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Impact of External Sector Indicators on Sovereign Debt Yield Spread: Case of Morocco

Impact des Indicateurs du secteur extérieur sur le spread de rendement de la dette souveraine extérieure : cas du Maroc

EL-QASEMY Mohamed

https://orcid.org/0000-0002-5620-4681

PhD Student

Faculty of Economics and Management

Universisty Ibn Tofail, Kenitra

Laboratory of Economics and Management of Organizations

Morocco

mohamed.elqasemy@uit.ac.ma

Lalla Zhor OMARI ALAOUI,

PhD Professor

Faculty of Economics and Management

Universisty Ibn Tofail, Kenitra

Laboratory of Economics and Management of Organizations

Morocco

lallazhor.omarialaoui@uit.ac.ma

Abstract

The yield spread of sovereign debt securities is one of the indicators most watched by investors. Many factors impact the spread of a country's sovereign debt. Those factors are whether domestic or external, or both. In view of the structural approach, the probability of default of an issuer depends on its domestic economic fundamentals. Indicators related to external sector are among those fundamentals. This paper analyzes the impact of Morocco's external sector on the yield spread of its sovereign debt issued on international financial markets.

Using an ARDL model and data covering the period of 1998-2019, we investigated the relationship of eight explanatory variables representing domestic factors related to the external sectors and global factors with the EMBI+ spread index of Morocco, as a dependent variable.

Our results have shown the significant and simultaneous impact of global factors and some other external sector indicators, meaning that sovereign risk of Morocco is determined by the conditions of risk and liquidity on the international market and the situation of some indicators linked to the external sector, such as public debt services/exchange reserves ratio, external public debt/GDP and the term of trade.

Keywords: Yield-Spread; Sovereign Debt; External Sector; Global Factors, Morocco

Résumé

L'écart de rendement (Yield Spread) des titres de dette souveraine est l'un des indicateurs les plus surveillés par les investisseurs. De nombreux facteurs influent sur le spread des dettes d'un pays. Ces facteurs sont internes ou externes, ou les deux. Au regard de l'approche structurelle, la probabilité de défaut d'un émetteur dépend de ses fondamentaux économiques domestiques. Parmi ces fondamentaux, nous avons les indicateurs représentant le secteur extérieur. Cet article analyse l'impact du secteur extérieur du Maroc sur le spread de rendement de sa dette souveraine émise sur les marchés financiers internationaux.

À l'aide d'un modèle ARDL et de données couvrant la période 1998-2019, nous avons étudié la relation de huit variables explicatives représentant des facteurs internes liés aux secteurs extérieurs et des facteurs mondiaux avec l'indice EMBI+ Spread du Maroc, en tant que variable dépendante.

Nos résultats ont montré l'impact significatif et simultané des facteurs globaux et de certains autres indicateurs liés au secteur extérieur, c'est-à-dire que le risque souverain du Maroc est déterminé par les conditions de risque et de liquidité sur le marché international et à la situation des indicateurs externes liés au secteur extérieur, tel que le ratio services de la dette publique sur les réserves de change, le ratio dette publique/PIB, ou les termes de l'échange.

Mots clés : Spread de rendement; dette souveraine; secteur extérieur; facteurs externes; Maroc.

Introduction

Several studies have shown the impact of a country's macroeconomic and institutional factors on the pricing of sovereign debt securities on the international financial market. Among these factors there are those related to the country's external finances, such as the current account of the balance of payments, the stock of foreign exchange reserves, the external position, the exchange rate, the exchange regime, economic openness, etc. In addition to domestic factors, there are factors related to "international market sentiment" that have been identified as impacting spreads as well. Some studies have shown that the spreads of emerging countries respond to those factors independently of the economic and institutional fundamentals of the concerned country (Remolona et al., 2007).

Morocco, as an emerging market, resorts frequently to external debt to fund its budget and economy. As it is shown by World Bank Data (see figure 1), the Moroccan sovereign risk, as proxied by the EMBI+ Index Spread, is better than that of developing countries or MENA region but it follows almost the same evolution as them. As is stated by many studies, we know that the Moroccan should be determined by domestic and external factors, but we are not sur if they have the same weight and their respective impacts are the same under any circumstances.

To our best knowledge there is no study tried to examine the sovereign risk – external sector nexus in the case of Morocco. Our study aims to analyze the impact of some variables related to Moroccan external sector on the pricing of Moroccan sovereign debt securities given the impact risk and liquidity conditions on international market. Thus, the main question to which we will try to answer is the following: **How the Yield Spread of Moroccan external sovereign debt is impacted by the changes of the external sector indicators given the impact of global factors**?

Answering this question would amount to analyzing, in the case of Morocco, the statistical correlation between the spread index and the factors representing external sector while controlling some global factors. For this purpose, we will analyze monthly data covering the period 1998-2019 using the ARDL model and E-views program.

Hence after a review of theoretical and empirical review (section 1), we will accomplish an empirical investigation (section 2) in order to examine the statistical relationship between the EMBI+ Spread Index of Morocco and some variables related to the Moroccan external sector which are identified by the literature as explaining the sovereign risk in emerging market.

1. Conceptual Framework and Literature Review

1.1. Credit Risk : Definition and approaches

The credit risk is defined as the possibility of suffering a loss on a credit instrument. This risk is of several types: counterparty risk (signature), asset price risk, exchange risk and liquidity risk. Credit risk arises primarily from the uncertainty of losses, which requires the investor to assess the distribution of future losses. The components of credit risk fall into three categories: (i)- risk of credit losses, which is measured by the probability of default, the exposure and the severity of the loss. (ii) - the migration risk which is understood through variations in the value of security and the transition matrix and the spread of the credit security. (iii)- and the degree of correlation of default risk with other assets in the case of a portfolio.

