

Market Inefficiencies during Currency Crises: Further Evidence

This paper examines patterns of irrational pricing of securities before and after currency crises in emerging markets. We first profile closed-end country funds and explain their normal price behavior. We then examine discounts between the market price of closed-end country funds traded on the New York Stock Exchange (NYSE) and the net asset value (NAV) of the underlying stocks in the case of Mexico, Thailand and Malaysia during their respective currency crises in 1994 and 1997. We note that during the period immediately preceding currency devaluations there was an abnormal reduction in the discount at which the closed-end funds trade. This implies that investors who participated directly in the emerging markets concerned correctly anticipated these currency crises and adjusted their portfolios accordingly, which was not the case for closed-end fund investors. We complement the findings of SCHMUCKLER and FRANKEL (1996), who examined the Mexican crisis of 1994 and show that the same pattern occurred in Thailand and Malaysia in 1997.

During the period immediately after the respective devaluations, we find that the price of closed-end funds maintained a high premium over NAV – one

that cannot be entirely explained by fundamentals such as currency risk, liquidity factors or direct market accessibility. If this pattern persists in other currency crises, a sharp decrease in the discount between the price of a closed-end fund and its underlying NAV implies that an abnormality exists in the market, creating an arbitrage opportunity.

1. Price Behavior of Closed-End Country Funds

Closed-end country funds are investment vehicles designed to hold securities traded in specific national equity markets, with shares in the funds themselves traded on major stock exchanges such as the NYSE. The initial number of shares that closed-end funds issue does not change over time, so that there is a fixed relationship between the local market value of all the securities that such funds hold and the market value of their own shares at prevailing exchange rates – i.e., the NAV of a given fund represents the aggregate local market value of the securities it holds converted to U.S. dollars at the market exchange rate divided by the number of fund shares outstanding. In an efficient market the NAV and the closed-end fund share price should be identical.

However, LEE, SHLEIFER and THALER (1991) have observed that, on average, closed-end funds

* Stern School of Business, New York University. Helpful comments by William Greene, Richard Levich and Heinz Zimmermann are gratefully acknowledged.

start trading at a premium to their respective NAVs and that eventually the premium turns into a discount which varies over time. Together with HARDOUVELIS, LA PORTA and WIZMAN (1994), they point out that country funds are more likely to be held by small-scale foreign investors while the underlying shares that go to make up the NAV are likely to be held by better-informed domestic investors in local markets and by and foreign institutional investors. Therefore, the typical discount to NAV may reflect the asymmetric information and differences in expectations of these two groups of shareholders.

One reason for the typical discount at which closed-end country funds tend to trade is that their NAV may be overstated because the underlying securities they hold have been withdrawn from the local trading market and shrink the supply. However, this factor is unable to fully explain the total discount at which the closed-end funds trade. Liquidity considerations, differing investor expectations and market inefficiencies may explain the rest of the discount, as may friction costs of converting the local-currency NAV into US dollars. This component is usually negligible, but may become important during currency crises when the volatility of the exchange rate rises dramatically. This would tend to elevate the market price of closed-end country funds relative to NAV.

2. Empirical Findings

We now examine the behavior of the difference between the NAVs of closed-end emerging market equity funds and their market prices in crisis situations – Mexico in 1994 and Malaysia and Thailand in 1997.

2.1 Mexico

We analyze the behavior of the price the Mexican Fund (MXF) – closed-end fund traded on the

NYSE that has as its objective investment in securities of publicly traded Mexican firms – in terms of the relationship between the NAV and the price of the fund from 1991 to 1996. As shown in Figure 1, MXF traded at a discount to NAV during 1994, but the discount dropped substantially during the second week of December 1994.^[1] Our finding is identical to that of SCHMUCKLER, FRANKEL et al. (1996) and implies that investors in the local market became pessimistic well before investors in the country funds.

To demonstrate that the decline in the MXF discount during December 1994 was not coincidental, we examine the time-series of the relationship between the price of the fund and its underlying stocks. We find that the series structurally changed during December 1994, and followed a different behavior after Mexico's devaluation. This indicates that the shock, which caused the discount to shrink before the devaluation of December 20, 1994, cannot be explained by the time series alone.

