Portfolio123 Virtual Strategy Design Class
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Topic 4E – Earnings Quality

Earnings quality. Honest accounting. The ethical high ground! You have to love it. This is where we don our shining armor and model for truth, justice and the FASB way. Or not.

It's good to be ethical. We hate crooks and manipulators. But as investment strategists, that gets us nowhere. What is, however, important to us is persistence. We're using numbers from the past to make investments that perform in the future, so anything that enhances persistence is good and anything that reduces it is bad.

That's why we care about earnings quality. We're looking to identify and model away from things that tend to diminish persistence. (If you absolutely need the rhetoric of morality, think of it this way: Earnings pumped by a scam have to come down because that sort of thing can't go on forever.) Keeping this is in mind will make it much easier for you to follow what we're doing and come up with pother ideas on your own.

Fear Factor

What investors fear most is out-and-out fraud. A particularly iconic example of this is the late-1963 salad oil scandal involving Anthony "Tino" De Angelis and his New Jersey-based Allied Crude Vegetable Oil Refining Company.

Discovering that he could get loans based on the value of the company's inventory, particularly from American Express (which created a new division that specialized in field warehousing) De Angelis obtained warehouse receipts for millions of pounds of vegetable oil which he discounted for cash. That in and of itself was a potentially troublesome venture as De Angeis had been driving the value of vegetable oil inventory upward through aggressive purchases of soybean oil futures. Unfortunately, though, that turned out to be the least of the problems. In fact, Allied did not possess nearly as much salad oil as it claimed.

Inspectors from American Express physically examined Allied's ships, looked at the contents of the tanks and saw oil. What they had not realized was that the tanks were filled mainly with water topped with just a small amount of oil, which was most visible given that the oil floated on top of the water. Allied even went so far as to connect some tanks so the minimal quantity of oil it actually had could be transferred between tanks as inspectors went from one to another. The crisis that occurred upon discovery was quickly managed through the market closure in deference to the assassination of President John Kennedy, which gave regulators the breathing room they needed to address the problems. But the fear remains present to this very day: How do we know companies have the inventories, sales, and so froth that they claim they have?

Bad News

There's a limit to how much we can do to detect fraud on the part of a truly determined, aggressive and creative criminal. It's hard to get through a lifetime of investing without getting caught at least once. This is one of many reasons why we diversify.

Good News

Scams certainly hurt. But we have to keep things in perspective. Remember why they make news. These are instances of man-bites-dog. Honest accounting is a dog-bite-man story, something in which the news media has no interest.

As it turns out, the deterrence of prison, coupled with generally-effective audit practices of U.S. accounting firms tend to keep such episodes at very modest levels. So in our day-to-day pursuit of alpha, we'll assume that if Apple computer reports that it sold a certain number of *iPhones* in a particular quarter, then it actually did so.

Day-to-Day Realities

Even within the law, there is much management can do to present earnings in a more favorable light than best practices might suggest. Detecting such occurrences, rather than discovering tanks that contain water in lieu of salad oil, is the role of earnings-quality analysis. The pursuit of alpha involves spotting potential problems along these lines before the market does.

And once again, we are in a good news-bad news situation. The good news is that the quantitative tools available to us today such as Portfolio123 can effectively aid us in this cause. The bad news, so to speak, is that we'll need to be willing to work with models that are much more complex than most we've seen. Do not expect to detect potential earnings manipulation with simple tests.

Manipulators, even those who manage to stay inside the law, do not wish to be detected, so in essence, they're going to make us roll up our sleeves and really break a sweat if we are to uncover their efforts. If you want to tangle with these characters, you won't need to get a gun and spend time on a firing range, but you will need to brush up on custom Formulas, ShowVar/SetVar, ISNA and financial-statement functions, and get good at making sure you handle parentheses properly (a balance between right and left). It's a pain in the neck, but a heck of a lot more palatable than chasing armed thugs around vacant warehouses. Therefore . . .

WARNING: Earnings Quality is not a strategy we can implement by typing in a few ratios and running some tests. This topic is going to be about ideas, not recipes. I'd give you recipes if I could, but between manipulators cooking up new tricks and the investment community rushing into anything that can be shown to work, we have to always stay on the job, even if or when we come up with ideas that test well. So the aim

here is to help you understand the topic with a view toward being able to develop your own ideas, and change them in the future as the need arises.

This will be our last topic in fundamental analysis (before we move on to sentiment, etc.). It might, therefore, help to think of this as the brutal obstacle course marine recruits have to run before graduating from boot camp. So with that delightful image in mind, let's start with the most basic earnings-quality topic, accruals

Accruals: The Mother of all Earnings Quality Metrics

Accruals consist of the non-cash portion of net income. Put another way, it's the difference between net income and cash from operations, or IncAftTax - OperCashFl.

Accruals aren't necessarily bad. They contain information that helps us in the important task of matching revenues with the expenses that helped to generate them. This can be challenging since important expenses often occur in accounting periods other than the one on which we are focusing. But there are many things in life that are valuable but capable of causing damage if misused. Fire is one obvious example. Accruals should be viewed in that light.

The linchpin of research into accruals is *Accrual Reliability, earnings persistence and stock prices* by Scott A. Richardson, Richard G. Sloan, Mark T. Soliman and Irem Tuna. They base the link between accruals and lack of persistence on the issue of reliability. They give the following example:

> If cash sales are made for $100 (with no returns allowed and no after sales service), then it is straightforward to book $100 of revenue in current period earnings. But if the sales are credit sales for $100, of which $100 ultimately ends up being collected as cash in the next period, uncertainty exists about the amount to record in current period earnings. An aggressive manager could book sales of $110, representing an error of +10 in current period accruals and earnings. Conversely, a conservative manager could book sales of $90, representing an error of -10 in current period earnings and accruals. This results in an errors-in-variables problem in accruals, because observed accruals are noisy measures of the future benefits or obligations that they represent.

This example, involving an increase in accounts receivable, involves considerable judgment and is, therefore, characterized by low reliability. So, too, might be an accrual caused by the recording of the value of inventory when it is ultimately sold. While we can reliably identify the physical unit that is sold, we cannot necessarily be certain of its cost. It may, for example, be one of 5,000 identical shirts purchased for resale by a company that operates a chain of retail stores. Management knows, in the aggregate, how much it paid for all 5,000 shirts. But because they were purchased gradually at varying prices, it cannot state with certainty the actual cost to the company of the specific shirt sold to John Doe at such-and-such branch on this specific day.