Credit risk analysis is done by reference to one or the other of the two theoretical approaches developed by financial theory, namely the structural approach and the reduced approach. The structural approach was developed by Black-Scholes (1974) and Merton (1974). According to this approach, the probability of default is assessed according to the borrower's specific characteristics: risks and business cycles, capital structure, financial risks, debt contract, seniority of the debt, immunities in the case of a sovereign issuer, etc. It is a rolling-time model that considers the default rate to be predictable as it is only the result of a process that leads an issuer from the difficulty of payment into bankruptcy. So, knowing the characteristics related to the loan contract and to the lender predicts the default and the amount of losses in the event of default.

In this approach we consider that the value of an issuer's asset follows a stochastic process and that, more importantly, debt securities are assimilated to a derivative contract on the value of this asset, thus giving the possibility of modeling the default risk. The value considered is marked market. Credit risk arises when the debt matures; the value of the firm is likely to fall below the face value of this debt. On the due date, two situations arise: if the value of the firm is greater than the face value of the debt, the lender recovers its debt, if the opposite situation arises, the lender would recover only the residual amount which may possibly be zero. This model has the advantage of being simple and taking into account the stochastic residual value. It has the disadvantage of considering that the probability of short-term default is assumed to be zero, since the model rules out any possibility of a sudden drop in the value of securities.

According to the structural approach, the level of the spread depends on two elements as it was suggested by Lubochinsky (2002) :

- The ratio between the price of the debt and the equity (shares). An increase in shares in the stock market would result in a decrease in the spread, and vice versa. This increase must therefore correspond to an improvement in the fundamentals of the firm, otherwise the link between the stock price and the spread is no longer relevant;

- The volatility of the value of the firm's assets as approximated by stock prices. The volatility analysis provides information on the impending default on the due date. The greater the volatility, the more it is possible that this value is lower than the value of the debts of the firm, the more the spread increases.

The reduced approach was developed by Pye (1974) and popularized by several authors including Duffie & Singleton (1999). Unlike the structural approach, the reduced approach does not associate the event of default with the value of the company. It considers that default of payment is an event of a stochastic process, which cannot be predicted. The default is a complicated phenomenon whose causes cannot be specified in advance and with a certain degree of precision. In practice, the default rate depends on numerous of economic factors, including the interest rate, and other fundamentals of the firm.

The lack of determinism in the probability of default and its dependence on the interest rate means that the reduced form models reflect the two essential characteristics of defaults, namely the probability of default and the recovery rate. According to this approach, "the credit spread therefore depends on the default rate and the recovery rate anticipated by the markets, themselves directly influenced by the evolution of economic activity (Lubochinsky, 2002). Our analysis framework is part of the structural approach which binds probability of default to the economic fundamentals of the issuer.

Sovereign credit risk is defined with reference to external sovereign debt. Sovereign debts are contracted by the central government with private non-resident creditors (international investors or international banks). These debts are of a commercial nature. Thus, the official financing contracted with multilateral and regional financial institutions and other states are not concerned by the sovereign risk framework analysis.

1.2. Credit Spread : Definitions, Components and Measuring

Credit risk for an investor is the probability of default by a debtor to pay back his debts at the due date and the possibility of losing all or part of his credit. This probability must be compensated by a higher return. As such, the yield spread corresponds to the positive interest rate differential that the riskiest issuer pays to its lenders. In other words, the yield spread corresponds to the additional return required on debt issued by a risky borrower (a company)

compared to debt of the same maturity, issued by a safe issuer (state), considered to be a benchmark. In the case of sovereign debt, it is the yield differential between the debt any sovereign issuer and the debt of the US Treasury. The yield spread is the component that remunerates the credit risk to which the creditor is exposed (Painvin & Paget-Blanc, 2007, p. 70).

Mathematically speaking, the yield spread is the difference between the discounted flows generated by a risky bond, and therefore with a larger spread, and the discounted flows generated by a risk-free bond, with a spread equal to zero. This difference should equal the expected loss of credit. The spread observed on the market is an indicator of risk assessment made by the average market operator (Bénassy-Quéré et al., 2003, p. 89).

The default risk results in a risk premium charged to the issuer, meaning that issuers who are not exposed to the risk of default, they are free of credit risk. A country (as sovereign debtor) is at zero default risk when it comes to its domestic debt. But when it comes to external debt, a country is not exempt from this risk.

It has been observed, in practice, that spreads can deviate widely from their level corresponding only to losses resulting from default. This is because of the presence of different premiums that exert their impact differently and make the spread widen or shrink more or less. Hence, in addition to the default risk, spreads contain four other premiums: risk premium which corresponds to unexpected losses and the way in which investors price this risk, liquidity premium, tax premium and default premium. Expressing the degree of risk appetite, the risk premium is responsible for the pro-cyclical behavior of spreads.

Before 2007 we have seen a substantial and steady narrowing of sovereign spreads in emerging debt markets. The average spread on the EMBI+ index (of merging markets) fell from about 1,020 basis points in October 2002 to 170 basis points in December 2006 (Remolona et al., 2007). This shrinking was not an indicator of a decline in credit risk in emerging countries but just an underestimation of the default risk by investors during a period of low risk aversion. The drop between the spread and credit risk reflects the attitude of investors who do not use observed probabilities of default to determine credit spreads. Instead, they demand a higher risk premium than historical risk expectation. This means that over a long period, the return on a bond portfolio more than compensates the investor for the credit losses suffered from (Painvin & Paget-Blanc, 2007, p. 63).

For the market's needs for information on credit risk, JP Morgan developed the EMBI + Spread indices. Expressing, in a direct way, the intensity/degree of credit risk, this index

tracks total returns for actively traded external debt instruments on emerging markets. Included in the EMBI+ Index US-dollar denominated Brady bonds, Eurobonds, and traded loans issued by sovereign entities. The EMBI+ index provides investors with a definition of the market for liquid emerging markets sovereign debt and its traded instruments (JP Morgan, 2004). When the index increases it means that the risk increases, and vice versa. The EMBI+ Index reflects the market perception of an emerging country's default risk and, in turn, gives an idea of the external financing conditions of this category of country. They are calculated as weighted averages of the securities in portfolios. The time series are seamless as the bonds mature, and relate only to liquid instruments (Ferrucci, 2003).

