

E NET ASSET VALUE TRIGGERS AS EARLY WARNING INDICATORS OF HEDGE FUND LIQUIDATION

Hedge funds are flexible and relatively unconstrained institutional investors, which may also use leverage to boost their returns. This investment freedom and their ability to leverage can pose risks for their creditors and trading counterparties, who need to safeguard their credit exposures. Triggers based on the cumulative decline in the total net asset value of a fund are frequently used by banks to protect themselves against credit losses stemming from hedge fund failures. An empirical examination of the indicator properties of such triggers as early warning signals of impending hedge fund liquidation finds that they are not very precise in detecting future problems. Nonetheless, they still provide opportunities for banks to review the risk profiles of the hedge funds they are exposed to, thereby allowing them to take necessary protective action against risks.

INTRODUCTION

Banks' trading agreements with hedge fund clients include various risk management and mitigation measures including the specification of termination events, which, if they occur, allow them to terminate trades outstanding and seize the collateral held. These events will also often trigger termination rights that cut across all agreements with a particular bank. However, in contrast to events of default, termination events generally do not trigger cross-defaults with third parties. For credit counterparties, net asset value or NAV-based triggers, in particular triggers of total NAV cumulative decline (total NAV triggers), represent a very important set of termination events. They can also be used by hedge fund investors for investment monitoring purposes.

In contrast to NAV-per-share cumulative decline triggers that only take into account the size of negative investment returns, triggers of total NAV cumulative decline refer to the percentage decline of a fund's total NAV.

Hence, they capture the joint impact of negative performance and investor redemptions, both of which are very important and interdependent factors in determining the viability of a hedge fund. However, investor withdrawals appear to be the main reason behind cases of hedge fund liquidation, although lacklustre returns also undoubtedly play an important and often leading role.¹ When a hedge fund is losing money, investors, or both, it is very important for the bank to prevent a situation whereby there would be insufficient investor capital left to guarantee the fulfilment of contractual commitments and potential future credit exposures. The provisional nature of hedge fund capital owing to potential investor redemptions poses a significant risk for hedge fund counterparties and is one of the main reasons why hedge funds are unlikely to receive high credit ratings from rating agencies.

HISTORICAL PERFORMANCE

The predictive power of total NAV triggers may be tested using so-called "signal-to-noise" ratio (STNR) analysis and other related indicators. STNR analysis compares the share of predicted cases of liquidation to the proportion of bad signals or noise in no liquidation situations (see Table E.1) and is neutral with respect to the relative frequency of cases of liquidation in all the episodes analysed.²

- 1 See Box 6 in ECB (2007), *Financial Stability Review*, June.
- 2 For an application to banking and balance-of-payments crises, see G. L. Kaminsky and C. M. Reinhart (1999), "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", *The American Economic Review*, Vol. 89, No 3, June. In the article, however, the inverse of the signal-to-noise ratio was used, i.e. the noise-to-signal ratio.

Table E.1 Calculation of signal-to-noise ratio and other related indicators

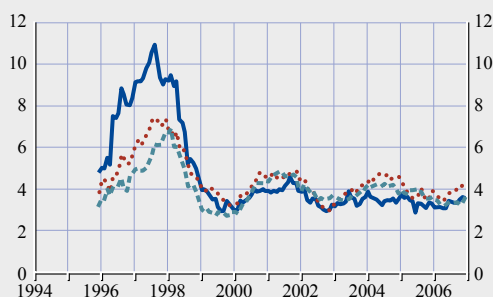
	Liquidation	No liquidation
Signal issued	A	B
No signal	C	D
Signal-to-noise ratio = $[A/(A+C)] / [B/(B+D)]$		
Share of predicted cases of liquidation = $A/(A+C)$		
Share of good signals = $A/(A+B)$		

Chart E.1 Signalling quality over time

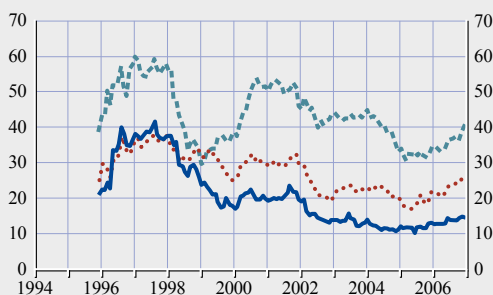
(Dec. 1995 - Dec. 2006; 24-month moving window)

