the amount of information asymmetry in each market. Moreover, Morris and Shin (1998) notes that multiplicity of equilibria is largely as the unintended consequence of two modeling assumptions and suggests that public information has a disproportionately larger impact on the outcome than private information.

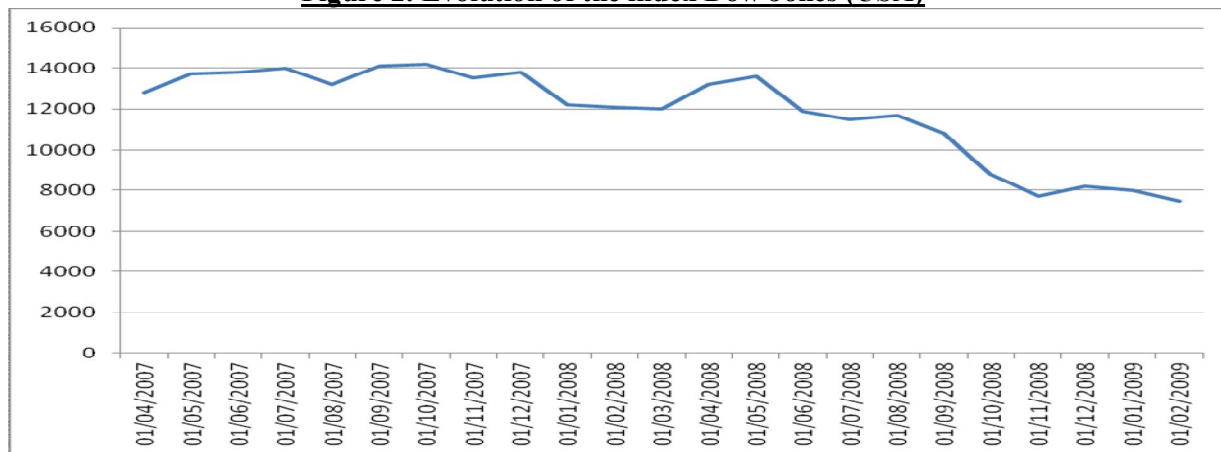
The evolution of the S & P 500, Nikkei 225 and Dow Jones seem to be the same (see figure 1, 2 and 3). Indeed, this evolution is characterized by a general trend downward in both accompanied by slight increases and decreases. Episodes of decline occurring in the U.S. market are echoed in the Japanese market. This can let the idea of the presence of a contagion effect.

Figure 1. Evolution of the index S&B 500 (USA)



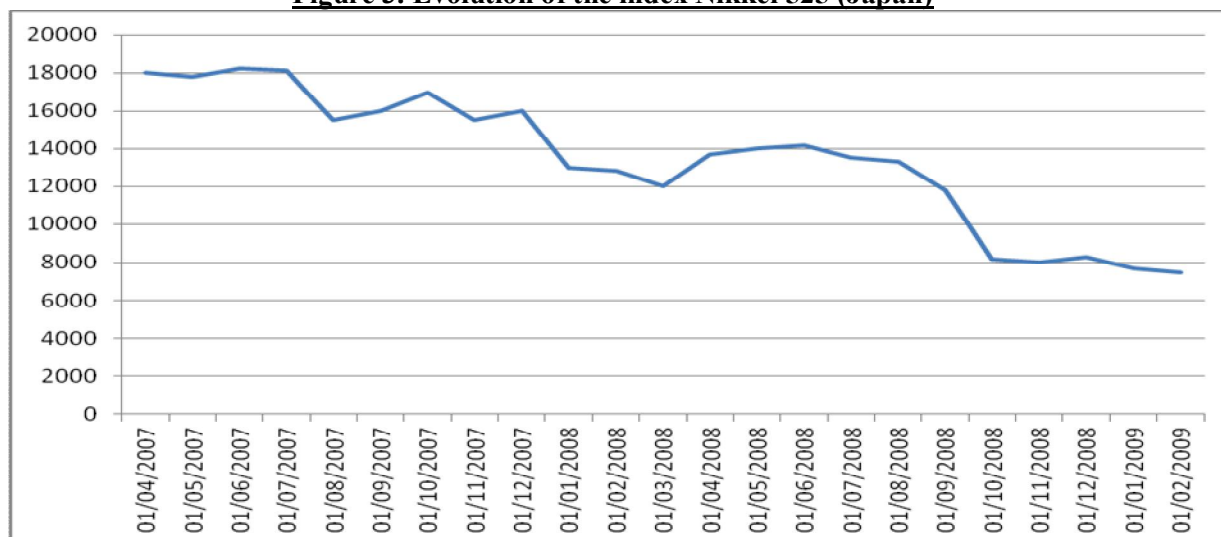
The index **declined** from 1475 points to 750 points at the end of the period: a decrease of 50%.

