



Default Risk and Accounting Measures

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Center for Accounting Research and Education
University of Notre Dame

Stephen Kealhofer
Diversified Credit Investments
San Francisco, CA

- Merton approach to corporate default risk
 - KMV implementation
- Accounting measures: The “fundamental” approach
 - **Altman[2000], “Predicting Financial Distress of Companies: Revisiting the Z-Score and Zeta Models”**
- Interpreting the fundamental approach using the Merton framework

- Ratio or “fundamental” analysis
 - **Leverage/coverage**
 - **Liquidity measures (“quick ratio”)**
- Cash flow analysis
 - **Projection of future cash flow versus cash flow requirements**
- Merton approach
 - **Focus on:**
 - Market value of underlying asset relative to liabilities
 - Volatility of market value

Basic idea:

- Market value, not cash flow, is the appropriate way to look at the firm's ability to pay

The approach:

- Firm market value evolves randomly through time
- Liabilities are pre-specified and do not change with time
- Payment default occurs due to inability to pay at the point that firm market value drops below the level of obligations

KMV: Using the Merton approach

Focus on the “distance to default”

- **Number of standard deviations to the default point**
- **Empirically mapped to default probability**

Successful approach

- Coherent, cause-and-effect model of credit
- Empirically out-performs alternatives

Implications

- Default is a capacity not a liquidity event
- Default can be understood via three primary variables:
 - **Market value of business (“asset value”)**
 - **Amount and structure of debt and non-debt obligations**
 - **Volatility of the market value of the business (“asset volatility”)**
- Traditional analysis fails to quantitatively address volatility

Dominated by Ed Altman's work

- Z-score
- Zeta model

The idea: Use the traditional accounting ratios to predict default, but do it in a modern statistical construct. (And throw in some other stuff that might help, too)

The result: A scoring model based largely on accounting measures that has quite reasonable default predictive ability

- Current assets – current liabilities
- Current assets/current liabilities
- Retained earnings
- Earnings before interest and taxes
- EBIT/interest expense
- “Earnings stability”: Std error of EBIT/TA around trend
- Average market value of equity
- Sales
- Total assets (used as a scaling variable and to measure size)

Importance of Altman's variables

“Regardless of which test statistic is observed, the most important variable is the cumulative profitability ratio, X4 [*retained earnings/total asset*]. In fact, our scaled vector analysis indicates that this single ratio contributes 25% of the total discrimination.”

Altman[2000] pp 39-40

X2, Retained Earnings/Total Assets (RE/TA).

Retained earnings is the account which reports the total amount of reinvested earnings and/or losses of a firm over its entire life. The account is also referred to as earned surplus. It should be noted that the retained earnings account is subject to "manipulation" via corporate quasi-reorganizations and stock dividend declarations. While these occurrences are not evident in this study, it is conceivable that a bias would be created by a substantial reorganization or stock dividend and appropriate readjustments should be made to the accounts.

This measure of cumulative profitability over time is what I referred to earlier as a "new" ratio. The age of a firm is implicitly considered in this ratio. For example, a relatively young firm will probably show a low RE/TA ratio because it has not had time to build up its cumulative profits. Therefore, it may be argued that the young firm is somewhat discriminated against in this analysis, and its chance of being classified as bankrupt is relatively higher than that of another older firm, *ceteris paribus*. But, this is precisely the situation in the real world. The incidence of failure is much higher in a firm's earlier years. In 1993, approximately 50% of all firms that failed did so in the first five years of their existence (Dun & Bradstreet, 1994). In addition, the RE/TA ratio measures the leverage of a firm. Those firms with high RE, relative to TA, have financed their assets through retention of profits and have not utilized as much debt.

Altman[2000] pp 10-11

What can the variables tell us about:

- Market value of the business?
- Asset volatility?
- Liabilities?

Some stylized facts:

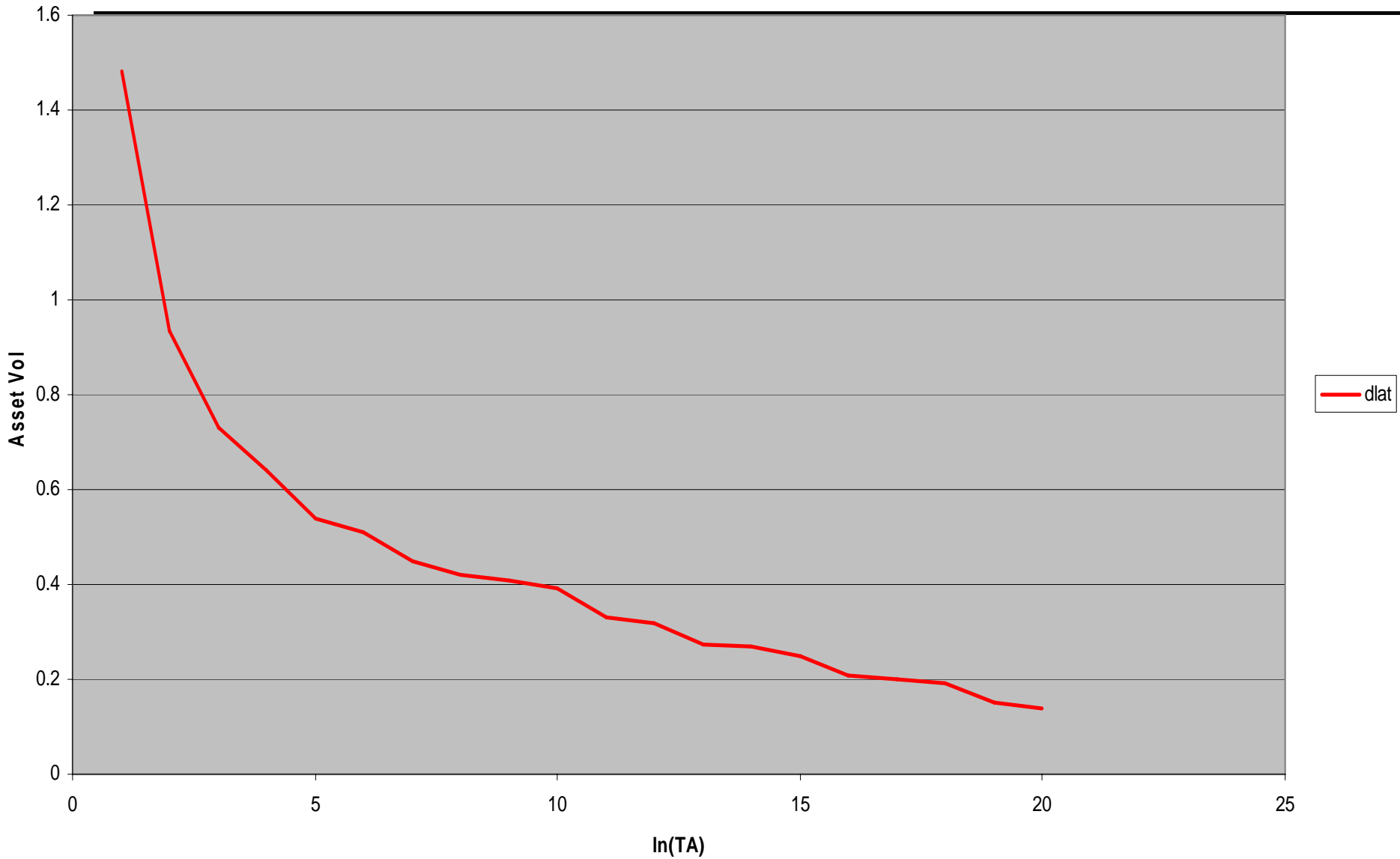
- Size is a good predictor of asset volatility
- Business market value increases with volatility
 - **Small businesses have higher values**
- Volatility and earnings are related
 - **1 observation volatility estimator**
 - **Censoring effect: low vol and negative earnings do not mix well**
- Low volatility firms use more leverage
 - **Debt issuance signals lower vol, thus lower value**

Accounting ratios are noisy and generally have bad statistical properties

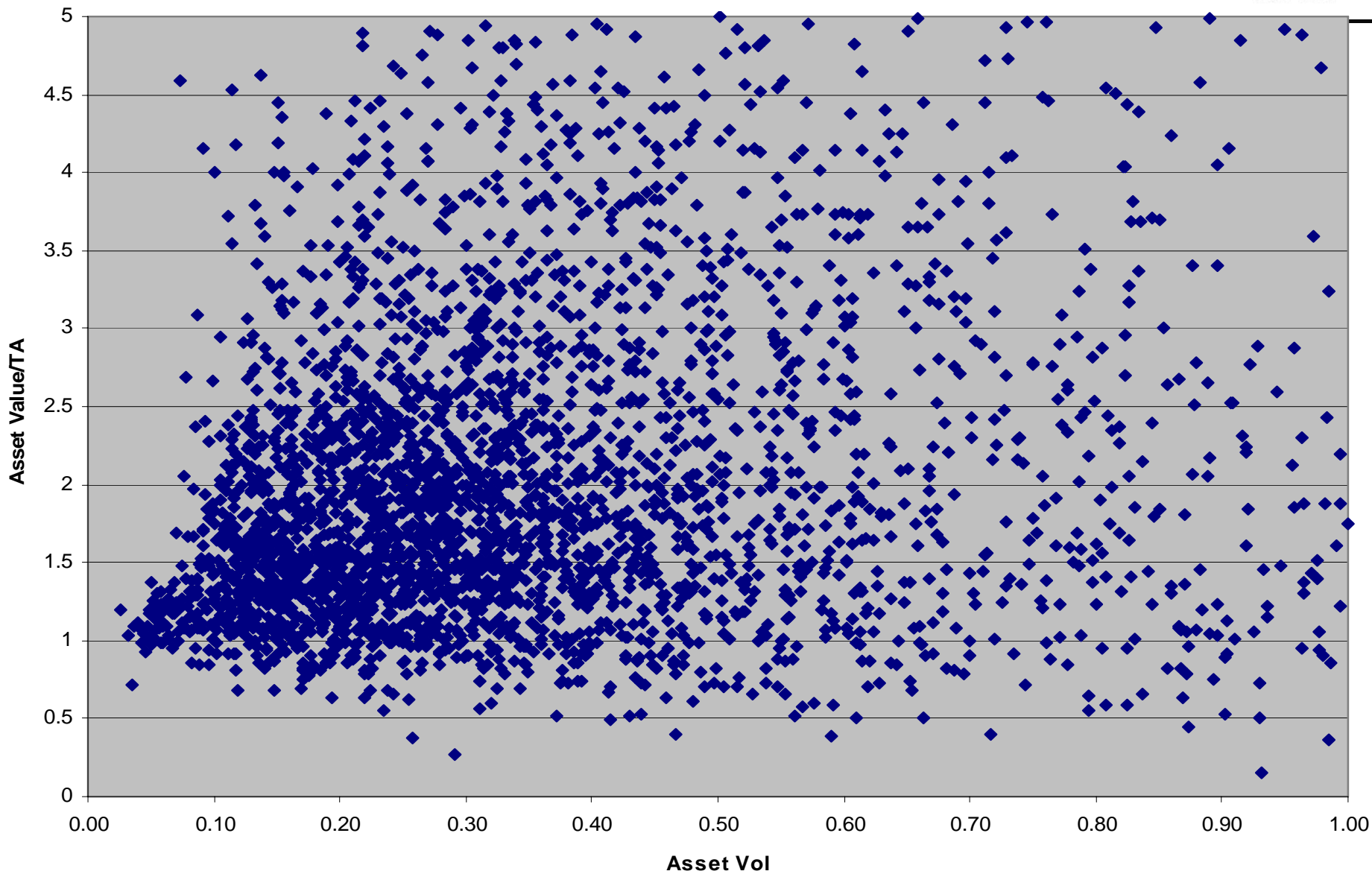
I characterize relationships by grouping one variable (“independent”) into ranges with equal populations and calculating the median value of the other variable (“dependent”) for that group

- Robust
- Good at demonstrating no relationship
- Doesn't indicate the strength of the relationship
 - **Consistent pattern**

