"The best way to win a contest for the largest tomato...
... is to paint a cantaloupe red...
... and hope the judges don't notice."

diBartolomeo and Witkowski, Financial Analyst Journal, 1997.

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Slide 2

Motivation

- One must be able to evaluate active managers if one is to hire them.
  - Finding the correct peer group for an investment strategy is the most important step in doing this.
  - If a fund is not being compared to the correct peer group the active returns and historic alpha & IR are misleading.
  - If a fund is mis-classified it may not be as diversifying in the context of other holdings as the investor may think.
- Checking fund classification can be a very simple & practical due diligence measure / selection criterion.
  - if a fund is misclassified, what else could be wrong with its management?
  - If a fund is misclassified and there's a comparable fund that is classified correctly why not choose the fund with the correct label?

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V1.0 Summary

- diBartolomeo & Witkowski, <u>Mutual Fund Misclassification: Evidence Base on Style Analysis</u> published in the AIMR journal in 1997.
  - Covered 748 funds
  - 6 peer groups: aggressive growth; growth; growth-income; income; international, and; small cap.
  - 298 or 40% of all funds were found to have a their greatest style analysis weight in a peer group other than their classification.
  - About 60% wound up being less risky than they said they were
  - About 40% wound up being more risky than they said they were

V 1.0 Summary … Cont'd

– When fund issuers were observed in aggregate, however there was evidence of systematic misclassification:

- "…although misclassification appears to take place in both directions (into more and less aggressive categories), among seriously misclassified funds, the ratio of funds misclassified was nearly 2/1…. The result allows us to reject the null hypothesis that an equal number of funds is misclassified upward and downward.

- "…probit analysis reveals that misclassification is not random, but related to fund size and assets under management to a statistically significant degree."

What is Style Analysis?

- Developed by Bill Sharpe in 1984, style analysis is best described as an OLS regression where the all independent variables B_n are constrained:

  - $Y = B_n X + \varepsilon$

  - $0 < B_n < 1$

  - $\Sigma B_n = 1$

- Since style weights add up to one they can be thought of as percentage weights.

- The greatest style weight will be assigned to the independent variable that explains most of the behavior of the dependent variable.

- In the specific case of fund classification, the fund returns are the dependent variable and peer group index returns are the independent variables

# What's Unique about Northfield's Style Analysis

- diBartolomeo & Lobosco. 1997. "Approximating the Confidence Intervals for Sharpe Style Weights". Financial Analysts Journal, vol. 53, no. 4 (July/August): 80-85

- We've implemented this methodology & only apply results that are approximately significant at the 5% level.

What's different in V2.0?

- Now using the TR Lipper fund DB. Over 20,000 US funds equity and fixed income in dataset.

- 169 initial fund classifications.

- Each fund is also assigned to one of 11 "Broad Allocations" and 4 "Asset Classes".

- Using Style Analysis we can see frequency of "misclassification" at 3 levels of granularity.

- We reclassify funds and recalculate peer group indices iteratively, until classifications converge.

- We apply the CUSUM method to determine the relevant lookback period.

- We calculate Precision Weighted Excess Returns (PWER) for each fund using Bayes Law with the peer group return as the prior – these can be useful in a manager selection process.

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What is CUSUM? Magellan case study…