- -15% on a monthly basis
- ... -25% on a rolling three-month basis
- - -40% on a rolling 12-month basis

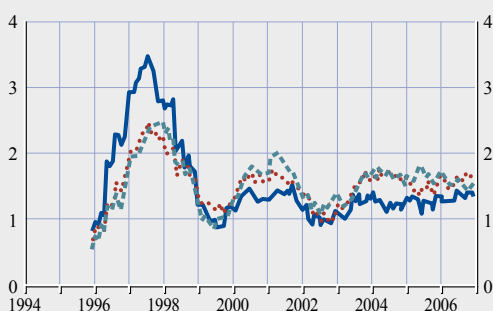
a) Signal-to-noise ratio



b) Share of predicted cases of liquidation; (%)



c) Share of good signals; (%)



Sources: Lipper TASS database and ECB calculations.

Notes: Excluding funds of hedge funds. For each trigger, only cases when respective changes in total NAV were available have been used in the calculations. A signal is issued when the respective trigger of total NAV cumulative decline is breached, and it is correct if it was issued on the date of the last reported returns before liquidation.

In the analysis that follows, a signal is issued when the trigger of total NAV cumulative decline is breached, and it is correct (i.e. it successfully predicted liquidation) if the date on which it was issued corresponds to the date

of the last reported returns before liquidation (see case “A” in Table E.1). However, it is important to note that the assessment of total NAV triggers based on information in hedge fund databases is hindered by a “liquidation” bias, which refers to the fact that hedge fund managers can stop reporting to a database before the final liquidation date of a fund.³

Another important factor to consider is the specific rules and threshold values of tests of total NAV cumulative decline. Information collected in the context of the ESCB Banking Supervision Committee survey of large EU banks on their exposures to hedge funds revealed that banks typically used triggers of total NAV cumulative decline of at least 15%, 25% and 40% calculated on a rolling one, three and 12-month basis respectively, although there was some variation in thresholds across and within banks.⁴ Given this information, further analysis in this section rests on these three versions of total NAV triggers.

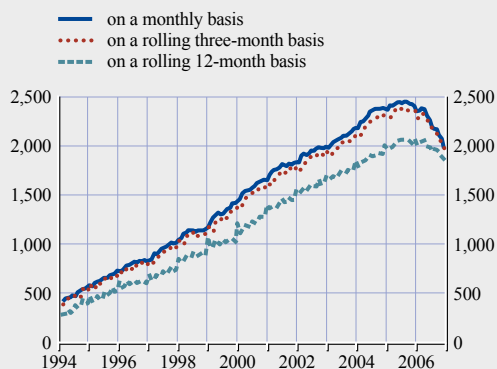
Based on information in the Lipper TASS database, in the period January 1994 to December 2006 the STNRs of all three selected versions of total NAV triggers calculated for 24-month moving windows were very volatile (see Chart E.1.a). Their values ranged from almost three to nearly five during much of the period from 1999 onwards, meaning that the share of cases of single-manager hedge fund liquidation that were successfully predicted was between three and five times larger than the share of misleading signals in no liquidation situations. The patterns of moving STNRs resemble synchronous waves, albeit with no clear superiority among selected triggers. The 12-month total NAV trigger would, however, have predicted relatively more cases of liquidation (see Chart E.1.b), but the number of available total NAV changes to evaluate this trigger was smaller than the numbers of available changes in total NAV on the rolling

3 See also Box 6 in ECB (2007), *Financial Stability Review*, June.

4 See ECB (2005), “Large EU banks’ exposures to hedge funds”, November.

Chart E.2 Number of available changes in total NAV

(Jan. 1994 - Dec. 2006)



Sources: Lipper TASS database and ECB calculations.
Notes: Excluding funds of hedge funds. The most recent data are subject to incomplete reporting.

one and three-month basis due to the longer lag (see Chart E.2).