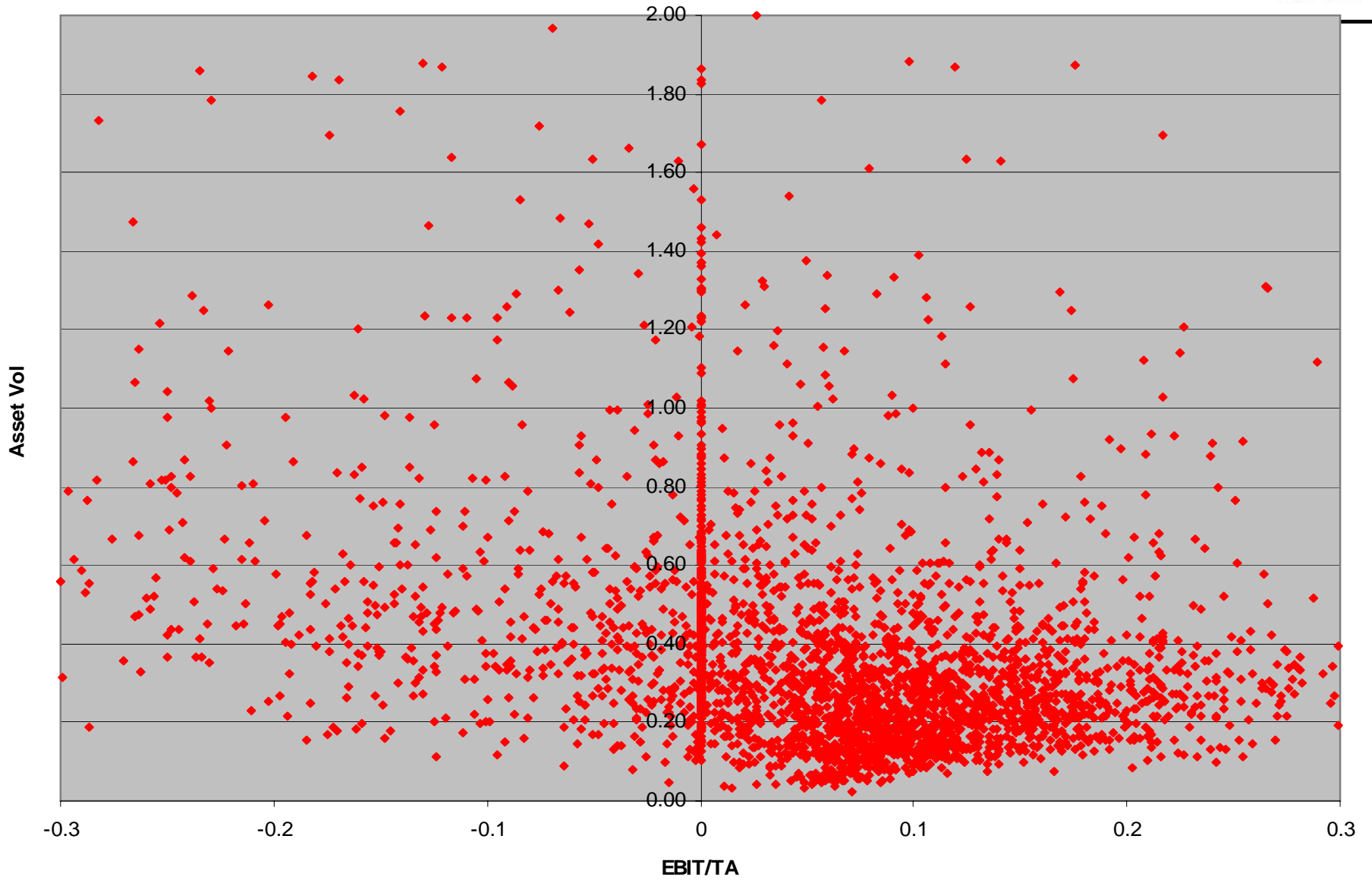
Asset Volatility vs Size



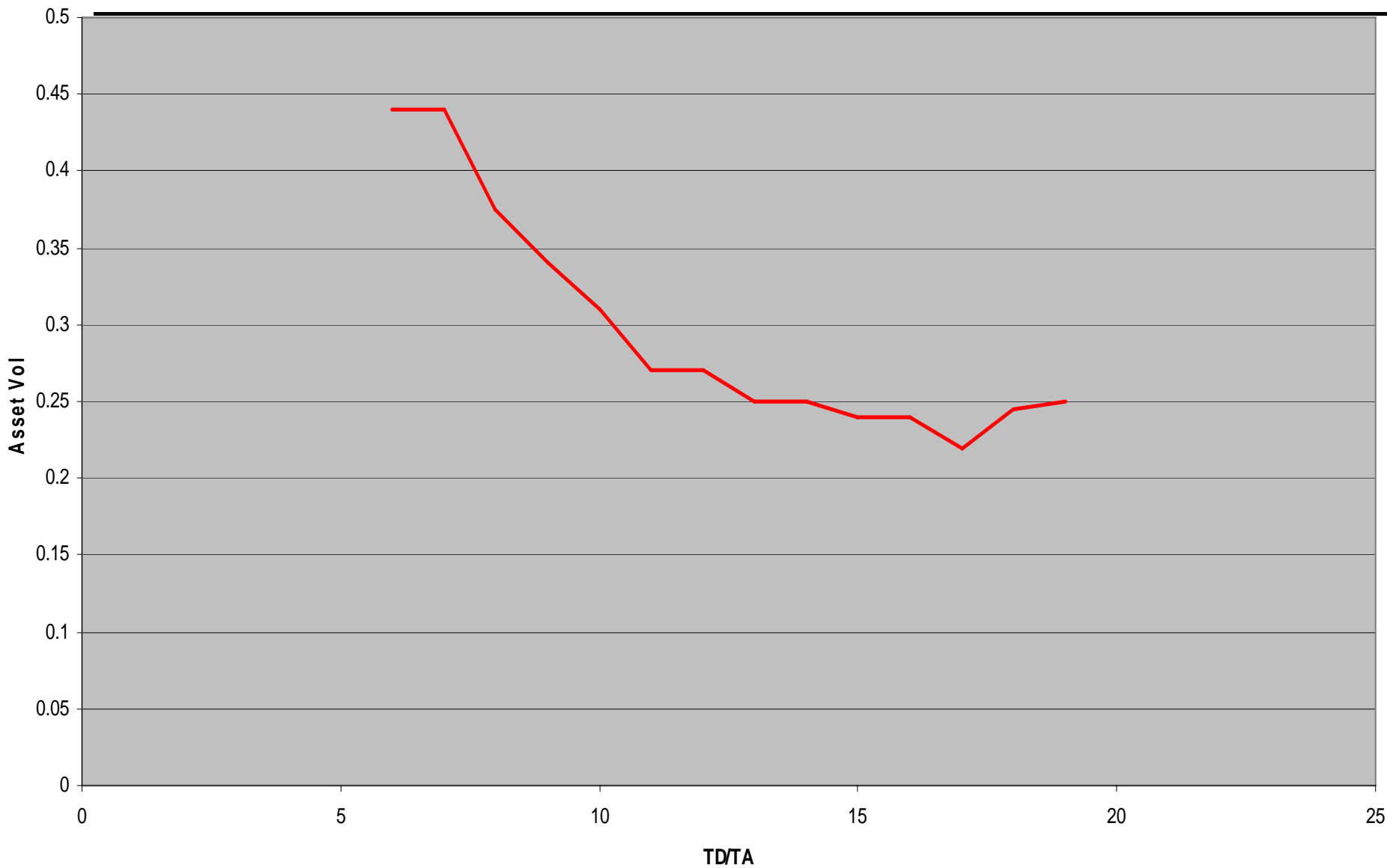
Market Value of Business vs Asset Volatility