Cumulative IR – Magellan vs. S&P
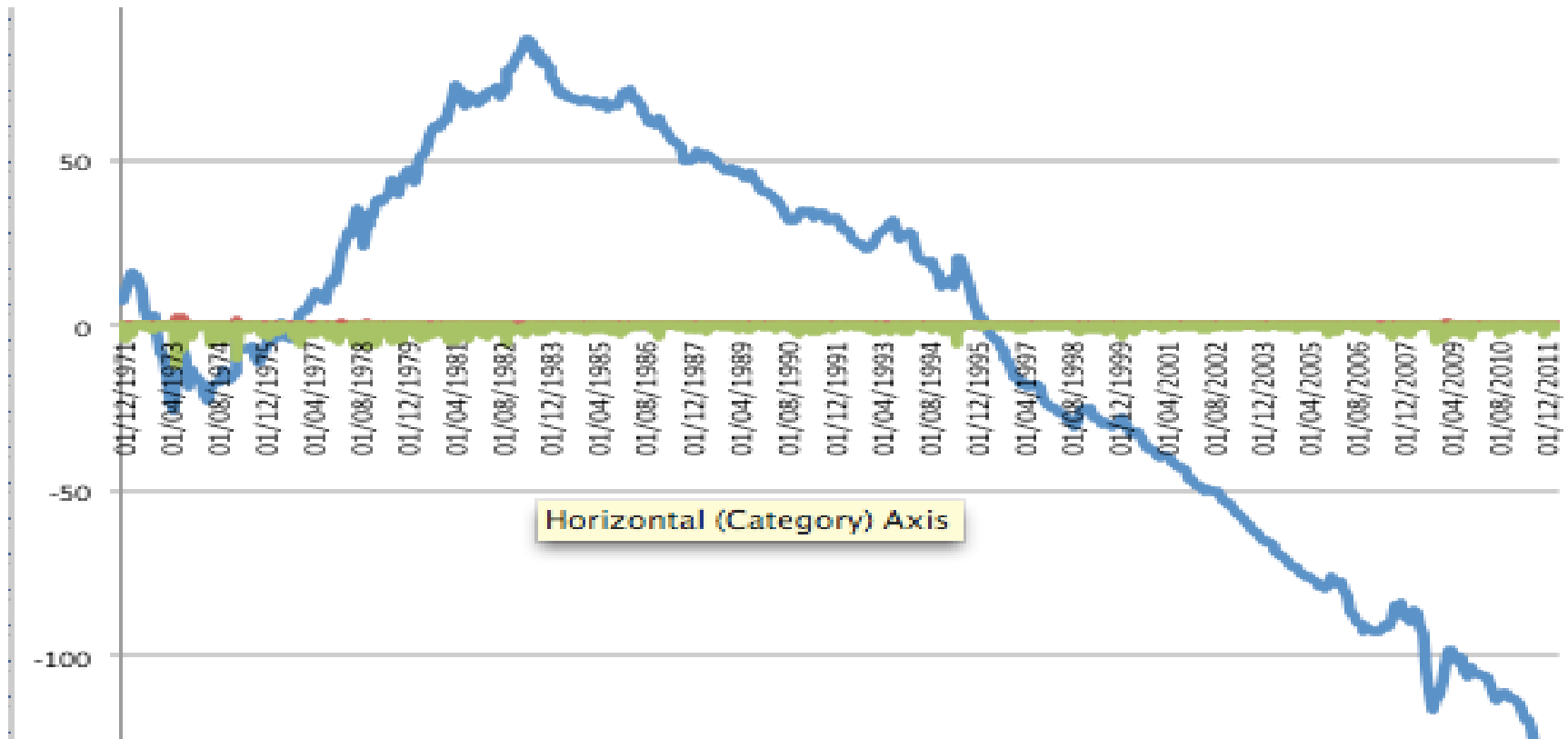
Magellan Case Study – cont'd…

- What happened in the mid 80's? Nascent technology boom… Peter Lynch, practicing what he preached ("buy what you know") began withdrawing from the management of Magellan.

- When considering Magellan now… which one do we want to analyze? The whole history? The glory years? The current reality?

- Using the CUSUM method to find the most recent major inflection point in the historic plot of cumulative IRs is a useful way to set a relevant look-back period for peer group classification and manager selection purposes.

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CUSUM details…

- Calculate active returns to peer group
- Calculate mean and standard deviation (we use a rolling window of 24 months by default)
- Use Mean and Standard Deviation to get the Information Ratio
- Calculate the cumulative sum of the information ratio, i.e. $CUSUM_n = CUSUM_{n-1} + IR_n$
- Calculate critical date point
  - Create series: $ABS(ER_n - ER_{n-1}) * SQRT(N - n)$
    - ER = excess return
    - N = total number of periods
    - n = current period
  - Find maximum in above series – the corresponding date is the pivot – bias towards the start of the series. Magellan CD = 09/83

Method - P1 – winnowing classifications

- 169 classifications are too many to provide enough depth, even with 20,000 funds, to build peer group indices.