The ability to predict cases of liquidation should also be accompanied by an adequate degree of signal accuracy. In this respect, the total NAV triggers chosen would have performed rather poorly. For example, since 1998, based on 24-month moving windows, less than 2% of the warnings issued were correct predictions of cases where liquidation subsequently occurred (see Chart E.1.c). However, when it comes to the decision on whether to act on the basis of

the signal given, banks are more likely to use breaches as an opportunity to investigate the reasons behind them, rather than choosing the termination option. A breach may free the bank from various obligations to the hedge fund client, for example, in relation to term margins or margin lock-ups, thereby allowing it to raise margin requirements, increase haircuts and possibly introduce additional risk mitigation measures. In other words, it can be used as an opportunity to reassess the hedge fund's risk profile and tighten credit terms, if deemed necessary.

The overall historical predictive power of different versions of total NAV triggers is summarised in Table E.2. Based on the full historical sample, the selected trigger of total NAV cumulative decline of at least 25% on a rolling three-month basis had the highest STNR, although the 12-month version would have predicted more cases of liquidation with the same share of good signals. Furthermore, if all three versions had been used in parallel (see the last column in Table E.2), the share of predicted cases of liquidation would have been even higher, albeit with a lower STNR and a lower degree of signal accuracy.

The analysis of aggregate signalling patterns up to the month of the last reported returns before liquidation reveals that the frequency of signals tends to rise before liquidation (see Chart E.3).

Table E.2 Overall historical signalling quality

(Jan. 1994 - Dec. 2006)

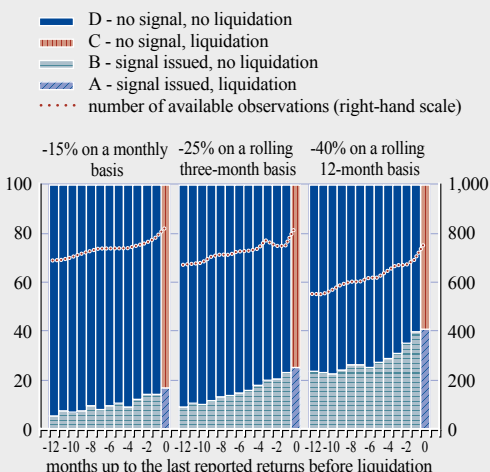
	-15% on a monthly basis	-25% on a rolling three-month basis	-40% on a rolling 12-month basis	at least one trigger
Aggregate signalling structure, %				
A - signal issued, liquidation	0.06	0.09	0.16	0.16
B - signal issued, no liquidation	4.24	5.96	10.79	12.62
C - no signal, liquidation	0.29	0.27	0.23	0.20
D - no signal, no liquidation	95.42	93.68	88.82	87.02
Total number of signalling observations	236,394	228,147	190,781	241,431
Indicators				
Signal-to-noise ratio = $[A/(A+C)] / [B/(B+D)]$	3.96	4.20	3.80	3.45
Share of predicted cases of liquidation = $A/(A+C)$, %	16.85	25.09	41.11	43.74
Share of good signals = $A/(A+B)$, %	1.35	1.48	1.48	1.22

Sources: Lipper TASS database and ECB calculations.

Notes: Excluding funds of hedge funds. A signal is issued when the respective trigger of total NAV cumulative decline is breached, and it is correct if it was issued on the date of the last reported returns before liquidation.

Chart E.3 Aggregate signalling patterns before liquidation

(Jan. 1994 - Dec. 2006; %; aggregate structure of signalling patterns before liquidation)



Sources: Lipper TASS database and ECB calculations.
Notes: Excluding funds of hedge funds. Only liquidated funds with the last reported returns before January 2007 and available signalling information at least on the date of the last reported returns.

Before liquidation, the aggregate share of the “B – signal issued, no liquidation” group is higher than the share of the same group calculated for all single-manager hedge funds in the database (see Table E.2), suggesting that signals repeated over a short time period should be a warning for banks to increase their vigilance.