Figure 2. Evolution of the index Dow Jones (USA)



Similarly, the index declined from 14,000 points to 7,500 points at the end of the period. A decrease of 45%.

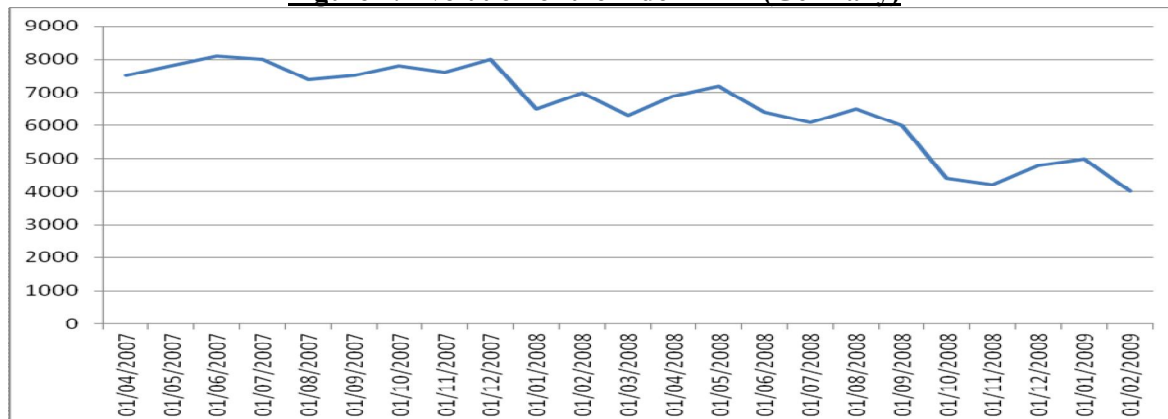
Figure 3. Evolution of the index Nikkei 525 (Japan)



The Nikkei index declined from 18 000 in 7500, a significant drop of about 58%.

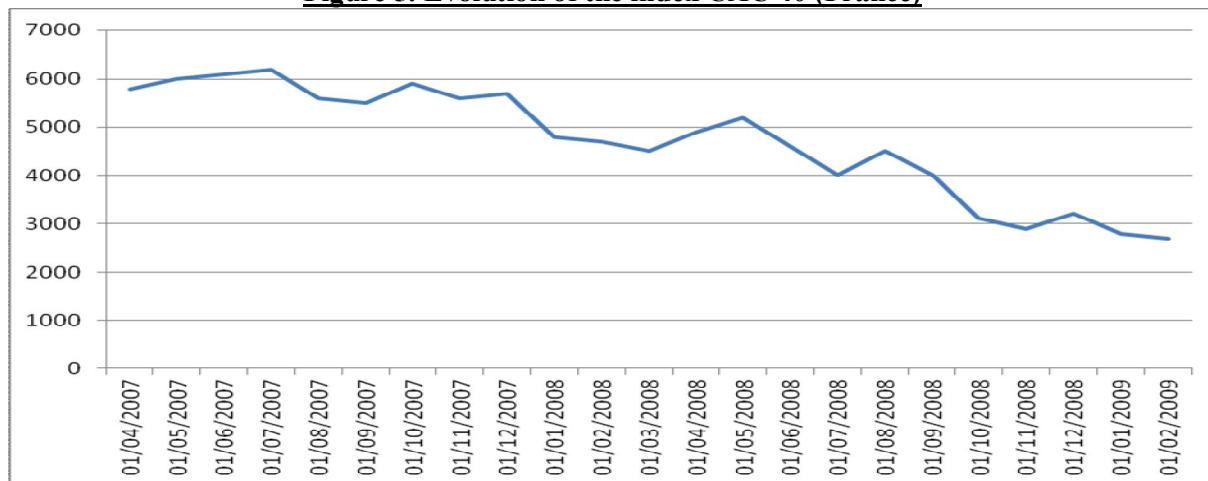
Developments DAX, CAC40 and KOSPI show some synchronization between the two gaits (see figure 4, 5 and 6). This response almost similar to the effects of the crisis can be explained mainly by the membership of both countries in a monetary union is the space of the Euro.

