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Sovereign Risk Mispricing and Investor Herding: MENA Debt Markets

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Abstract

In response to the scarce evidence regarding herd behavior in emerging and frontier debt markets, this paper investigates the potential mispricing of MENA sovereign risk. We explore whether this mispricing results from international investor herding, where MENA debt assets are collectively treated as a singular class, rather than being influenced by macroeconomic fundamentals. Leveraging high-frequency financial datasets spanning 55 countries from 2004 to 2019, we utilize various regression specifications and apply the Blinder-Oaxaca decomposition approach to uncover the determinants of sovereign risk pricing in MENA compared to other global regions. The results reveal a distinct asymmetric herd behaviour in MENA debt markets, emphasizing the treatment of MENA debt assets as a unified category. Furthermore, our findings suggest that the mispricing of MENA sovereign risk predominantly arises from discriminatory conduct by international investors, rather than disparities in the quality of macroeconomic fundamentals between MENA and non-MENA regions.

JEL classification: G12; G14; G15; F34

Keywords: Herding; contagion; mispricing; CDS spreads; bond yields; sovereign risk; sovereign debt; MENA.

1. Introduction

In the decade preceding the onset of COVID-19, the MENA region experienced significant transformations in the dynamics of sovereign debt. These shifts were propelled by lower global interest rates, prompting governments to embark on heightened borrowing activities from diverse sources[1]. This upswing in borrowing was chiefly aimed at supporting extensive investments in development-focused infrastructure, potentially exposing the region to an increased risk of repayment challenges. This scenario not only presents a crisis for certain countries within the MENA region but also carries the potential for a contagion effect, with ramifications extending to the broader area (Lane, 2012; Arteta and Hale, 2008).

The central focus of this study is to delve into the intricate dynamics of MENA sovereign debt, aiming to determine whether these assets are consistently mispriced and treated as a homogenous asset class, thereby neglecting essential macroeconomic fundamentals. The potential mispricing identified may find its roots in the herding behavior exhibited by international investors, driven by factors such as asymmetric information, insufficient resources for comprehensive economic analysis due to market size, or institutional considerations like geographic heuristics for diversification.

Despite marked improvements in macroeconomic fundamentals across numerous MENA countries over the last decade, characterized by robust average exports, GDP growth, and enhancements in various macroeconomic indicators, governments continue to bear a higher premium when issuing sovereign bonds. This premium is estimated to be approximately 2.9 percentage points, even after accounting for issuance costs and macroeconomic fundamentals (see Morsy & Moustafa, 2020 and OECD, 2022). This additional cost represents a bias from the international market, potentially hindering better development prospects. Understanding the intricate role of international herding against the backdrop of the MENA region becomes imperative. Moreover, the cost of insurance against defaults on MENA's sovereign debt in emerging and frontier markets, measured by credit default swap (CDS) spreads, has exhibited a widening trend over the past decade. This widening indicates a deteriorating assessment by the

[1] MENA countries have issued hard currency sovereign eurobonds, while taking on other bilateral, commercial, and syndicated loans.

market, including investors and creditors, of credit risks, country-specific risks, and/or asset class-wide risks for MENA's sovereign assets. This perplexing trend contradicts the efficient market hypothesis (EMH), which posits that rational investors diligently leverage all available market information. According to the EMH, asset prices should consistently reflect publicly available information, and yield differentials among bonds from different sovereigns should mirror disparities in macroeconomic fundamentals (see Ferrucci, 2003).

However, departing from the EMH, the MENA region's emerging and frontier markets may be experiencing distortions in the pricing of sovereign debt due to imperfect information about its economies. Investors, confronted with the high cost and complexity of acquiring information to assess sovereign risk, may succumb to herding behavior. Additionally, investors may need to rebalance portfolios and secure liquidity in response to shocks elsewhere. In instances of herding, risk premia fail to adapt to changing macroeconomic conditions, disproportionately influencing the prices of specific debt assets. Furthermore, the allocation of funds across countries and new information about one country can prompt investors to reassess prospects for other countries with superficially similar characteristics (see Calvo and Mendoza, 1996; Beirne and Fratzscher, 2013). In essence, investor herding introduces informational frictions, leading to the evaluation of sovereign risk in countries with bleak or unattractive fundamental credentials based on the characteristics of other countries. Our proposition is that the pricing of MENA sovereign risk, as measured by bond yields and CDS spreads, has been susceptible to herding contagion—movements detached from underlying macroeconomic fundamentals in the region.

Various prior studies have delved into the determinants of sovereign risk pricing, with a predominant focus on government bond yields as a key metric for evaluating sovereign risk. These investigations have often centered on elucidating sovereign risk dynamics in emerging and developing economies (Ferrucci, 2003; Eichengreen and Mody, 1998; Presbitero et al., 2016; McGuire and Schrijvers, 2003; Dell'Erba et al., 2013). Edwards (1985) conducted a seminal study exploring the factors influencing government bond yields, revealing that domestic macroeconomic fundamentals played a pivotal role in determining the sovereign risk price. Key factors identified included public debt, foreign reserves, current account balance, and inflation. Additionally, Eichengreen and Mody (1998) highlighted the external interest rate environment as a crucial determinant of sovereign spreads. More contemporary research has extended its focus to examine

sovereign CDS spreads and their determinants in both developed and emerging economies (Fontana and Scheicher, 2016; Dooley and Hutchison, 2009; Remolona et al., 2008).

While the literature on sovereign risk pricing is extensive, there is a notable scarcity of studies addressing the mispricing of sovereign debt and the phenomenon of herding contagion, especially in the context of interactions between developed and emerging economies (Beirne and Fratzscher, 2013; De Grauwe and Ji, 2012; Aizenman et al., 2013a; Longstaff et al., 2011). Aizenman et al. (2013b) conducted a comprehensive examination focused on the pricing of sovereign risk across 60 economies, utilizing CDS spreads as a key metric. Their findings revealed evidence of mispricing in the European context, relative to macroeconomic fundamentals such as public debt, fiscal balance, trade openness, external debt, inflation, and the TED spread[2]. Despite the wealth of literature on sovereign risk, these studies contribute valuable insights into the underexplored dimensions of mispricing and herding contagion, offering a nuanced understanding of the intricate dynamics within and between developed and emerging economies.