1.3. Theoretical Models

A sovereign default of payment can be the result of debt repudiation or the lack of capacity to pay. Because of insolvency, caused by a severe fiscal deficit or lack enough exchange reserves, a country can default on its external sovereign debt. In both cases, the creditors may lose all the lent sums, given that there is no binding force which can oblige a sovereign debtor to reimburse its debts in full and at the due date, unless the army of the creditor's country is mobilized, which is no longer possible nowadays days. When a sovereign debtor is unable to pay off his debts, negotiations are held with his creditors to conclude an arrangement rewarding both parties.

Generally speaking, the absence of a binding institutional and legal framework organizing the relationship created around sovereign debt operations, combined with imperfect financial markets actually would lead to the disappearance of the sovereign-credit market and stop capital flows toward emerging sovereign countries. In practice, it is observed that these defaults did not lead to a stop of the flow of loans to emerging countries. Countries continue to borrow on international capital markets, and it seems that it would always be lenders who are ready to invest by buying debt securities issued by sovereign issuers.

To explain how the sovereign debt market continues working despite the absence of a binding legal and institutional framework, several theoretical models have been developed. While recognizing that the task is not easy, these models are almost unanimous on the need to develop an institutional framework more adequate for the prosperity of the sovereign debt market. We will present three main approaches.

- The reputation-based approach of Eaton & Gersovitz (1981) assumes that not all legal sanctions are relevant. It considers that for sovereign debtors, the opportunities and gains resulting from these arrangements following default are greater than the costs of

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outright debt repudiation. The only incentive for a sovereign debtor to repay his debts is to preserve his reputation as a good borrower. The debtor believes that if he loses his reputation, he will lose his ability to go on international financial market again.

- Bulow & Rogoff (1989) believe that the main motivation of a sovereign debtor to repay his debts is the threat of direct sanctions that lenders can impose by going to the courts of their countries. Such sanctions can cost defaulting debtors their ability to freely transact in financial and goods markets. This idea was subsequently taken up by Eaton (1991) who explains that debtors cannot make use of the "privilege" of debt repudiation; creditors can impose sanctions on them and prohibit them from access to the financial market in the future (Eaton, 1991) .

- According to Kletzer & Wright (1998), there is an implicit assumption that the observed cases of default are the underlying effects of international financial relations. At the end there is always a balanced relationship between sovereign debtors and their creditors secured by arrangements that satisfy everyone. For private investors intervening in the financial markets, sovereign debt remains the safest. The absence of legal guarantees does not mean that it would be difficult for lenders to collect their debts. In fact, loans to sovereign issuers, especially emerging and developing countries are more profitable. The average yield on claims vis-à-vis emerging countries are found to be higher compared to those of developed countries. For the authors, even loans that were subject to default were often profitable ex-post. The non-contingent nature of sovereign loan contracts masks a richer contractual space resulting from the structure of maturities, renegotiation, rescheduling and cuts in funding to defaulting countries.

The idea of these models is that reputation and sanction are the main incentives for sovereign debtors to whatever they can in order to avoid insolvency and defaulting on their debts. Knowing, international investors are more likely to lend their money to emerging countries. By doing so, sovereign debtors and creditors are holding international sovereign debt market.

1.4. Empirical Studies

Empirical studies have identified several factors that explain sovereign risk and therefore yield spread as measured by the EMBI+ index. These studies fall into three main categories: The first category identifies global factors, related to conditions of risk and liquidity on the international market as the main determinants of the spread. The second suggests that domestic factors are the most influential in determining spread. The last group focuses on the

conditions under which these factors (global and domestic) exert their respective effects on the spread.

Domestic factors concern macroeconomic fundamentals of the sovereign debtor. These factors include public debt, debt-to-GDP ratio and debt servicing-to-GDP, fiscal position, public investment, inflation, as well as political risk (Akitoby & Stratmann, 2006; Kennedy & Palerm, 2014; Manasse & Roubini, 2005; Rowland & Torres, 2004). Institutional variables, such as the quality of institutions, enrollment rate in secondary education, the literacy rate of the populations, average number of years of schooling, past default of payment, per capita-GDP, natural resources and openness have been identified as significant determinants of the cost of financing (spread) (Zaklan et al., 2006).

In addition to these factors, several other studies have found that domestic factors relating to the external sector are important in explaining the behavior of the sovereign debt yield spread. Hence, in their study to identify the determinants of the spread of emerging market sovereign issuance as well as of the creditworthiness of the issuers, Rowland & Torres (2004) have found that the spread is explained, among other macro-economic variables, by reserves-to-GDP ratio, and the debt-to-export ratio, exports-to-GDP ratio, and debt service to GDP. In the same way, Salem & Castelletti-Font (2016) found that a highly deteriorated net foreign position can be a differentiating factor for investors. Indeed, the existence of a "twin deficit" put substantial upward pressures on sovereign bond yields over the medium term.

Some interesting studies have attempted to demonstrate the correlation between the prices of exported commodities and the yield spread of sovereign debts of emerging markets. Arezki & Brückner (2012) found that in countries with democratic regimes, the price of exported commodities impacts spread. Ams et al. (2018) suggested that factors as terms of trade, recession in capital provider countries, an increase in international borrowing costs, and crisis in an important country that causes contagion across trade and financial markets can lead a country to default on its external debt. Similarly, Hilscher & Nosbusch (2010) found that the volatility of terms of trade is both statistically and economically significant in explaining spread variation. The explanatory power of changes in terms of trade and volatility of terms of trade is substantial, even after controlling for global factors and sovereign credit ratings. It is robust to instrumenting for terms of trade with commodity price indices. In a study dating back to 9ss, Hong G. Min (1999) have shown that improved terms of trade and increased net foreign assets are associated with lower yield spreads and low foreign reserves-to-GDP ratio,

low (high) export (import) and high debt-service ratio, are associated with higher yield spreads.