We first analyzed the weekly difference in the logarithm of the price of the MXF and the logarithm of the NAV. To eliminate the trend in the series and reject non-stationary based on the correlogram and partial-correlogram, we use the first difference of the series. We then fitted ARIMA models based on the lowest AKAIKE Information Criterion Corrected (AICC) for different periods to detect structural changes in the series. We considered the series from February 10, 1994 to December 8, 1994 and compared the results to the analysis of the same series ending in December 15, 1994. We find that during the second week of December 1994 the structure of the series changed from a Moving Average (MA) of order 1 to an Autoregressive (AR) model of order 1. This implies that the regular movement of the series cannot explain the shrinkage in the discount between the price of the fund and the NAV before the currency devaluation.

Following the devaluation, the MXF traded at a premium to its NAV, which reached levels as high as 20% in March of 1995. There appears to be no economic reason for such a premium, which

Figure 1: The Mexican Fund (MXF)

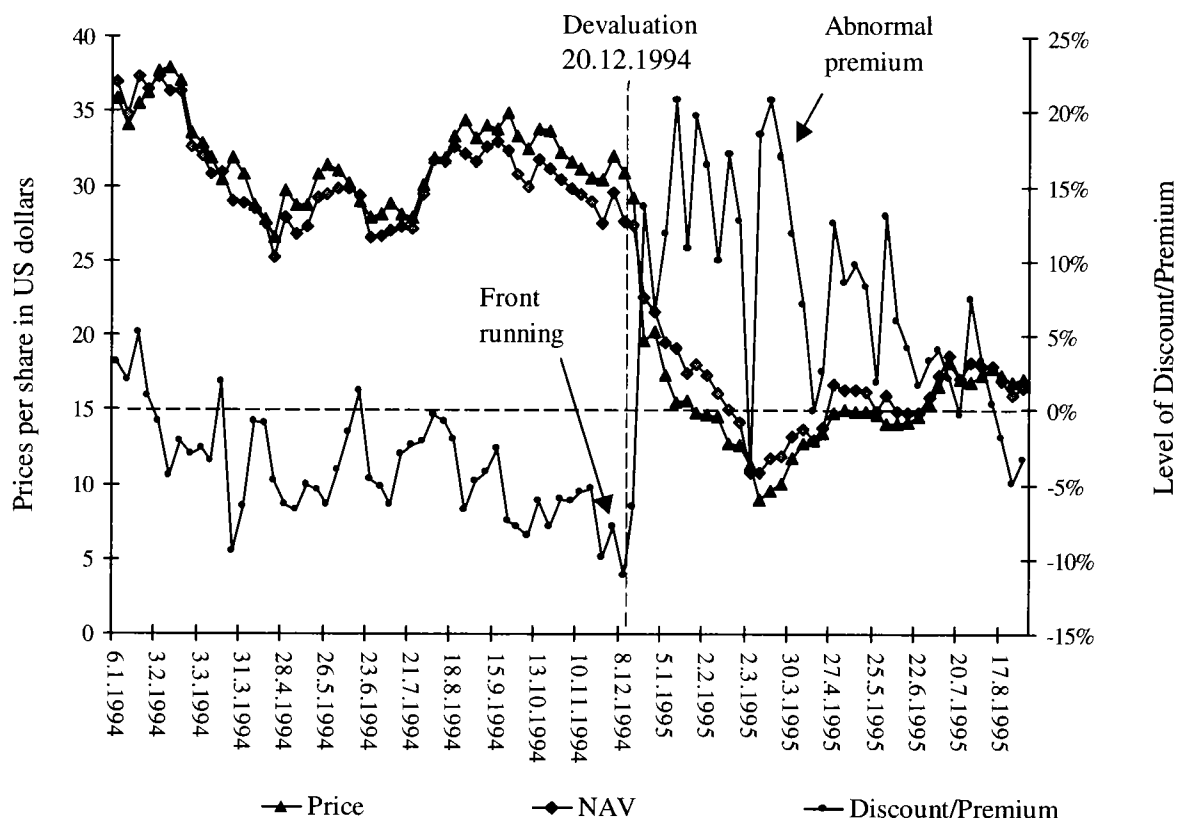


Table 1: The Mexican Fund – Time Series Properties of the Relationship between the Price of the Fund and its Underlying Stock

| Beginning of the series | Ending of the series | Model | Coefficient | Standard deviation | T-Value |
|-------------------------|----------------------|---------------|--------------|--------------------|---------|
| 2/10/94 | 12/8/94 | ARIMA (0,1,1) | MA (1) .7439 | .1094 | 6.80 |
| 2/10/94 | 12/15/94 | ARIMA (1,1,0) | AR (1) .8801 | .0863 | 10.20 |

seems to have been created by market inefficiencies. Possible reasons include the difference in expectations between MXF investors and investors in the local market. The hypothesis is that the underlying share prices declined more than the price