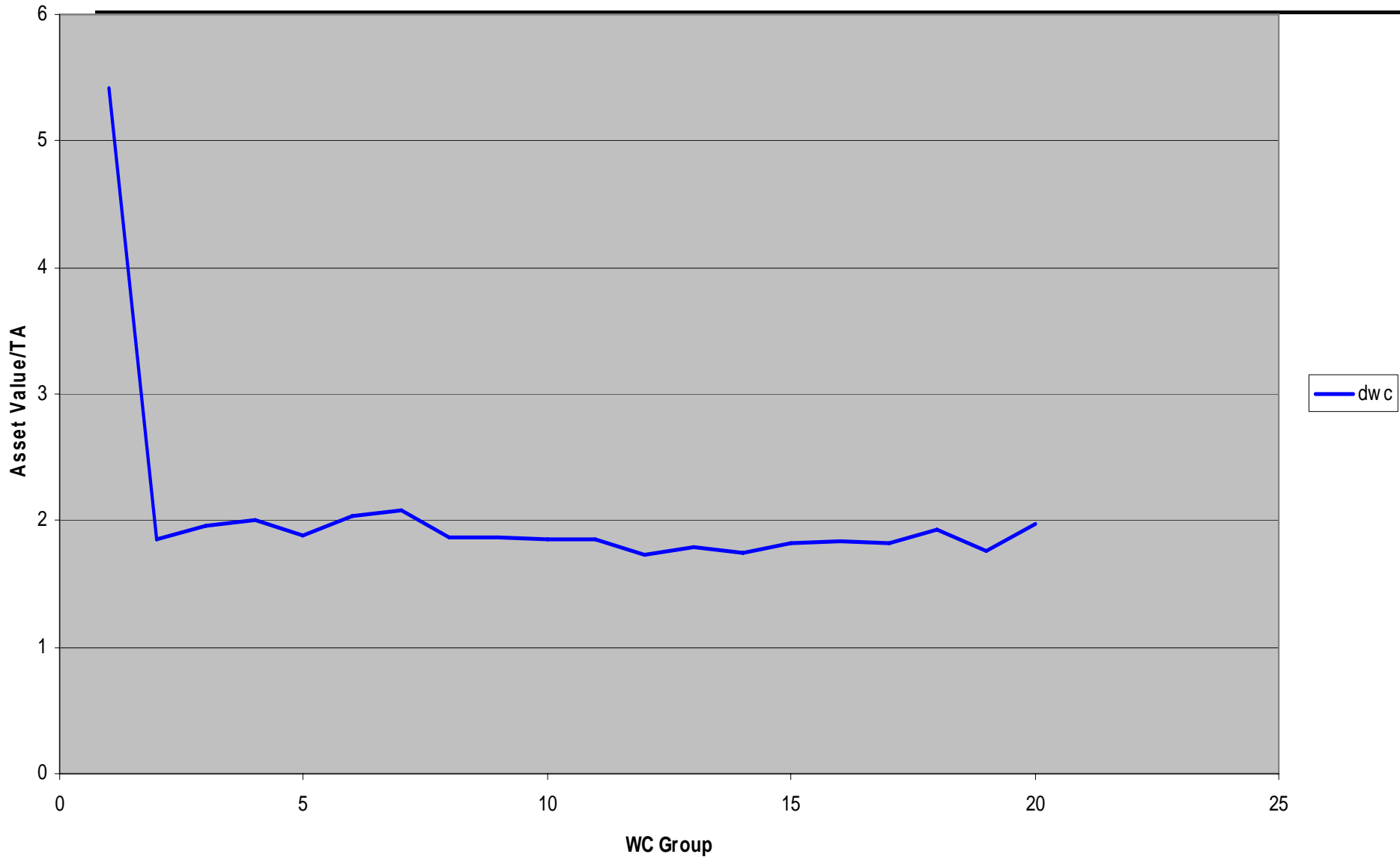
Asset Volatility vs EBIT



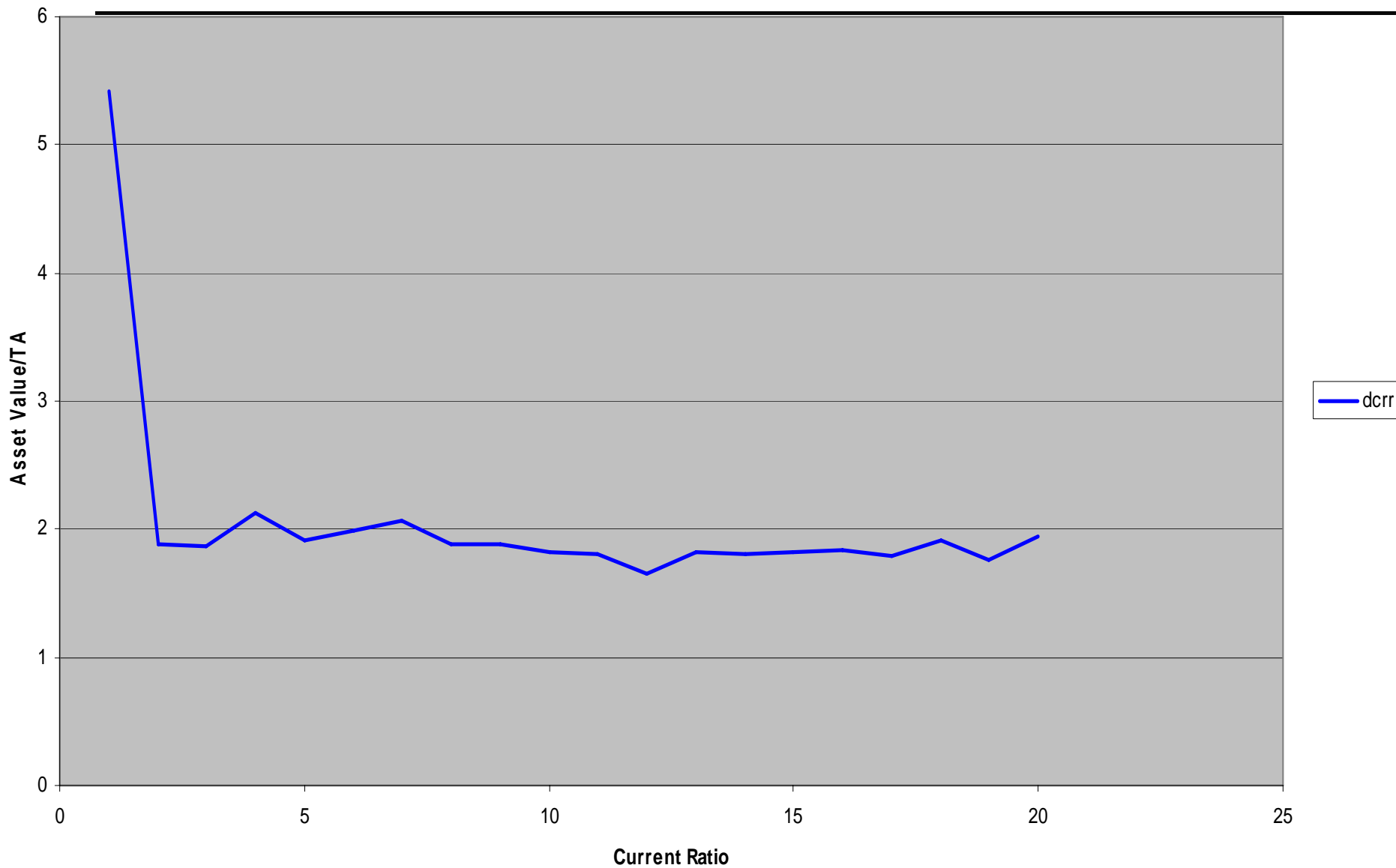
Asset Volatility vs Total Debt



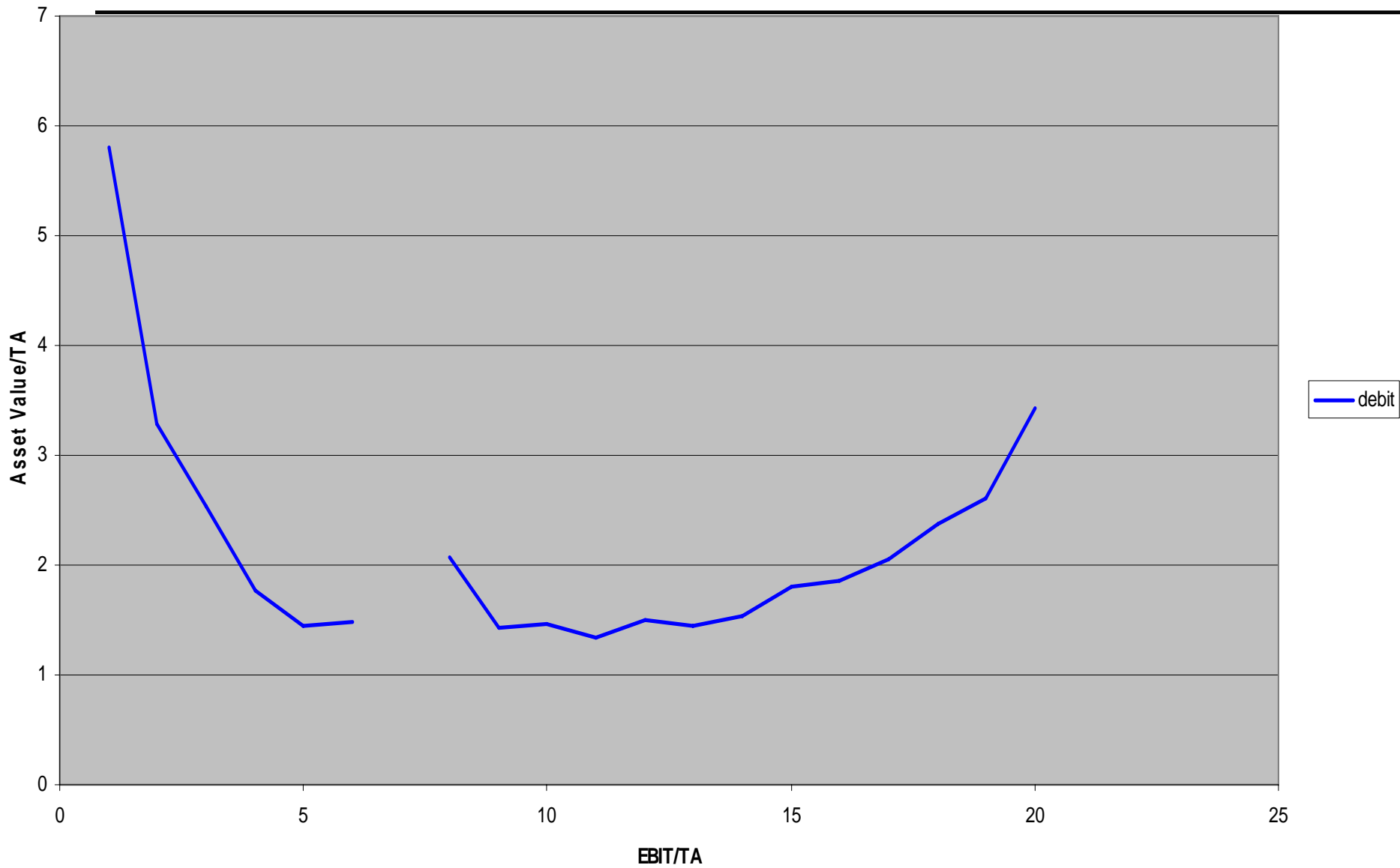
Market Value of Business vs Working Capital Group



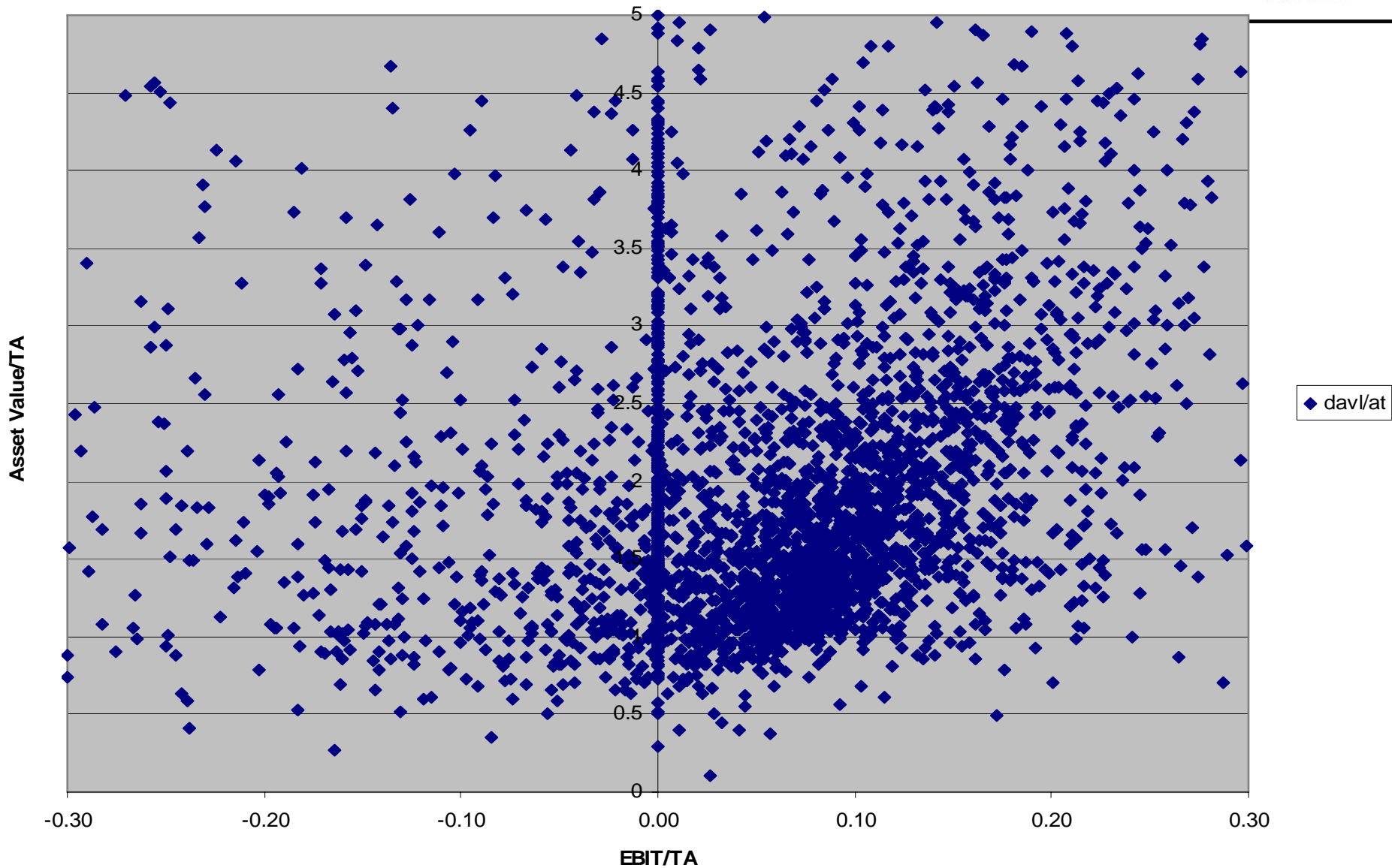
Market Value of Business vs Current Ratio