Among the pioneering studies on the impact of global factors on the spread of emerging countries is that of Mcguire & Schrijvers (2003). In their study, the authors noticed that spreads of sovereign debt across emerging countries tend to move in tandem over time, suggesting that those spreads react to common forces across markets. There are stains of "common factors" that investors take into account to price debt securities. The fact that the investment community has the same attitude vis-à-vis the risk does make the emerging market debt spreads move and change in the same way. Generally those forces are proxied by the VIX index among others, like the spread of corporate rated BBB, the high-yield spread and the implied volatility on US Treasuries, FTSE and NASDAQ stock indices, etc. This idea was also defended by Comelli (2012) who uses the concept of "market sentiment" to express those "common forces". Indeed, for this author, the concerns that international investors could have about the potential impact of the economic recession, in the event of a crisis, have a negative impact on debtors' spreads which may increase as a result.

These conclusions are in line with that of Banerji et al. (2014) who found that the shock of the financial crisis in the United States had a direct impact on the spread of emerging Asian economies. Wang & Yao (2014) have concluded at the same findings in Latin America when studying the impact of global factors (VIX and TED) after 2007 crisis. Monetary policy in central developed countries (the United States more specifically) impacts capital flows to emerging countries Rey (2018). In a context of capital mobility, monetary policies become ineffective and capital can ebb, thus increasing the financing cost on the international financial market for emerging countries. This idea was initially developed by Eichengreen & Mody (1998) and after Dailami et al. (2005) for whom the Fed's policy interest rate has a significant influence on the spread of emerging countries. Kodres et al. (2008) add market expectations on this policy interest rate, as well as the volatility of these expectations.

Petrova et al. (2010) add more precision by indicating that the vulnerabilities of the financial sector and the global liquidity conditions – as they are proxied by the VIX volatility index and the yields of US government securities - have a significant impact on spreads but only in the short term. In the long term, it is the country's economic and institutional fundamentals that prevail in determining this spread. This conclusion was subsequently confirmed by Csonto & Ivaschenko (2013) and Hilscher & Nosbusch (2004) who highlighted, in addition to overall liquidity conditions, the effect of uncertainty. Global factors are considered to be high

frequency variables; hence they have short-term impact, while macroeconomic variables which tend to be of low frequency, so as their impacts are only felt on the long-term.

González-Rozada & Yeyati (2008) also identify other variables such as risk appetite/aversion, global liquidity and contagion of systemic crises. Their results highlight the critical role played by exogenous factors in the evolution of borrowing costs in emerging economies. In addition to these channels of transmission of external shocks to individual country risk, Mcguire & Schrijvers (2003) designates the rating system. Theoretical studies and some empirical evidence show that external conditions could have non-linear effects on the spread, leaving heavily indebted countries more vulnerable to adverse shocks (Dailami et al., 2005; Kennedy & Palerm, 2014).

In the context of an emerging country like Morocco, we can express the following hypothesis:

- H1: Indicators of external sector are the main determinant of yield spread of Moroccan sovereign debt securities;

- H2: Global factors tend to be more prevalent in determining the yield spread when it is a period of risk aversion and financial crisis;

- H3: Global factors are the main determinants of the yield spread over the short term.

2. Empirical Analysis

2.1. Analysis of the evolution of the yield spread of Moroccan sovereign debt

From 1998 to 2019, the evolution of the Moroccan sovereign debt spread, as measured by EMBI+ spread index, on the international financial market is as shown in the graph below.

Graph 1: Evolution of the EMBI+ spread indices of Morocco, the group of developing countries and MENA
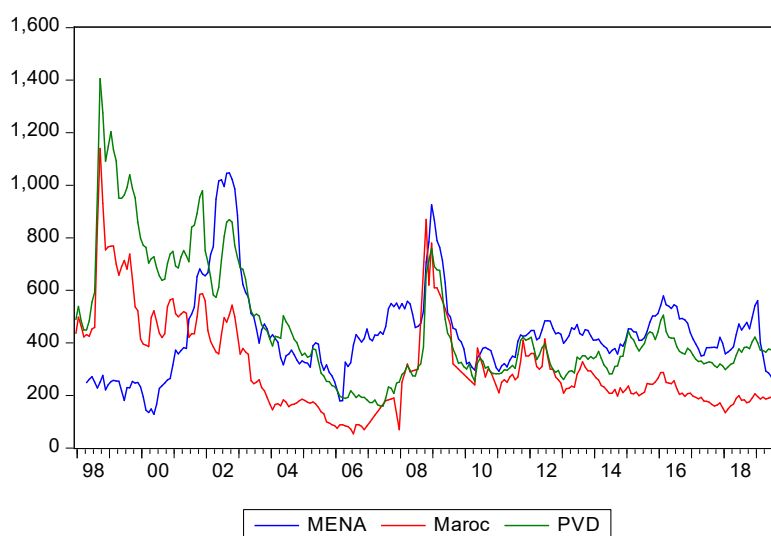

Source: World Bank Data base

Moroccan debt securities reached their peak of deterioration in September 1998 with an EMBI + index of 1140. The second deterioration was recorded in October 2008 (870 points). The best performance was achieved in July 2006 with only 54 points and in December 2007 with 70 points. Since June 2010, the index has been below its 2008 level, but it has never reached its 2006 performance.