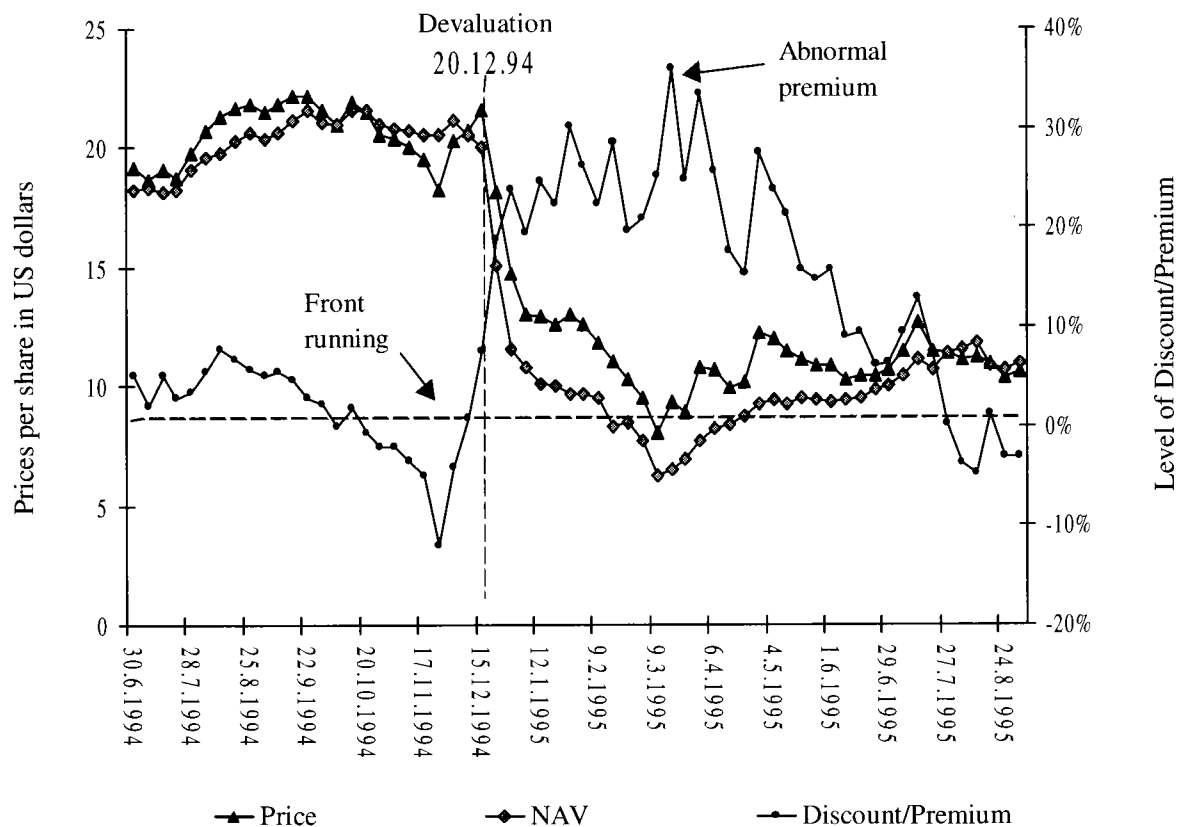
of MXF because some investors in the local market previously had sold Mexican securities – possibly foreign institutional investors who would soon have to disclose their holdings, with the likelihood that the market would penalize them due to

the high perceived risk associated with Mexico at the time – which drove prices down. Another factor may have been that many local investors were likely to run into solvency problems as a result of the crisis, and therefore had an incentive to move funds out of Mexico to increase their “bankruptcy option“.[2] At the same time, the view that the premium at which MXF was trading relative to its NAV was caused by optimism on the part of MXF investors seems difficult to sustain in the light of a dramatic decline in the Bolsa from January to March of 1995. Regardless of the reason, investors who held MXF during the period were effectively paying a significant premium relative to its NAV – see Figures 1 (MXF) and 2 (MXE).