Figure 4. Evolution of the index DAX (Germany)



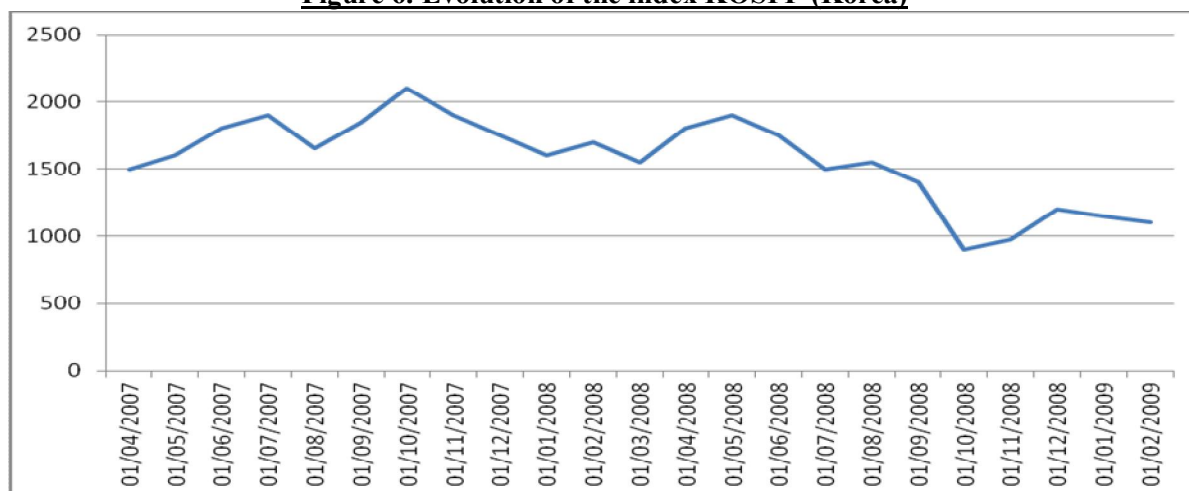
Index declined from 8000 points to 4000 points at the end of the period. A decrease of 50%.

Figure 5. Evolution of the index CAC 40 (France)



The index declined from 6000 points to 2700 points at the end of the period. A decrease of 55%.

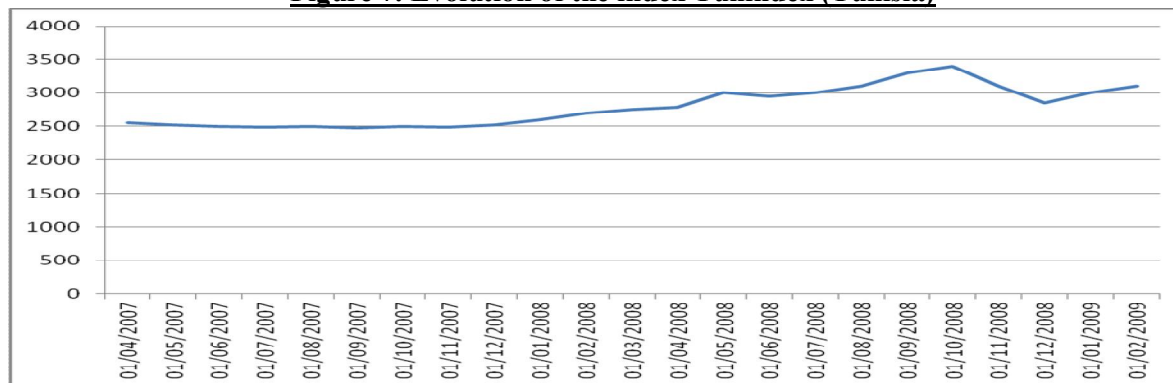
Figure 6. Evolution of the index KOSPI (Korea)