The graph shows four main phases: (i) - 1998-1999 period corresponds to the Asian financial crisis and its consequences on emerging countries. It shows how developing countries have been affected, more or less, in the same way. Morocco suffered almost the same effects in terms of the spread which reached its historic level. (ii) - 2000-2007 period corresponds to an unprecedented phase of economic growth in Morocco which was boosted by a strong external demand, investment flows, privatization of many state-owned enterprises, and GSM lines concessions. (iii) - The third period, 2008 – 2011, has known two major events: the global financial crisis and the sovereign debt crisis of the peripheral countries of Europe (Greece, Ireland, Spain, and Portugal). The public debt in Europe has heavily impacted the developed economies and weakened economic growth in these countries, negatively affecting emerging economies like Morocco. Then, the "Arab Spring" which also increased the geopolitical risk and heavily stroke the MENA region economy. (iv)- The fourth period, 2012-2019, was characterized by a post-crisis global context. This context has been characterized by weak external demand addressed to Moroccan economies, which has contributed to deteriorating most macroeconomic indicators since the 2007, as it shown by the graph bellow.

Graph 2: Evolution of some domestic macro-economic variables of Morocco (2000-19)
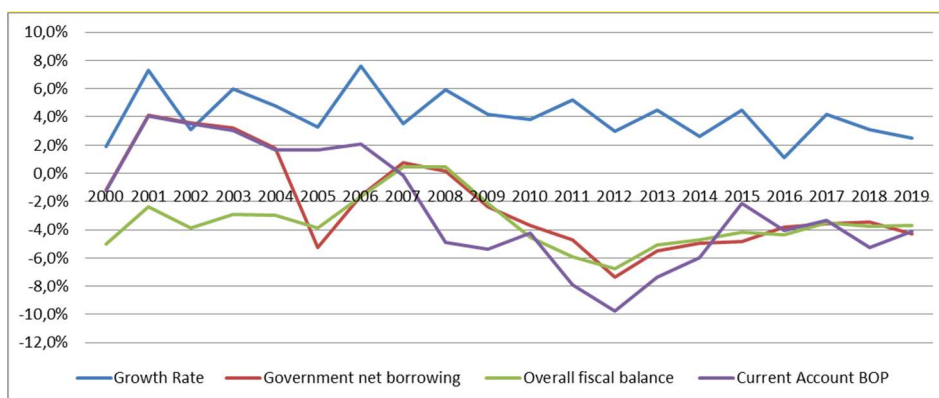
Source: Ministry Of Economy and Finance, Morocco

As shown in the graph, the average growth rate over the entire period (2000-2019) did not exceed 4.1%, while the overall budget balance was on average -3.5% of GDP, the financing

requirement of 2.2% of GDP and the current account of the balance of payments of -2.5% of GDP. Beside the external factors related to the global financial crisis, these indicators were also a result of the weak competitiveness and diversification of Moroccan economy despite the steady structural reforms implemented since 2000. The current account deficit originates from the deterioration of terms of trade or a very high internal exchange rate (IER) which corresponds to the ratio of the prices of non-tradable goods and services to those of tradable goods and services. As suggested by Bettah et al. (2020), the lower growth rate, the higher the IER is, exacerbating the current account deficit and raising the funding requirement. As a result, the public external debt has been increasing annually, in average, by 3.44%.

Overall, compared to similar countries, Morocco has shown certain economic and financial resilience in facing global crisis. It is why its sovereign risk was during the considered period better to others' as it is shown in the graph 1. This graph shows that during the period 1998-2019, there has been a co-movement between the Moroccan EMBI+ Spread Index and the spread index of the other two groups of countries (MENA and developing countries). As we have discussed before, this co-movement can be explained by the presence of global "common factors" that simultaneously determine the level and the evolution of emerging countries spread. We note as well that the index concerning Morocco was at a lower level since almost the beginning of the 2000s, indicating that Moroccan sovereign risk was at a lower level compared to those countries.

2.2. Data and methodology

2.2.1. Data description

On the basis of the above literature, we retained eight independent variables to explain the behavior of our dependent variable which is the EMBI+ Spread of Morocco which we represented by LOGEMBI. Six variables are representing domestic variables related to Moroccan external sector (see table below) and two others represent global factors, namely VIX Index and TED Rate Spread Index. These latter are defined as below:

- The CBOE Volatility Index (VIX) measures market expectation of near-term volatility conveyed by stock index option prices. It is a real-time index that represents the market's expectations for the relative strength of near-term price changes of the S&P 500 index (SPX). Because it is derived from the prices of SPX index options with near-term expiration dates, it generates a 30-day forward projection of volatility. Volatility, or how fast prices change, is often seen as a way to gauge market sentiment, and in particular the degree of fear among market participants. It is an

important index in the world of trading and investment because it provides a quantifiable measure of market risk and investors' sentiments[1].

- The TED Rate spread is the difference between the three-month Treasury bill Rate and the three-month LIBOR based on U.S. dollars. To put it another way, the TED spread is the difference between the interest rate on short-term U.S. government debt and the interest rate on interbank loans[2].

The period chosen for the study is characterized by the presence of a global financial crisis which heavily impacted the economies of emerging countries. This crisis started in the USA in 2007 and turned into a public debt crisis in Europe from 2011. Like several authors (Afonso et al., 2012; Cantor & Packer, 1996; Özmen & Doğanay Yaşar, 2016), we assume that the crisis had disrupted the relationship between the spread index and its explanatory variables by introducing a structural change in the time series. We assume that the statistical relationship before and after the crisis was not the same (Chow, 1960). To differentiate these two periods, we opted for the addition of an exogenous binary "dummy" variable: "CRISIS". There is great ambiguity surrounding the exact date of the 2007 global financial crisis outbreak (Guidolin & Tam, 2013). Like many studies, we used the CHOW Test to determine the date of structural change in our variables' time series. This test detected the existence of a structural break at 2008M11, two months after the Lehman Brothers bankruptcy and the onset of the financial crisis.