- So we rank each classification according to 2 parameters:
  - (1) The number of funds in the classification
  - (2) The average correlation in returns between funds

- and build a third ranking (3) composed of 40%(1) + 60%(2)

- we add the first two sectors by ranking (3) from each broad allocation

- then add all classifications in the "sector equity" & "diversified equity" broad allocation – these are all very deep and need to be represented

- add the next 40 sectors by ranking (3)

- Distribute the displaced funds amongst the remaining 69 sectors by finding the highest correlation to the corresponding equally weighted sector index return.

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Method - P2 – find grossly misclassified funds

- In addition to belonging to one of 169 fund sectors, each fund belongs to one of 11 "broad allocations" and one of 4 "asset classes".

- We set up a style analysis where fund returns are the dependent variable and the asset class indices are the independent variables

- If the primary style analysis weight is a different asset class than the one the fund is assigned to & it is significant (TVal >=2.0) we consider the fund to be "grossly misclassified".

- Transition matrix - 309 in the lower triangular – 107 in the upper - 416 total…

	Money Market	Fixed Income	Mixed Assets	Equity	Total
Money Market		0	0	0	0
Fixed Income	5		8	10	23
Mixed Assets		117		89	206
Equity	0	43	144		187
					416

Method – P2 – Broad Allocation Level

- After removing the "Asset Class" level mis-classifications from the data set, we do the same process for the "Broad Allocation" level. This time we have 350 out of 395 in the upper triangular – the vast majority of which are Mixed Asset transitions to riskier "broad allocations".

	MMM	MM	SIC	SIM	GMFI	MA	USTG	WFI	GDFI	AF	USDE	WE	SE	TOTAL
Municipal Money Market	x													0
Money Market		x												0
Short/Intermediate Corporate			x											0
Short/Intermediate Municipal				x	11									11
General Municipal Fixed Income				25	x									25
Mixed Assets				18		x		20			10	304	5	357
US Treasury & Government							x							0
World Fixed Income								x						0
General Domestic Fixed Income									x					0
Alternative Funds										x				0
US Diversified Equity											x			0
World Equity												x		0
Sector Equity											2		x	2
														395

Method – P3 – Sector Level…

- There's too many sectors, even after the winnowing process, 63, to use all of them as independent variables – so we limit the independent variables to the ones that belong to the same "broad allocation" as the dependent variable fund.

- In some cases there may not be enough history – especially after applying the CUSUM critical date, to allow enough degrees of freedom to run the style analysis (any regression needs more observation than independent variables)

- The resultant table is too big to print here… but out of 23,853 funds that met the screening criteria, 6,796 funds were reclassified by the process – or about 28%. Of those, 3,577 transitioned to less risky sectors and 3219 transitioned to more risky sectors.

- But what happens if we break this result down further and look at individual "Broad Allocations"

Method P4 – Sector level Cont'd

- What happens when we break it down further & look at just the funds in the Equity broad allocations?
  - 224 out of 1369 or 16% of funds changed classification in the "Sector Equity" broad allocation.
  - 3094 out of 6606 or 46% of funds changed classification within the "Diversified Equity" broad allocation
    - There were 6796 transitions in the entire dataset – nearly half of them took place within the "Diversified Equity" slice of data.
    - Diversified Equity is actually the closest dataset for comparison to V1.0 of this study where there were 6 peer groups based on growth/value style criteria – this broad allocation contains 18 peer groups also based on growth/value criteria, just breaking things out further by capitalization
      - V1.0 classifications: agg growth, growth, growth-income, income, international & small cap.
      - V2.0 classifications: large cap growth, large cap core, large cap value, mid cap growth, mid cap core, mid cap value, etc.

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Method P4 – Sector level Cont'd (2)

- In "Diversified Equity" we find a comparable level of misclassification to the V1.0 of this study, done 18 years ago. It's apples & oranges since the classification schemes are different, or maybe we should call it "apples and pears" as the classification criteria are similar, even though the current study is 3 times more granular.

  o I wouldn't give the 6% increase much thought – it could just be down to the increased granularity of the peer group buckets.

  o It could also be down to the increased coverage of smaller funds with relatively low TNA

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Aggregate TNA & Misclassification

- In Diverse Equity, of the 3094 total misclassified funds, 1453 funds were reclassified into riskier asset classes. 1641 were put into less risky asset classes – it's hard to say whether anything systematic is going on.