The index declined from 2000 points to 1200 points at the end of the period. A decrease of 40%.

The evolution of the index TUNINDEX shows an overall upward trend until the date 09/17/2008. After this date the index has experienced ups and downs. Overall, the trend seems normal; there is no effect on falls or sudden increases and durable. Tunisian financial market does not seem to be very influenced by the subprime crisis. This can be explained by the intrinsic characteristics of the Tunisian market, an underdeveloped market and elemental thing that can make him more or less immune to that crisis.

Figure 7. Evolution of the index Tunindex (Tunisia)



The index increased from 2600 points to 3100 points at the end of the period. An increase of 20%.

5.1 Descriptive statistics of the main indices

Table 1 shows the descriptive statistics of the seven sets of indices under study. Based on the results provided by the statistics of Kurtosis and Skewness two observations we can conclude: The kurtosis is always greater than three. This confirms with a high probability of occurrence of extreme values. Similarly, the coefficient of Skewness is negative and different from zero for all indices, except for Tunisia. This assumption does not verify the asymmetry of returns. This asymmetry is reflected in the fact that volatility is lower after rising after a fall in profitability since negative shock has more effect than a positive shock. In summary, these data show the existence of an abnormal form of empirical distributions, and that all these features are specific to financial variables at high frequencies.

Table 1. Descriptive statistics

Country	France	Germany	USA	Corea	Japon	USA	Tunisia
Index	CAC 40	DAX 30	DJ	KOSPI	Nikkei	S&B 500	Tunindex
Average	5 620	6 820	9 452	1 459	10 895	1 158	2 955
Median	5 725	6 952	9 568	1 498	10 954	1 199	3 062
Maximum	6 137	8 028	14 012	2 239	18 125	1 489	3 425
Minimum	2 653	4 924	6 923	956	7 489	741	2 496
SD (*)	428,302	132,952	194,451	205,307	276,368	212,785	0.121
Skewness	- 0,681	- 0,782	- 1,504	- 0,449	- 0,663	- 1,438	0,274
Kurtosis	3,559	4,134	4,055	3,459	3,687	3,283	3,816
Observation	480	480	480	480	480	480	480

(*) Standard Deviation

5.2 Impact of liquidity on the performance of international financial markets

To assess the impact of liquidity during the period 2000-2009, the financial markets of countries in our sample, we will try to estimate the relationship between money supply M2, which is defined in the proxy liquidity and returns financial markets defined above.

The estimation is given by the following relationship:

$$\log(SI)_t = \alpha_0 + \alpha_1 \log(M_2)_t + \varepsilon_t \quad (1)$$

With

SI: Stock Index;

M2: Money supply M2 direction

α_0 and α_1 :Parameters to estimate

ε_t : Error Term

The estimation of model gives the following results:

Table 2. Model estimation

Parameters	U.S.A	Japon	Tunisia	France
α_0	0,557	0,612	0,0212	0,587
(t)	(6,201)	(5,652)	(13,158)	(8,982)
α_1	0,652	0,529	0,532	0,501
(t)	(0,889)	(2,825)	(5,652)	(4,863)

(t) : student test

According to the results provided by table 2, we see that liquidity has a positive and statistically significant impact on the financial market indexes in the case of United States of America, Japan, Tunisia and France. The U.S. market is much more sensitive to liquidity than its analogues Japanese and French. On the Tunisian market and as it was mentioned in the study graphic, liquidity has a positive impact but a little small compared to other markets. This may be, for example, the size and structure of the Tunisian market. This market is elementary stage of development and state of

gradual opening and very conservative. Regarding the U.S. and Japanese markets, liquidity seems to have more impact. Indeed, these markets are highly connected, or even integrated.