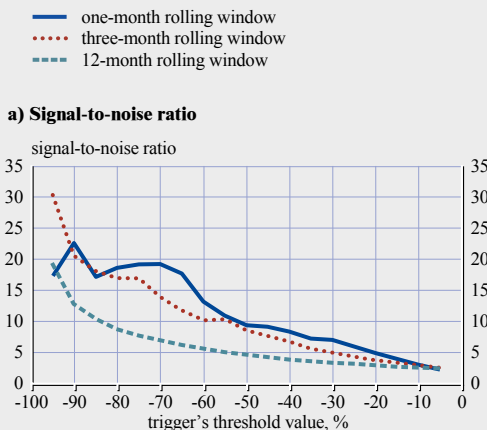
OPTIMISING NAV TRIGGER PARAMETERS

So far, only three versions of total NAV triggers have been examined, but the analysis could be expanded by finding the optimal configuration of the parameters of total NAV triggers in order to maximise their usefulness as an early warning signal based on STNR.

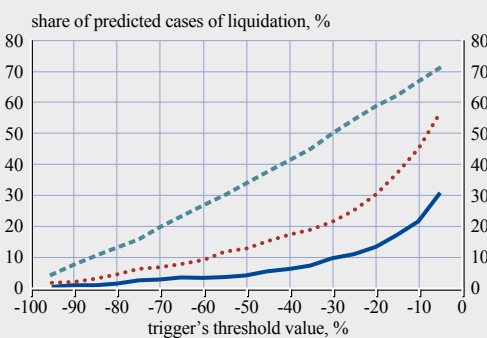
For this purpose, three parameters of total NAV triggers are allowed to vary: the trigger’s threshold value, the length of the rolling window and the forecast window within which a hedge fund’s liquidation can occur. In the previous section, historical testing was based only on a one-month forecast window, meaning that the signal was correct only if it was issued

Chart E.4 Values of selected indicators by a trigger’s threshold value and the length of a rolling window given a 1-month forecast window

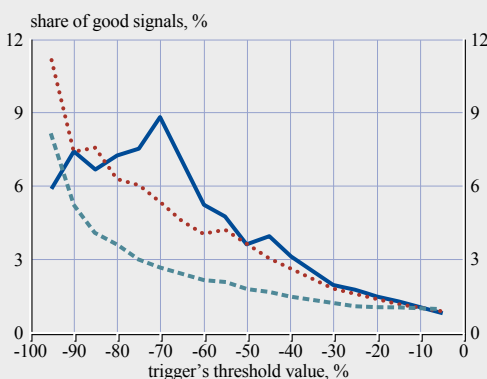
(Jan. 1994 - Dec. 2006)



b) Share of predicted cases of liquidation



c) Share of good signals

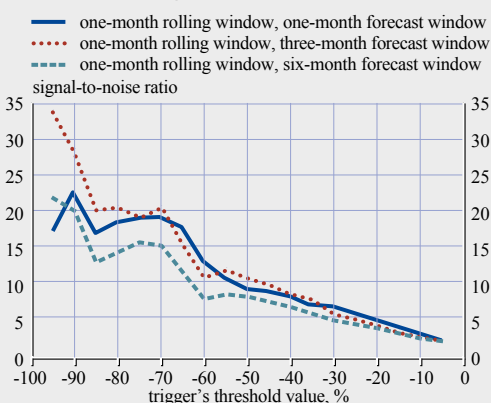


Sources: Lipper TASS database and ECB calculations.
Notes: Excluding funds of hedge funds. A trigger’s threshold value changes in increments of 5%.

