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Transition Assessment of The Bangladeshi Financial Market Stress Regimes: A Markov Switching Modeling Approach

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Abstract: This study aims to assess the resilience of the Bangladeshi financial market by analyzing episodes of economic crises and identifying potential turning points that may lead to market distress. The research seeks to provide a detailed understanding of the vulnerable aspects of financial instability in Bangladesh and propose actionable recovery strategies. The study employs Hamilton's Markov Switching Model (1989), a standard methodology from business cycle literature, to construct financial market regimes and identify economic episode turning points in Bangladesh. The Markov Switching Modeling (MSM) approach is used to examine the transition period movements within the financial market, focusing on current financial episodes and the broader economic sector's dynamic movements. The analysis reveals significant economic vulnerabilities within the Bangladeshi financial market, with specific episodes of financial distress identified through the MSM approach. The findings highlight the cyclical nature of financial crises in Bangladesh and underscore the importance of early detection of economic turning points to mitigate market distress. The study concludes that Hamilton's Markov Switching Model is a valuable tool for forecasting financial crises in emerging markets like Bangladesh. The identification of turning points in economic episodes provides crucial insights into the timing and nature of financial distress, enabling policymakers to implement timely interventions. The implications of this research are significant for policymakers and financial institutions. By identifying early warning signals of financial stress, this study contributes to the development of strategies that enhance the resiliency of financial institutions and reduce the risks and costs associated with financial crises. The methodology and findings can be applied to other emerging markets facing similar vulnerabilities, providing a framework for proactive economic management.

Keywords: Markov Switching Model, Financial Regimes, Economic Distress, Transition Phases, Bangladesh

1. Introduction

According to Hamilton's (1989) introduction of Markov Switching Models (MSM) revolutionized the analysis of business cycles by enabling the identification of turning points and providing clear indicators of recessions. Over the past few decades, MSM has garnered substantial attention in economic and financial literature due to its robustness in capturing regime shifts and economic transitions. In the context of Bangladesh, where the financial sector is prone to economic shocks, the central bank has been actively involved in maintaining financial stability and preventing liquidity crises. However, the regulatory framework of the central bank requires continuous amendments to effectively respond to these financial vulnerabilities (Islam, 2020).

Bangladesh's financial institutions, particularly banks, have faced several economic shocks that have led to significant downturns, including bankruptcies and stock market declines. These challenges are exacerbated by factors such as political instability, trade imbalances, and a heavy reliance on foreign aid, making the country particularly vulnerable to global economic shifts (Mahmood & Islam, 2019). These economic vulnerabilities underscore the importance of understanding the transition periods within the financial regimes of the country. This study examines the financial crises and economic distresses encountered by the Bangladeshi banking sector, employing the Markov Switching Modeling (MSM) approach to analyze the period from 1998 to 2015. The study aims to describe the dynamics of financial regime shifts and identify the factors that contribute to economic vulnerabilities within the Bangladeshi financial market.

Moreover, the global financial crisis of 2008, which significantly impacted the real economy worldwide, exposed the fragility of financial institutions, including those in Bangladesh. This crisis highlighted the need for robust models that can provide early warning signals to policymakers, enabling them to implement preemptive measures to enhance financial resilience (Reinhart & Rogoff, 2009). The application of MSM in this research not only identifies business cycle turning points but also provides critical

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insights into the assessments of currency, banking, and financial crises in Bangladesh. These insights are crucial for designing policy interventions that can mitigate the adverse effects of economic downturns and ensure long-term financial stability (Rahman & Barua, 2021).

Through this approach, the study aims to propose remedies that should be undertaken by the government and policymakers to overcome periods of economic distress and enhance the stability of the financial market. This research contributes to the broader understanding of how developing economies like Bangladesh can navigate the complexities of globalization and financial liberalization, ensuring that they are better equipped to handle future financial crises.

2. Literature Review

The credit-to-GDP gap, often regarded as a key indicator of financial stability, was found to have no significant contribution to the likelihood of entering a financial stress regime during the out-of-sample period. This finding aligns with Gadea-Rivas and Perez-Quiros (2015), who similarly questioned the predictive power of this indicator. Abiad (2007) also explored the signalling capabilities of Markov Switching (MS) models during the Asian financial crises, comparing them to the outcomes of standard binary early warning models. Schularick and Taylor (2012) further emphasized the predictive power of MSM approaches in delivering precise statistical measures. Building on these works, the current study aims to examine both the low and high periods of financial market regimes, focusing specifically on the dynamics within the Bangladeshi financial market.

Gadea-Rivas and Perez-Quiros (2015) examined the role of credit in forecasting major recessionary episodes by assessing its impact on a business cycle's dynamic turning points. Similarly, this study explores several key forecasting indicators to predict the entry into and exit from financial market stress regimes, with an emphasis on understanding the chronological episodes that define these regimes.