5.3 Study Contagion

Statistically, the correlation coefficient is used to study the strength of the bond between two or more variables. This coefficient is given by the following equation:

$$\rho(a, b) = \frac{\text{Cov}(a, b)}{\sigma_a \sigma_b} \quad (2)$$

With:

$\rho(a, b)$: Correlation coefficient

$\text{Cov}(a, b)$ measures the covariance between index of market (a) and index of market (b)

σ_a : Measure the stock market risk (a) : Standard Deviation

σ_b : Measure the stock market risk (b) : Standard Deviation

The results are given in the following table 3:

Table 3. Correlation coefficient

Country	U.SA	Japon	Tunisia	France
Etats-Unis	1	0,979	0,148	0,878
Japon	0,979	1	0,158	0,897
Tunisia	0,148	0,158	1	0,225
France	0,878	0,897	0,225	1

From the table above, we enjoy a significant correlation coefficient between stock markets American, French and Japanese. We interpret this importance as evidence of contagion between these markets. By cons, there is a low ratio between the Tunisian market and other markets. This shows that the Tunisian market is not influenced by other markets and consequently the financial crisis has no impact on the Tunisian stock market.

5.4 The impact of subprime crisis on the Tunisian economy

The international financial crisis has not affected Tunisia as a very marginal since the factors behind the crisis are not known to present, for several reasons:

First, outstanding housing loans do not exceed 10% of GDP, against about 87% in the United States. Then the housing credits are strictly regulated. In fact:

- The amount of housing credit may not exceed 80% of the dwelling;
- The duration of the credit housing up to 25 years;
- Banks are required to apply a fixed interest rate;
- Interest rates on loans for housing are limited;
- The use of securitization remains limited.

Second, currency investments are primarily made through the Central Bank of Tunisia (BCT). Since the outbreak of the crisis in August 2007, the Central Bank has taken steps to ensure the safety of its investments, including:

- Reducing the proportion of investments from international banks to 75% of total reserves before the crisis to 30% in October 2008;
- Encourage investment in sovereign bonds have the highest level of security;
- Make deposits with international banks leading. This question banks rated "A" since the beginning of 2008;
- Limit the maturities of investment banking to more than one month in order to maintain a high degree of liquidity, which ensures greater responsiveness.

Third, foreign investment in stock market, their share is 25% of market capitalization, of which almost 90% are held by investors and not by reference to foreign investors.

Finally, at the money market, the situation of international financial markets can in no way be compared to the Tunisian reality because:

- The money market is characterized, in Tunisia, a significant excess liquidity;

- The rate at which these exchanges were carried out was on average 5.30% during the first week of October 2008, the rate not exceeding 5 basis points interest rate of the Central Bank, which is 5.25%.

In general, we can say that the causes which have been at the origin of the crisis and its spread do not exist in Tunisia. This being so, the provisions have been taken to prevent its spread to our country, thanks to the control of different channels through which it is likely to spread. As a result, there is no need to worry about the Tunisian financial market.

6. Conclusion

In the context of this paper we described the subprime crisis while focusing on the contagion. Indeed, we sought to identify the causes of that crisis as well as the transmission channels of contagion. These channels primarily reflect the role of liquidity in the rapid spread of the crisis. The U.S. housing crisis has turned into financial and banking crisis, itself leading to a global economic crisis with the risk of recession in the United States, Europe and elsewhere.

Euro zone which is the main partner of Tunisia in the field of trade and investment, will experience a growth rate revised down which will affect the request to Tunisia and, consequently, the pace of exports growth. To cope with this situation, Tunisia remains dependent on the ability of European countries to overcome the crisis and the ability of the economy to raise the competitiveness of its products and service to increase its ability to attract foreign investment. Remains to be said that the dimensions taken by the crisis lead us to ask questions about the effectiveness of liberalism and state intervention in the economy.

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