The existence of an active futures market for the Mexican peso on the Chicago Mercantile Ex-

change after March 1995 eliminated the currency advantage of holding MXF instead of the underlying shares. To analyze whether the currency friction could explain the MXF premium that existed from December 1994 to March 1995 we sum the daily-expected depreciation of the peso to the expected transfer risk of exchanging pesos into dollars. This can be approximated by the spread between dollar-denominated Mexican government debt over U.S. Treasuries. The expected depreciation rate per annum is the spread between U.S. Treasuries and peso-denominated government debt.[3] We conclude that currency friction cannot explain the premium, because with daily liquidity it was never above .2% and therefore insignificant compared to the observed MXF price premium.

Figure 2: The Mexican Equity and Income Fund (MXE)



2.2 Thailand

We analyze the behavior of the Thai Fund Inc. (TTF) – a closed-end fund traded on the NYSE that has as its objective to invest in publicly traded Thai equities and baht denominated debt – from 1995 to the first quarter of 1998. We examine the relationship between the market price of TTF and its NAV. As shown Figure 3, TTF traded at a small premium until April 1997.[4] During the second week of June 1997 the premium rose in the wake of the Thai devaluation of July 2, which

implies that investors in the local market became pessimistic well before investors in TTF. We again analyze the time-series relationship between the price TTF shares on the NYSE and the underlying stocks. We find that the series structurally changed during the third week of June 1997, which indicates that the shock that caused the rise in the premium before the July 2 devaluation cannot be explained by the time series.

We applied the same statistical methodology that we used to analyze the MXF. We also used the

Figure 3: The Thai Fund (TTF)