The best management can do is assign a cost based on a systematic protocol such as FIFO (assume the item purchased first in time was the one that was just sold, First-In-First-Out, and assign the cost of that to the sale as the associated expense) or LIFO (assume the last item to be purchased is the one that was just sold, Last-In-First-Out, and use that cost as the expense associated with the sale). If price levels are rising, then EPS will be pumped up by use of FIFO inventory accounting, since we'll be associating lower costs with current sales. Is it aggressive? Yes. Is it evil? Well, the company has to make some sort of artificial assumption so we can hardly try to indict a CFO who goes this route, and discloses it in the footnotes to the financials. (Fraud would be using FIFO while saying LIFO, but that doesn't happen.)

Not all Accruals Are Equal

Richardson, et. al. point out that not all accruals are equally unreliable. Consider, for example, changes in accounts payable. These involve financial obligations that can be clearly tabulated.

The authors expanded their inquiry first by extending the definition of accruals beyond the traditional focus on non-cash components in working capital to include non-current components of the balance sheet as well, to classifying categories of accruals based on reliability, and to quantifying the impact of various categories of accruals on earnings persistence.

Generally, their conclusions are based on regression studies using the following approach:

$$ROA_{t+1} = a + bROA_t + b_1Factor_1 + b_2Factor_2 \ldots . + b_nFactor_n$$

The coefficient for the ROA factor is high and significant, as we expect considering what we've seen before about the persistence of ROA. The other factors are components of accruals and their associated factors. They tell us about the extent and direction of their impact on ROA in period t+1; the authors also present significance data.

I encourage those who are interested in the numbers to download and read the paper.

For present modeling purposes, I'm not going to drill down here into the components of accruals, but I am going to give you the framework to enable you to go further on your own if you wish. That, actually, is the most important goal of this Topic. Development of quantitative strategies based on earnings quality is still an emerging area, meaning we don't yet have all the answers. So once you nail down the basics and see some examples of how one might work, each of you has just as good a chance of hitting the mother lode as anybody else.

The decomposition of accruals starts with the following definition of total accruals:

TACC = ΔWC + ΔNCO + ΔFIN

- TACC = Total Accruals
- ΔWC = Change in working capital net of cash, short-term investments and short-term liabilities
- Δ NCO = Change in net non-current operating accruals
- ΔFIN = Change in net financial assets

Each of the three components of TACC can be further deconstructed and assessed in terms of reliability.

ΔWC = ΔCOA - ΔCOL

- ΔWC = Change in working capital net of cash, short-term investments and short-term liabilities
- ΔCOA = Change in current operating assets; mainly receivables and inventories
- ΔCOL = Change in current operating liabilities net of short-term debt; mainly, payables

Estimates of COA, mainly receivables and inventories, involve considerable subjective judgment and, hence, are characterized by low reliability. COL, on the other hand, is a high-reliability item given the precision with which we can measure its key component, accounts payable.

ΔNCO = ΔNCOA – ΔNCOL

- ΔNCO = Change in non-current operating accruals
- ΔNCOA = Change in non-current operating assets, mainly property, plant and equipment (PPE) and intangibles
- ΔNCOL = Change in non-current operating liabilities, such as long-term payables, deferred taxes, and post-retirement benefits

NCOA is a low-reliability item. Its dominant components, PPE and intangibles, are beset by subjectivity regarding the manner in which their initial book values are depreciated or amortized. Such judgments occur in the method of computing the periodic charges, useful lives, and anticipated salvage values. As is apparent from special writeoffs that often occur, the initial sets of polices are often recognized as having been deficient, leading to unrealistic results. NCOL, on the other hand, is a mixed bag. Some items, such as long-term payables, are amenable to credible measurement while others, such as postretirement benefits, are more difficult to quantify. So on the whole, NCOL is considered a medium-reliability item.

ΔFIN = ΔSTI + ΔLTI - ΔFINL

- ΔFIN = Change in net financial assets

- ΔSTI = Change in short-term investments
- ΔLTI = Change in long-term investments
- ΔFINL = Change in current financial liabilities, consisting of short-term debt, long-term debt and preferred stock

FINL consists mainly of high-reliability items that can be measured with reasonable degrees of confidence. STI consists of marketable securities with readily observable market values. FINL, meanwhile, likewise consists of reasonably quantifiable debt and preferred equity items. The challenge in this category is LTI. One component, long-term investments, is reasonably measurable. Another is long-term receivables, which is plagued by the measurement difficulties that are at best comparable to and possibly more challenging than those of low-reliability current accounts receivable. On the whole and based on this mixture, the authors regard FINL as a medium-liability item.

Here's the equation for the extended version of TACC:

TACC = ΔCOA – ΔCOL + ΔNCOA – ΔNCOL + ΔSTI + ΔLTI – ΔFINL

And here it is in tabular form:

Table 1

Components of TACC		
Primary Level	**Secondary Level**	**Reliability Assessment**
+ΔWC		Medium
	+ΔCOA	Low
	+ΔCOL	High
+ΔNCO		Low/Medium
	+ΔNCOA	Low
	– ΔNCOL	Medium
+ΔFIN		High
	+ΔSTI	High
	+ΔLTI	Medium
	–ΔFINL	High

Everyone, however, should be interested in what this means for equity performance. Table 2 reproduces results of the Sloan et al study regarding size-adjusted one-year performance of decile portfolios formed on the basis of sorting companies from low to high on the basis of TACC and its components (bear in mind that these items are scaled by Total Assets; in fact, more recent commentators change the TACC acronym to TATA which stands for Total Accruals to Total Assets). The hedge portfolios assume long positions in the lowest decile group and short positions in the highest decile groups. Remember, too, that wen it comes to accruals, lower is better.

Table 2

Decile	TACC	ΔCOA	-ΔCOL	+ΔNCOA	-ΔNCOL	+ΔSTI	+ΔLTI	-ΔFINL
Low	0.066	0.069	-0.027	0.070	-0.008	0.022	0.026	-0.76

2	0.038	0.061	0.001	0.054	-0.003	0.013	0.098	-0.24
3	0.029	0.029	0.001	0.049	0.019	0.005	0.015	-0.10
4	0.028	0.017	0.016	0.033	0.007	0.005	0.015	0.07
5	0.016	0.026	0.016	0.022	0.007	0.005	0.015	0.28
6	0.015	0.007	0.018	0.004	0.016	0.005	0.015	0.35
7	0.012	0.010	0.010	-0.001	0.033	0.005	0.015	0.32
8	-0.011	-0.017	0.017	-0.009	0.007	0.005	0.015	0.38
9	-0.026	-0.025	0.020	-0.029	0.019	0.016	0.002	0.44
High	-0.067	-0.076	0.028	-0.091	0.003	0.015	-0.026	0.29
Hedge	0.133	0.145	-.055	0.161	-0.011	0.007	0.052	-0.015
t-statistic	10.25	11.79	-4.64	14.02	-1.08	0.71	5.40	-10.09

The passage of time since publication of this study (which used data from 1962-2001) raises concern regarding whether the investment community has incorporated these principles into stock pricing to such a degree as to eliminate investable opportunities. Let's see. If the Accounting Gods are smiling, this is going to work. If not, we should at least wind up with lots of ammunition (custom formulas) and ideas we can use to develop new approaches.