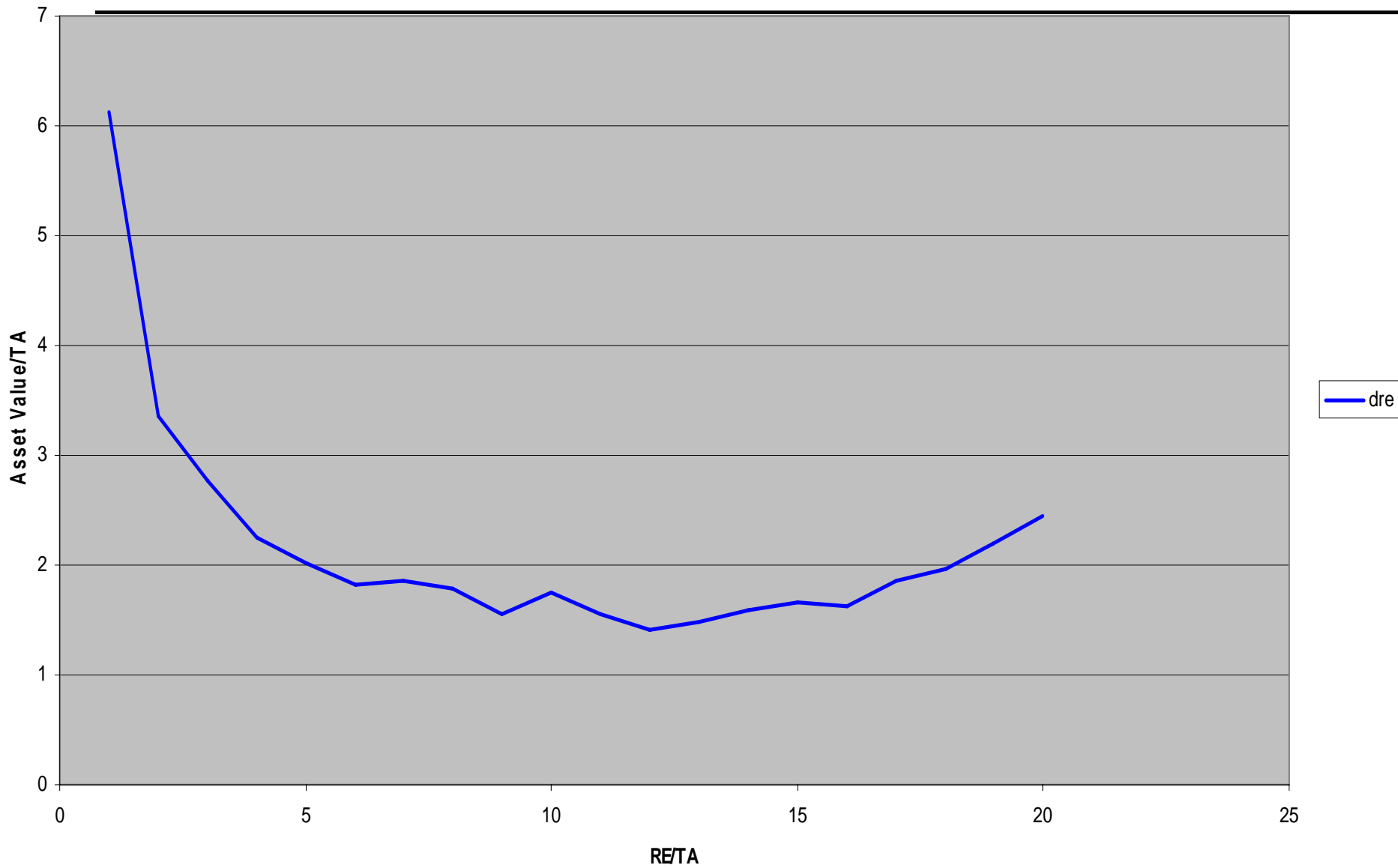
Market Value of Business vs EBIT



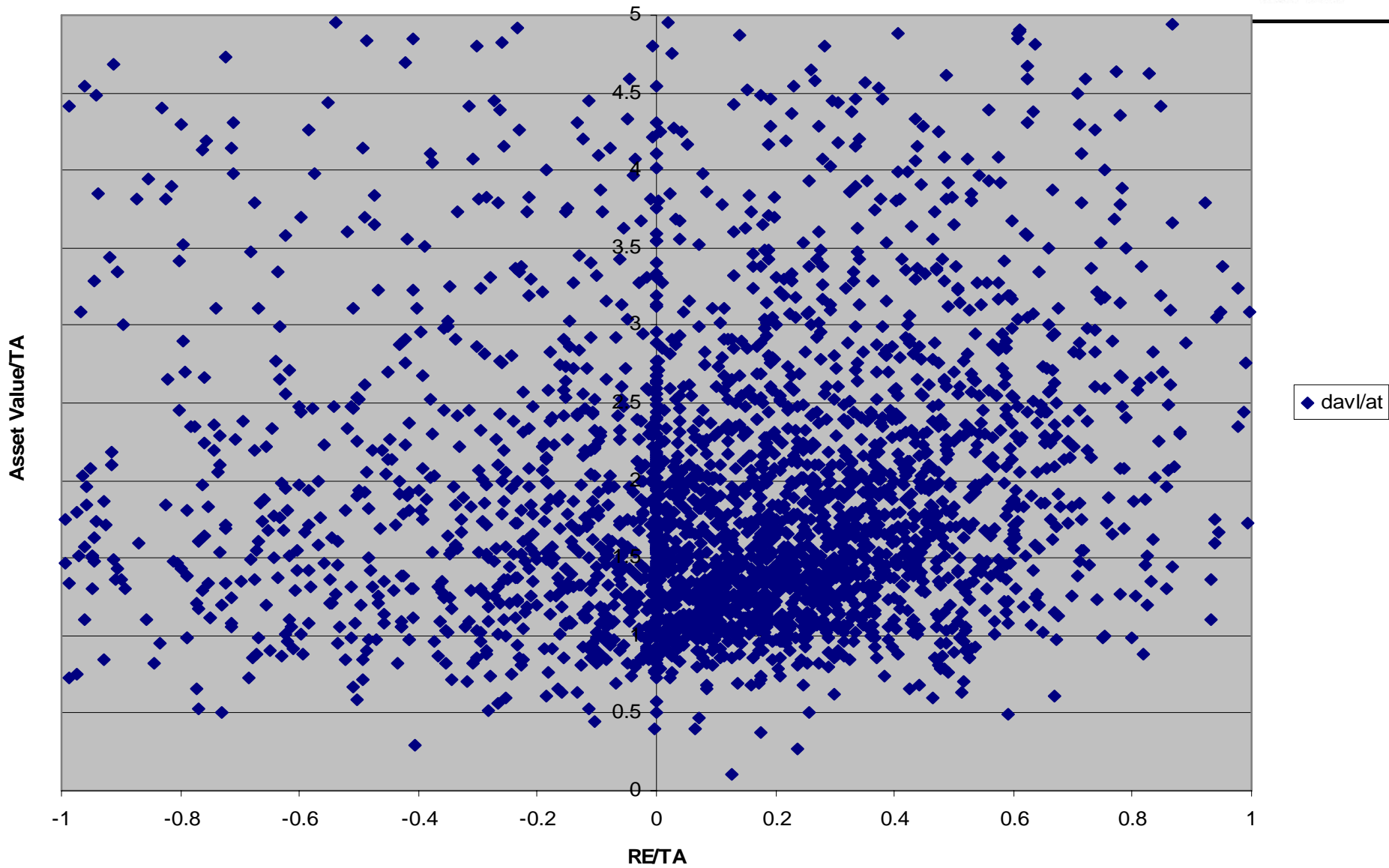
Market Value of Business vs EBIT



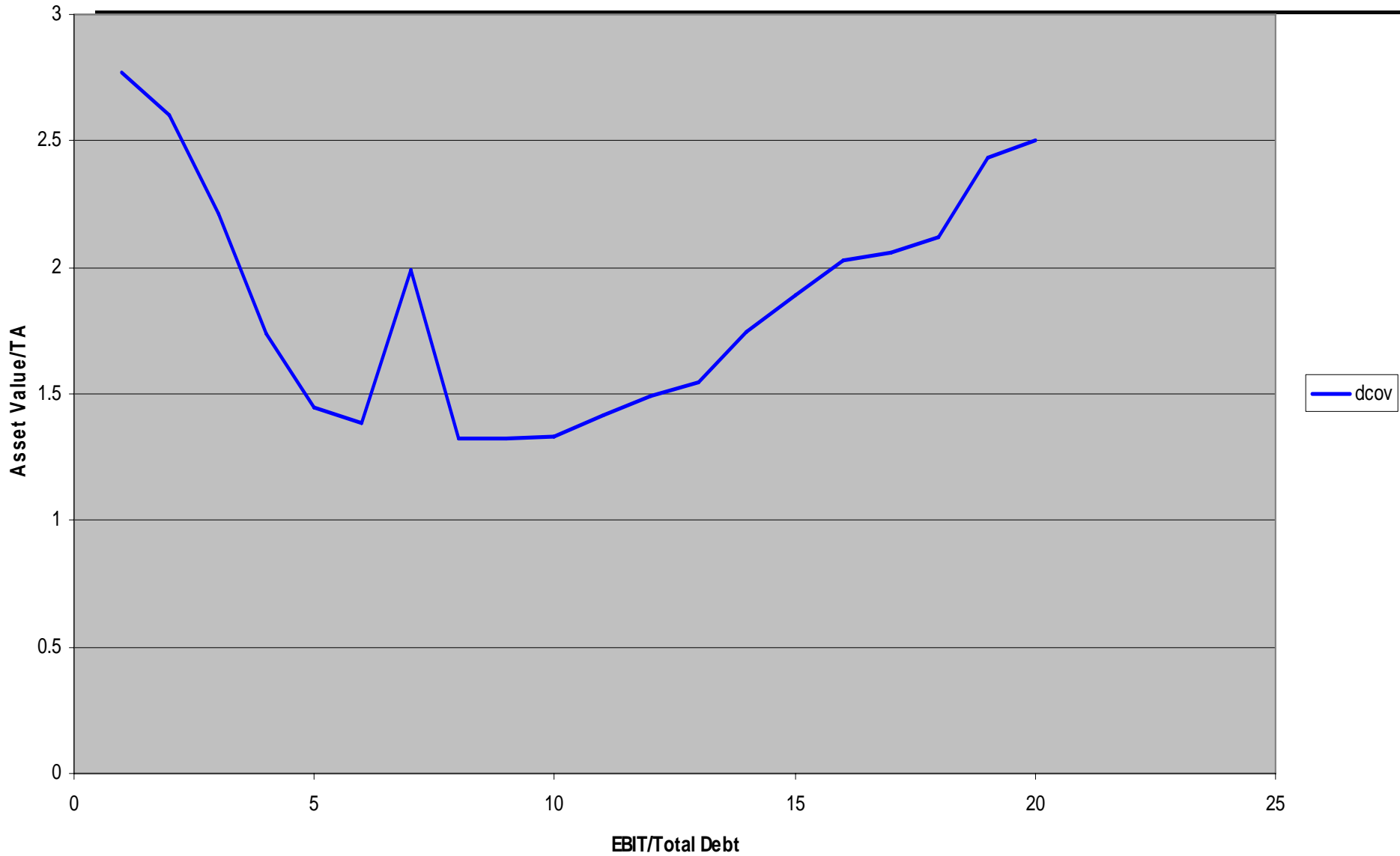
Market Asset Value vs Retained Earnings



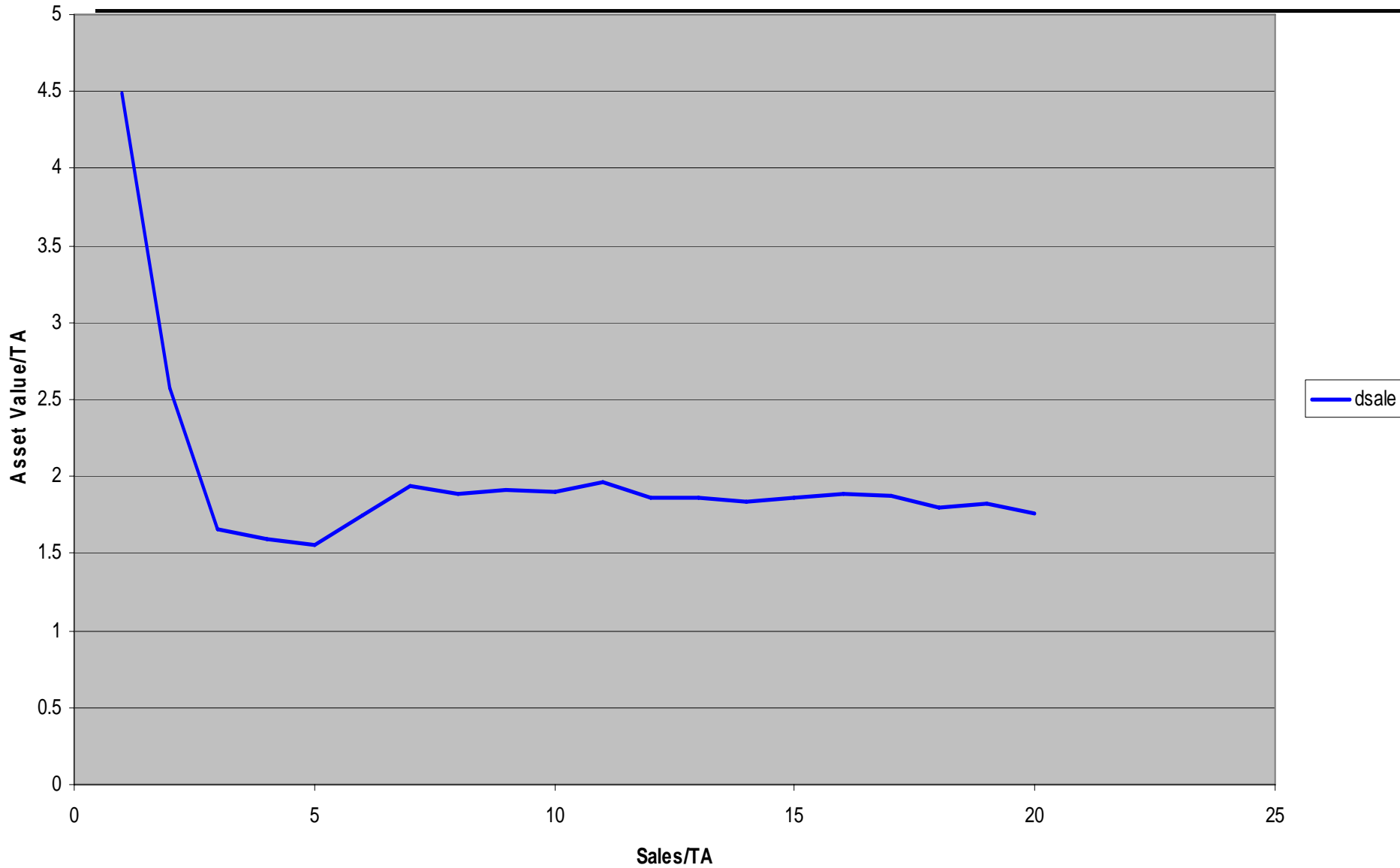
Market Value of Business vs Retained Earnings