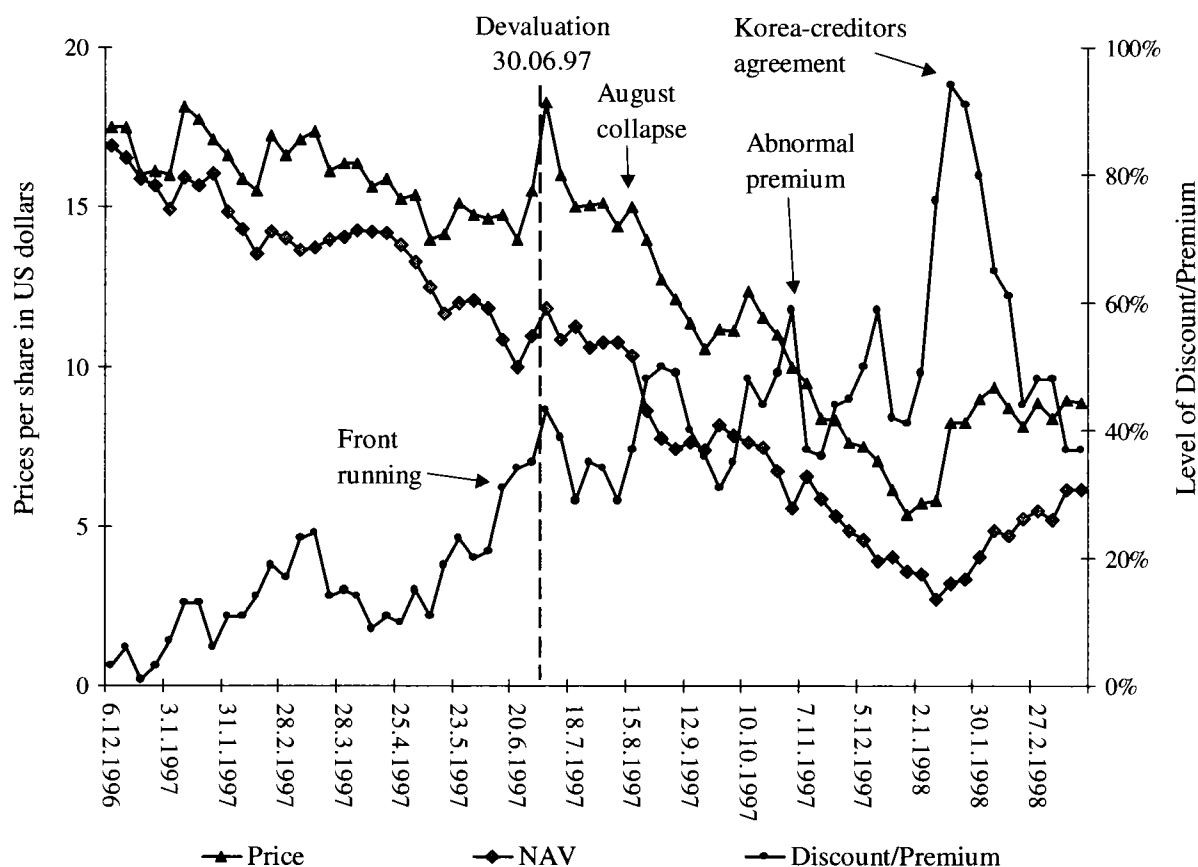


Table 2: The Thai Fund – Time Series Properties of the Relationship between the Price of the Fund and its Underlying Stock

| Beginning of the series | Ending of the series | Model | Coefficient | Standard deviation | T-Value |
|-------------------------|----------------------|---------------|---------------|--------------------|---------|
| 5/15/96 | 5/28/97 | ARIMA (1,1,0) | AR (1) -.3635 | .1412 | -2.57 |
| 5/15/96 | 6/13/97 | ARIMA (0,1,1) | MA (1) .3231 | .1406 | 2.30 |

first difference on the logarithmic discount between the TTF price and the NAV. We analyzed the weekly series from May 15 1996 to May 28 1997 and compared the results to the analysis of the same series ending on June 13 1997. We find that during the first two weeks of June 1997 the structure of the series changed from an AR (1) to an MA (1) model. This finding leads us to reject the hypothesis that the regular movement of the series can explain the increase in the premium before the devaluation of the baht.

In contrast to the Mexican case, the Thai markets rebounded after the July devaluation of the baht on the expectation that Thailand would reform its financial sector and move rapidly toward solution of its structural problems. These expectations proved to be premature, and the Thai market collapsed in August 1997. Between the devaluation of July 2 and the market collapse that started during the third week of August, the premium between the NAV and the market price of TTF increased to 37%, which suggests the presence of asymmetric information on the part of local and foreign institutional investors in the Thai market.

After the August collapse of the Thai market, TTF traded at a substantial and volatile premium to its NAV, which reached levels as high as 59% in 1997 and 94% in 1998 – see Figure 3. There appears to be no economic reason for the substantial premium, which may instead have been caused by market inefficiencies. As in the Mexican case, the

premium seems attributable to differences in expectations between the investors in TTF and investors in the local market. In contrast to the Mexican case, however, in the case of Thailand we cannot reject the possibility that the premium of the fund was caused by optimism, since there were positive developments in Thailand before the mini-crash of the NYSE and the onset of the Korean crisis in October 1997. These plus the continuing problems in Japan's financial system may have had an important impact on the difference in expectations between the investors in the local market and the investors in TTF – notably related to the added uncertainty associated with economic prospects of Asia as a whole. The effects on the Thai market became very evident during January 1998, when expectations about a deal between Korea and its creditors caused the premium between the price of the TTF and its underlying shares to reach 94%. Regardless of the reason for the premium, investors that held TTF were holding a portfolio that was dominated by a portfolio of the underlying shares.

To analyze whether the currency friction explained part of the premium on TTF shares from June 1997 to March 1998, we sum the daily expected depreciation of the baht to the implied transfer risk of exchanging bahts into dollars using the same methodology as in the Mexican case above, and reject the hypothesis that the friction costs explain the premium.

2.3. Malaysia

Finally, we analyzed the behavior of the price of the Malaysia Fund Inc. (MF), a closed-end fund traded on the NYSE that has as its stated objective investment in publicly traded Malaysian equities and ringgit-denominated debt, from 1996 to 1997. We again examine the relationship between its NAV and the NYSE price of the fund. As shown in Figure 4, the MF traded at a discount to its NAV during 1996 and the first two quarters of 1997. The discount started to decline substantially and turned into a premium during the second week of August 1997, several weeks before the full development of the Asian crisis. As in the Mexican and the Thai cases, this finding implies

that investors in the local markets became pessimistic well before MF investors.

We again analyze the time series relationship between the price of the Malaysia Fund and the underlying stocks, and find that the series changed structurally during the first week of August 1997 – indicating that the shock causing the discount to shrink before the currency meltdown at the end of August cannot be explained by the time series.