First, let's create a truckload of custom formulas that will allow us to work with those ratios.

The following formulas articulate the elements of ΔCOA

Formula Name: $ChRec
Formula: ((IsNA(RecvblQ,0)-IsNA(RecvblPYQ,0))/AstTotTTM)*100

Formula Name: $ChInvent
Formula: ((IsNA(InventoryQ,0)-IsNA(InventoryPYQ,0))/AstTotTTM)*100

Formula Name: $ChOthCA
Formula: ((IsNA(AstCurOtherQ,0)-IsNA(AstCurOtherPYQ,0))/AstTotTTM)*100

The following formulas articulate the elements of ΔCOL

Formula Name: $ChPayable
Formula: ((IsNA(PayablesQ,0)-IsNA(PayablesPYQ,0))/AstTotTTM)*100

Formula Name: $ChTxPay
Formula: ((IsNA(TxPayableQ,0)-IsNA(TxPayablePYQ,0))/AstTotTTM)*100

Formula Name: $ChOthCL
Formula: ((IsNA(LiabCurOtherQ,0)-
IsNA(LiabCurOtherPYQ,0))/AstTotTTM)*100

The following formulas articulate the elements of ΔNCOA

Formula Name: $ChPPE
Formula: ((IsNA(NetPlantQ,0)-IsNA(NetPlantPYQ,0))/AstTotTTM)*100

Formula Name: $ChInvEq
Formula: ((IsNA(InvstEqQ,0)-IsNA(InvstEqPYQ,0))/AstTotTTM)*100

Formula Name: $ChAstIntan
Formula: ((IsNA(AstIntanQ,0)-IsNA(AstIntanPYQ,0))/AstTotTTM)*100

Formula Name: $ChAstOther
Formula: ((IsNA(AstCurQ,0)-IsNA(AstCurPYQ,0)) /AstTotTTM)*100

The following formulas articulate the elements of ΔNCOA

Formula Name: $ChDfdTx
Formula: ((IsNA(TxDfdICQ,0)-IsNA(TxDfdICPYQ,0))/AstTotTTM)*100

Formula Name: $ChMinInt
Formula: ((IsNA(NonControlIntQ,0)-
IsNA(NonControlIntPYQ,0))/AstTotTTM)*100

Formula Name: $ChOthLiab
Formula: ((IsNA(LiabNonCurOtherQ,0)-
IsNA(LiabNonCurOtherPYQ,0))/AstTotTTM)*100

The following formula articulates the elements of ΔSTI

Formula Name: $ChSTI
Formula: ((IsNA(InvstSTQ,0)-IsNA(InvstSTPYQ,0))/AstTotTTM)*100

The following formula articulates the elements of ΔLTI

Formula Name: $ChLTI
Formula: ((IsNA(InvstAdvOtherQ,0)-
IsNA(InvstAdvOtherPYQ,0))/AstTotTTM)*100

The following formula articulates the elements of ΔFINL

Formula Name: $ChDbtCL
Formula: ((IsNA(DbtSTQ,0)-IsNA(DbtSTPYQ,0))/AstTotTTM)*100

Formula Name: $ChLTD
Formula: ((IsNA(DbtLTQ,0)-IsNA(DbtLTPYQ,0))/AstTotTTM)*100

Formula Name: $ChPfd

Formula: ((IsNA(PfdEquityQ,0)-IsNA(PfdEquityPYQ,0))/AstTotTTM)*100

To create our ranking system, we'll define a single factor that implements TACC, which I'll henceforth refer to as TATA since, as we've seen, each element is scaled to Assets:

$$COA - \Delta COL + \Delta NCOA - \Delta NCOL + \Delta STI + \Delta LTI - \Delta FINL$$

Here is how it translates into our actual TATA rank factor:

($ChRec+$ChInvent+$ChOthCA)-($ChPayable+$ChTxPay+$ChOthCL)+
($ChPPE+$ChInvEq+$ChAstIntan+$ChAstOther)-
($ChDfdTx+$ChMinInt+$ChOthLiab)+
($ChSTI)+($ChLTI)-($ChDbtCL+$ChLTD+$ChPfd)

Use the radio buttons to choose the down arrow, to create an ascending sort in which lower values of TATA are preferred.

I'm going to run a series of annual five-bucket tests on the TATA ranking system using PRussell 3000 ex Finance universe I created. (In case you haven't noticed before, when you run a ranking system performance test and see the bar graphs, you can click on the Excel download icon and get the exact numerical values that correspond to each bucket.)

Table 3

Bucket	2006	2007	2008	2009	2011	2012	2013	2014	2015
1 -Low	8.4	3.9	-47.1	61.0	-11.8	4.5	40.1	3.9	-5.5
2	13.3	6.8	-37.7	44.1	-2.6	16.7	41.8	6.2	-5.2
3	18.1	4.0	-35.2	50.0	-1.8	12.5	40.2	6.0	-6.9
4	23.2	0.5	-36.2	67.1	0.1	16.9	45.1	11.0	-10.6
5 – High	14.7	-4.7	-38.4	77.7	-.62	14.7	42.5	0.1	-15.2
High-Low	6.3	-8.6	8.7	16.7	5.7	10.2	2.4	-3.8	-9.7

Here are my takeaways:

- TATA contains useful information, but
- TATA by itself is not a silver bullet that can carry a strategy
- Generally, performance of High-Low is good, but there are some notable exceptions
- The reversal in TATA performance expectations during this sample period preceded some tough times for the market: Can a longer-term timing/warning signal be developed based on the market's increased tolerance for lower-earnings quality and higher risk (a symptom of less rational investor behavior)? Have at it! (Now, considering the potential "signal" we're seeing, I bet you really can't wait to see how 2016 turns out.)