- What happens if we follow the money?

- Funds reclassified "down" have an aggregate TNA of 1,655,954

- Funds reclassified "up" have an aggregate TNA of 1,126,710

- 1655954/1126710 = 1.47

- 1641/1453 = 1.13

- So we can say – not only are there more "down" funds – "down" funds are on average 1.47/1.13 = 1.3 times bigger than "up" funds.

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A Surprising Result… sort of…

- On the face of it, this result doesn't support the theory that fund managers intentionally misclassify their funds as being less risky than they actually are in order earn superior results to their peer group.

- The above strategy only works during a bull market, however.

- Unlike the original study, this one includes the GFC.

- Being LESS risky than your peer group makes you outperform during a downturn.

- Other possible reasons for this result:

  – Post GFC, retail fund managers have become more conscious of absolute risk as an important risk measure for most retail stakeholders (the majority without the resource to own a diversified portfolio of funds)

  – Retail fund managers have also had to keep more cash in reserve to be able to accommodate divestments – this would naturally make their funds less volatile.

Method P4 – Sector level Cont'd (3)

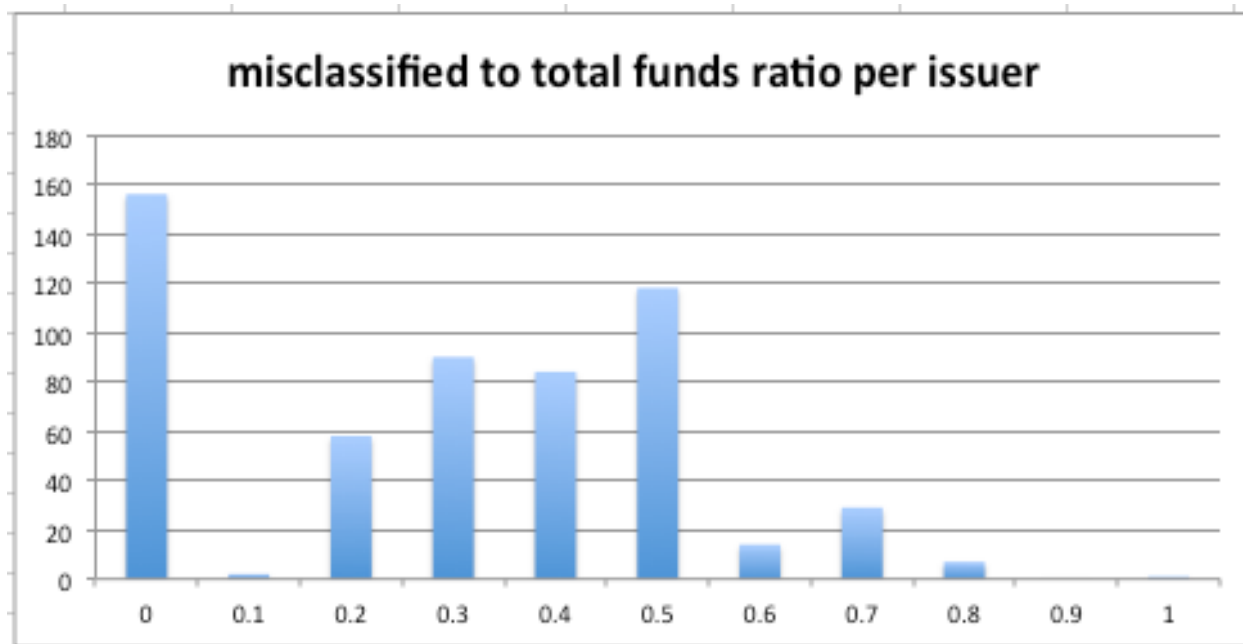- How about the other sectors, broken down by broad allocation?