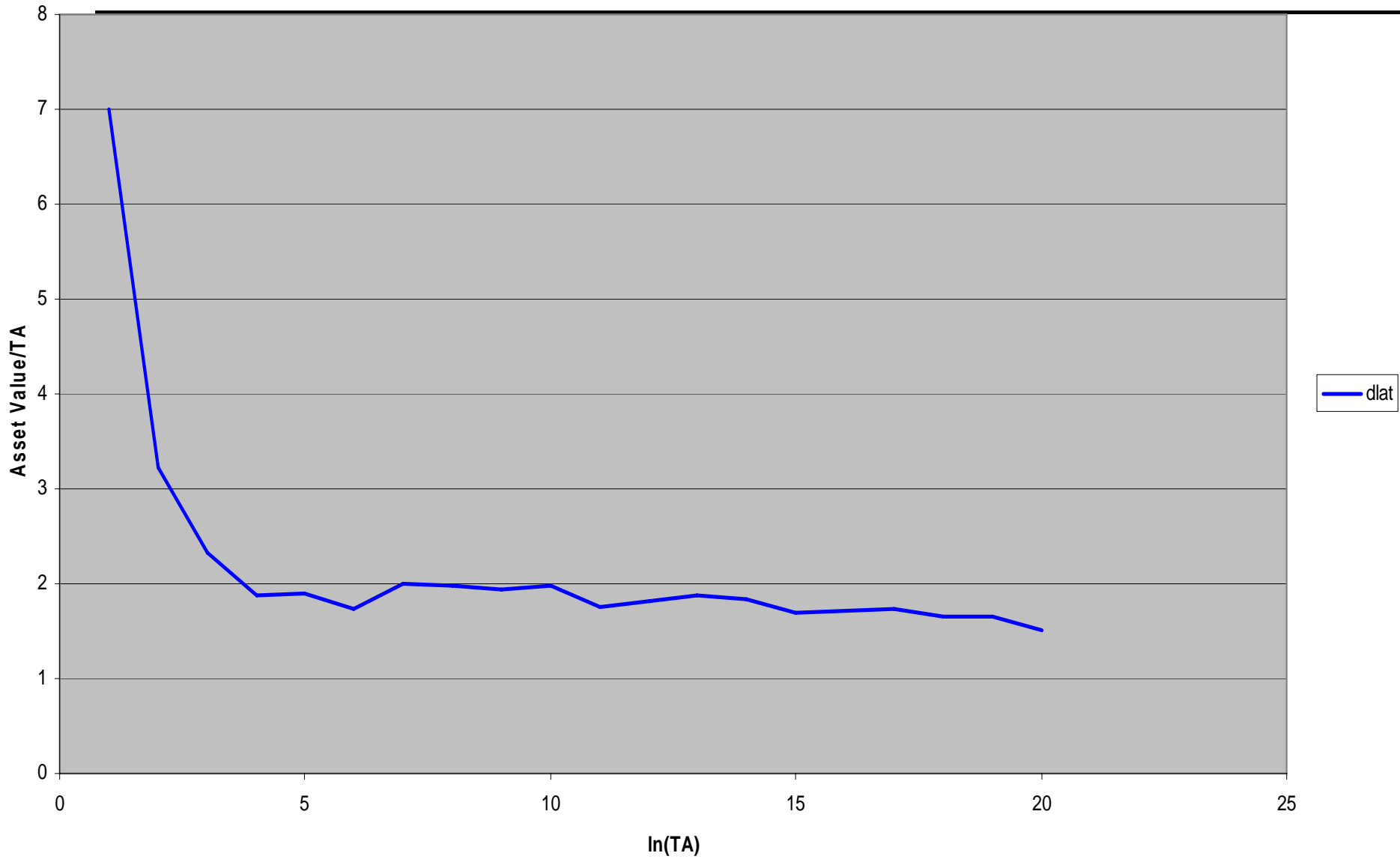
Market Value of Business vs Coverage



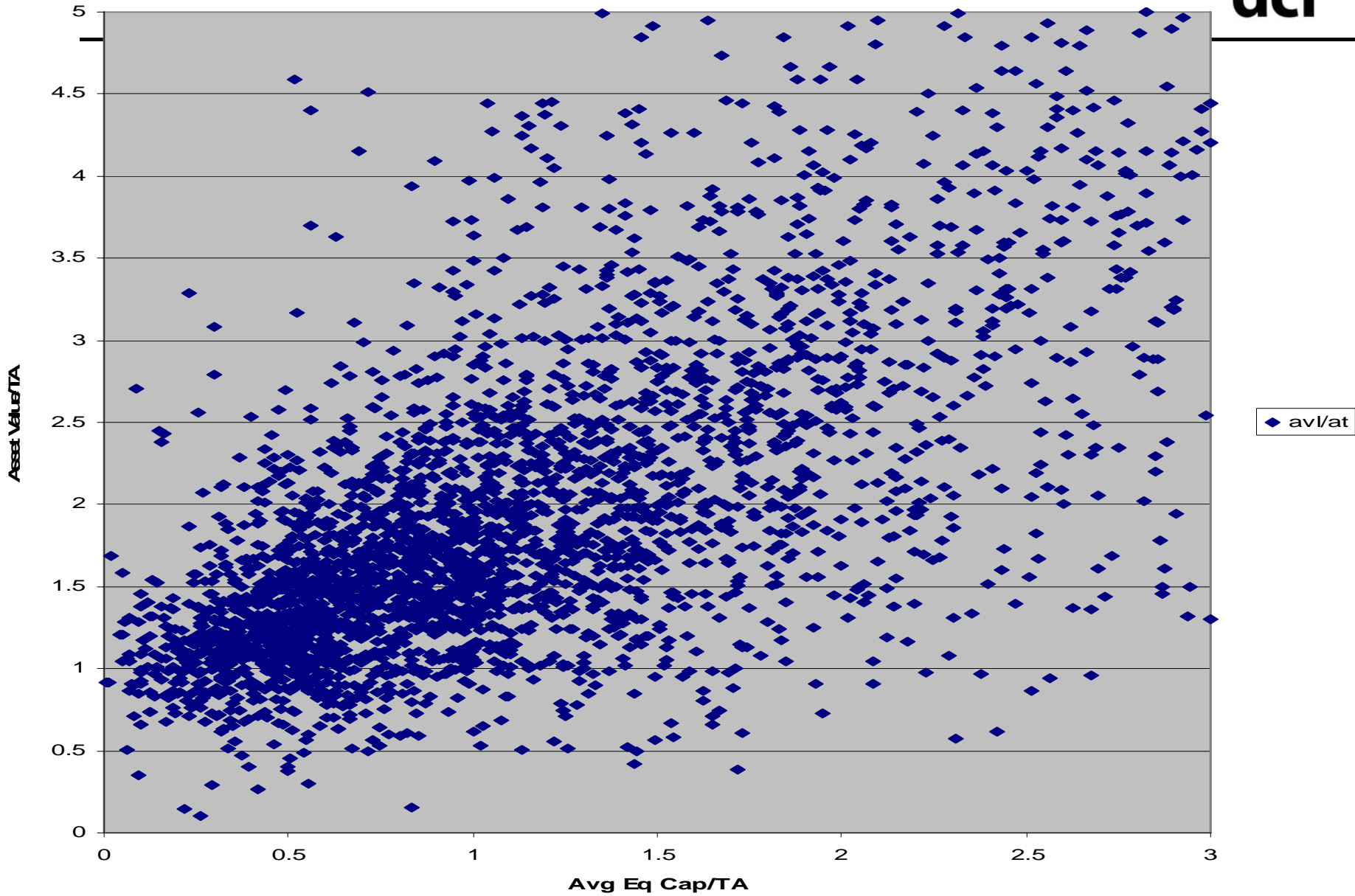
Market Value of Business vs Sales



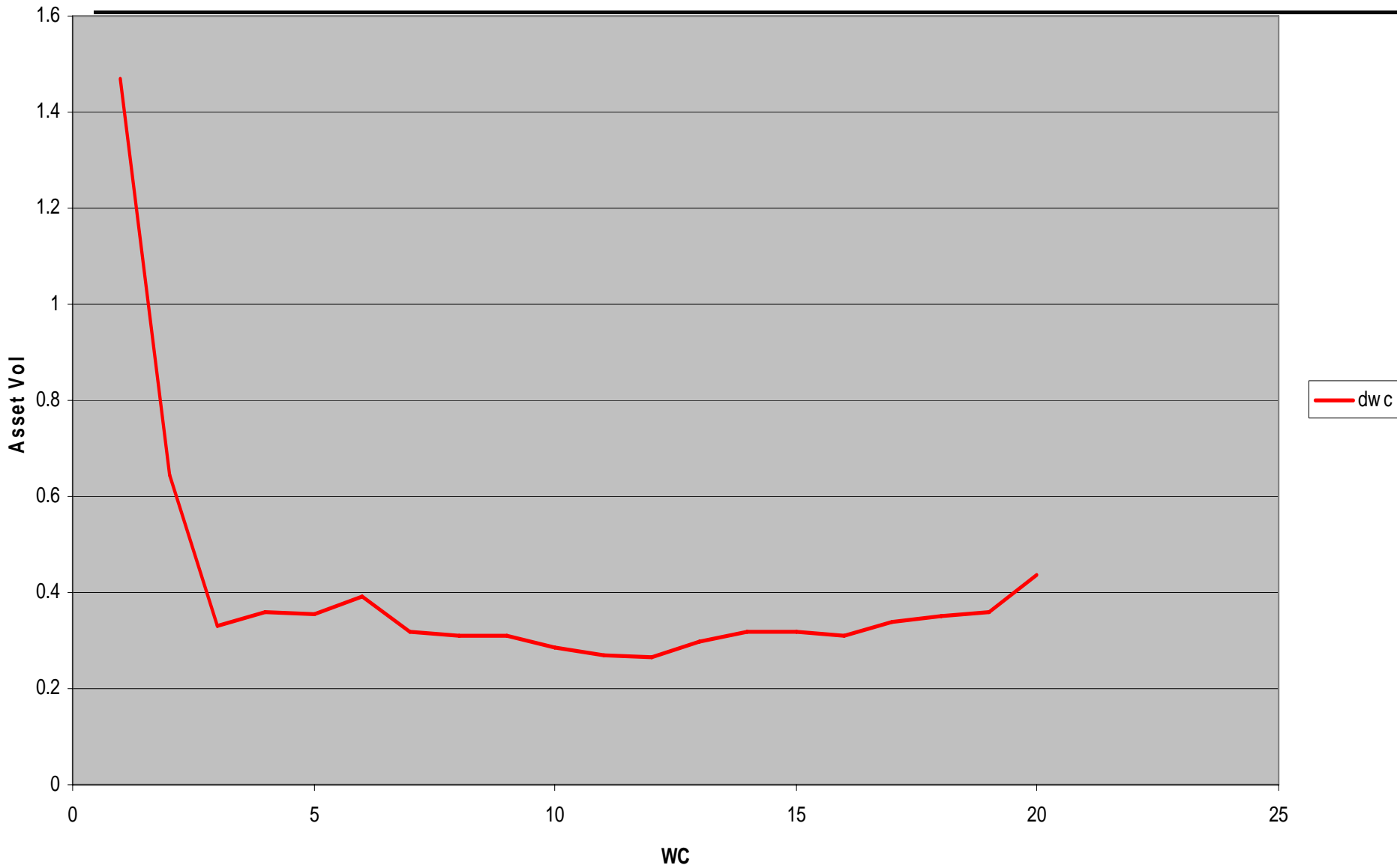
Market Value of Business vs Size



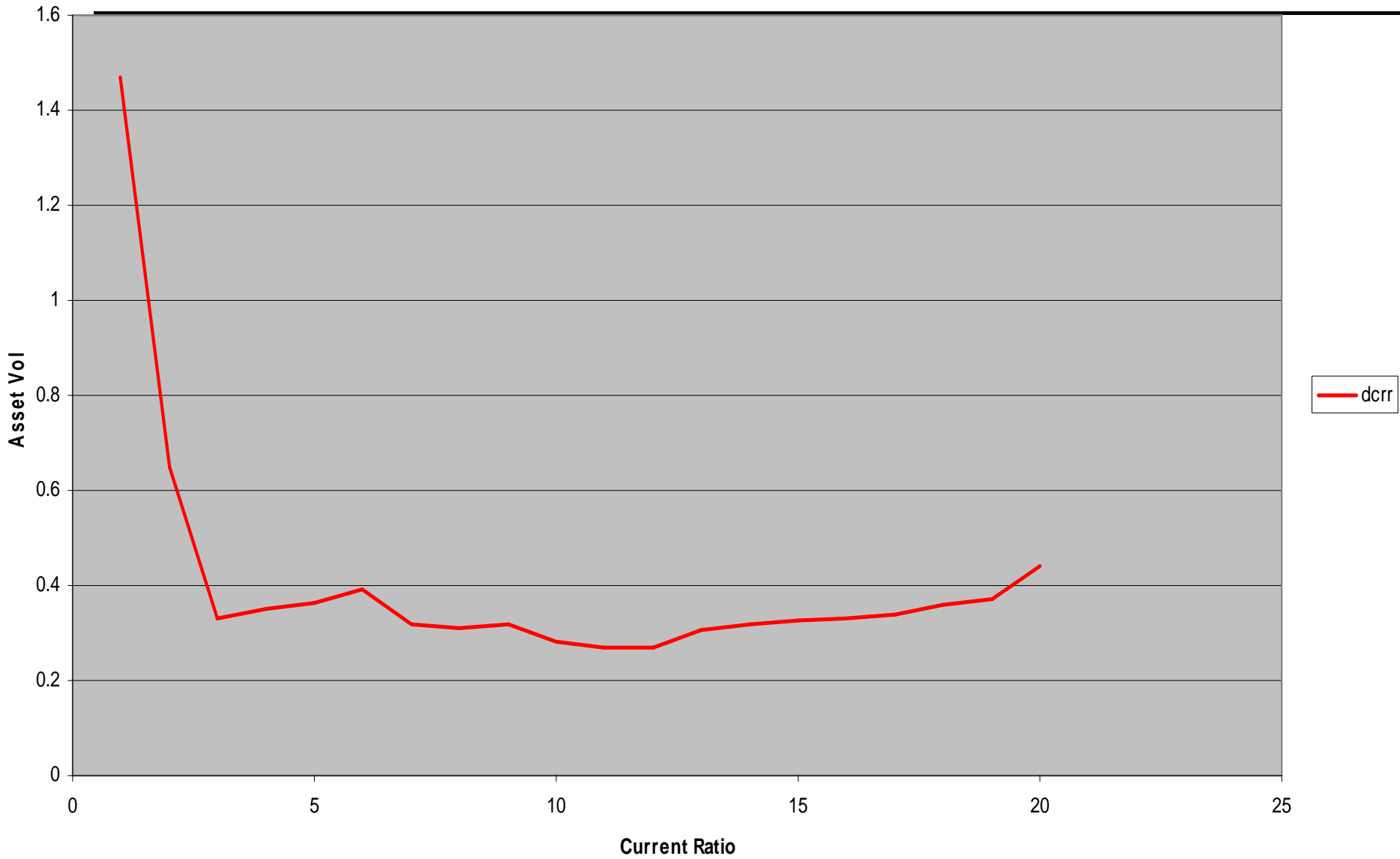
Market Value of Business vs Average Equity Value