Data are monthly, covering the period 1998-2019. The source of the data, the theoretical framework of their relationship with the spread, and the direction of the correlation, are as shown in the table below. Whenever, it is possible, the series are transformed on logarithms (LOG)

Table 1: Definition of variables and related data

Variables	Theoretical framework & correlation	Sources
EMBI+ Spread Index of Morocco (LOGEMBI)	Dependent variable	
CBOE Volatility Index: VIX (LOGVIX)	(Comelli, 2012; Hilscher & Nosbusch, 2010; Wang & Yao, 2014) Positive Correlation	Chicago Board Options Exchange, CBOE Volatility Index: VIX [VIXCLS], retrieved from FRED, Federal

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[1] From Investopedia.com website: https://www.investopedia.com/terms/v/vix.asp (retrieved, March 21, 2021).

[2] See. From https://www.investopedia.com/terms/t/tedspread.asp (retrieved, March 21, 2021).

Variables	Theoretical framework & correlation	Sources
		Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/VIXCLS , March 20, 2021.
TED-Spread index. (LOGTED)	(Agur et al., 2019; Hilscher & Nosbusch, 2010; Wang & Yao, 2014) Positive Correlation	Federal Reserve Bank of St. Louis, TED Spread [TEDRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/TEDRAE , March 20, 2021
Balance of payments current account/GDP (CCBPTOBIP)	(Kennedy & Palerm, 2014) Negative Correlation	The Office des Changes and Haut Commissariat au Plan, Morocco
Net international reserves (LOGRIN)	(Hong G. Min, 1999; Rowland & Torres, 2004) Negative Correlation	Central Bank, Morocco
Prix du phosphate [3] (LOGPHOSPH)	(Arezki & Brückner, 2012) Negative Correlation	https://www.indexmundi.com/fr/matieres-premieres/?marchandise=phosphate&mois=300
Public external debt servicing/net international reserves (LOGSDEXTORIN)	(Hong G. Min, 1999; Rowland & Torres, 2004) Positive Correlation	Ministry Of Economy and Finance, Central Bank, Morocco
External Public Debt/GDP (LOGEXPD)	(Rowland & Torres, 2004) Positive Correlation	Ministry Of Economy and Finance, Morocco
Terms of Trade (LOGTOT)	(Ams et al., 2018; Hilscher & Nosbusch, 2010; Hong G. Min, 1999) Negative Correlation	International Monetary Fund https://data.imf.org/?sk=2CDDCCB8-0B59-43E9-B6A0-59210D5605D2
Dummy variable of 2007 Global Crisis (CRISIS)	Like (Alper et al., 2013; Trebesch, 2009) we used binary dummy to proxy financial crisis Positive correlation	---

Source : Created by the authors

2.2.2. Econometric methodology

To analyze the relationship between the spread and its determinants, empirical studies have used specification under ARDL (Autoregressive Distributed Lag). These studies include panel studies (Ferrucci, 2003; Özatay et al., 2007) and case studies (Aslan, 2013; Stolbov, 2016). This method, proposed by Pesaran et al. (2001), has several characteristics defend its use in this study. Indeed, despite the possible presence of endogeneity, the ARDL model provides unbiased coefficients of explanatory variables with valid t-statistics, so endogeneity is not a

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[3] Natural Phosphate (Morocco), 70% BPL, contrat, fas, Casablanca

problem in the ARDL technique. The model is less demanding in terms of order of integration because the variables can be stationary either in levels or in first difference. For these considerations the model is efficient and consistent, whatever the size of the sample. Another very important advantage is that the model makes it possible to test the (in)existence of a co-integration between the variables. When exists, co-integration involves a bidirectional or unidirectional relationship between the two categories of variables. It also implies the presence of an error correction mechanism, i.e. short-term shocks are corrected to reach a long-term equilibrium without loss of information (Nkoro & Uko, 2016).

An ARDL model will thus allow us to analyze the nature of the relationship between yield spread of Moroccan public debt securities and its explanatory variables.

An "ADF Unit Root Test" was carried out on all the series of the aforementioned variables in order to verify their eligibility for an ARDL model. This test has shown that the 9 variables, including the dependent variable, are stationary either at the first difference I(1) or at level I(0). The variables selected meet the requirement of an ARDL model and their coefficients can be estimated.

The specification of the ARDL model in our case is as follows:

$$
\begin{aligned}
\Delta \textbf{LOGEMBI}t = & [\beta 0 + \beta 1 \text{ LOGVIX}(t-1) + \beta 2 \text{ LOGTED }(t-1) + \beta 3 \text{ CCBPTOBIP}(t-1) \\
& + \beta 4 \text{LOGRIN}(t-1) + \beta 5 \text{ LOGPHOSPH}(t-1) + \beta 6 \text{ LOGSDEXTORIN }(t-1) \\
& + \beta 7 \text{ LOGEXPD}(t-1) + \beta 8 \text{ LOGTOT}(t-1)] + \left[\sum_i^P \gamma i \ \Delta \text{ LOGEMBI }(t-i)\right] \\
& + \left[\sum_i^P \pi i \ \Delta \text{LOGVIX }(t-i) + \sum_i^P \kappa i \Delta \text{ LOGTED }(t-i) + \sum_i^P \psi i \ \Delta \text{CCBPTOBIP}(t-i) \right. \\
& + \sum_i^P \tau i \ \Delta \text{LOGRIN}(t-i) + \sum_i^P \mu i \ \Delta \text{LOGPHOSPH }(t-i) + \sum_i^P \theta i \ \Delta \text{LOGSDEXTORIN}(t-i) \\
& \left. + \sum_i^P \theta i \ \Delta \text{LOGEXPD}(t-i) + \sum_i^P \zeta i \ \Delta \text{LOGTOT}(t-i)\right] + \varepsilon t
\end{aligned}
$$

Where:

- LOGSPREAD : Log of EMBI+ Spread Index Of Morocco
- LOGVIX : VIX Index (in log)
- LOGTED : TED Rate Index (in log)
- CCCPBTOBIP : Current account/GDP
- LOGRIN: International reserves (in log)
- LOGPHOPH: Phosphate prices (in log)
- LOGSDEXTORIN: External public debt services/International Reserves (in log)
- LOGEXPD : External Public Debt/GDP (in log)
- LOGTOT : Terms of exchanges Index

2.2.3. Results

The results of this estimation are as shown in the table below. The choice of the most appropriate ARDL model is made on the basis of the AIC selection criterion with a maximum

of allowed "lags" of 6. The Bounds-Test confirmed the presence of co-integration of the variables (5.39 > I(1)=3.11 at 5%).

