Spectral Analysis of Secondary Market Mexican External Debt Prices

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ABSTRACT

The secondary market for developing country debt currently is one of the fastest growing segments of the fixed income securities market. This paper examines the spectral properties of secondary market Mexican external debt price variations from January 1986-December 1992. The analysis presented in this paper suggests that the secondary market for Mexican external debt may be characterized by the "random-walk with drift" model. Moreover, large (small) spectral density estimates at high (low) periodicities suggest that secondary market price variations were positively autocorrelated and aperiodic in nature, although there is some evidence to suggest the possible presence of short-period harmonic resonances. Cross-spectral analysis of the relationship between the 10-year U.S. Treasury bond interest rate and secondary market Mexican external debt prices appears to verify the theoretical relationship between market determined interest rates for default-free, dollar denominated debt and secondary market debt prices. More importantly, estimated phase-lag relationships suggest that the secondary market for Mexican external debt probably was inefficient at the semi-strong level.

THE SECONDARY MARKET FOR DEVELOPING COUNTRY DEBT1

The formidable external debt burden of many developing countries has been the subject of intense analytical scrutiny since 1982 when Mexico suspended principal repayments on its official international commercial bank debt. This event marked the onset of what came to be known as the international debt crisis.2 Largely in response to the promulgation of debt-for-equity swaps offered by debtor countries to reduce dollar-denominated foreign commercial bank debt, which was preceded by commercial banks' portfolio adjustment and widespread dumping of debt paper, an active secondary market for developing country debt evolved.

In order to avoid the chronic rescheduling episodes that plagued the debt management process, large money-center commercial banks began around 1986 to securitize developing country loans into more easily tradable bonds. The resulting sharp increase in trading volume was given additional impetus in March 1989 when U.S. Treasury Secretary Nicholas Brady announced that financial support from multinational institutions and the government of Japan would be mobilized to negotiate reductions in loan principal and debt service. The "Brady Plan" called on the World Bank and the IMF to make loans that would enable debtor governments to negotiate debt-reduction agreements with commercial banks. With these funds as collateral, debtors could exchange their debt to foreign commercial banks at a discount for new bonds or at par for bonds carrying reduced rates of interest, or both. Many of these loans were converted into "Brady bonds" in which the principal was secured by zero-coupon U.S. Treasury bonds. Despite the fact that a significant portion of developing country debt was "restructured" into bonds backed by the U.S. Treasury guarantees, secondary market prices continued to be characterized by extreme volatility.

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EFFICIENT CAPITAL MARKETS

There is a substantial body of literature on the relationship between asset yield and market efficiency. The literature identifies three levels of market efficiency (weak, semi-strong, and strong) and is concerned with specific assumptions about the information set available to investors and the manner in which market prices are established. Numerous studies in the 1960s [Fama, 1970] tested market efficiency at the "weak" level, which posits that variations in contemporaneous securities prices fully reflect all information implied by prior price movements. In weakly efficient markets, current prices respond instantaneously and without bias to new information, which implies the absence of price regularities with prophetic significance. Markets that are weakly efficient may be described by the process

\[ P_t - P_{t-1} = \xi_t \]

where \( P_t \) is the market price in period \( t \), and \( P_{t-1} \) is the price in period \( t-1 \). The random error term \( \xi_t \) is sometimes referred to as "white noise," where \( E(\xi_t) = 0, \ E(\xi_t \xi_{t-1}) = 0 \). Equation (1) is known as a "random walk" model. It says that the best estimate of the current price of a security is the price that prevailed in the previous period. A variation of this process is

\[ P_t - P_{t-1} = \zeta + \xi_t \]

where \( \zeta \) is a constant parameter. This model is known as a "random walk with drift."

"Semi-strong" tests for market efficiency are concerned with whether securities prices efficiently adjust to all publicly available information. In other words, the semi-strong version of the efficient markets hypothesis contends that securities prices cannot be predicted on the basis of other economic time series. Finally, "strong" tests for market efficiency contend that securities prices cannot be predicted on the basis of any information, whether proprietary or public. Markets that are efficient at the strong level preclude the possibility of predicting future securities prices even on the basis of "insider" information.

An area of particular interest to economists and financial analysts concerns the underlying dynamic processes of the secondary market for developing country debt. Webster and Bhat [1993] and Webster [1994; 1995], for example, have examined the efficiency of the secondary market for developing country debt and the possibilities of earning "above average" returns. The purpose of this paper is to examine the spectral properties of monthly secondary market Mexican external debt price variations during the period January 1986-December 1986 (84 observations). The paper also investigates the presence of "weak-level" efficiency in the secondary market for Mexican external debt, and briefly discusses the possibility of market efficiency at the semi-strong level by examining the cross-spectral properties of secondary market prices with 10-year U.S. Treasury bond interest rates.

SPECTRAL ANALYSIS

In their seminal study on the application of spectral analysis to economic phenomena, Granger and Morgenstern [1963] investigated the presence of weak-level efficiency in New York stock market prices. Spectral analysis is a statistical technique for detecting regular cyclical patterns, or periodicities, in time series data. Spectral analysis attempts to discriminate between components of the total variance recurring at regular intervals from those due to random fluctuations ("white noise"). The estimated components at each frequency (spectral density estimates or power spectrum of the series) are then used to examine the underlying dynamic properties of a time series.