Various MS models have been employed in the analysis of currency crises, though few have focused on banking crises. For example, Engel and Hakkio (1996) and Martinez-Peria (2002) investigated the European Monetary System currency crisis, while Cerra and Saxena (2002), Arias and Erlandsson (2004), and Brunetti et al. (2007) examined the South-East Asian currency crisis. In the realm of banking crises, Simorangkir (2012) focused on bank runs during the 1997-98 Asian banking crisis, while Hollo et al. (2012) concentrated on systemic economic and financial stress in Europe. Additionally, Duprey et al. (2015) studied financial market turmoil in EU countries. Using the MS-VAR model, Hartmann et al. (2013) demonstrated that major output responses to financial stress are far more pronounced with more severe negative collapses when regime switches are accounted for. However, none of these studies have thoroughly examined the determinants of key switching behaviours.

Filardo (1994) and Diebold et al. (1994) established the existence of time-varying movements in the Markov process, showing that the likelihood of transitions between regimes is significantly dependent on a set of key indicators that can effectively forecast the characteristics of cyclical dynamic fluctuations. Maria Afreen (2020) contributed to this field by forecasting financial distress within the broader economic context, particularly concerning banking volatility, through early warning systems and filtering tools. Thibaut and Benjamin (2017), along with Romer and Romer (2015), also utilized the MS model to create predictive indicators aimed at recovering from financial vulnerabilities.

3. Methodology

The Markov Switching Model (MSM), introduced by Hamilton (1989), is one of the foremost nonlinear models for time series analysis. It incorporates multiple structures (equations) corresponding to different regimes, which are consistent with the behaviour of time series data. The MSM model is particularly notable for its ability to capture complex dynamic patterns by allowing for regime switching. This switching mechanism follows a unique feature—namely, the first-order Markov chain—which is regulated by an unobservable state variable (Kuan, 2002). In essence, the Markovian structure of MSM suggests that the model's behaviour depends on its immediate past state, which in turn determines the current state of the variable.

This stands in contrast to the random switching model proposed by Goldfeld and Quandt (1972), where the switching is independent over time. The MSM model differs from models of structural change by allowing for frequent changes at random time points, as opposed to the occasional changes induced by exogenous variables in the latter. The MSM is particularly well-suited for describing correlated data across different time periods, as it can exhibit distinct dynamic patterns.

Consider a simple switching model involving two autoregressive (AR) specifications, where sts_tst is an unobservable state variable for the variable ztz_tzt, taking the value of either 1 or 0:

$$z_t = \begin{cases} \alpha_0 + \beta z_{t-1} + \varepsilon_t, & s_t = 0 \\ \alpha_0 + \alpha_1 + \beta z_{t-1} + \varepsilon_t, & s_t = 0 \end{cases} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where $|\beta| < 1$ and ε_t are random variables with mean zero as well as variance σ_ε^2. This is a stationary AR(1) process with the value of mean $\alpha_1/(1-\beta)$ when $s_t = 0$ and it switches to another stationary AR(1) process possessing mean $(\alpha_0 + \alpha_1)/(1-\beta)$, when s_t changes from 0 to 1. Then provided that $\alpha_1 \neq 0$, this model admits at different levels two dynamic structures with regard to the state variable s_t, depending on the value. In this case, $z_t$are governed by distinct means by two distributions and s_t identifies the switching between those two distributions or regimes (Augustyniak, 2014).

In this study, an MSM was developed where the latent specific variable in a sovereign economy controls the sequential shift regime of periods that are endogenously determined. The model in this specific form can be considered parsimonious, meaning that tests for endogenous switching could be framed as simple parameter restrictions. Turner, Startz, and Nelson (1989) explained that the parameters of the MSM can be estimated through maximum likelihood estimation (MLE) with minor modifications to the recursive filtering process. Monte Carlo experiments suggest that MLE performs well in estimating the parameters of endogenous switching models and in testing for endogeneity.

This research visualizes the transitional phases of the Bangladeshi economy's financial episodes through graphical figures based on variables related to banking and financial sector volatility and profitability indicators. The dependent variable selected is the return on equity (RoE). Similar research methodologies have been employed by previous authors, such as Maria (2020), who constructed indicators to forecast financial distress through early prediction of volatility. Using these variables, the study constructs transitional turning point movements of financial episodes from the perspective of Bangladeshi economic vulnerability, as shown in Figure 1. This framework can assist policymakers in predicting future economic shocks by measuring phases of financial market stress or eventual regime shifts.