We used the same statistical methodology that we used to analyze the MXF and the TTF. We also used the first difference on the logarithmic discount between the MF price and the NAV. We analyzed the weekly series from July 5 1996 to July 4 1997 and compared the results to the analysis of the same series ending on July 18 and

Figure 4: The Malaysian Fund Inc. (MF)

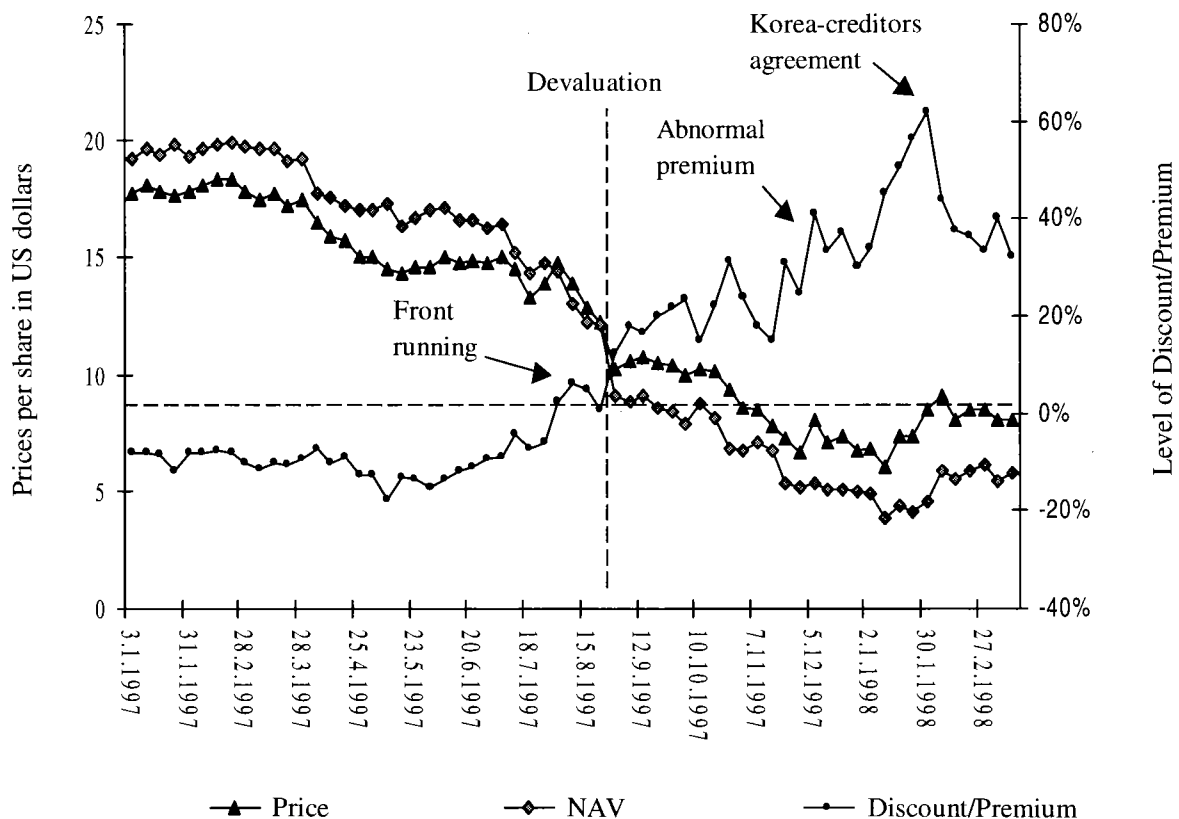


Table 3: The Malaysian Fund Inc. – Time Series Properties of the Relationship between the Price of the Fund and its Underlying Stock

| Beginning of the series | Ending of the series | Model | Coefficient | Standard deviation | T-Value |
|-------------------------|----------------------|---------------|---------------|--------------------|---------|
| 7/5/1996 | 7/4/97 | ARIMA (1,1,0) | AR (1) –.3680 | .1286 | –2.86 |
| 7/5/1996 | 7/18/97 | ARIMA (1,1,0) | AR (1) –.3770 | .1276 | –2.95 |
| 7/5/1996 | 8/18/97 | White Noise | | | |

August 8 of the same year. We find that between July 18 and August 8 the structure of the series changed from an AR (1) model to white noise, given that the model that was best was an ARIMA (1,1,0), although the t-value of the coefficient was not statistically significant. This finding leads us to reject the hypothesis that the regular movement of the series can explain the discount turning into a premium before the depreciation spiral of the ringgit that started at the end of August.