- The propensity for weakness in the low ranked (highest TATA) group seems worth noting
- The often-significant underperformance of the highest group (lowest TATA, best of the best in earnings quality) seems to be telling us something but off hand, I don't yet know what it is. Maybe it's something peculiar about industries that might be clustering in this end of the range. Maybe it's something about accounting line items among companies clustered in this end of the range. Based on logic, we can never allow test results to push us off our understanding of what TATA is and what it means for earnings quality and what it should mean for stocks. What the numbers do tell us is that we're still missing some pieces of the puzzle and that more work is needed to find the answers. My initial guess is that whatever the answer turns out to be, it will require us to accompany TATA by some screening/Buy/universe-narrowing rules to pre-qualify the stocks that get subjected to a TATA rank.
- Working with individual components of TATA (the custom formulas) seems like a good first step toward solving the most-favorable-TATA puzzle. Ditto industry membership and line items on the statement of cash flows.

While the rank performance test isn't what we hoped it might have been, it would still be nice to have at least some indication that there really is something there, even if we're not yet in a position to fully develop it. Create a Finance, GICS(40), free PRussell 3000 universe. Use the pre-set "Basic: Quality" and "Basic: Value" ranking systems to create an equally-weighted "QV" system. We'll use that to select 20 stocks. Next, create a single-rule screen: Rating ("Basic: Sentiment") > 80.

That's a pretty decent model. We've got value, and we cover the all-else factors that can make or break a low-to-high valuation sort; use of the Quality ranking systems covers the risk component of Required Return and we're using the Sentiment ranking system as a way to get at shares of companies seen as able to deliver growth (remember, we're talking about an expectation, not necessarily a future reality, but that's all we can do when it comes to the future). The test results are pretty good.

After testing, I add another rule, Rating("TATA")>20 and test again. I'm not aiming for the best TATA metrics; I'm just trying to weed out prospective garbage.

Table 4 summarizes the MAX (4-week rebalancing) test results:

Table 4

	R3000 ETF	Original Screen	Adding TATA rule
Annual Return %	4.92	18.98	20.26
Standard Deviation %	15.86	23.27	21.78
Avg. 4 Wk Period	0.50	1.76	1.72
Avg. 4 Wk Up Period	3.34	4.89	4.67
Avg. 4 Wk Down Period	-3.96	-3.14	-2.90

Is there a significant difference? No not really. But the minor change is, at least, in the direction of unfavorable TATA being troublesome. Interestingly, in the rolling test, we

see that the tiny advantage of screening out TATA-dogs shows during down periods. This is not really enough to carry an investing strategy (as if it needs much, the basic strategy itself looks pretty decent). But it does provide a hint that creative energy devoted to unraveling the mysteries of TATA may be time well spent.

Other Earnings Quality Ratios

As suggested above, it is possible for the investor to develop productive strategies using TATA. But we have reason to believe that not all accruals are created equal. Some are less reliable and more likely to restrain stock-market returns, than others. In this section, we'll focus on some of the noteworthy accrual-based ratios that can target more specific problems.

There are more worthwhile earnings quality ratios than we can detail here, but they are well presented in *What's Behind the Numbers* by John Del Vecchio and Tom Jacobs. The analysis of the ratios described below can serve as a sound template for your work with other earnings-quality metrics.

Days Sales Outstanding – DSO

How often do you use cash to make a purchase? If you're like most nowadays, the answer was probably "Seldom, especially for purchases of more than, say, twenty dollars." When consumers consider such questions, they typically think in terms of credit or debit cards; either physical cards or electronic entries that are the functional equivalent to showing the plastic. When businesses consider such questions, they often think in terms of trade credit; arrangements wherein payment can be made a certain number of days after taking delivery of goods or services. Either way, the company records the sale when the transaction occurs, and when that happens, the consideration (i.e., payment) received by the seller is recorded as an increase in assets. When the company does not receive cash, it instead receives a new account receivable, an I.O.U.

Often in the consumer arena, the obligations represented by accounts receivable are paid quickly and reliably. If the consumer defaults, the loss is borne by the entity that supplied the credit (the bank that issued the credit card, the car loan, the home mortgage).

In business-to-business transactions (which include consumer goods that are sold, for example, by a manufacturer to a distributor rather than the end-consumer) a creditor may likewise participate in a transaction and assume the risk of default, but often, the seller bears the risk of non-payment.

Non-payment risk is recognized by companies by refraining from booking 100 percent of sales as accounts receivable. A portion is set aside in a reserve known as Allowance for Doubtful Accounts. If Doubtful Accounts as a percent or total Accounts Receivable is rising, that could be a signal that customers are finding it difficult to pay their bills, a situation that could well lead to a future decrease in the pace of new orders. This data item is not always available in quantitative platforms, so it often cannot be incorporated

directly into our strategies. But it can be found and examined in the company financial statements. In addition, as we'll see below with other ratios, there are other ways for us to capture the sort of problems we'd want to see with doubtful receivable as a percent of total.

A very important signal involving Accounts Receivable is Days Sales Outstanding, or DSO. This tells us how long it's taking, on average, for the company to collect on its Receivables. The formula for this ratio is as follows:

DSO = (Accounts Receivable / Sales) * 91.25

In Portfolio123 syntax, this is: (RecvblMRQ/SalesMRQ)*91.25

Actually, though, for the kind of work we'll have to do, it pays to get into the habit of articulating ratios like this using the more generalized functions:

(Recvbl(0,qtr)/Sales(0,qtr))*91.25.

For the sake of convenience and to have numbers similar to what we may see elsewhere, we multiply the quotient of receivables and sales by 91.25 in order to express the result in annual terms.

We'll illustrate how this can help us by considering Table 5, while depicts an episode from Apple's recent past. DSO is not likely to be an issue for Apple for sales made directly by it to consumers through its own stores or its web site, since these are likely to come from its own inventory and be financed by bank-issued credit cards. But the business-to-business aspects of receivables will be relevant for product sold by Apple to distributors (i.e., to wireless carriers or independent retailers) for distribution to consumers. We'll go back in time, and pretend the June 2013 quarter was just reported. Looking backward from that vantage point, here is what we see.