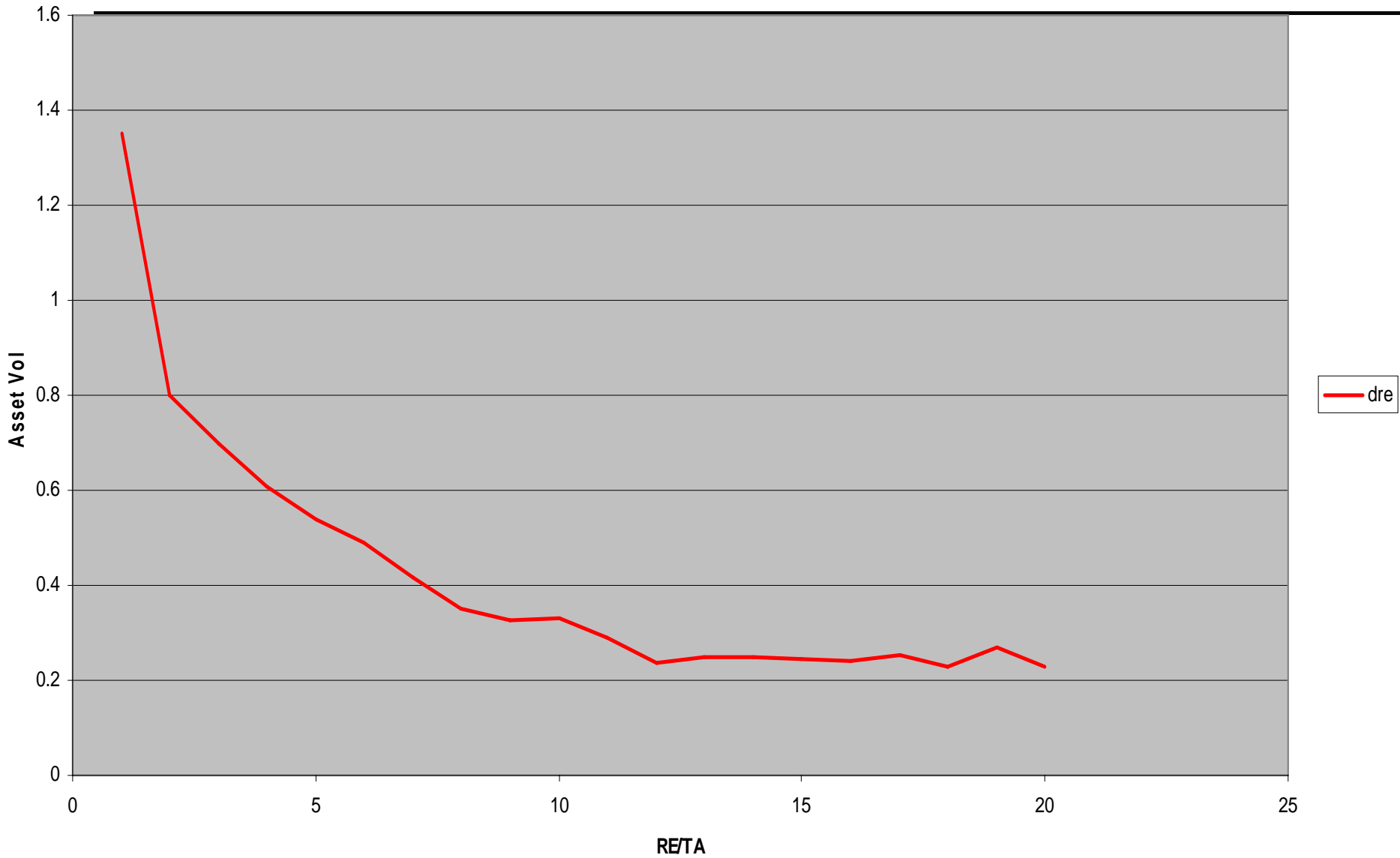
Asset Volatility vs Working Capital



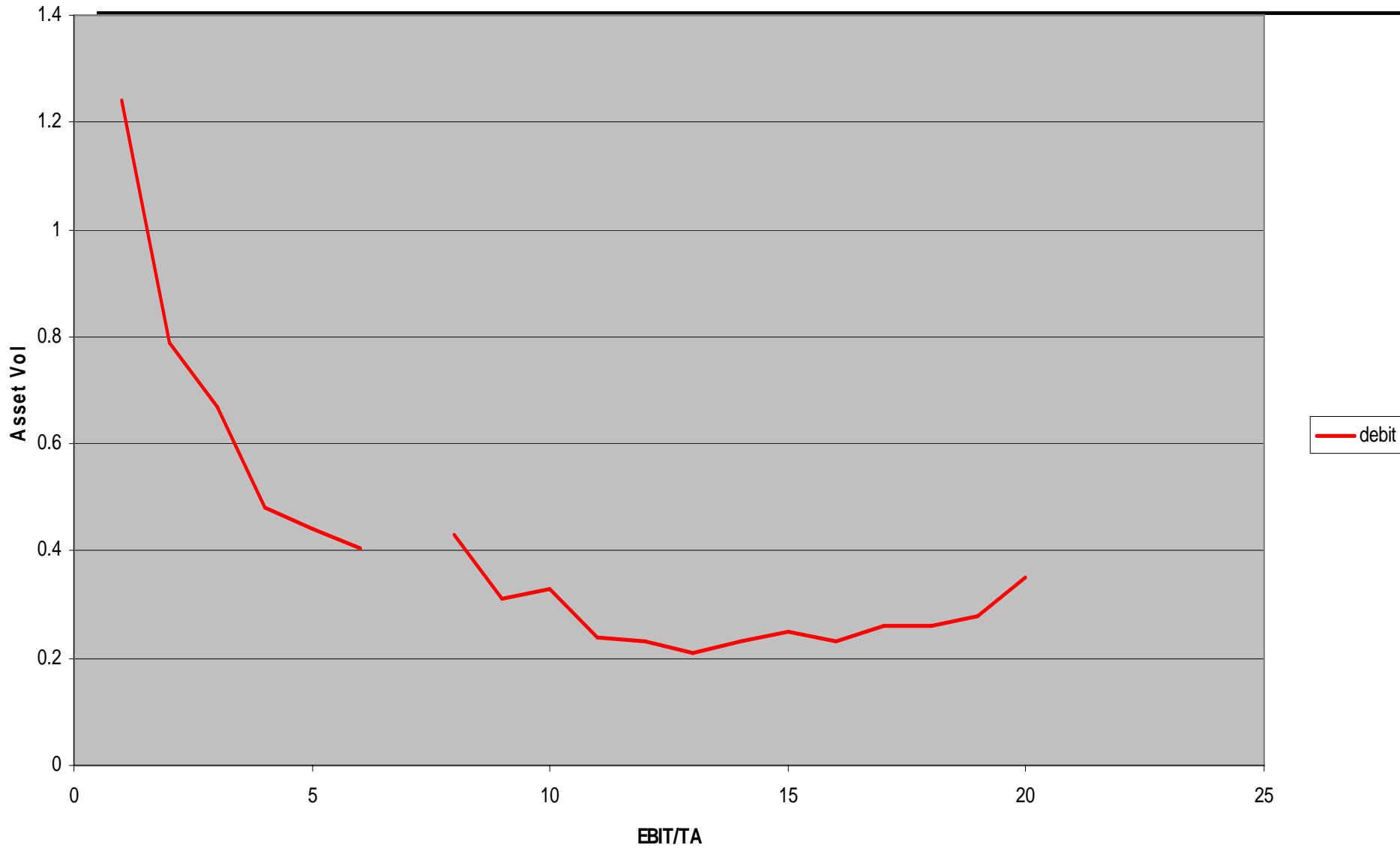
Asset Volatility vs Current Ratio



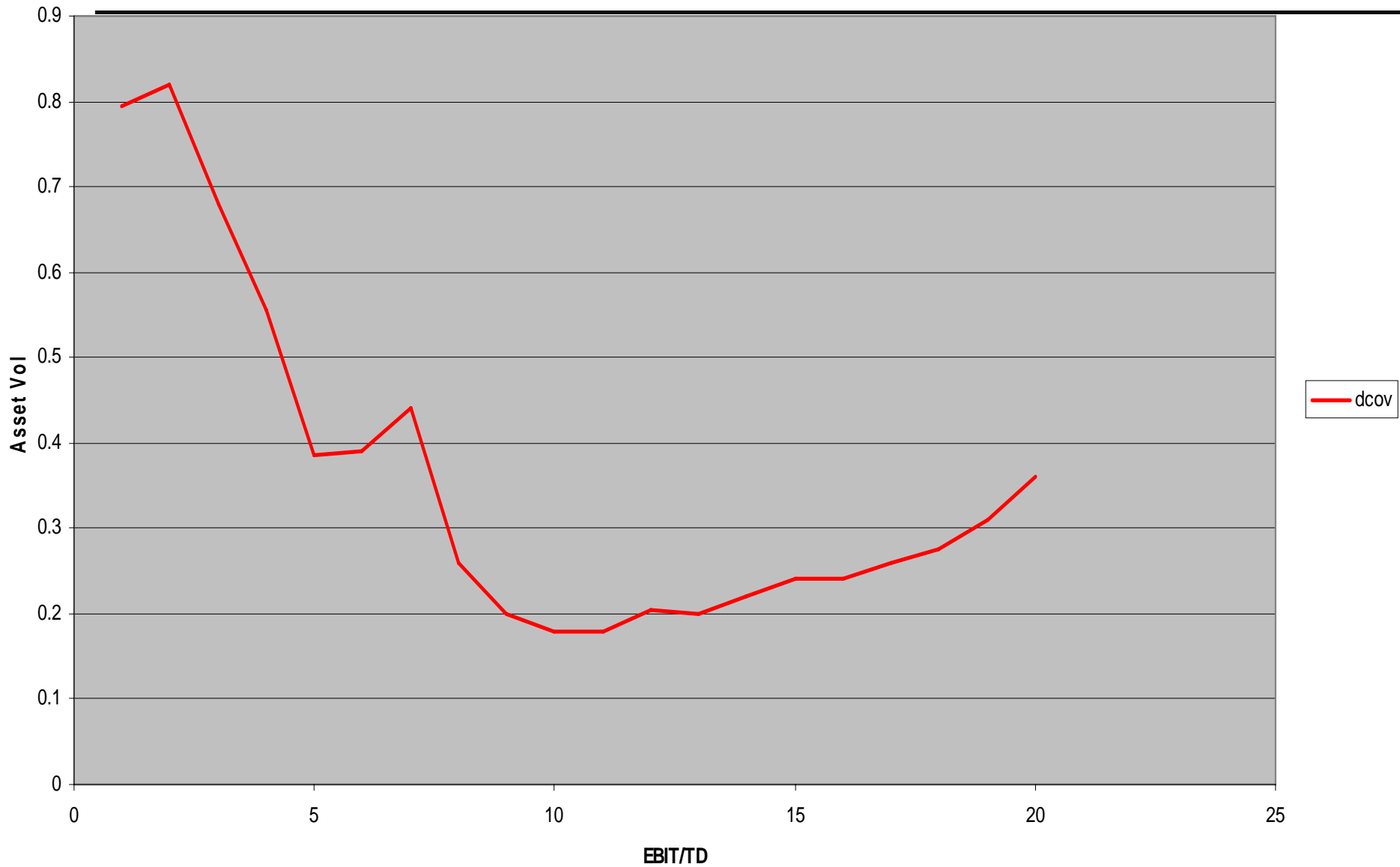
Asset Volatility vs Retained Earnings



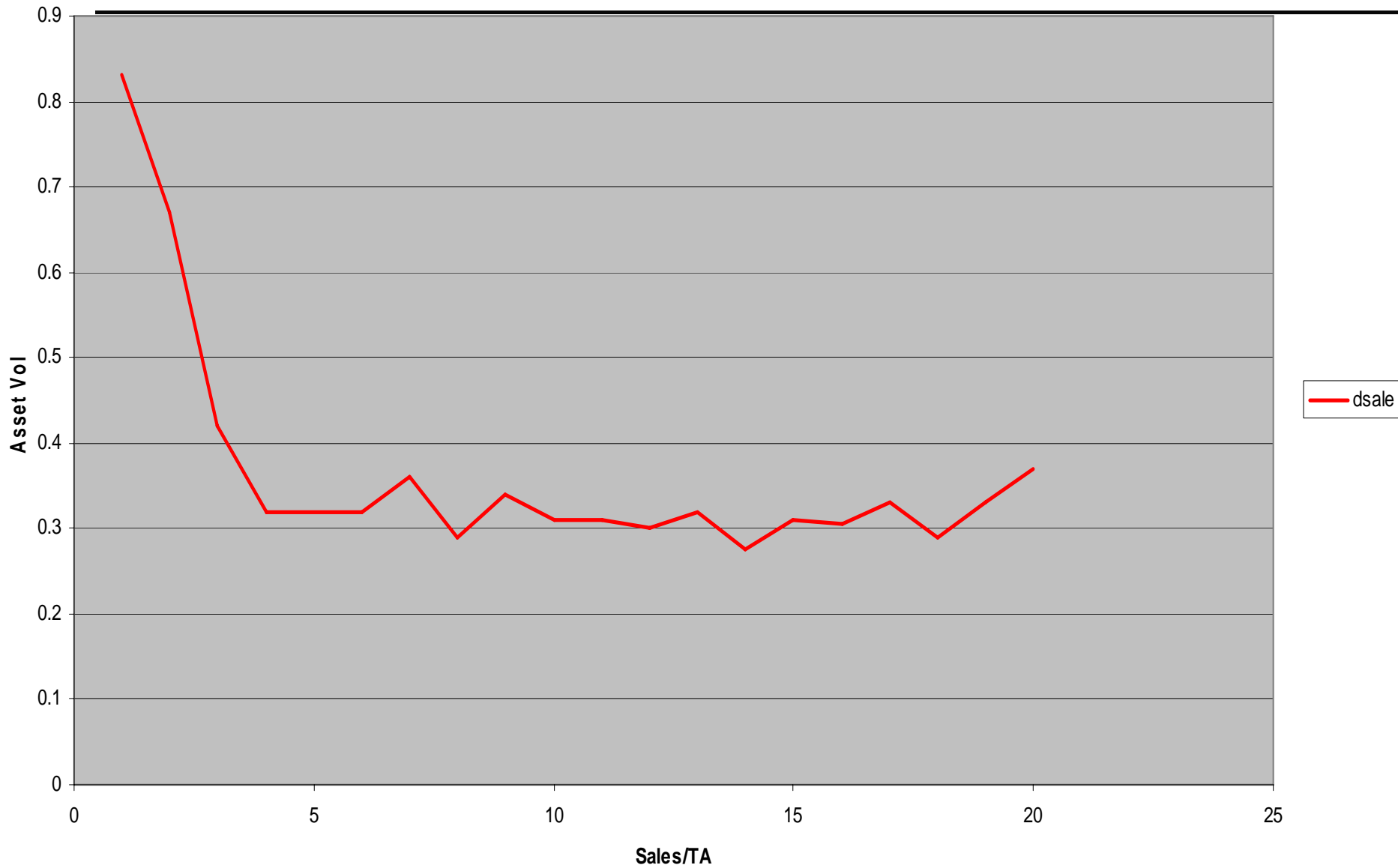