After the August currency meltdown, the MF traded at a premium to its NAV, which reached levels as high as 40% in December 1997 and 60% the following January. As in the Mexican and Thai cases, we contend that there is no economic reason for such premium, but that instead it was the result of market inefficiencies. A portfolio that held the MF at a premium was dominated by one holding the underlying shares. To once more analyze whether currency friction could explain the premium on the MF for the period after the ringgit devaluation we use the same methodology employed in the Mexican and Thai cases to reject the hypothesis that currency friction explains the premium.

3. Conclusions

Before and during currency crises there appear to be market inefficiencies that arise and that could allow traders to profit. As observed in the three

cases considered here, direct participants in the respective local markets evidently were able to foresee the crises before investors in the closed-end country funds, causing a significant price discrepancy between the closed-end country fund shares and their respective underlying shares. The investors who dominate the local markets are nationals of the countries concerned and large international funds, while the country-fund investors are foreign nationals and smaller managed mutual funds. The finding that the NAV declined well before the price of the closed-end funds suggests asymmetric information in favor of the direct participants in the local markets, acted-upon under crisis conditions to reduce exposure to those markets and driving closed-end fund prices to a premium. This premium creates an arbitrage opportunity, which will tend to fade as normal country-fund discounts to NAV reappear after the impact of currency crisis ebbs.

Footnotes

- [1] The behavior that the Mexican Equity and Income Fund (MXE) had prior to the devaluation is the best example of asymmetric information, but because SCHMUCKLER and FRANKEL et al. show that the MXF has some causality effects in relation to the MXE we did not use it as the anchor of our argument.
- [2] The bankruptcy option is the value of the option to pay a creditor less than the face value of its claim in light of the possibility of seeking bankruptcy protection in the courts.
- [3] We used the 90-day maturity in all securities. In the Mexican issued debt we used the CETE for peso denominated and the TESOBONO for dollar denominated debt.
- [4] TTF traded at a small discount during 1995 and the beginning of 1996. The discount then turned slowly into a small premium. The premium implies that investors in the local markets were less optimistic than the investors in the fund. But since the change occurred slowly and the small premiums can be explained by the fact that the Thai market is difficult to access for small investors, we reject the notion that the change in expectations was directly related to the devaluation of the baht in June of 1997.

References

- AGENOR, P. R. and J. AIZENMAN (1991): „Contagion and Volatility with Imperfect Credit Markets“, National Bureau of Economic Research Working Paper 6080.
- DE LONG, J. B., A. M. SCHLEIFFER, L. A. SUMMERS and R. WALDMANN (1990): „Noise Trader Risk in Financial Markets“, *Journal of Political Economy*, Vol. 98, no.4, pp. 703–738.
- DOOLEY, M. P., E. FERNANDEZ-ARIAS and K. M. EDWARDS, S. (1997): „The Mexican Peso Crisis: How Much did we Know? When did we know it?“, National Bureau of Economic Research Working Paper 6334.
- HARDOUVELIS, G. A., R. LA PORTA and T. A. WIZMAN (1994): „What Moves the Discount on Country Equity Funds?“, National Bureau of Economic Research Working Paper 4571.
- KLETZER (1994): „Recent Private Capital Inflows to Developing Countries: Is the Debt Crisis History?“, National Bureau of Economic Research Working Paper No. 4792.
- LEE, C. M. C., A. SCHLEIFER and R. THALER (1991): „Investor Sentiment and the Close-End Fund Puzzle“, *Journal of Finance*, Vol. 46, No.1, pp.75–109.
- ROUBINI, N. (ed.) (1998): „Chronology of the Asian Currency Crisis and its Global Contagion“, Web page at www.stern.nyu.edu/~roubini/asia/AsiaChronolgy.html.
- SCHMUCKLER, S. and J. FRANKEL, (1996): „Country Fund Discounts, Asymmetric Information and the Mexican Crisis of 1994: Did Local Residents Turn Pessimistic Before International Investors?“, National Bureau of Economic Research Working Paper 5714.