While some prior studies have analyzed determinants of sovereign risk pricing, there is a paucity of research exploring the mispricing of sovereign debt and herding contagion, particularly in developing countries like those in the MENA region. This paper fills the gap in the literature by probing two pivotal questions: First, is there empirical evidence of contagion and herding behavior by international investors in MENA's debt markets, treating the region as one asset category? If so, what is the nature of this herding behavior, and does it exhibit asymmetry? Second, to what extent is the pricing of MENA's sovereign risk subject to bubbles—indicative of financial markets mispricing MENA's sovereign risk, as evidenced by the dynamics of bond yields and CDS spreads?

The paper is organized as follows: In Section 1, we introduce the topic and review pertinent literature. Section 2 discusses the conceptual framework. Section 3 outlines the methods employed and the analysis. The data sources, summary statistics, and Stylized Facts are detailed in Section 4. Subsequently, Section 5 presents the estimated results, and finally, Section 6 concludes the paper and provides policy recommendations.

[2] The TED spread is the difference between the U.S. LIBOR rate and the 3-month U.S. treasury rate.

2. Conceptual Framework

There are two contrasting perspectives in the analysis of investment behavior and financial market participation: the traditional and behavioral finance views. The foundation of the conventional financial framework lies in the Efficient Market Hypothesis (EMH) and its associated implications. According to the EMH, in an efficient market, prices fully incorporate all available information, rendering investment strategies ineffective in consistently outperforming the market in the long run. The EMH relies on assumptions about investor rationality and the efficacy of arbitrage.

The initial assumption of the EMH posits that investors in financial markets are inherently rational. Even if some deviate from rationality, their trades are presumed to be random and collectively cancel each other out, thereby insignificantly affecting prices. The second assumption suggests that if investors display irrational behavior similarly, arbitrageurs will step in to exploit pricing anomalies, thus correcting the market. Historical empirical evidence from the 1970s seemed to align with the predictions of the EMH.

However, the 1980s witnessed several empirical findings contradicting the EMH (Shefrin and Statman, 2000). Notably, the efficiency of security prices was questioned, with researchers like de Bondt (2009) proposing that stocks with high price-to-earnings ratios (PE) were overvalued, while those with low PE ratios were undervalued. Faced with these anomalies and the inadequacy of traditional financial models based on the EMH, a new field of finance emerged – behavioral finance, challenging the dominance of the EMH (Shiller, 2003).

Barberis and Thaler (2003) delineate two fundamental pillars of behavioral finance: limits to arbitrage and psychology. They argue that real-world arbitrage comes with inherent risks and costs, hindering the correction of mispricing in the financial market. This perspective sharply contrasts with the EMH, which heavily relies on the presumed ability of arbitrageurs to eliminate mispricing.

Various stock crises, including the stock market crash of 1997, the Asian crisis of 1997, the dot-com bubble of the 2000s, and the financial crisis of 2008, prompted investigations into financial market movements. Traditional EMH provides limited resolution to these inquiries. Despite a consensus among investors, it is often confined and localized, lacking reliance on private information. This implies that assuming independent investment decisions by investors may be

unreasonable. Instead, investment choices appear to hinge on investors' information preferences, especially following the observation of a financial crisis elsewhere. A crisis in one region can catalyze international investors in other regions to reassess their region's fundamentals and seek information about the distant crisis. Consequently, aggregate irrational market behavior and herding can persist even when investors learn that fundamentals are unrelated.

Expanding the EMH debate, we explore the neoclassical income convergence hypothesis, the Capital Asset Pricing Model (CAPM), and the Arbitrage Pricing Theory (APT). These theories have significantly contributed to academic research, offering insights into how the price of a financial asset is determined under equilibrium conditions. They highlight the segmentation of financial assets in domestic markets from the movement of financial assets in the global market. Building on these theories, we present an illustrative framework demonstrating how the price of sovereign risk is determined, motivating the formulation of an empirical strategy.

The conventional approach to modeling equilibrium sovereign spreads, following Mora's seminal paper (2006), posits that the spread of a bond over a risk-free interest rate is contingent on the probability of a country defaulting and the associated loss to the creditor. Typically, this probability of default is exogenously determined within the IMF–World Bank's Debt Sustainability Framework, based on indicators such as the sustainability of external debt relative to solvency measures (e.g., GDP) or liquidity indicators (e.g., revenue or export earnings).

3. Methodology and Analysis

3.1 Fundamental Framework: Baseline Specification

In behavioral finance, two primary categories of herding exist. The first is institutional herding, which is based on the observed investment behavior of a specific category of investors, whether individual or a group. Herding in this context refers to the co-movement in the observed investment patterns of these investors. The second category is market-wide herding, which focuses on detecting herding at the market level rather than at the individual investor level. This form of herding occurs when investors in the market collectively ignore the individual characteristics of stocks and instead follow the overall performance of the market.

While the first method of herding detection requires detailed information on every transaction made by the selected investor category, it often suffers from misidentification by investors or infrequent data observations. The approach of this paper is to detect market-wide herding, where investors in the market overlook individual stock characteristics and instead mirror the performance of the market.

Christie and Huang (1995) and Chang et al. (2000) have proposed methods to detect market-wide herding using cross-sectional data of stock returns. Building on these methods, Galariotis et al. (2016), Beirne and Fratzscher (2013), and Bikhchandani and Sharma (2001) have identified market-wide herding in sovereign debt markets. Christie and Huang (1995) suggest that herding becomes more prevalent during periods of market stress, defined as extreme returns in a market portfolio. Under these conditions, individual stock returns tend to cluster around the overall market return as investors suppress their private information, leading their investment decisions to mimic collective actions in the market.