Asset Volatility vs EBIT



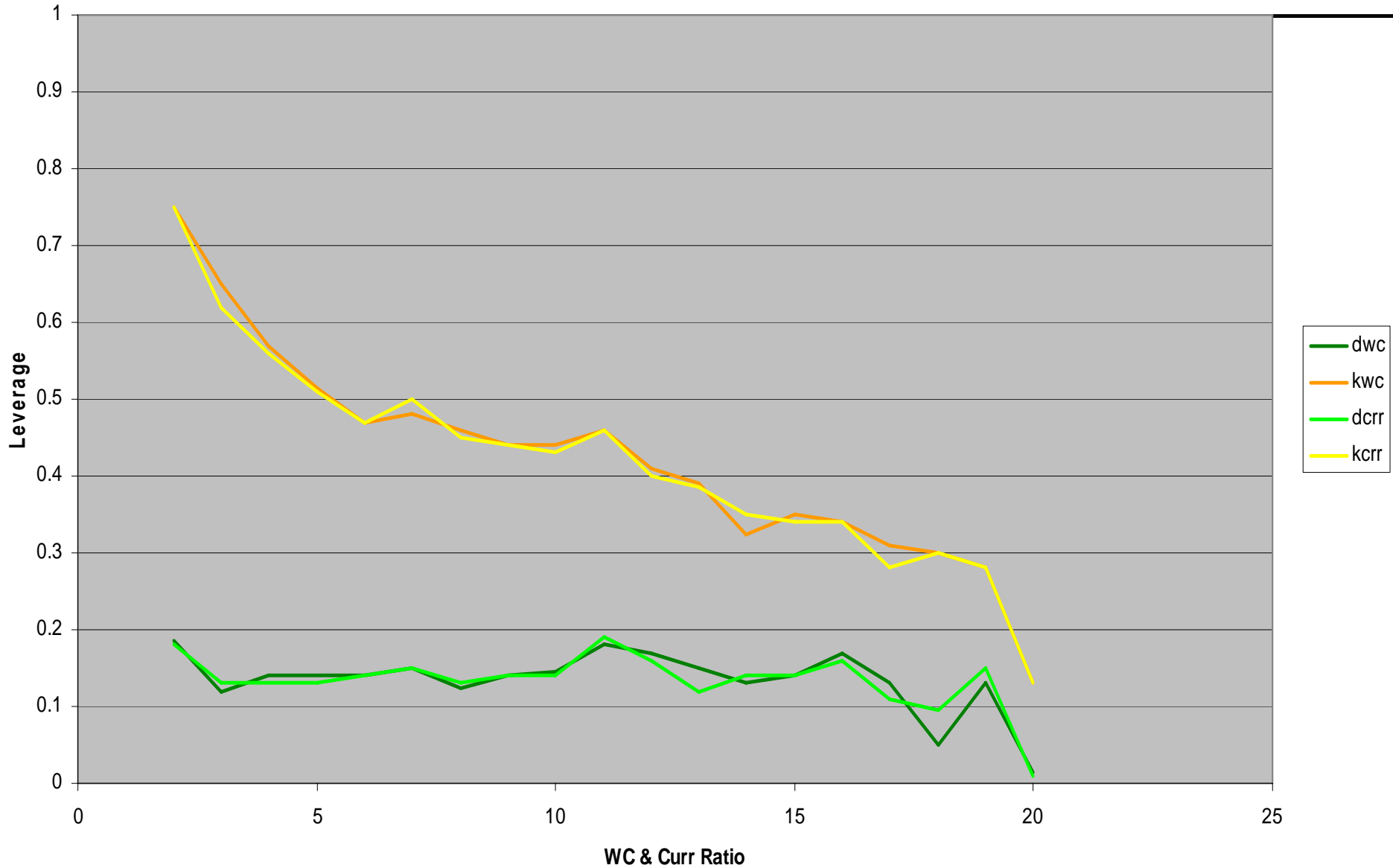
Asset Volatility vs Coverage



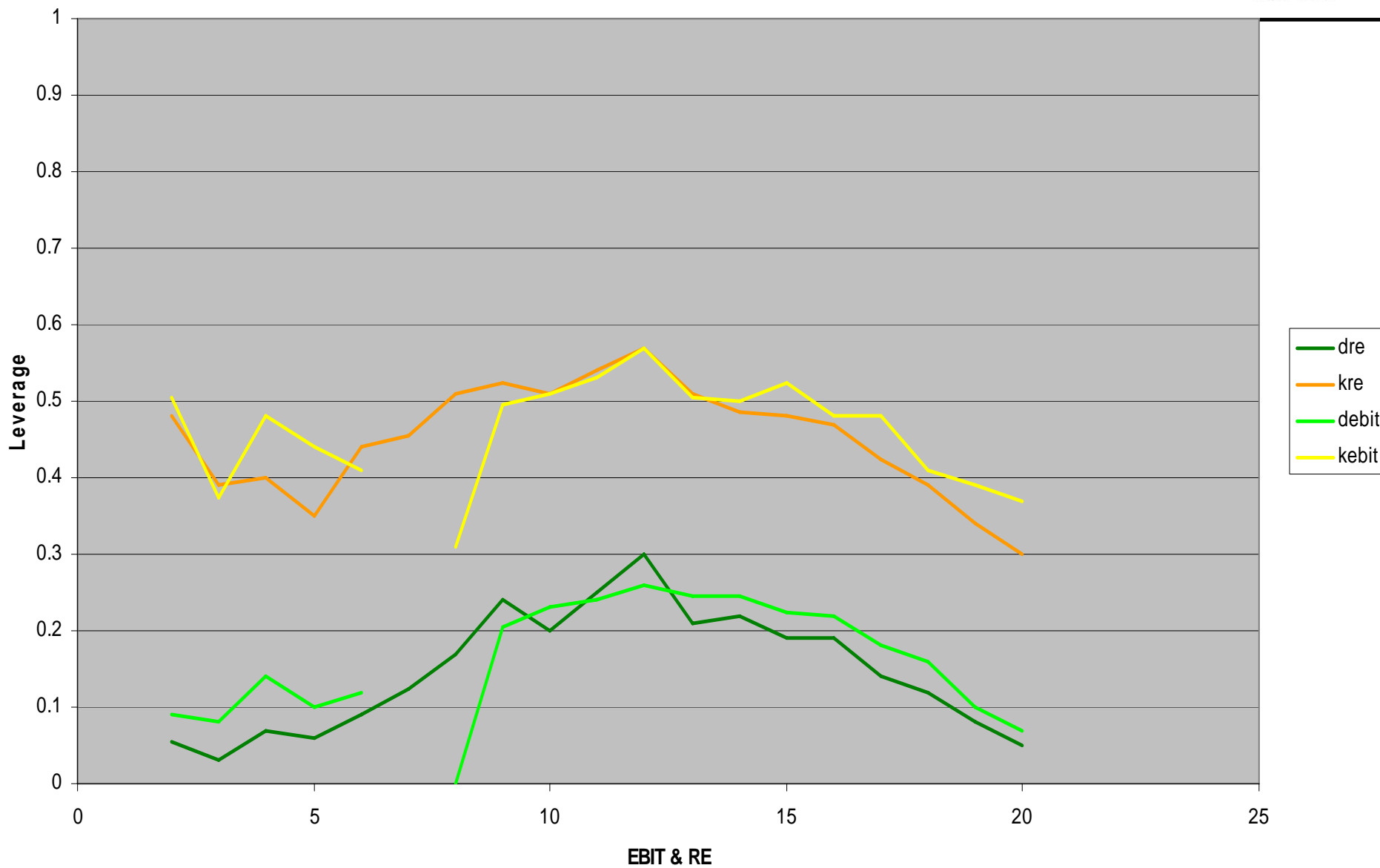
Asset Volatility vs Sales



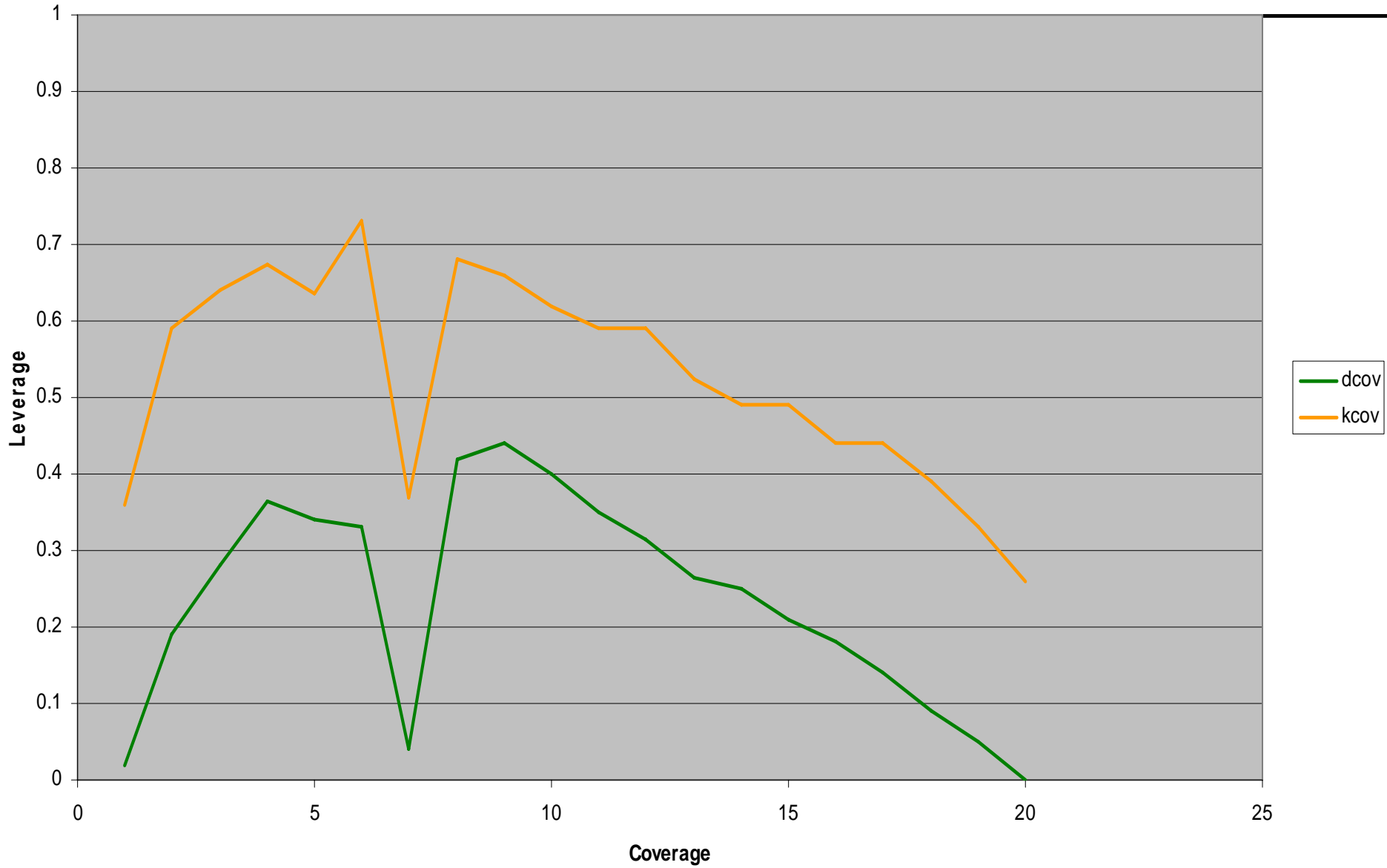
Leverage vs Working Capital and Current Ratio