4. Results / Analysis

The linearity of traditional models often fails to capture the asymmetric features inherent in financial market cycle fluctuations. In contrast, the Markov Switching Model (MSM) offers an appealing framework for addressing the non-linear dynamics present in contemporary financial market cycles. Hamilton's (1989) regime-switching model was initially developed to allow the mean of output growth to evolve according to a two-state Markov switching process. This model enables the differentiation between expansion and contraction phases, thus providing a moderate reflection of the stylized facts of modern financial market cycles. Similar research approaches have been undertaken by authors in previous studies (e.g., Maria, 2020) to predict vulnerabilities as determinants of crises.

The significant specification of the distinguished MSM model comprises two states with a primary regressor (C) and additional non-AR switching requirements. By assuming common error variance across regimes, it is presumed that the regressor constant named C is the most noteworthy due to its time-invariant nature, contributing to significant transition probability between regimes.

Based on the empirical findings (Table 1), the MSM-AR(4) model reveals that the transition probability of a recession, as analyzed through the financial episodes of the AR(4) model, is statistically significant overall. The model's initial aim is to characterize financial market cycle fluctuations into distinct regimes, observing the likelihood of regime switching over the examined period from 1998 to 2015. The MSM-AR(4) model is moderately appropriate for illuminating the financial market cycles in Bangladesh. The analysis indicates that recession phases are generally steeper and shorter than expansionary phases, which is consistent with the characteristics of the Bangladeshi financial market. According to the historical financial market cycle profile of Bangladesh, the duration of recessionary periods has been moderately longer than expansionary phases. The log-likelihood ratio statistics from the model also support the acceptance of the MSM-AR(4) model in a moderate manner.

Figure 1 depicts the smoothed probability of a recession derived from the MSM-AR(4) model. The analysis shows that past Bangladeshi financial market cycles, or macro-prudential cycles, had four notable recessionary episodes predicted to occur in 2002M10, 2007M03, 2010M08, and 2012M08. The corresponding troughs were marked at 2002M10, 2007M12, 2010M06, and 2012M12, respectively. These predicted recessionary phases correspond well with the historical financial market cycle chronology of Bangladesh. The results of the turning point analysis reveal that the MSM model identified eight major turning points corresponding to two significant episodes (peak and trough) in the Bangladeshi financial market cycle.

Table 1: Parameter Estimates of Hamilton's (1989) Markov-Switching Model

Variable	Coefficient	Std. Error	z-Statistics	Prob.
		Regime 1		
C	-25.94	117.49	-.2208	0.8252
LOG(SIGMA)	1.307	0.061	10.89	0.0000
		Regime 2		
C	-0.25.91	2138.32	-0.22	0.825
LOG(SIGMA)	-2.66	0.0691	-43.39	0.0000
		Common		
AR(1)	2.21	0.0857	25.85	0.0000
AR(2)	-0.814	0.2523	-3.22	0.0012
AR(3)	-1.088	0.2519	-4.32	0.0000
AR(4)	0.687	0.0854	8.04	0.0000
		Transition Matrix Parameters		
P11-C	1.17	0.65	1.79	0.073
P21-C	-3.55	0.52	-6.85	0.00
		Log Likelihood: 142.56		

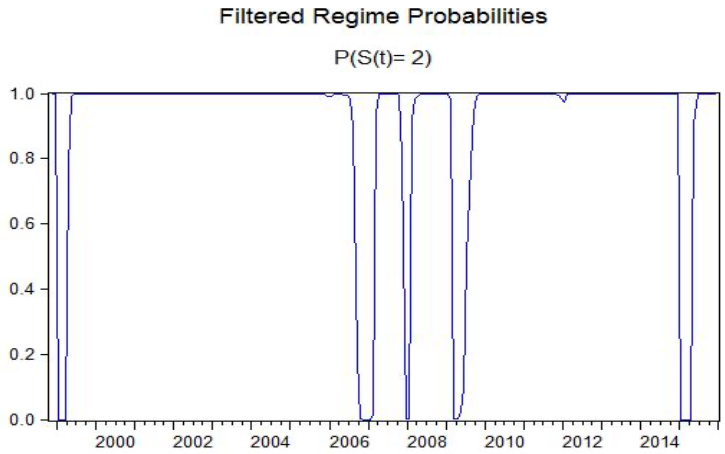

Figure 1: Smoothed Probability of Financial Episodes (1998-2015) for the Bangladeshi Banking Economy.

Although the MSM-AR(4) model offers a reasonably moderate depiction of financial market cycle fluctuations in Bangladesh, the univariate MSM-AR(4) model suggests that the recession duration is relatively shorter compared to the real financial market cycle in Bangladesh. Thus, a limitation of the univariate MSM framework is its inability to capture the comprehensive information needed to characterize the broad-based fluctuations in a country's general macroeconomic activity. This finding supports the view that Hamilton's conventional univariate MSM framework may be less effective for financial market cycle analysis, especially when monthly observations are considered.