Christie and Huang argue that rational asset pricing models would predict a linear relationship between dispersions in individual assets and the market return. This implies that dispersions are an increasing function of the market return. To measure return dispersion, Christie and Huang (1995) propose the cross-sectional standard deviation (CSSD) method, expressed as:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N} (R_{i,t} - R_{m,t})^2}{(N-1)}}, \quad (1)$$

In the formula, where N represents the number of assets, $R_{i,t}$ denotes the return of asset i at time t, and $R_{m,t}$ is the cross-sectional average return of N assets at time t, the Cross-Sectional Standard Deviation ($CSSD_t$) is calculated by squared-return deviations. This method, however, tends to be sensitive to market outliers. In a subsequent study, Chang et al. (2000) propose an alternative metric known as the Cross-Sectional Absolute Deviation (CSAD). This metric, based on the conditional version of the Capital Asset Pricing Model (CAPM), is expressed as follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N} \left|R_{i,t} - R_{m,t}\right|, \quad (2)$$

Therefore, the existence of herd behavior in the market would signify not only a reduction in dispersions but also a non-linear relationship between the dispersions and the market return. Specifically, this implies that the dispersions will decrease, or at least increase at a less-than-proportional rate concerning the market return. Chiang and Zheng (2010) made modifications to the specification proposed by Chang et al. (2000) and computed CSAD as follows:

$$CSAD_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2 |R_{m,t}| + \gamma_3 R_{m,t}^2 + \epsilon_t \ . \quad (3)$$

The empirical methodology adopted in this paper is grounded in the framework established by Chiang and Zheng (2010), with one enhancement to the method proposed by Chang et al. (2000). Chiang and Zheng (2010) augment the equation (3) by introducing an additional term on the right-hand side. This addition is designed to account for asymmetric investor behavior during varying market conditions. As previously mentioned, herd behavior is assumed to be more likely during periods characterized by substantial market movements.

To capture this characteristic, indicative of a non-linear relationship between Cross-Sectional Absolute Deviation (CSAD) and the equally weighted market return, a non-linear term ($R_{m,t}^2$) is incorporated into the model. The hypothesis is that the presence of investor herds would result in a decrease, or at least an increase at a less-than-proportional rate, in CSAD concerning the market return. Consequently, market-wide herding would be indicated by a negative and statistically significant value of the coefficient γ_3 of $R_{m,t}^2$.

3.3 Transmission and Spillover Effects of Contagion and Herding Behavior

To assess contagion and herding spillover effects, we adopt the methodology outlined by Chiang and Zheng (2010). Our approach involves comparing international herding evidence in MENA against each region of the world. We augment equation (3) by introducing the squared return of the debt market in region and/or country j and time t into the regression. Consequently, the contagion and spillover equation is formulated as follows:

$$CSAD_t = \gamma_0 + \gamma_1 R_{i,m,t} + \gamma_2 |R_{m,t}| + \gamma_3 R_{j,m,t}^2 + \epsilon_t, \quad (4)$$

where $R_{j,m,t}^2$ represents the squared return from another regional or country market, denoted as j. The coefficient γ_3 anticipated to be negative and statistically significant if events in one market

induce herding behavior in another. Furthermore, the specification in equation (4) enables us to consider asymmetric investor behavior under various market conditions. It allows us to discern whether herding against MENA exhibits greater persistence compared to that observed against other world regions.

3.4 Deciphering Factors Influencing Sovereign Spreads

Leveraging insights from Beirne and Fratzscher (2013) and De Grauwe and Ji (2012), we broaden the sovereign risk pricing framework by extending it to estimate a standard panel regression model with country- and time-fixed effects, as presented below:

$$S_{it} = \alpha_0 + \alpha_i + \beta_1 X_{i,t} + \gamma_1 R_{j,t} + \epsilon_{i,t}, \quad (5)$$

where S_{it} represents the price of sovereign risk. We examine two distinct financial indicators of sovereign risk: government bond yield spreads (relative to a benchmark rate, which will be discussed later) and sovereign CDS spreads. The vector $X_{i,t}$ captures macroeconomic fundamentals, encompassing various indicators of economic solvency and liquidity (see section 4). Country-fixed effects are denoted by α_i. R_{jt} stands for the regional price of sovereign risk for the region where country i is located, excluding country i itself. This can be interpreted as the impact of changes in market sentiment, reflecting how the markets perceive the creditworthiness of MENA countries with specific characteristics. The coefficient reflects alterations in market sentiment toward MENA countries with defined macroeconomic characteristics. Essentially, an increasing negative coefficient of R_{jt} implies a growing market discernment in evaluating the creditworthiness of MENA countries with given macroeconomic attributes.

The calculation of the regional price of risk involves computing an unweighted average of the sovereign risk prices in other regional economies. However, it's essential to note that our regional classification does not align with the classifications employed in common emerging markets bond indices like the J.P. Morgan Emerging Market Bond Index (EMBI) and the Bloomberg African Development Bank African Financial Markets Initiative (AFMI) index. Consequently, we adopt an equal-weighting approach for regional price averages. The subsequent section provides a detailed explanation of the methodology employed to identify instances of sovereign risk mispricing in MENA.

3.5 Detecting Sovereign Risk Mispricing and Contagion: Blinder-Oaxaca Decomposition

Conceptually, within the empirical framework outlined in equation (5), there are four potential sources of mispricing in sovereign risk. Firstly, financial markets may price economic fundamentals differently between regions, where debt markets in MENA exhibit heightened sensitivity to a set of fundamental characteristics compared to other regions. This phenomenon is often termed as fundamental contagion.

Secondly, if creditors treat MENA debt markets as a singular asset class, there could be an escalation in the cross-country regional transmission of sovereign risk. This occurs as markets respond to changes in observable and unobservable factors in neighboring countries within the region. We refer to this as herding contagion.

The third source is represented by the country-specific fixed effects, denoted as α_i. While there are various possible interpretations for these effects, in the context of our study, the most plausible one is country risk premia.

The fourth source of mispricing is the unsystematic component of equation (5), specifically the residuals. Residuals offer insights into herding contagion across countries at specific points in time. Detection of herding contagion involves scanning for clusters in the residuals. Notably, if positive residuals are concurrently found in several countries, and these countries substantially cluster with a marked and unexplained increase in sovereign risk pricing, a pure herding contagion is identified[3].

An increase in sovereign spreads has the potential to negatively impact investor confidence and other macroeconomic fundamentals. Consequently, our model places emphasis on whether the price of sovereign risk is strictly exogenous to the fundamentals encompassed in the vector X_{it} of equation (5). If such a mechanism exists, it would likely manifest itself only after some period lags. To address this, our approach involves estimating dynamic versions of equation (5) and conducting diagnostic tests to assess the validity of our exogeneity assumption. This allows us to

[3] See similar applications in Beirne and Fratzscher (2013) and Boyson et al. (2010).

explore whether the relationship between sovereign risk and economic fundamentals exhibits any temporal dependencies or if the impact is immediate and adheres to the exogeneity assumption.