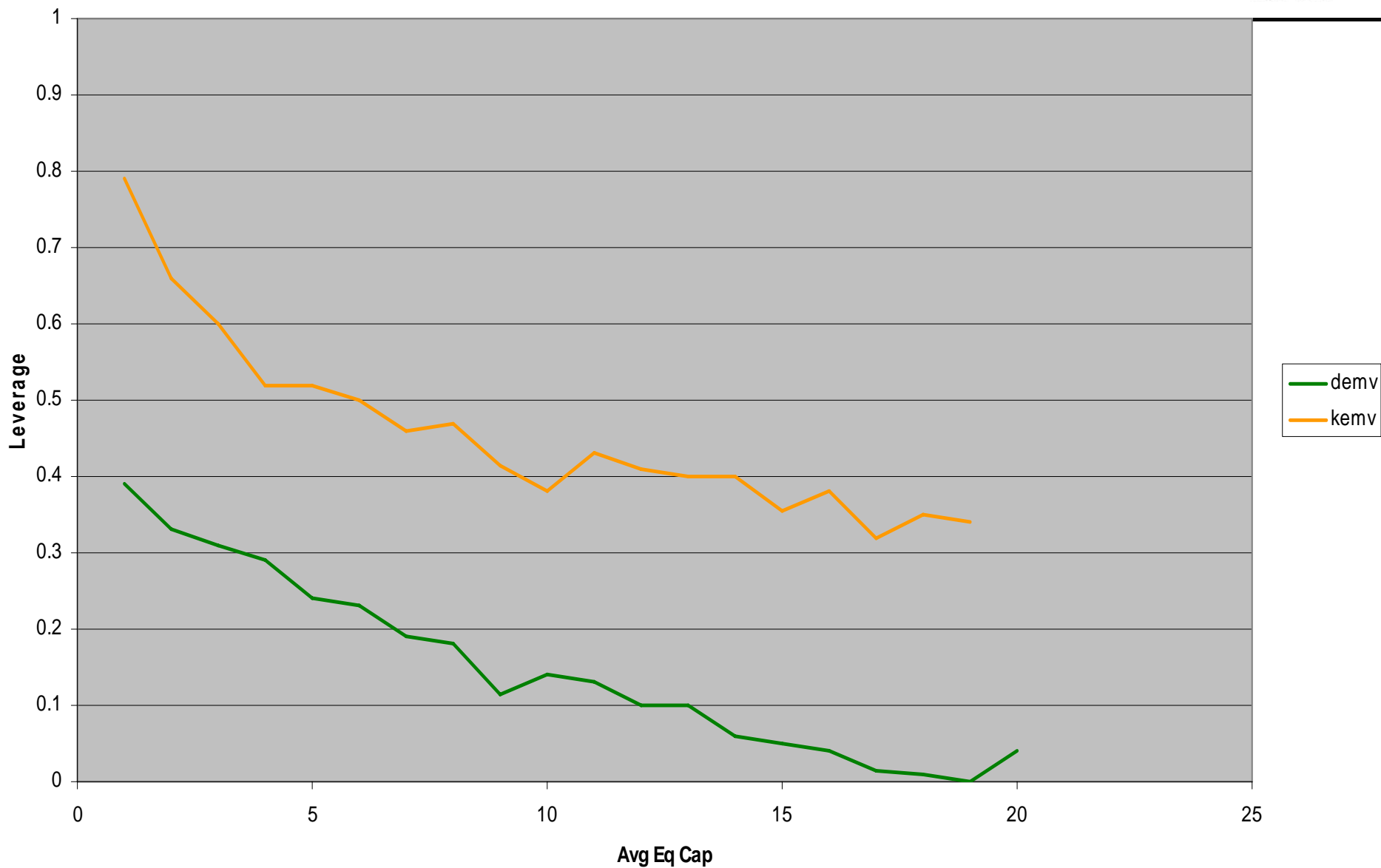
Leverage vs EBIT & Retained Earnings



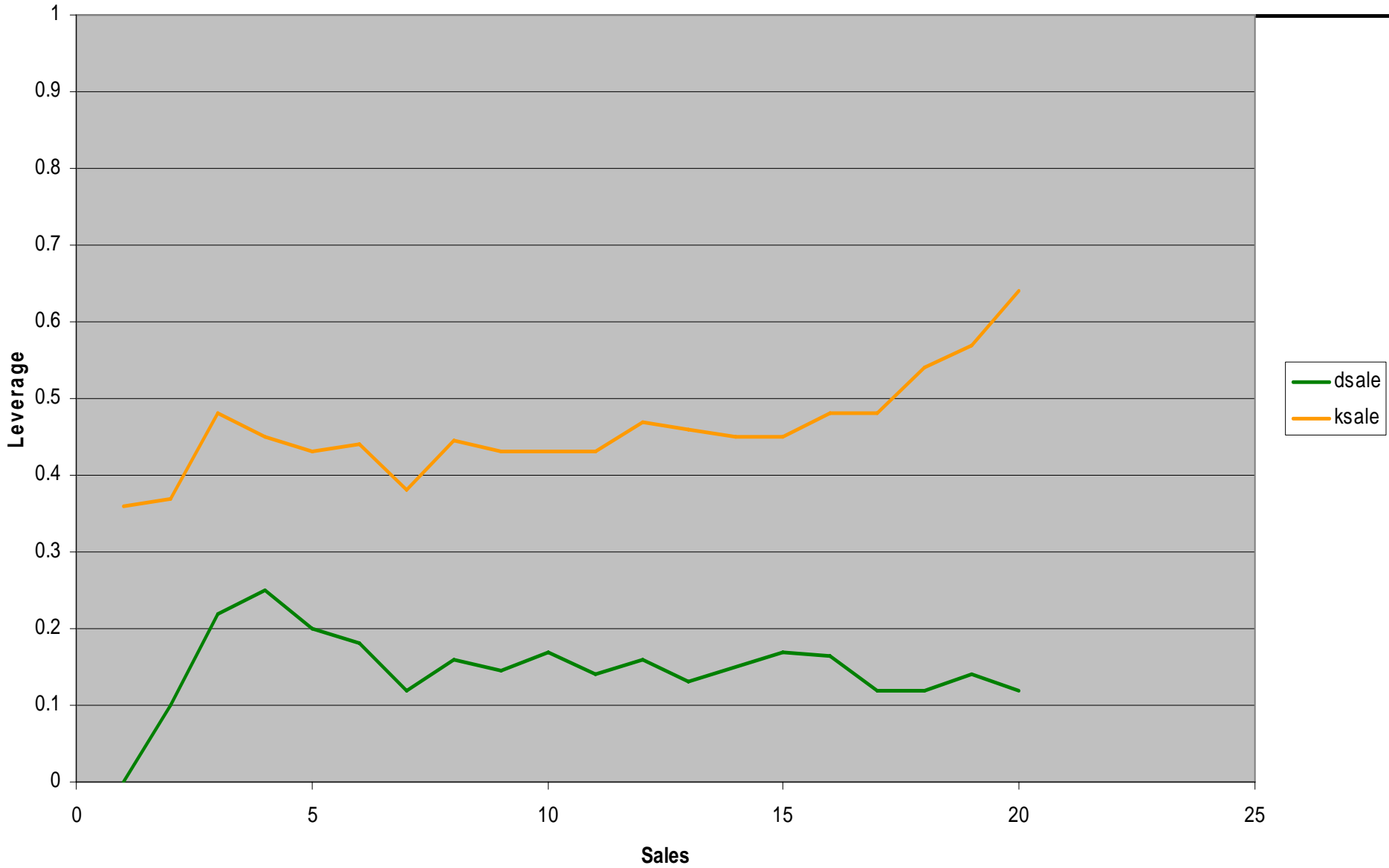
Leverage vs Coverage



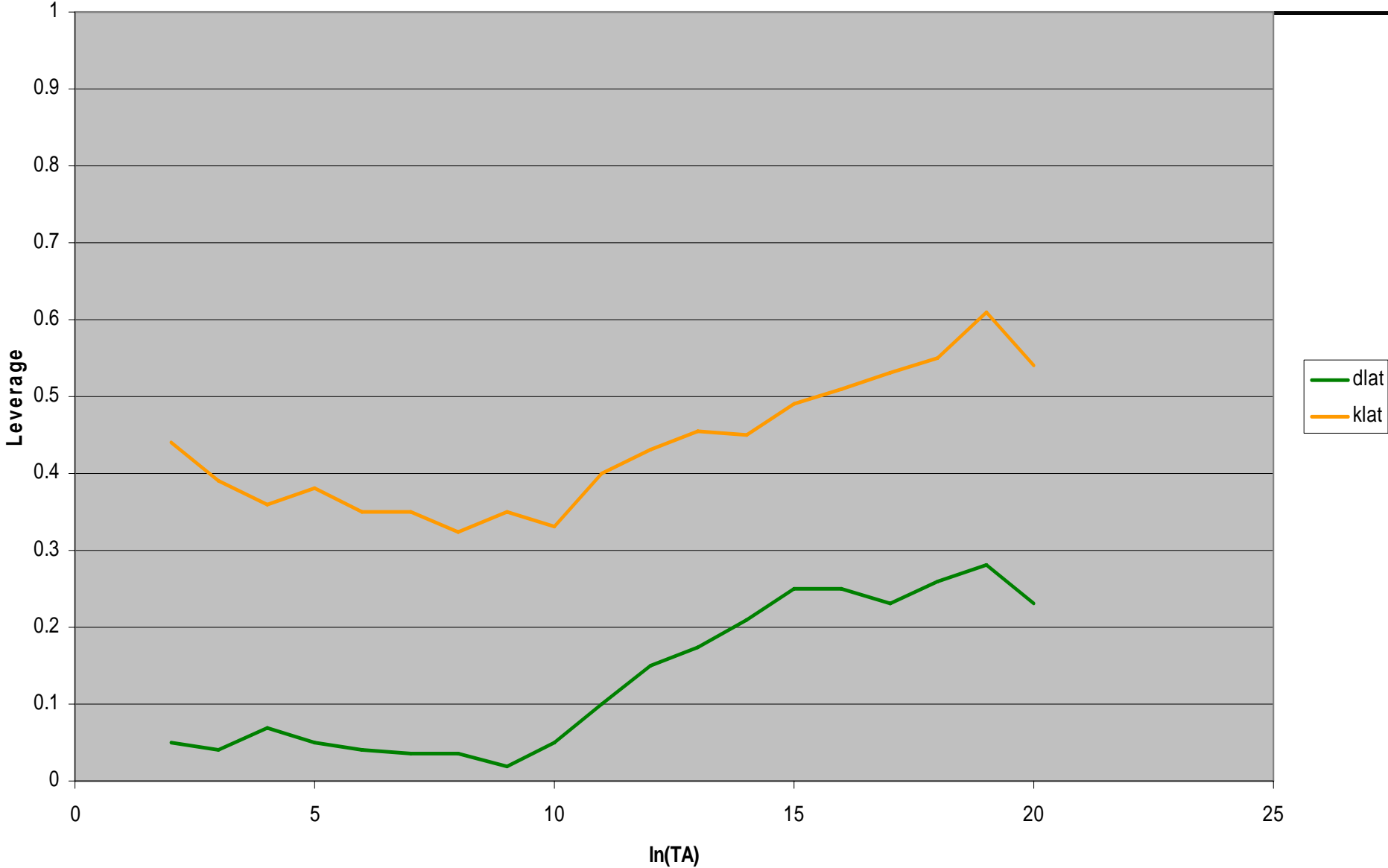
Leverage vs Average Equity Capitalization



Leverage vs Sales



Leverage vs Size



The Z-Score/Zeta model variables

- Working capital & current ratio
 - **Not much relationship to firm value or volatility**
 - **Book leverage (total liabilities)**
- Retained earnings & EBIT
 - **Strong relationship to volatility; "U"-shaped value relationship**
 - **Not much leverage relationship**
- Coverage
 - **Primarily volatility related through EBIT**
 - **Picks up some book leverage effect**
- Average market value of equity
 - **Related to firm value**
 - **Primarily a measure of book leverage**
- Sales
 - **Not much relationship to value or volatility**
 - **Not much relationship to leverage**
- Total assets as a size variable
 - **Strong relationship to volatility**
 - **Some relationship to book leverage, probably induced by volatility**

Retained earnings and age of firm not that related

- Age variable does not help much in predicting volatility

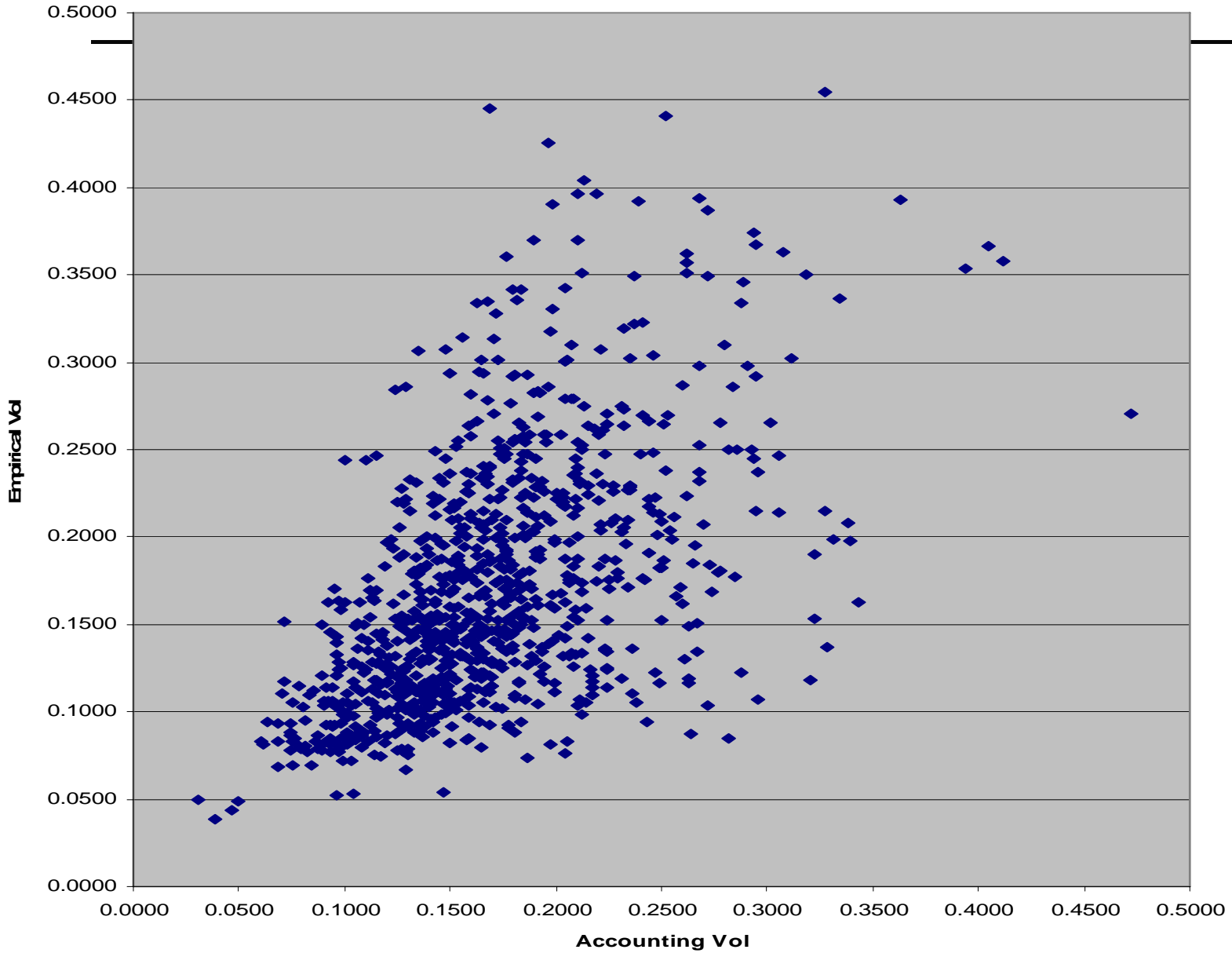
Can construct a reasonable predictor of volatility from accounting variables

- Size, retained earnings, EBIT, industry

Cannot improve current market value as a predictor of future market value using any of these variables

- Can construct a (noisy) estimate of market value

Empirical Volatility vs Accounting Based Volatility



Despite “fundamentalist” predilections, the information content of the accounting variables is often not obvious or intuitive

- Coverage ratio

Much of the value for default prediction comes from describing volatility

- Why should retained earnings or EBIT be a good volatility predictor?