Table 2 : Results of regression

ARDL Cointegrating And Long Run Form,
Dependent Variable: LOGEMBI
Selected Model: ARDL(1, 3, 1, 6, 6, 6, 0, 0, 0)
Date: 09/18/21   Time: 16:49
Sample: 1996M01 2020M07
Included observations: 247

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGVIX)	0.255367	0.067083	3.806761	0.0002
D(LOGVIX(-1))	-0.184563	0.124691	-1.480165	0.1403
D(LOGVIX(-2))	0.140714	0.079551	1.768855	0.0783
D(LOGTED)	0.064712	0.038596	1.676651	0.0951
D(LOGTOT)	5.231966	1.722534	3.037365	0.0027
D(LOGTOT(-1))	0.144266	2.952417	0.048864	0.9611
D(LOGTOT(-2))	-4.951666	2.575538	-1.922576	0.0559
D(LOGTOT(-3))	2.484029	2.782196	0.892830	0.3729
D(LOGTOT(-4))	-2.835888	2.657596	-1.067088	0.2871
D(LOGTOT(-5))	3.637029	1.697087	2.143101	0.0332
D(LOGPHOSPH)	-0.094271	0.302445	-0.311696	0.7556
D(LOGPHOSPH(-1))	0.393055	0.259791	1.512963	0.1318
D(LOGPHOSPH(-2))	0.073042	0.172682	0.422986	0.6727
D(LOGPHOSPH(-3))	0.091340	0.156966	0.581911	0.5612
D(LOGPHOSPH(-4))	0.142448	0.183941	0.774423	0.4395
D(LOGPHOSPH(-5))	-0.372194	0.164912	-2.256921	0.0250
D(LOGSDEXTP)	0.117971	0.144426	0.816826	0.4149
D(LOGSDEXTP(-1))	0.012343	0.131435	0.093911	0.9253
D(LOGSDEXTP(-2))	0.078575	0.133974	0.586494	0.5582
D(LOGSDEXTP(-3))	0.273084	0.137371	1.987932	0.0481
D(LOGSDEXTP(-4))	-0.203306	0.125570	-1.619066	0.1069
D(LOGSDEXTP(-5))	-0.353572	0.132152	-2.675491	0.0080
D(LOGEXPD)	0.242486	0.093591	2.590905	0.0102
D(LOGRIN)	0.053667	0.076449	0.701996	0.4834
D(CCBOPTOGDP)	-0.829661	0.541934	-1.530927	0.1273
D(CRISIS)	-0.146375	0.073398	-1.994268	0.0474
CointEq(-1)	-0.219380	0.081802	-2.681857	0.0079

Cointeq = LOGEMBI - (1.0559*LOGVIX -0.0620*LOGTED - 0.8047*LOGTOT +1.0157*LOGPHOSPH + 0.6273*LOGSDEXTP + 1.1053*LOGEXPD + 0.2446*LOGRIN -3.7818*CCBOPTOGDP -0.6672*CRISIS)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGVIX	1.055868	0.158484	6.662283	0.0000
LOGTED	-0.062039	0.088788	-0.698731	0.4855
LOGTOT	-0.804661	0.994653	-0.808987	0.4194
LOGPHOSPH	1.015659	0.262213	3.873404	0.0001
LOGSDEXTP	0.627333	0.413050	1.518782	0.1303
LOGEXPD	1.105321	0.352251	3.137881	0.0019
LOGRIN	0.244631	0.338247	0.723234	0.4703
CCBOPTOGDP	-3.781841	2.239775	-1.688491	0.0928

CRISIS	*-0.667219*	*0.363313*	*-1.836484*	*0.0677*

Diagnostic tests show that the model is robust:

- Heteroscedasticity: table reports estimates with robust standard errors, using the White correction for heteroscedasticity.
- RAMSEY TEST, Probability = 0.67;
- Serial LM test, Probability = 0.38;
- Adjusted R-squared = 0.95;
- Durbin-Watson stat= 2.12;
- CUSUM: stable, and CUSUM of sq: relatively stable.

The "Bounds-Test" indicates the presence of a long-term relationship between the independent variables and the explained variable. The negative sign of the error correction term (CointEq (-1) = - 0.219) with a very significant P-Value (0.007) confirms this long-term relationship between the two sides of the equation. This situation means that the disequilibria triggered by the short-term shocks of the previous periods disappear over time, leading to a convergence over time between the explanatory variables and the dependent variable.

We can summarize the significant explanatory variables as shown by the following table.

Table 3 : Significant variables at 5% - 10%

	Significant over the long term at 5-10%	Significant over the short term at 5-10%
LOGVIX (VIX Index)	X	X
LOGTED (TED Rate Index)		X
CCCPBTOBIP : (Current account/GDP)	X	
LOGRIN (International reserves)		
LOGPHOPH (Phosphate prices in log)	X	X
LOGSDEXTORIN (External public debt services/International Reserves)		X
LOGEXPD (External Public Debt/GDP)	X	X
LOGTOT (Terms of exchanges Index)		X
CRISIS (dummy)		X

Source: created by the authors

Over the short term, all variables are significant at 5%, except three variables: Ted index, current account of balance of payments and international exchange reserves. Over the long term, significant variables at less than 5% are the VIX index, phosphate prices, and the external public debt-to-GDP ratio. The current account of the balance of payments and the variable dummy are significant respectively to 9% and 6,7%. These variables are accompanied by coefficients with expected signs, except for the "phosphate price" variable. As shown by the table the main explanatory variables, on the long term and short term, are the