To empirically quantify the extent of mispricing and discrimination against MENA debt markets, we employ the Blinder-Oaxaca decomposition approach (Blinder, 1973; Oaxaca, 1973). The Oaxaca decomposition enables us to disentangle mispricing in MENA debt markets relative to other regions and identify the contribution of country-specific fundamentals versus regional factors in explaining the so-called "MENA premia." In the subsequent debt pricing equations, f and nf represent the MENA debt market and any non-MENA regional debt market, respectively.

$$S_{it}^{f} = \alpha_0^{f} + \alpha_i^{f} + \beta_1^{f} X_{it}^{f} + \gamma_1^{f} R_{jf}^{f} + \epsilon_{it}^{f}$$

$$S_{it}^{nf} = \alpha_0^{nf} + \alpha_i^{nf} + \beta_1^{nf} X_{it}^{nf} + \gamma_1^{nf} R_{jf}^{nf} + \epsilon_{it}^{nf} \quad . \tag{6}$$

Subsequently, the gap or mispricing in the average spread of a MENA market relative to a non-MENA market is represented as follows:

$$S_{it}^{f} - S_{it}^{nf} = \alpha_0^{f} + \alpha_i^{f} + \beta_1^{f} X_{it}^{f} + \gamma_1^{f} R_{jf}^{f} - (\alpha_0^{nf} + \alpha_i^{nf} + \beta_1^{nf} X_{it}^{nf} + \gamma_1^{nf} R_{jf}^{nf}). \tag{7}$$

By adding and subtracting $\beta_1^{f} X_{it}^{nf}$ and $\gamma_1^{f} R_{jf}^{nf}$, respectively, to and from equation (7), we obtain the Oaxaca-Blinder decomposition as follows:

$$S_{it}^{f} - S_{it}^{nf} = (\alpha_0^{f} - \alpha_0^{nf}) + (\alpha_i^{f} - \alpha_i^{nf}) + \beta_1^{f}(X_{it}^{f} - X_{it}^{nf}) + \gamma_1^{f}(R_{jf}^{f} - R_{jf}^{nf}) + (\beta_1^{f} - \beta_1^{nf}) X_{it}^{nf} + (\gamma_1^{f} - \gamma_1^{nf}) R_{jf}^{nf}. \tag{8}$$

Equation (8) encapsulates distinct terms that collectively represent various aspects of sovereign debt market dynamics. These terms encompass differences in mean spread values between MENA and other regions, averages of MENA premia over other regions, mispricing influenced by variations in the average quality of macroeconomic fundamentals between MENA and non-MENA regions, and investor discrimination and mispricing in MENA debt markets relative to other regions. The disparities between the coefficients βs and γs in the equation denote the discriminatory component within financial markets, reflecting how the creditworthiness of MENA

sovereign debt instruments is perceived in comparison to countries with similar economic characteristics in other regions of the world.

4. Data and Stylized Facts

4.1 Pricing Dynamics of Sovereign Debt

This section addresses the selection of data and provides key insights into the evolution of sovereign risk pricing in MENA over the past decade. A fundamental consideration lies in defining sovereign risk, with our approach centered on scrutinizing how financial markets assess sovereign debt risk. In particular, we examine two distinct financial indicators of sovereign debt risk: the daily closing prices of sovereign CDS spreads and government bond yield spreads. These financial metrics signify the additional borrowing cost incurred by a MENA country in international financial markets concerning the risk-free country, reflecting the level of indebtedness associated with the probability of default.

All the sovereign Credit Default Swaps (CDSs) and bond issues analyzed have a maturity of 10 years and are denominated in developed country currencies, typically in U.S. dollars.[4] Sovereign CDS spreads offer several advantages over sovereign bond spreads. Numerous studies have demonstrated that CDS spreads often lead bond spreads in price discovery (Alper et al., 2013; Gyntelberg et al., 2017; Coudert and Gex, 2010). CDS spreads are also available for fixed maturities, and taking credit risk positions via CDS requires less funding liquidity. It's worth noting that the lead of the sovereign CDS market is particularly notable for high-yield emerging and developing countries. However, in low-yield countries such as Germany, France, and Austria, the sovereign bond market still takes precedence.

Our empirical analysis encompasses a sample set of 55 countries, categorized as follows: 4 MENA, 13 African, 6 Latin American, 8 Asian, 15 developed European, 5 developing European, and 4 other developed countries[5]. The selection of countries was influenced by factors such as data

[4] We also considered using bonds issued in local currencies to establish baseline costs estimates, but unfortunately there is no reliable data on CDS, and bonds issued in local currency for all countries in our sample.

[5] 4 MENA (Algeria, Egypt, Morocco, Tunisia), 13 African (Angola, Cameroon, Côte d'Ivoire, Ethiopia, Gabon, Ghana, South Africa, Kenya, Nigeria, Namibia, Rwanda, Senegal, Zambia), 6 Latin American (Argentina, Brazil, Chile, Colombia, Mexico, Peru), 8 Asian (China, India, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam), 15 developed European (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy,

availability and the size of the country in the regional market. The sample period spans from January 1, 2004, to September 30, 2019. All data utilized for this analysis are sourced from Bloomberg and DataStream International.

Table 4.1 presents the statistical properties of the daily Credit Default Swap (CDS) spreads (column 1) and government bond yield spreads (column 2) for each region in the sample markets, covering the period from January 1, 2004, to September 30, 2019. Notably, throughout the observed period, nearly all developing, emerging, and frontier markets exhibit higher average bond returns than their developed counterparts. Latin America and Africa particularly stand out with the highest returns recorded among the regions under consideration. The volatility levels of the developing, emerging, and frontier markets are generally higher than that of the developed regions. The least volatile markets are Australia, Japan, New Zealand, and the United States, with a standard deviation of 32.7 and 1.9 in CDS and bond markets, respectively. In general, the distributions of debt market returns are statistically non-normal and leptokurtic and show positive skewness.