5. Discussion

The analysis reveals that non-performing loans (NPL) and the minimum capital asset ratio are critical indicators that signal a transition toward a high regime of financial stress within Bangladesh's financial market. Conversely, prudential parameters indicate a shift towards greater stability within the macroeconomy. The in-sample assessment confirms the ability of these indicators to provide early warning signals well in advance of regime shifts, sometimes several quarters before a change occurs. Out-of-sample results further validate the model's performance, particularly during periods of global economic and financial crises.

Maria Afreen (2020) utilized dynamic tools to describe financial crises in the economic sector, demonstrating the efficacy of such approaches. The Markov Switching (MS) model enhances traditional early-warning models by identifying a more suitable set of key indicators and detecting significant episodes of financial stress. This research extends the utility of the MS model by demonstrating its superior predictive performance compared to traditional early-warning models. Specifically, the MS model significantly outperforms other model specifications in assessing financial stress episodes within the Bangladeshi financial market, particularly during periods of transition.

The findings suggest that incorporating the MS framework into financial monitoring practices can significantly enhance the ability to anticipate and manage financial stress. This is especially relevant for emerging economies like Bangladesh, where financial markets are more vulnerable to external shocks. The MS model's ability to identify regime switches and provide early warnings offers valuable insights for policymakers, enabling them to implement timely interventions that can mitigate potential crises. This study underscores the importance of using advanced econometric models, such as the MS, to better understand and navigate the complexities of financial market cycles in developing economies.

In other emerging markets, such as those in Southeast Asia, Latin America, and Sub-Saharan Africa, the application of the MS model to predict financial stress has also shown promising results. For example, studies in Southeast Asian economies—characterized by similarly volatile financial markets—demonstrate that the MS model can effectively capture financial stress cycles, as evidenced during the Asian financial crisis (Simorangkir, 2012; Arias & Erlandsson, 2004). These studies highlight that the predictive power of the MS model is not confined to advanced economies but also extends to emerging markets, which often experience more frequent and severe financial shocks.

In contrast, in developed economies such as the United States and Western Europe, MS models have been employed to analyze and predict recessions and financial stress with a generally higher degree of accuracy. This is largely due to the more stable and mature financial systems in these regions (Engel & Hakkio, 1996; Martinez-Peria, 2002). The variation in model performance between developed and emerging markets can be attributed to structural differences in these economies, including the robustness of financial institutions, regulatory environments, and the availability of high-frequency data.

This comparison indicates that while the MS model is a powerful tool across various contexts, its effectiveness can be influenced by the specific characteristics of the financial systems in different economies. Emerging markets,

with their unique challenges and greater susceptibility to external shocks, may benefit significantly from the application of the MS model as part of their financial monitoring and crisis management strategies.

6. Concluding Remarks

The Markov Switching (MS) model has proven to be a robust tool for constructing early-warning systems that can effectively predict economic episodes leading to financial stress in a country's economy. The results from this study underscore the model's ability to identify crucial financial turning points, offering a significant advantage in terms of predictive power. This capability is essential for policymakers, who can leverage these insights to forecast potential economic shocks and implement preemptive measures, thus mitigating the risks associated with financial distress. The graphical representation of the transition function within the MS model, as presented in this research, demonstrates its practical application in identifying and addressing vulnerabilities in financial markets..

7. Limitations And Future Recommendations

While the MS model offers substantial advantages, it also presents certain limitations, particularly in the complexity of its estimation process, especially when incorporating time-varying transition probabilities. The model, as originally developed by Hamilton (1989), distinguishes between different economic states by analyzing continuous dependent variables, which accurately reflect the magnitude of financial crises. However, the MS model does not predetermine the timing of crisis episodes. Instead, it deduces the chronological probability of a specific state and the likelihood of episode transitions, effectively capturing regime shifts as part of a hidden Markov chain. This allows for a detailed and nuanced analysis of dynamic turning points in financial cycles.

Conventional early-warning systems may struggle to produce consistent results, especially when dealing with the complexities of global financial crises. In contrast, the MS model delivers more reliable outcomes, particularly in the context of identifying and responding to such crises. Markov Switching models have been widely utilized in business cycle literature to pinpoint turning point dynamics and accurately date recessions. In scenarios where appropriate continuous measures are lacking, smoothed probabilities of regime transitions offer a valuable method for documenting financial episodes, particularly in the Bangladeshi financial sector, with specific reference to currency, banking, and financial volatility.

Policymakers can greatly benefit from these methodologies, which enhance the resilience of financial institutions by providing early warning signals. This, in turn, can significantly reduce the risks and costs associated with financial crises, ensuring more stable economic growth and better preparedness for future financial disruptions.

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