the employment beta

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ORIGINS OF THE EMPLOYMENT BETA

One of the most important criteria for selecting target industries is their employment growth. This research now brings in a measure of the employment volatility of target industries, called the **employment beta**, to be used in the targeting process. The calculation of employment betas draws directly from common stock investment models that generate the well known common stock beta coefficient. The employment beta enables planners and developers to consider the volatility of employment alongside the growth of employment in target industries. If given the choice between two target industries showing high employment growth when one of the industries exhibits major upswings and downswings in employment, the wise choice would obviously be to pursue the more stable industry. To avoid employment volatility, we will transfer over a well accepted investment technique for avoiding stock return volatility to an economic development application.

This article explains the construction and use of the employment beta, which is a statistic that relates the employment variability in a four-digit NAIC (North American Industry Classification) to the employment variability of total non-farm employment. Industries with high employment betas are more vulnerable to layoffs and plant closings. In this research, we identify industries with the desirable mix of high employment growth AND employment stability.

Using the Common Stock Beta

Security analysts and portfolio managers use the common stock beta coefficient in constructing investment portfolios. For each listed and widely traded stock, a beta coefficient is available to measure the volatility of the investment return on the stock relative to the overall volatility of return on the stock market. If the volatility of return on the stock is the same as the overall market, the beta coefficient will equal 1.0. The return on a stock is its price change plus dividends received, all divided by the purchase price. Stocks with returns more volatile than the market have beta coefficients greater than 1.0, and, conversely, stocks with returns less volatile than the market have beta coefficients less than 1.0. Risk takers would buy high-beta stocks if they anticipated a rising market; a stock with a beta of 1.5 would provide a return of 15 percent on a 10 percent increase in the overall market. A 10 percent market decline, however, would increase their loss to 15 percent. Risk avoiders would prefer low-beta stocks and be satisfied with lower gains in rising markets, but be protected by lower losses in falling markets.

Where to Find Stock Beta Coefficients

Two readily available, free sources of common stock beta coefficients are (1) Bloomberg.com, at http://bloomberg.com and (2) Yahoo!Finance at http://finance.yahoo.com . Enter the stock's ticker symbol to obtain the data page which will provide the beta. Using stock betas, portfolio managers are able to construct stock portfolios with a weighted average beta that conforms to the investor's willingness to assume risk, i.e., to his/her "comfort zone." A risk-taker will build a higher beta portfolio than will the risk avoider.

Professor William Sharpe, Originator

The common stock beta was originated by Professor William F. Sharpe and first published in the Journal of Finance in 1964. The beta coefficient

A NEW CRITERION FOR TARGETING INDUSTRIES

This article explains the construction and use of the employment beta, which is a statistic that relates the employment variability in a four-digit NAIC (North American Industry Classification) to the employment variability of total non-farm employment. Industries with high employment betas are more vulnerable to layoffs and plant closings. In this research, we identify industries with the desirable mix of high employment growth AND employment stability. Using a 48 industry sample to demonstrate the process, industries are classified as: Desirable, Acceptable, Less Acceptable and Unacceptable target industries. The employment beta is offered as an enhancement to economic development planning.

became widely used in the 1970's and remains in wide use today. Sharpe has been affiliated with the Stanford University Graduate School of Business since 1970. Dr. Sharpe developed the Capital Asset Pricing Model (CAPM), of which the common stock beta coefficient is the key element. For this and his considerable other asset pricing research, Sharpe was awarded the Nobel Prize in Economics in 1990. (A summary list of the academic and professional literature associated with beta and CAPM is provided; please see Bibliography.)

DEVELOPING THE EMPLOYMENT BETA

We now convert the common stock beta to an *employment beta*. Instead of relating the volatility of stocks to the overall stock market, we will now relate the volatility of employment in selected NAICs (North American Industry Classifications) to US total non-farm employment. Using Bureau of Labor Statistics employment data, we have compiled the monthly percentage employment change for total non-farm employment and for 48 sample NAICs for the period January 1990 until April 2004. The four-digit NAIC is being treated as the "stock", and monthly percentage change in total non-farm employment is used as the "market". The "return" on the NAIC is employment growth (like a stock's price growth) earned in each time period. The statistical methodology used is basically the same as Sharpe's; a simple linear regression (ordinary least squares).