Table 4.1: Descriptive statistics for daily sovereign CDS and government bond yield spreads

	Obs.		Mean		Median		Std. dev.		Skewness		Kurtosis	
	CDS	Bonds	CDS	Bonds	CDS	Bonds	CDS	Bonds	CDS	Bonds	CDS	Bonds
MENA	481	7819	291.74	4.77	256.96	4.33	145.44	3.06	0.81	1.58	3.31	8.98
Africa	25063	20655	270.90	4.77	225.93	4.33	174.36	3.06	1.39	1.59	6.32	8.98
Latin America	22681	9928	372.13	7.92	182.71	6.57	688.93	3.34	5.64	1.49	42.83	3.18
Asia	25302	20655	187.66	6.40	176.09	4.87	100.89	3.48	1.65	1.04	9.83	33.12
Developed Europe	52831	69007	182.31	3.44	53.00	3.68	854.82	2.55	15.16	3.60	281.23	3.29
Developing Europe	19139	14171	204.34	6.22	192.66	6.05	124.00	2.84	0.97	0.43	5.03	1.79
Other Developed	12364	19979	58.80	3.53	55.00	3.45	32.74	1.97	1.04	0.05	4.88	5.05

4.2 Macroeconomic Factors and Global Liquidity Conditions

Aligned with the factors emphasized in the existing literature, the analysis incorporates the comprehensive state of the economy, as measured by GDP growth and real per capita GDP. These macroeconomic factors effectively encapsulate a country's economic activity and growth.

Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom), 5 developing European (Bulgaria, Hungary, Poland, Russia, Turkey), and 4 other developed countries (Australia, Japan, New Zealand, United States).

The set of variables in X (as per equation 6) also encompasses domestic economic fundamentals that serve as indicators of country default risk or creditworthiness. These sovereign debt indicators include government debt/GDP, external debt/GDP, current account/GDP, imports, inflation, reserves, fiscal balance/GDP, and investment/GDP. A body of research, including works by Dailami et al. (2008), Aizenman et al. (2013a), Riedel et al. (2013), Kennedy and Palerm (2014), and Amstad et al. (2016), among others, consistently finds that domestic fundamentals play a significant role in determining sovereign spreads in developing economies. Factors such as high government debt ratios, elevated inflation, suboptimal investments, low trade surpluses (or high deficits), and insufficient foreign reserves are all anticipated to contribute to higher interest rates on sovereign debt spreads.

In the literature, the set of variables in X (as per equation 6) incorporates industrial country (primarily U.S.) interest rates or the Fed target rate as a proxy for global liquidity. Additionally, alternative measures such as high-yield corporate bonds in advanced economies are included to capture global risk appetite or financial conditions. It is anticipated that increases in international interest rates will elevate the default probability and risk premium in developing, emerging, and frontier markets, diminish the demand for risky assets, and consequently, lead to an increase in sovereign spreads. Findings from studies such as those by González-Rozada and Levy-Yeyati (2008), Özatay et al. (2009), and Banerji et al. (2014) suggest that sovereign default risks and spreads in developing, emerging, and frontier markets are significantly influenced by global financial conditions, proxied by a subset of variables including foreign exchange and LIBOR rates. In this analysis, we use the 3-month USD LIBOR rate as a proxy for global liquidity conditions.

Data on macroeconomic fundamentals are sourced from the World Bank's World Development Indicators (WDI) and the International Monetary Fund's International Financial Statistics (IFS). The transformation of quarterly data into a monthly format is achieved using three indicators: the Bloomberg Night-Time Lights Index (NLI), the Industrial Production Index (IPI), and Institutional Investor's Country Credit ratings (IIR). This approach allows for a more granular analysis. To accommodate heterogeneity in relationships across countries, our estimation and analysis encompass the entire sample and sub-region categories, with a particular distinction made based on countries' ratings according to the IMF/World Bank debt sustainability framework.

5. Results and Discussion

5.1 Estimates of Contagion and Herding Dynamics

We commence by investigating whether evidence of herd behavior exists in MENA sovereign debt markets and proceed to test for contagion and herding spill-over effects, comparing herding patterns in MENA with those in other regions. Table 5.1 presents the outcomes of the baseline herding and contagion regressions across all regions in our sample. To assess the sensitivity of results to the choice of the aggregate portfolio, we execute each of equations (3) in column one and (4) in columns two to seven twice: first, for the Credit Default Swap (CDS) market (refer to panel A), and second, for the bond market (refer to panel B). The table illustrates contagion and international herd behavior within each region of the sample markets. It is essential to note that a negative and statistically significant value of the coefficient γ_3 of $R^2_{m,t}$ in the first column is indicative of herding, while γ_3 in the in the subsequent six columns is negative and statistically significant if herd behavior against MENA is observed.

Table 5.1 reveals significant evidence of market-wide herding in MENA throughout the entire timeframe, consistently observed at conventional significance levels in comparison to other world regions (refer to the first column). This finding aligns with results from other studies (e.g., Chiang and Zheng, 2010; Hwang and Salmon, 2004), which similarly demonstrate evidence of herding in developing, emerging, and frontier economies. The subsequent six columns present findings indicative of contagion and herding spill-over effects from Australia, Japan, New Zealand, and the United States to the MENA sovereign Credit Default Swap (CDS) market. Similar patterns are observed for Asia, developed, and developing Europe affecting the MENA sovereign bond market. This asymmetry in investor behavior suggests the existence of herding or adverse herding effects and substantiates our initial hypothesis that MENA debt assets are treated as a single category or class. Consequently, the question arises: Why do investors treat MENA debt assets as a unified category? Is it rational herding based on accurate analysis of macroeconomic fundamentals, or is it spurious herding and misperception due to stronger asymmetric information in the case of MENA?

These central questions should be paramount in the literature on sovereign risk pricing in MENA. If the observed changes in MENA sovereign risk pricing over the pre-10 years of the COVID-19[6] pandemic can be attributed to lower government and external debt ratios, faster GDP growth rates, and fewer restructurings, one may hold a relatively optimistic view regarding the market's debt pricing behavior. Conversely, if the alterations in MENA sovereign risk pricing are driven by an otherwise unexplained shift in behavior, there is no a priori reason to dismiss the possibility of spurious herding behavior against MENA.