Broad Allocation	% change
Short/Intermediate Corporate	10.3883495
World Fixed Income	13.277512
Short/Intermediate Municipal	13.559322
General Domestic Fixed Income	13.6784741
US Treasury & Government	16.3461538
Sector Equity	16.3623083
Alternative Funds	21.0629921
Mixed Assets	23.4936429
World Equity	25.1047194
Municipal Money Market	27.2959184
General Municipal Fixed Income	30.8453922
Money Market	34.1237113
US Diversified Equity	46.8362095

- In general, less risky classifications are at the top of the table with some notable exceptions all the way at the bottom of the table
  - Municipal Money Market
  - Money Market
  - General Municipal Fixed Income
- Here, the intuition is that the cross sectional dispersion within the peer group is so tight & the correlation between style analysis independent variables is so great that the process breaks down.

Misclassification data aggregated by issuer

- Total number of issuers: 559
- Thought experiment – for each issuer find the ratio of misclassified funds to total funds issued…
- 156 issuers have a ratio of "0" – giving them a perfect classification record!

misclass-ratio	issuer
0	156
0.1	2
0.2	58
0.3	90
0.4	84
0.5	118
0.6	14
0.7	29
0.8	7
0.9	0
1	1

misclassified to total funds ratio per issuer

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Misclassification Data by Issuer (contd.)

- Top 20 by TNA

issuer	TNA	funds	transitions	% trans
Vanguard (	3544261	341	70	0.205279
Fidelity Ma	1840433	982	393	0.400204
American F	1345315	745	311	0.41745
BlackRock	959658.3	340	83	0.244118
T Rowe Pri	607570.2	231	92	0.398268
JPMorgan	546574.5	550	159	0.289091
State Stree	543342	222	51	0.22973
Franklin Te	407041.3	434	172	0.396313
BlackRock	393512.9	477	125	0.262055
Dimension	317399.6	90	24	0.266667
PIMCO	316968.1	479	110	0.229645
Charles Sch	278454.7	98	26	0.265306
Federated	244724.8	290	94	0.324138
Goldman S	233136.9	443	121	0.273138
Dreyfus Co	226577	411	151	0.367397
Invesco Fu	213076.2	627	181	0.288676
MFS Invest	204873.2	579	180	0.310881
Wells Fargo	189826.7	406	135	0.332512
Oppenhein	187102.7	347	112	0.322767
Dodge & Co	179926.5	6	4	0.666667

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Misclassification by Issuer – (contd.)

- diBartolomeo & Witkowski found that Fund issuers with Lots of assets under management are less likely to misclassify, whereas individual funds are more likely to be misclassified the bigger they are – "Belonging to a big fund complex seems to reduce the probability of a fund being misclassified… the assets in the fund itself, however are positively correlated with misclassification".

- The first part of this statement is still true – fund issuers with just 1 fund under management have a misclassification rate of 51% -- 23% more than the average, 28%. The result is intuitive, these fund issuers are under pressure to raise their TNA – fund misclassification is the simplest way to tell a good story.

Misclassification by Issuer – (contd.)

- The second part also remains true – TNA across all funds that have correct classification is 12,108,119 – TNA across all funds with incorrect classification is 5,454,169. So the TNA weighted misclassification rate it 45% which is greater than the average of 28%. That means that funds that are misclassified are bigger, on the whole, than funds that aren't. This is also intuitive – "the positive correlation between fund size and misclassification may result from the difficulty of managing a large portfolio while strictly adhering to one market segment in which liquidity may be limited…"

Conclusions

- Anecdotally – it seems things haven't changed much in the 19 years since V1.0 of this study was published.
  - A similar percentage of funds have been misclassified.
  - The classification scheme is different here, but:
    - the classification criteria are similar… just more granular
    - if the motivation exists to misclassify, people do it, regardless of the label on the bucket or the direction of misclassification.
- Within Equity funds - most misclassification happens in "diversified equity" funds that use style as opposed to sector criteria.
- The overwhelming majority of misclassification at the "broad allocation" level was in the "mixed assets" category. This makes total sense as that category purposefully includes anything & is therefore pretty useless as a descriptor of a strategy.
- The validity of this approach for Money Markets & low risk fixed income strategies is questionable & needs to be verified.