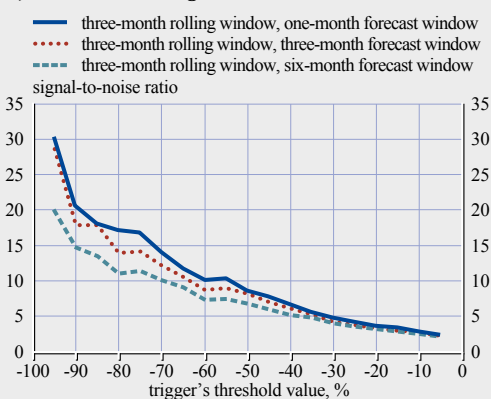
Chart E.5 Signal-to-noise ratio by total NAV trigger's threshold value, the length of a rolling window and the forecast window

(Jan. 1994 - Dec. 2006)

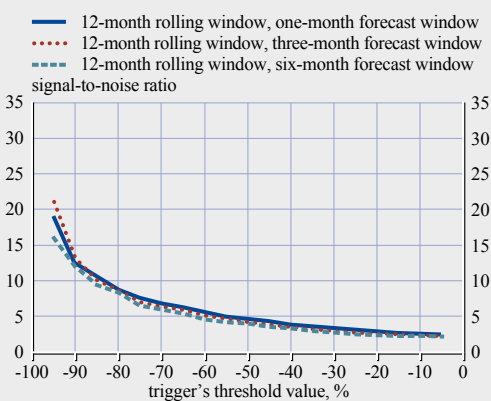
a) One-month rolling window



b) Three-month rolling window



c) 12-month rolling window



Sources: Lipper TASS database and ECB calculations.
Notes: Excluding funds of hedge funds. A trigger's threshold value changes in increments of 5%.

on the date of the last reported returns before liquidation.

The optimisation presented in this Special Feature seeks to find maximum STNR values over the whole historical sample of hedge funds' total NAV in the Lipper TASS database. In this way, a greater weight is given to more recent information since there is a larger number of changes in total NAV available at more recent dates.

In Charts E.4.a-c, the values of STNR, the share of predicted cases of liquidation and the share of good signals are shown as a function of the total NAV trigger's threshold value given a one-month forecast window and three typical rolling windows. As illustrated in Chart E.4.a, STNRs peak at very low trigger values. Moreover, the longer the rolling window is, the lower the STNRs generally are. Such low threshold values for the triggers may be impractical from a bank's point of view, since the share of predicted cases of liquidation decreases rapidly with a lower threshold value (see Chart E.4.b). In addition, lower triggers only marginally increase the share of good signals (see Chart E.4.c). Contrary to expectations, longer forecast windows generally do not seem to improve the predictive power of total NAV triggers (see Charts E.5.a-c). Furthermore, it should be noted that the optimisation results are sensitive to the time period analysed, as indicated by the variation of STNRs and other indicators over time in Charts E.1.a-c.

CONCLUDING REMARKS

Termination triggers based on total NAV cumulative decline are an important tool in a bank's arsenal of risk management tools for safeguarding its credit exposures, since a substantial fall in a hedge fund's capital may significantly increase the credit risk it faces from lending to a hedge fund. However, owing to strong competition among prime broker banks for lucrative hedge fund servicing business, some larger hedge funds have reportedly managed to negotiate relatively low threshold

values of total NAV triggers, thereby raising potential future credit risk for banks. Therefore, banks that engage in a credit relationship with a hedge fund should conduct an extensive due diligence before setting appropriate NAV-based triggers. In addition, hedge fund investors may also find it useful to monitor cumulative changes in total NAV, but their ability to withdraw funds is hampered by various redemption restrictions applied by hedge funds (see Box 4 in Section 1.3 of this FSR).

When hedge funds use several prime brokers simultaneously, banks are usually only able to monitor their own dealings with a hedge fund client leaving them with an important information gap on the entire risk profile of the fund as a whole on a continuous basis. Moreover, most hedge funds only supply banks with monthly NAV statements, although some funds also provide intra-month NAV estimates, which however are not usually used as a basis for a termination event. Nevertheless, more frequent information on total NAV, even if not legally applicable for tests of total NAV cumulative decline, may prove useful as a monitoring tool against an unfolding adverse scenario.

All in all, it appears that total NAV triggers are not very precise early warning signals of hedge fund liquidation. This means that other information, e.g. a hedge fund's investment strategy, age, total NAV size or return volatility, should also be taken into account when assessing the risk profile of a hedge fund. Nonetheless, NAV triggers provide opportunities for banks to review the risk profiles of hedge funds to which they are exposed and to take necessary protective action to mitigate the risks.