Table 5

Qtr. Ended	6/13	3/13	12/12	9/12	6/12	3/12	12/11	9/11
Qtr. Offset	0	1	2	3	4	5	6	7
Sales	35,323	43,603	54,512	35,966	35,023	39,186	46,333	28,270
Receivables	13,453	13,336	21,534	18,692	14,298	13,769	16,484	11,717
DSO	34.8	27.9	36.0	47.4	37.3	32.1	32.5	37.8
Sales MRQ	35,323	43,603	54,512	35,966	35,023	39,186	46,333	28,270
Sales PYQ	35,023	39,186	46,333	28,270	28,571	24,667	26,741	20,343
PYQ % Change	0.9%	11.3%	17.7%	27.2%	22.6%	58.9%	73.3%	39.0%
Qtr. end Stock Price	55.31	61.34	73.31	91.48	79.74	81.87	55.30	52.07

Sales and Receivables are in millions of dollars; Stock prices adjusted for splits and dividends

Starting with the quarter that ended September 30, 2011, we see that sales remained classified as accounts receivable (i.e. they had not yet been paid and therefore could not

be reclassified as cash) for an average of 37.8 days. In other words, amounts recorded by Apple as Sales remained "outstanding" as receivables for 37.8 days. Over the next three quarters, the pace of payments moved up and down within the 30s, but in the quarter ended September 30, 2012, it slowed suddenly and dramatically to 47.4 days on average.

Obviously, one plausible explanation is that Apple's distribution customers ran into financial difficulties, or found the product unsatisfactory, and couldn't or wouldn't pay bills until such issues were resolved. But that's not likely. The companies to which Apple sold iPhones and iPads are big-time outfits that don't struggle to pay bills. And no reports of product-quality problems surfaced. What most likely happened, whether through excess enthusiasm and ordering on the part of Apple's corporate customers and/or aggressive persuasion on the part of Apple (perhaps through the offering of more lenient payment terms) is that Apple's customers took delivery of more product than seemed likely, given historic trends of sales, to exceed the pace of consumer "takeaway." This is not always a problem. If, indeed, consumers step up their buying all will be well. But if that does not happen, the "excess" product will remain in distributor inventories and eventually cause them to slow down the pace of ordering from Apple.

During the first half of the sample period, Apple had been reporting strong, albeit decelerating, rates of sales growth and experiencing strong share price gains, culminating in a peak of 96.28 that was achieved on September 19, 2012. Results for the period ended September 20, 2012, the information from which investors could have calculated the 47.4 DSO figure, was released on October 25, 2012, by which time the stock had already retreated to 83.59. Thereafter, sales growth continued to decelerate and the stock price continued to fall. Apparently buyers who had stepped up purchases in the September 2012 quarter, whether of their own volition and/or as a result of persuasion by Apple, erred. They wound up with more inventory than they needed and had to offset that by reducing their pace of purchasing in upcoming periods.

We also see that investors failed to properly factor the impact of the larger-than-usual increase-in-accounts-receivable accrual into the price of Apple stock. When results for the quarter ended June 20, 2013 were reported, on July 23rd, shares closed at $58.44, 30% below the closing price on the day investors could have computed the exceptionally large 47.4 DSO. Given normal reporting lags, investors were not able to have captured the peak or the trough directly from DSO, although they may have been able to come closer had they been attuned to general trends that caused the results to have been reported as they were. But even a myopic focus on reported DSO could have prevented shareholders from suffering a 30% decline, at a time when the S&P 500 rose 16%.

DSO does not provide a perfect investment signal. There may be occasions when it may be appropriate to sell a larger amount of product than unusual into the distribution channel (a practice that is referred to as "channel stuffing" when one wishes to cast it in a negative light). An example might be the release of a new product, or an upgrade to an existing product, where companies prepare to meet legitimately anticipated surges in consumer demand.

Let's now consider how we might create a strategy to use what we know about DSO.

Start by creating a lot of DSO-based custom formulas for different time periods. Here are some examples:

Formula Name: $DSO_0_QTR
Formula: (Recvbl(0,qtr)/Sales(0,qtr))*91.25

Formula Name: $DSO_1_QTR
Formula: (Recvbl(1,qtr)/Sales(1,qtr))*91.25

And so on . . . I created a total of 12 such Custom Formulas, up through $DSO_11_QTR. I may or may not use each of them in any given model, but it's nice to get the formula creation out of the way up front so they'll be there it I need them. Needless to say, you can go further back in time if you want.

Using the Apple scenario as an idea generator, I want to build a screen that weeds out companies that have recently experienced a noteworthy jump in DSO. The challenge is that like beauty, noteworthy is in the eye of the beholder. I'm choosing to work with year-over-year (PYQ-type) comparisons in DSO. I figure that different businesses have different customs based on different characteristics, so rather than just aim at the lowest DSO numbers I can find, I want to aim at DSO numbers are good or bad relative to the nature of the business and that this is best defined by a company's own history. Ideally, PYQ DSO comparisons should be negative or even.

Since DSOchgPYQ does not exist as a prebuilt factor, I'm create a series of these items using ShowVar (or SetVar if you have a model you want to bring to sim/port). I could do these as custom formulas, but since I can't use custom formulas inside custom formulas, it would require me to recreate multiple $DSO formulas and probably drive me crazy with getting parentheticals to match. But that's me. If you're better at this, then go for it.

Here's an example of a ShowVar rule I'll use:

ShowVar(@DSO_PYQoff0,$DSO_0_QTR/$DSO_4_QTR)

Since I want to be able to experiment with the screen as I work, I'll create as many of these as I can given the Custom formulas I saved. So I'll continue in sequence finishing with:

ShowVar(@DSO_PYQoff7,$DSO_7_QTR/$DSO_11_QTR)

I'm still not sure exactly what the final screen will look like, but I suspect that in identifying really high recent DSO, I'm going to want to have and be able to use if I wish an easy way to identify the maximum of these PYQ changes and the average of these PYQ changes. So I'll create two more have-them-there-in-case-I-want-them items:

ShowVar(@Avg0to3,Avg(@DSO_PYQoff0,@DSO_PYQoff1,@DSO_PYQoff2,@DSO_PYQoff3))

ShowVar(@Max0to3,Max(@DSO_PYQoff0,@DSO_PYQoff1,@DSO_PYQoff2,@DSO_PYQoff3))

I'm going to get crazy now and brainstorm, in the screener, a bunch of ideas. I'm not so much interested in backtesting as I am in looking at the companies that pass the screen (use the "Screen Factors" report) to see if the DSO PYQ patterns I'm getting are the ones I want.

Here are a bunch of ideas I tossed into the hopper:

- ShowVar(@s1,(($DSO_0_QTR/$DSO_4_QTR)^(1/4))-1<0)
- ShowVar(@s2,($DSO_0_QTR/$DSO_3_QTR)<1)
- ShowVar(@s3,@DSO_PYQoff0<1.25*@Avg0to3)
- ShowVar(@s4,@DSO_PYQoff0<1.25*@Max0to3)
- ShowVar(@s5,@Max1to4<1*@Avg0to3)
- ShowVar(@q,@s1+@s2+@s3+@s4+@s5)

Notice that these are Boolean rules that return 1 (true) or 0 (false). That gives me opportunities to finish like this:

- @q>=3 (This allows me to do a Piotroski-like thing, to require that multiple conditions be true.