Table 5.1: Overall contagion and herding regression results

	MENA	Africa	Latin America	Asia	Developed Europe	Developing Europe	Other Developed
Panel A: CDS Market							
Intercept	14.654***	6.261***	17.556***	8.195***	7.498***	10.127***	8.888***
	(0.078)	(0.078)	(0.061)	(0.109)	(0.009)	(0.065)	(0.077)
γ_2	1.055***	0.868***	-0.058***	-0.462***	0.009***	0.413***	0.379***
	(0.137)	(0.022)	(0.010)	(0.032)	(0.001)	(0.015)	(0.016)
γ_3	**-0.021*** **	0.026***	0.003***	0.123***	0.000***	0.003***	-0.002***
	(0.003)	(0.001)	(0.000)	(0.002)	(2.420)	(0.001)	(0.000)
Adjusted R^2	0.214	0.598	0.734	0.520	0.380	0.214	0.844
Panel B: Bond Market							
Intercept	1.588	1.678***	10.771***	13.209***	2.556***	9.054***	25.837***
	(1.820)	(0.282)	(0.142)	(0.138)	(0.014)	(0.089)	(0.245)
γ_2	5.976***	0.035***	0.307***	0.851***	0.277***	0.968***	0.162***
	(0.519)	(0.035)	(0.021)	(0.019)	(0.002)	(0.019)	(0.059)
γ_3	**-0.169*** **	0.011***	0.001***	-0.006***	-0.002***	-0.012***	0.015***
	(0.027)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)
Adjusted R^2	0.485	0.808	0.187	0.130	0.264	0.204	0.158

Notes: The table presents the results for equation (3) in column (1) and equation (4) in columns (2)– (7). $CSAD_t$ is the Cross-Sectional Absolute Deviation (CSAD) of returns at day *t* when the market return is positive. γ_2 is the coefficient of the absolute value of the positive market portfolio return at day *t* and γ_3 is the coefficient of the squared positive market return at day *t* in column (1) and the squared return from another regional or country market in columns (2)–(7). In Panel A, the first section presents the results when the CSAD measure is estimated from the CDS markets. In order to test the sensitivity of results, Panel B presents the results when the CSAD measure is estimated from the bond markets. Standard errors appear in parentheses. ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively. Bold cases denote negative and statistically significant herding coefficients at the 1% level.

5.2 Sovereign Spread Drivers: Decomposition Estimates

Table 5.2 presents the results of estimating equation (5), examining whether fundamental macroeconomic information announcements or changes in market sentiment induce herding behavior against MENA compared to other regions. The results exhibit both intuitive and robust

[6] To isolate the effect of COVID-19 and subsequent crises, we concluded our estimations at the end of 2019.

characteristics, evident in the signs and significance levels of the coefficients. It is crucial to emphasize that a consistent narrative emerges between the two types of sovereign risk—bond spreads and CDS spreads—regarding the determinants of the price of sovereign risk. The empirical evidence generally establishes a plausible and intuitive connection between macroeconomic fundamentals, changes in market sentiment, and sovereign risk pricing. Factors such as higher government and external debt, lower GDP growth and real per capita GDP, deteriorating fiscal and current account balances, lower reserves, and volatile market sentiment are consistently associated with a higher sovereign risk price in debt markets. However, there are plausible cross-region differences in these relationships.

As discussed earlier, R_j reflects changes in sentiment as MENA debt markets come into or fall out of favor. In Table 5.2, R_j suggests an increasingly discriminating market against MENA. This distinction is even more evident in the bond market, where MENA's sovereign risk pricing is more sensitive—with the largest coefficient across regions (-5.127)—to market sentiment than in the CDS market (-0.034). Coming after Africa, with a more sensitive CDS market (-0.347).

A second noteworthy finding pertains to changes over time in the relationship between fundamentals and sovereign risk pricing. In general, the empirical evidence indicates that the international market tends to consider specific economic characteristics of borrowing countries. As evident in most of the regressions, the government debt/GDP and external debt/GDP ratios are significantly positive and smaller than one. This result suggests that a higher level of indebtedness is associated with a higher probability of default and, consequently, a higher sovereign risk price.

The coefficient of the reserve ratios consistently appears negative when statistically significant, as anticipated. This suggests that the reserve ratios consistently influence the pricing of sovereign risk. These findings are in line with the conclusions drawn by Gelos et al. (2011) and Olabisi and Stein (2015). This outcome carries noteworthy implications from a policy perspective: it underscores the importance for MENA countries to exercise careful management of their international reserves to alleviate potential impacts on their sovereign risk prices.