VIX Index and the external public debt/GDP Ratio. The crisis has a small impact in explaining the EMBI+ spread index of Morocco and its coefficient has a wrong sign. The other two variables, namely the term of trade and the public debt servicing-to-international reserves ratio only impact the dependent variable on the short term. The balance of payments current account, international exchange reserve and the TED index have no impact, at all, on the dependent variable. These results suggest the following comments:

- The positive correlation between the phosphate price variable and the spread would have confirmed the conclusions of Arezki & Brückner (2012). But we can't take into consideration such a conclusion, as it is known in Morocco that natural resources are used to finance economic and social development. Since the 2008 global financial crisis, phosphate prices were engaged in the same evolution as the EMBI+ spread index Morocco, confirming the existence of common forces impacting the same way these two variables. As asserted by Zhang & Broadstock (2018), there was an increase of connectedness in global commodity prices following the 2008 global financial crisis. The financial market seems to not pay close attention to this variable when it comes to pricing Moroccan debt securities.

- The current account seems to be significantly correlated to the dependent variable as it was suggested by (Kennedy & Palerm, 2014). As it was asserted by (Edwards & Werner, 2009), since the financial collapses of the 1990s, this domestic indicator is closely watched by the investors. The current account is at the center of the dynamic of many other factors: real exchange rate, terms of trade, internal exchange rate, and more globally the soundness of an economy, among others.

- As the Public external debt servicing-to-net international reserves ratio concerned, our result confirms the conclusion of previous studies (Hong G. Min, 1999; Rowland & Torres, 2004). The external insolvency of an emerging country, like Morocco, is directly linked to the state of this indicator. The short term relationship with the dependent variable can be explained by the high frequency nature of this variable.

- As sugested by Rowland & Torres (2004), the ratio public external debt-to-GDP is significantly correlated to the EMBI+ Spread Index of Morooc over the long term and the short term. This varaible shows the dynamic of the external debt on the long term and the degree of its sustanability. In Morocco, the average economic growth rate was 4,1% on the 2000-2019 period, while the external debt increased, in average, by 3,44%, suggesting that the Moroccan external finances were globally sustainable.

- The VIX index is significantly correlated to the dependent variable confirming the results of many previous studies (Comelli, 2012; Hilscher & Nosbusch, 2010; Wang & Yao, 2014). This result is in accordance with the idea that in periods of financial crisis, domestic macroeconomic variables tend to be less important in defining the spread index In this context, global variables which express the risk and liquidity conditions on international markets become dominants in determining this index. As we know the period considered in this studied was punctuated by at least three financial crises (1990s, 2007-2009, and 2011 European financial crisis).

Our results couldn't approve our entire hypothesis, as shown by the table below:

Table 4 : Hypothesis Testing

Hypothesis	Conclusion	Detail
H1: Indicators of external sector are the main determinant of yield spread of Moroccan sovereign debt securities.	Proven	The external variables tend to be significantly correlated to dependent variable on the long run and short term and are linked with the dependent variable with a long run relationship.
H2: Global factors tend to be more prevalent in determining the yield spread when it is a period of risk aversion and financial crisis.	Proven	The financial crisis tends to exacerbate the effect of global factors as drivers of contagion among countries.
H3: Global factors are the main determinants of the yield spread only over the short term;	Rejected	In the same way to aforementioned domestic variables related to external sector, global factors determine the spread on the short term and on the long-term

Source: created by the authors

Conclusion

In this paper we have attempted to analyze the impact of global factors and Moroccan external sector indicators on the behavior of the Moroccan sovereign debt spread, as measured by the EMBI+ Index. After reviewing the main conclusions of some theoretical and empirical studies, we empirically analyzed the relationship between the explained variable, EMBI+ spread index of Morocco, with eight explanatory variables. Two variables, VIX index and the Ted Rate Index, represent global factors and six other variables representing Morocco's external sector: public external debt/GDP ratio, external debt service/net exchange reserves ratio, stock of net international reserves, prices of phosphates, terms of trade, and the current account of the balance of payments. Data are monthly and covers the period 1998-2019 regressed on ARDL model by using E-Views.

The results of our study confirm some of the previous empirical studies in the case of Morocco. Our results have shown the significant and simultaneous impact of global factors represented by the VIX Index and some other external sector indicators like public debt services, public debt to GDP and the term of trade.

In terms of economic policies implications, it is important to stress that there is not much to do about the VIX index to reduce the yield spread of Moroccan debt securities on the financial markets. Nevertheless, Moroccan authorities have to improve other significant factors related to external debt. So they need to implement strong and profound structural reforms in order to (i)- enhance the competitiveness of Moroccan economy and take advantages of many free trade agreements signed by Morocco with fifty or so countries (ii)- reduce dependency on external funding. These reforms have to be conducted under a new paradigm. For this purpose, the new economic model proposed by the Special Commission on the Development Model can be a very good opportunity to engage in a new generation of structural reforms. To succeed this ambitious endeavor, it is necessary to secure a large and a strong involvement of the main forces and partners about the "strategic Transformation Priority Areas" (La Commission Spéciale sur le Modèle de Développement, 2021).

It is worth noticing that academic researches on the Moroccan sovereign risk are very scarce. Our objective throughout this paper is to contribute in launching the debate about this crucial question. As it is stated by the sovereign ceiling doctrine, there is strongly linkage between sovereign risk and credit risk of the rest of the economy. As result, a thorough understanding of the sovereign risk is fundamental in understanding some important economic issues.

Our analysis suffered from a limitation imposed by the ARDL model which does not support a large number of variables with further lags. This constraint forced us to limit the number of variables and to omit intermediate variables. Using the PLS approach in the future, we would make it possible to overcome this limit and expand the number of variables considered while addressing the complex relationship between all possible explanatory and explained variables.

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