- @q1=1 (This uses a single rule and passes companies for which the condition is true.)

You can use non –Boolean variations if you wish; just make sure you deactivate whichever rows need to be deactivated (change the green dot at the beginning of the row to a red dot) to prevent your screen from tripping over its own feet.

Remember, though, that our trial and error is not aimed at producing backtested alpha. It's aimed at getting a group of passing stocks with DSO PYQ patterns consistent with what we want (whether bullish or bearish). Once we have that, we'll add a ranking system and test. But at this stage, our concern is with the success we're having in translating the general idea of good/bad DSO trend into something the P123 server can correctly process.

The sample screen has been created and saved as DSO_Example and is available here: http://www.portfolio123.com/app/screen/summary/159808?mt=1

REMEMBER: To make this work, you must have the $DSO_0_QTR through $DSO_11_QTR custom formulas saved in your account! Note, too that I use the

PRussell3000 universe and a rule to exclude finance, GICS(40) – you can eliminate that by creating and referencing your own Russell 3000 ex finance universe.

I'll go over some other important items but it won't be necessary to create additional models. The DSO screen should serve as a template for work you can do with other ratios.

Ultimately, be creative. As previously noted, this is an emerging area in which there is plenty of room for you to discover things. And considering what we saw with the TATA rank tests, this could be a ripe field for short strategies (but be aware that those who have become famous for working along these lines aren't just running automated models; they are also doing case-by-case research on the companies they uncover, to make sure they aren't being fooled by numeric specification; so if you want to b e serious about this sort of thing, learn to love http://www.sec.gov/search/search.htm).

Finally, don't assume you have to generate alpha by looking for companies with good earnings quality. You could define and screen to eliminate bad earnings quality, and then continue on with another set of screening/buy rules and a ranking system you like to use.

Days Sales in Inventory– DSI

The idea behind this ratio is similar to that which guides DSO except that here, we're tracking the pace at which inventories are sold. When DSI rises to an uncomfortable level, it means that the company is making or acquiring product faster than it can sell it. That may lead to a reduction in margins (and hence return on equity) in order to entice buyers to purchase wares they did not want at the standard price. It may signal diminishing demand for the company's offerings. It may also signal a potential writeoff should the company find it necessary to reduce the book value of its inventory. Such scenarios may lead to poor share returns. Conversely, a noteworthy decline in DSI could signal better times.

The formula for DSI is as follows:

DSI = (Inventories / Cost of Goods Sold) * 91.25

In generalized Portfolio123 syntax, DSI for the most recent quarter would be:

(Inventory(0,qtr)/CostG(0,qtr))*91.25.

Table 6 shows relevant data for tire-maker Goodyear as of 8/1/2013.

Table 6

Qtr. Ended	3/13	12/12	9/12	6/12	3/12	12/11	9/11	6/11
Qtr. Offset	0	1	2	3	4	5	6	7
Sales	4,853	5,045	5,264	5,150	5,533	5,683	6,062	5,620
Cost Goods S	3,758	3,911	4,113	3,963	4,428	4,643	4,787	4,352
Inventories	3,168	3,250	3,596	3,940	3,969	3,856	4,037	4,032

DSI	76.9	75.8	79.8	90.7	81.8	75.8	77.0	84.5
Gross Margin	22.6%	22.5%	21.9%	23.0%	20.0%	18.3%	21.0%	22.6%

Sales and Cost of Goods Sold and Inventories are in missions of dollars

The most recent DSI figure, 76.9, appears favorable – near the low end of the two-year range – but unspectacular. So to this point, Goodyear seems to present a situation that is satisfactory, but little more. Consider, though, that many businesses are seasonal. The most blatant example is, of course, retailing, where most of a merchant's annual sales are made in the latter months of the calendar year. But other businesses are likewise seasonal, or at least enough so to cause us to question the usefulness of consecutive-quarter, as opposed to year-to-year comparisons. New vehicle sales, which necessarily influence tire sales, have some of this quality. That may also be the case with demand for replacement tires, which depend to some extent on the timing of maintenance and in turn, on miles driven. So let's examine Table 7, which presents year-to-year DSI comparisons.

Table 7

Qtr. Ended	**3/13**	**12/12**	**9/12**	**6/12**
Qtr. Offset	**0**	**1**	**2**	**3**
DSI - current	76.9	75.8	79.8	90.7
DSI – yr. ago	81.8	75.8	77.0	84.5
Ratio	0.94	1.00	1.04	1.07

Ratio is current DSI divided by DSI a year ago

The simple ratio computed by dividing current DSI by DSI from the prior-year period reveals something interesting. By factoring out seasonal factors, we are now able to see that in the latest available quarter, Goodyear was in fact converting its inventory to sales more quickly. Table 8 shows how this impacted gross margins and the stock price.

Table 8

Qtr. Ended	**12/13**	**9/13**	**6/13**	**3/13**	**12/12**	**9/12**	**6/12**
DSI Ratio	0.97	0.90	0.83	0.94	1.00	1.04	1.07
Gross Margin	27.0%	24.9%	25.2%	22.6%	22.5%	21.9%	23.0%
Stock Return	6.5%	46.8%	21.3%	-8.7%	13.3%	3.2%	5.2%
SP 500 Return	9.9%	4.7%	2.4%	10.0%	-1.0%	5.8%	-3.3%

We see, here, that the drop in DSI did, in fact, presage a period of higher margins and superior share returns.

Other Useful Ratios

Here are some other useful ratios that can be analyzed in manners similar to those that were demonstrated for DSO and DSI.

Days Payables Outstanding (DPO): This is the flip side of accounts receivable. When companies pay for goods and services received on trade credit, they are reducing their cash holdings. The formula for DPO is:

DPO = (Payables / Cost of Goods Sold) * 91.25

In generalized Portfolio123 syntax, DPO for the most recent quarter would be:

(Payables(0,qtr)/ CostG(0,qtr))*91.25.