Table 5.2: Sovereign spreads driver results

	MENA	Africa	Latin America	Asia	Developed Europe	Developing Europe	Other Developed
Panel A: CDS Market							
GDP growth	-0.004	-0.017***	-0.041**	-0.001	-0.054**	-0.002	0.007
	(0.012)	(0.007)	(0.014)	(0.005)	(0.017)	(0.014)	(0.005)
Real per capita GDP	-0.000***	-0.000***	-0.371***	-0.160**	-0.718**	-0.095	-0.003
	(0.000)	(0.000)	(0.047)	(0.063)	(0.407)	(0.462)	(0.043)
Government debt/GDP	0.003	0.000	0.011***	0.015***	1.034**	0.001*	0.000
	(0.003)	(0.001)	(0.001)	(0.002)	(0.381)	(0.000)	(0.000)
External debt/GDP	0.005	0.002	0.006**	0.001	-0.162	-0.115	-0.011
	(0.019)	(0.005)	(0.003)	(0.004)	(0.115)	(0.097)	(0.009)
Current account/GDP	-0.003	-0.006*	-0.010**	0.003	-0.055**	0.006	0.020
	(0.007)	(0.003)	(0.005)	(0.003)	(0.021)	(0.013)	(0.012)
Imports	0.004*	0.003***	0.004***	0.009*	0.002**	0.013***	0.003
	(0.002)	(0.001)	(0.001)	(0.005)	(0.000)	(0.003)	(0.003)
Inflation	0.042***	0.014***	0.011*	0.007	-0.019**	0.017*	0.002
	(0.008)	(0.003)	(0.005)	(0.006)	(0.009)	(0.010)	(0.019)
Reserves	0.000	0.000	-0.266***	-0.005	0.131***	-0.135**	-0.128**
	(0.000)	(0.000)	(0.025)	(0.019)	(0.029)	(0.074)	(0.048)
Fiscal balance/GDP	0.003	-0.011*	-0.062***	-0.004**	-0.041**	0.003	-0.019
	(0.022)	(0.006)	(0.004)	(0.002)	(0.016)	(0.009)	(0.010)
LIBOR	0.007	0.009**	-0.031***	-0.033***	0.004	0.007	0.012
	(0.016)	(0.004)	(0.004)	(0.010)	(0.004)	(0.008)	(0.029)
Exchange rate	-0.038***	-0.001*	-0.027***	0.003**	0.034**	0.000	0.003**
	(0.002)	(0.000)	(0.004)	(0.002)	(0.014)	(0.000)	(0.001)
Investment/GDP	0.001	0.003	0.024***	0.004	0.001	-0.005	0.007
	(0.001)	(0.003)	(0.004)	(0.004)	(0.001)	(0.004)	(0.009)
R_j	**-0.034*** **	-0.347***	-0.039***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.002)	(0.014)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	406	694	799	669	112	148	297
# of countries	4	12	6	8	15	5	4
Panel B: Bond Market							
GDP growth	0.010	0.002	-0.013***	0.023	-0.501***	-0.044*	0.002
	(0.021)	(0.011)	(0.003)	(0.034)	(0.114)	(0.031)	(0.011)
Real per capita GDP	-0.000*	0.000	-0.253***	-0.000**	-2.538**	0.000	0.000
	(0.000)	(0.000)	(0.049)	(0.000)	(1.297)	(0.000)	(0.000)
Government debt/GDP	-0.011**	0.000	0.000	0.034*	2.057***	0.008**	0.000
	(0.006)	(0.002)	(0.000)	(0.019)	(0.438)	(0.003)	(0.002)
External debt/GDP	0.127***	0.021***	0.013***	-0.025	-1.189	-0.049	0.021***
	(0.036)	(0.009)	(0.002)	(0.048)	(1.417)	(0.096)	(0.009)
Current account/GDP	0.043**	0.006	-0.008***	0.024	0.038	-0.311***	0.006
	(0.018)	(0.015)	(0.002)	(0.026)	(0.027)	(0.087)	(0.015)
Imports	0.007	0.010	0.027***	-0.007	-0.325*	0.013	0.010
	(0.004)	(0.012)	(0.004)	(0.008)	(0.182)	(0.021)	(0.012)
Inflation	0.072***	0.054***	0.044***	0.251**	0.319***	0.006	0.054***
	(0.012)	(0.008)	(0.005)	(0.115)	(0.027)	(0.114)	(0.008)
Reserves	-0.877***	-0.024	-0.138***	-0.532***	-0.014***	-0.446*	-0.024
	(0.259)	(0.026)	(0.015)	(0.165)	(0.002)	(0.260)	(0.026)
Fiscal balance/GDP	0.167***	-0.024***	-0.002**	-0.106	-0.063**	0.139	-0.024***
	(0.039)	(0.005)	(0.001)	(0.146)	(0.030)	(0.094)	(0.005)
LIBOR	0.044	0.022	-0.007	-0.085	-0.056*	0.803***	0.022
	(0.033)	(0.015)	(0.008)	(0.191)	(0.037)	(0.207)	(0.015)
Exchange rate	0.235	-0.187**	-0.004***	0.044	-0.008***	0.015*	-0.187**
	(0.206)	(0.106)	(0.001)	(0.051)	(0.002)	(0.008)	(0.106)
Investment/GDP	0.012	0.061***	0.007**	0.117**	0.191***	-0.251***	0.061***
	(0.028)	(0.018)	(0.002)	(0.000)	(0.027)	(0.059)	(0.018)
R_j	**-5.127*** **	-0.027***	-0.000***	-0.000**	-0.000***	0.000	-0.027***
	(0.627)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)
Observations	306	349	563	217	338	288	349
# of countries	4	6	8	15	5	4	6

Notes: The table presents the results for equation (5). R_j is the regional price of sovereign risk. ***, **, and * represent significance at the 1%, 5%, and 10% level, respectively. The numbers in the parentheses are standard errors.

The coefficients of the current account/GDP and fiscal balance/GDP are, as expected, negative when significant. This indicates that a higher deficit (or lower surplus) will result in a higher perceived probability of default. The coefficients of GDP growth, real per capita GDP, imports, inflation, LIBOR, and the exchange rate also have the expected sign when significant. However, the estimated coefficient of the investment/GDP ratio is negative and significant, as expected, only in Australia, Japan, New Zealand, and the United States. This result suggests that in developed countries, as indicated by Edwards (1985), a higher propensity to invest will tend to be associated with a lower perceived probability of default.

In summary, the evidence presented in this section reveals discriminatory behavior against MENA in determining its sovereign risk price and underpricing of its macroeconomic fundamentals compared to other world regions. This discrimination suggests a mispricing of sovereign risk in MENA debt markets. To quantify the extent of this mispricing and discrimination against MENA debt markets, we apply the Oaxaca-Blinder decomposition approach in the next section.

5.3 Sovereign Debt Pricing Differential: Decomposition Estimates

The key message of Table 5.3 is that investors seem to treat MENA sovereign debt as one asset class and to do so significantly more than what is witnessed for other world regions. Recall that the Blinder-Oaxaca decomposition decouples mispricing in MENA's sovereign debt markets relative to other regions and pins down the contribution of country-specific macroeconomic fundamentals versus regional factors in explaining MENA premia. Table 5.3 shows that in MENA, the mean of the sovereign debt price estimate is 5.593 in the CDS market and 4.842 in the bond market, compared to 4.822 in CDS market and 4.490 in bond markets for non-MENA regions. This yields a significant sovereign debt pricing differential of 0.771 in the CDS market and 0.352 in the bond market.

In Panel A of Table 5.3, we present a breakdown of the sovereign debt pricing differential into three components, elucidating the impact of regional disparities in endowments (explained effect), coefficients (unexplained effect), and their simultaneous influence on the pricing gap between MENA and non-MENA regions. Our three estimates reveal that the pricing gap is predominantly

propelled by variations in coefficients rather than endowments (refer to columns (1) and (3)). Notably, the substantial overall increases in columns (1) and (3) indicate that differences in coefficients entirely account for the observed pricing gap.