It would seem that increases in DPO, reflecting a tendency to be slow with bill payment, should be seen as a favorable development if for no other reason than the message it sends regarding the company's stature in the marketplace, its ability to force suppliers and vendors to wait to be paid. Consider, too, the company's ability to use the cash a little longer while it waits to pay bills. But this sort of thing can be carried just so far. Sooner or later, even the most powerful firms must, indeed, pay their bills. There is also the other side of the coin. It is possible that an uptrend in DPO may portend trouble, reflected in difficulty paying bills. Hence DPO can be difficult to use on a standalone basis. It is likely it would have to be used in conjunction with other items that show rising or falling fundamental strength.

Cash Conversion Cycle (CCC): This is an example of DPO being used together with other ratios. CCC, a combination of DSO, DSI and DPO, generate an overall measure of how changes in key working capital areas impact cash. The formula for CCC is:

CCC = DSO + DSI – DPO
= ((Receivables / Sales) * 91.25) +
((Inventories / Cost of Goods Sold) * 91.25) –
((Payables / Cost of Goods Sold) * 91.25)

In generalized Portfolio123 syntax, CCC for the most recent quarter would be:

((Recvbl(0,qtr)/Sales(0,qtr))*91.25)+((Inventory(0,qtr)/ CostG(0,qtr))*91.25)-
((Payables(0,qtr)/ CostG(0,qtr))*91.25)

DSO and DSI measure a company's ability to monetize its most important current assets and it's clear that faster (low DSO and low DSI) are positive. But this provides only a partial view of working-capital. Just as the company must monetize current assets, it most also, in a sense, de-monetize accounts payable, its most important business-oriented current liability. Think of CCC as a "net" ration, analogous to revenue minus expenses.

Cash Receipt Cycle (CRC): As important as it is to view company performance (e.g., the income statement) on a net basis, it can still be useful to evaluate the firm on a gross basis, on revenue trends for example. CRC, a combination of DSO and DSI, is such a metric. Its formula is:

CRC = DSO + DSI
= ((Receivables / Sales) * 91.25) +
((Inventories / Cost of Goods Sold) * 91.25)

In generalized Portfolio123 syntax, CRC for the most recent quarter would be:

((Recvbl(0,qtr)/Sales(0,qtr))*91.25)+((Inventory(0,qtr)/ CostG(0,qtr))*91.25)

We can view the relationship between CRC (a "gross" ratio) and CCC (a "net" ratio) similarly to the way we view an income statement. With respect to the latter, we care most about net income. But revenue trends are a precursor to that: Under normal business circumstances – i.e., except in exceptional situations such as major cost-cutting efforts or divestitures – favorable revenue trends are a necessary, if not sufficient, condition for healthy net income trends. Hence when it comes to monetization of working capital accounts, CRC might not be our primary metric, but it can be useful nonetheless as a potential catalyst for favorable (i.e., rapid) CCC trends.

Deferred Revenue: This is a potentially useful item but one that may be difficult to use in screening rules and better suited to case-by case company-specific analysis. Deferred revenue refers to revenue booked by the company but not yet earned. A classic example is an annual subscription paid up front for magazine that is published monthly. On day one of the transaction, the publisher gets a year's worth of revenue and can record that as cash. But the product has not yet been delivered. So rather than balancing the increase in cash with an increase in revenue, the publisher instead books an increase in a balance-sheet account known as deferred revenue (or unearned revenue, prepaid revenue, or something like that). After one month, when one issue of the magazine has been delivered to the customer, one-twelfth of that sum will be removed from deferred-revenue and transferred to revenue. If all of the deferred revenue is expected to be earned within one year, it will be booked as a current liability. If some or all of it is likely to be earned after more than a year – an upfront payment on a two-year subscription – then part of it will be placed in a non-current deferred revenue account. If a company is growing, we should expect to see deferred revenue grow more quickly than sales; i.e., potential future sales higher than the current level of earned sales. Conversely, if deferred revenue is growing more slowly than sales, it could portend a decelerating sales growth in the future, most likely the near future. Unfortunately, databases used in quantitative platform don't always include deferred revenues. When that occurs, as is the case with Portfolio123, the best we can do is approximate with Miscellaneous Liabilities.

Days in Miscellaneous Liabilities (DML): Miscellaneous Liabilities is a catch-all that may be labeled as such on the balance sheet or as "other" liabilities or some similar identifier. The formula for DML is as follows:

DML = ((Misc. Current Liab. + Misc. Noncurrent Liab.)/Sales) * 91.25

In generalized Portfolio123 syntax, DML for the most recent quarter would be:

((LiabCurOther(0,qtr)+LiabNonCurOther(0,qtr))/sales(0,qtr))*91.25

This will capture deferred revenue. The problem is that it will capture other items as well, such as pension-related liabilities, not all of which should be similarly interpreted.

The foregoing is by no means a complete list of all possible earnings-quality measures. But it contains the major items and learning to use them will provide you with a method you can apply to others that may be available now or in the future as databases continue to be refined.

The Beneish PROBM Score (or M Score)

Now, we should be in a position to look in detail at the M-Score, something that is now available on p123 as a pre-set item. The basics to be discussed here are largely a recapitulation of what's in the P123 detailed descriptions. But I think it's worthwhile to go back into the material here, since you might now see it in a different light as a result of having completed the above fundamental-analysis boot camp obstacle course. And, perhaps, you're now in a better position to be inspired by, how people create things like this – with a view toward coming up with your own ideas.

Messod (Daniel) Beneish doesn't mince words. While he's as sensitive as anyone to the relationship between certain measures of earnings quality and earnings persistence, and investigates the matter, PROBM, the acronym for the output of his model is a euphemism for probability of manipulation, more specifically, probability of earnings manipulation. He developed his model by comparing a sample of 74 firms that were identified as earnings manipulators through SEC enforcement actions and/or media reports during a 1982-92 sample period (in sample: 1982-88, out of sample: 1989-92) to a larger sample of non-manipulators. *The Detection of Earnings Manipulation*, a June 1999 paper eventually published in 24 Financial Analyst's Journal 36 (1999)

Using a technique known as weighted exogenous sample maximum likelihood probit (WESML) and an assumption that the proportion of manipulators in the sample was .0069 (based on the number of firms found to have been manipulators during the in-sample period), Beneish identified eight factors to be studied. Given the absence of an economic theory of manipulation, Beneish selected factors, all of which could be calculated from readily-available accounting data, based on three categories:

- Company future prospects – This reflects the notion that manipulation would seem more likely to occur where prospects are poor

- Cash flows and accruals – This, as we have seen, is the classic focus of earnings manipulation

- Incentives – Certain factors might encourage management to manipulate earnings even where prospects are not poor

The eight factors in the Beneish model, all of which are framed in such a manner as to associate higher vales with increased probability of manipulation, are as follows:

1. Days Sales in Receivables Index (DSRI)

$$(Receivables_t/Sales_t) / (Receivables_{t-1}/Sales_{t-1})$$

   This is a straightforward earnings-quality concept we explored above. A sizable increase in Receivables relative to Sales could be the result of a relaxation in credit policy in order to spur the pace of sales.