Table 5.3: Blinder-Oaxaca decomposition estimates of sovereign debt pricing differential.

	Panel A: CDS Market		**Panel B: Bond Market**	
	(1)	(2)	(3)	(4)
OVERALL				
Non-MENA	4.822***		4.490***	
	(0.015)		(0.063)	
MENA	5.593***		4.842***	
	(0.029)		(0.094)	
Difference	-0.771***		-0.352***	
	(0.034)		(0.112)	
Endowments *(Explained)*	2.987		-9.830	
	(1.886)		(10.969)	
Coefficients *(Unexplained)*	-0.090**		2.664***	
	(0.039)		(0.251)	
Interaction	-3.668*		7.518	
	(1.881)		(10.998)	
FUNDAMENTALS	*Explained*	*Unexplained*	*Explained*	*Unexplained*
GDP growth	0.370***	-0.122***	0.023**	-0.125**
	(0.114)	(0.026)	(0.011)	(0.043)
Real per capita GDP	0.028	-0.166**	0.524	-0.328*
	(0.237)	(0.184)	(0.391)	(0.213)
Government debt/GDP	-0.001	0.347***	-0.213***	1.269***
	(0.002)	(0.082)	(0.047)	(0.101)
External debt/GDP	0.117**	-1.378***	0.279***	-1.996***
	(0.035)	(0.258)	(0.061)	(0.286)
Current account/GDP	-0.313***	-0.229***	0.082	0.028
	(0.030)	(0.027)	(0.056)	(0.041)
Reserves	0.211	-0.017	-0.611***	2.112***
	(0.494)	(0.043)	(0.066)	(0.388)
Fiscal balance/GDP	-0.251***	-0.201***	-0.279***	-0.218***
	(0.029)	(0.051)	(0.037)	(0.062)
LIBOR	0.077*	0.643***	0.315***	1.164***
	(0.052)	(0.111)	(0.075)	(0.140)
Exchange rate	0.522***	-0.085**	0.057*	-0.041*
	(0.161)	(0.036)	(0.038)	(0.027)
Investment/GDP	-0.053***	0.351***	-0.085***	0.929***
	(0.010)	(0.078)	(0.021)	(0.128)
Other	Yes	Yes	Yes	Yes
Observations	3,436		3,256	
Number of countries	50		55	

Notes: *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively. The numbers in parentheses are standard errors

A noteworthy observation is that MENA's endowments, particularly concerning GDP growth, external debt/GDP, and exchange rate, contribute to a reduction in the observed pricing gap. This

inference is drawn from the higher endowment levels of these variables in MENA compared to non-MENA regions (see columns (1) and (3)). The findings also highlight that current account and fiscal balances, reserves, and investment performance in the four MENA countries exhibit the most pronounced negative association with the sovereign risk pricing of MENA debt. This is evident both in terms of significance and magnitude, as reflected by the reported coefficients of these variables in both CDS and bond markets. These results suggest that MENA stands to gain substantial benefits from fiscal and investment policy reform programs, leading to lower sovereign risk prices and reduced default probabilities.

In general, the findings presented in Table 5.3 offer compelling evidence that the shift in the mean value of sovereign risk prices in the four MENA countries exceeds what can be accounted for solely by the mean values of macroeconomic fundamental variables. While enhanced country characteristics do play a role in reducing the pricing gap, their contribution represents only a fraction of the total change. Conversely, the greater contribution comes from alterations in the unexplained coefficients, signaling a broader shift in market sentiment and a tendency toward discrimination against MENA.

The cumulative impact of these factors is an elevation in the premium paid by MENA countries. Despite positive changes in country-specific attributes, the disproportionate influence of unexplained coefficients suggests a prevailing market bias or skepticism toward the region, resulting in an amplified sovereign risk premium for MENA nations.

In summary, our findings suggest that the mispricing of sovereign risk in MENA is primarily attributed to a discriminatory element within financial markets, reflecting biases in the assessment of the creditworthiness of MENA sovereign debt. This mispricing is not driven by disparities in the average quality of macroeconomic fundamentals between MENA and non-MENA regions. One plausible explanation for this discriminatory behavior is the influence of global information processing. It appears that investors in each MENA debt market tend to shape their investment strategies based on those of mega institutional investors. Consequently, if these mega institutional investors establish a consensus regarding investment decisions in MENA debt markets, other investors in these markets may herd, either inadvertently or intentionally. This herding behavior is expected to be significant regardless of the market's current state.

6. Conclusion and Implications

The paper undertakes an examination of contagion and herd behavior in MENA's sovereign debt markets, along with an analysis of the determinants influencing MENA's sovereign risk pricing. The results affirm the presence of asymmetric investor behavior in the Egyptian, Algerian, Moroccan, and Tunisian debt markets, indicating herding or adverse herding effects and emphasizing the treatment of MENA debt assets as a singular category or class. A notable revelation is that significant movements in MENA's sovereign debt market over the past decade are not overtly linked to macroeconomic fundamentals. This underscores that the mispricing of sovereign risk in MENA stems from a discriminatory component within financial markets, relating to the perceived creditworthiness of MENA sovereign debt rather than differences in average macroeconomic fundamentals between MENA and non-MENA regions.

The analysis underscores the importance for MENA governments to exercise prudence in choosing debt financing options for national development strategies. The clustering of MENA bonds into a single asset class renders them highly susceptible to shifts in market sentiment. To mitigate this vulnerability, MENA governments are advised to enhance communication to raise international awareness about their country-specific fundamentals and economic reform progress. Lengthening the maturity structure of debt assets is recommended to reduce rollover risks, aligning better with the extended return profiles of infrastructure projects. Recent initiatives by countries to issue 30-year debt assets align with this strategy. Diversification of international lenders/investors is crucial for minimizing exposure to abrupt risks. Lastly, recognizing the tendency of investors to cluster MENA sovereign debt assets underscores the need for multilaterals to provide nuanced messages on MENA's debt situation, facilitating improved differentiation based on fundamentals.

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