2. Gross Margin Index (GMI)

$$((Sales_{t-1} - Cost\ of\ Goods\ Sold_{t-1}) /Sales_{t-1}) / ((Sales_t - Cost\ of\ Goods\ Sold_t) /Sales_t)$$

   If this index is above 1.00, that would signal poor performance. That, in turn, could present an incentive for manipulation.

3. Asset Quality Index (AQI)

$$(1 – ((Current\ Assets_t + Net\ Plant_t) / Total\ Assets_t)) / (1 – ((Current\ Assets_{t-1} + Net\ Plant_{t-1}) / Total\ Assets_{t-1}))$$

   This index measures change in that portion of the asset base characterized by less certainty. An index value greater than 1.00 signals potential increased investment in cost deferral, something that increases the likelihood of manipulation. In cases where the data is such that AQI is not defined, a neutral score of 1.00 is assigned.

4. Sales Growth Index (SGI)

$$Sales_t / Sales_{t-1}$$

   This is a particularly interesting factor. Typically, investors see strong rates of sales growth as a good thing. But notice from the real world what happens when a growth company suddenly decelerates. Shares tend to fall sharply as investors jump ship in response to the perceived end of the glamour days. This phenomenon can put considerable pressure on managers to avoid such a scenario, or at least postpone it for as long a period as possible. That can be a powerful incentive for earnings manipulation.

5. Depreciation Index (DEPI)

$$(Depreciation_{t-1} / (Depreciation_{t-1} + Net\ Plant_{t-1})) / (Depreciation_t / (Depreciation_t + Net\ Plant_t))$$

An index value greater than 1.00 would signify that the pace at which assets are being depreciated has slowed. This enhances reported earnings since depreciation is an operating cost. There could be legitimate reasons for such a slowing, such as addition of assets with longer estimated useful lives to the overall mix. But it could also come from manipulation; such as, for example, revisions to useful lives of the existing asset base. Like SGI, DEPI could reflect legitimate considerations. But neither factor alone is likely to push a company's score up to the point where it could legitimately be deemed a manipulator. The important consideration is how SGI and DEPI combine with other factors. In cases where the data is such that DEPI is not defined, a neutral score of 1.00 is assigned.

6. Sales General and Administrative Expense Index (SGAI)

$$(SG\&A_t/Sales_t) / (SG\&A_{t-1}/Sales_{t-1})$$

This factor reflects the notion that disproportionate increases in SG&A relative to sales signifies decreased company efficiency and hence presents an incentive to manipulate earnings to present a better portrayal to the outside world. In cases where the data is such that SGAI is not defined, a neutral score of 1.00 is assigned.

7. Leverage Index (LVGI)

$$((Long\text{-}Term\ Debt_t + Current\ Liabilities_t)/Total\ Assets_t) / ((Long\text{-}Term\ Debt_{t-1} + Current\ Liabilities_{t-1})/Total\ Assets_{t-1})$$

The presumption from an increase in this index, an increase in leverage, is that an increase on the role of debt covenants might present an incentive for earnings manipulation.

8. Total assets to Total Accruals (TATA)

$$Net\ Income\ before\ Extraordinary\ Items_t - Cash\ from\ Operations_t / Total\ Assets_t$$

This is, or course, the penultimate indicator discussed above, but here, a more simplified straightforward version of the metrics is used. Whichever one you prefer, higher index values, signifying increased prevalence of accruals, means cash plays a lesser role in underpinning reported earnings, thus suggesting a higher potential for manipulation.

Based on empirical study comparing manipulator and non-manipulator universes, Beneish calculated a company's PROBM score as follows:

$$PROBM = -4.84 + 0.92*DRI + 0.528*GMI + 0.404*AQI + 0.892*SGI + 0.115*DEPI - 0.172*SGAI - 0.327*LVGI + 4.679*TATA$$

We understand from the way the factors were articulated that higher PROBM scores indicate increased likelihood of manipulation. It would, therefore, seem feasible to rank companies in a list or universe from high to low and simply assume that lower means better (less probability of manipulation).

But actually, Beneish wound up introducing cutoff scores that separate likely manipulators from non-manipulators in a binary manner. He did this based on an analysis of the investor's tolerance for a Type I error (Classifying a firm as a non-manipulator when it is, in fact, a manipulator; is in contrast to a Type II error which classifies a non-manipulating firm as a manipulator). For example, if balancing the likely returns on shares of manipulators versus non-manipulators an investor determines that it would take 40 successful investments in non-manipulators to offset a loss likely to be experienced with shares of a single manipulator company, we would describe the cost of error as being 40:1. Because higher scores are associated with increased likelihood of manipulation, the higher the assumed cost of error, the more encompassing the cutoff criteria (i.e., the lower the PROBM cutoff level, the more negative the score) would have to be. Based on this framework, the thresholds are as follows:

Table 9

Presumed Cost of Error	Assume company is a potential Manipulator if PROBM is above . . .
10:1	-1.49
20:1	-1.78
40:1	-1.89

(Note that Beneish did not specify threshold as explicitly as is done in Table 9. Instead, the information there is pieced together from material found in two separate papers.)

It's important to keep in mind when modeling with PROBM that approximation is the name of the game. Beneish never assumed companies with scores above or below a particular threshold were or were not manipulators. The cutoffs acknowledge that false signals will be present and are established with a view toward tolerance for error. (This makes sense. To completely eliminate error, we'd have to be so encompassing as to score even the most honorable companies as potential manipulators, and that accomplishes nothing more than a meteorologist who says that we'll have temperature tomorrow but doesn't say how much.) This supports the notion that earnings-quality is not necessarily the

linchpin of a strategy but is best used to help define a border universe and then run regular strategies against the better-quality group.

Conclusion

I warned you this was going to be rugged. It's the way we have to go in order to tangle with manipulators.

We have now concluded our work in the area of fundamental analysis. We've had some recipes along the way. But the overarching goal has not been to give you a cooked-seafood meal but rather the ability to catch and cook fish on your own, and, hopefully, that there's a lot, a heck of a lot actually, you can do creatively, as opposed to just assuming PE<x is all there is.

Henceforth, we'll move into Momentum/Sentiment/Noise.