Calculating Employment Betas

The linear regression was accomplished by setting the NAIC monthly employment percentage change as the dependent variable and the total non-farm employment as the independent variable. The resulting employment betas now represent the volatility of employment in a NAIC relative to the volatility of employment in total non-farm employment. The result for each NAIC was a simple equation much like the familiar equation for a straight line, $\mathbf{y = a + bx}$, where **y** is the dependent variable, the employment change in the industry, **b** (the beta) is the slope of the line, and **x** is the independent variable, the total non-farm employment change. The intercept, **a**, was not directly used in the analysis. The employment beta is a valuable statistic to be used in ranking target industries as to their relative desirability. The results will demonstrate that an industry with a high beta will have high volatility of employment; it will likely experience major swings in employment and possible layoffs. We will next generate employment growth statistics alongside employment beta information in order to compile relative rankings of target industries.

Measuring Employment Growth

Another statistic necessary to evaluate the performance of a common stock is, of course, the company's ability to grow. Stock investors are concerned that the companies in which they are invested are able to grow sales, market share, profit, cash flow, and dividends. All these growth measures are carefully tracked by security analysts. Economic developers value growth as well; emphasizing the employment growth of target industries. Our model generated a monthly compound growth rate for each NAIC, which was then annualized. For example, NAIC 6216, Home Health Care Services, showed employment growth of 3.77 percent per year. Our analyses and rankings now consider employment growth and employment volatility, by adding the employment beta to the selection process. Employment growth and beta values are presented and analyzed in the following results.

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THE RESULTS

To demonstrate the use of the employment beta, we selected 48 industries categorized at the four-digit NAIC level. Each NAIC's employment growth and betas are displayed in Table 1, each in descending order. The employment betas ranged from 6.15 in NAIC 3361, Motor Vehicles Manufacturing, to -0.53 in NAIC 5221, Depository Credit Intermediation. Interpretation of the numbers is as follows: if Total Non-Farm employment is expected to increase by 1 percent, then employment in Motor Vehicles Manufacturing would increase by 6 percent. On the other hand, employment in motor vehicles would go down by about 6 percent if non-farm employment falls by only 1.0 percent. The high beta confirms this industry's reputation for employment volatility. Security analysts label motor vehicles a "cyclical industry" because of these patterns. NAIC 5221, with a beta of -.53, is less volatile than the total and the minus sign indicates that a slight movement will occur in the opposite direction of the economy. NAIC 5221, Depository Credit Intermediation, is the savings and thrift industry. It has been a stable, slow-growing industry; it is not vulnerable to major economic swings.

Grouping Industries by Growth and Beta Measures

It is now possible to use the employment beta in industry targeting strategies by compiling the following four industry groupings.

Desirable Target Industries: High Growth/ Low Volatility meet the following growth/beta criteria. (1) their employment growth has exceeded the total non-farm average growth of 1.49 percent, and (2) their betas are less than 1.0 These indus-

TABLE 1

Employment Betas and Employment Growth Rates

Part A: Employment Betas in Descending Order		Part B: Employment Growth Rates in Descending Order	
NAIC's	**Beta**	**NAIC's**	**Growth**
3361	6.15	5415	7.63%
5415	4.38	7132	5.25%
3342	4.30	6112	4.87%
3344	4.07	5121	3.84%
7132	3.94	6216	3.77%
4541	3.60	6233	3.55%
5112	3.22	6113	3.48%
3372	3.14	4541	3.35%
3151	2.85	5621	3.07%
3132	2.84	5614	3.00%
3131	2.82	3342	2.88%
4512	2.59	7131	2.87%
5418	2.38	7112	2.67%
3322	2.24	3254	2.39%
3152	2.02	5112	2.16%
7131	1.98	3322	2.16%
4532	1.94	8139	2.10%
3343	1.82	4248	1.58%
5121	1.71	6221	1.45%
4521	1.54	4232	1.37%
5614	1.52	5418	1.35%
3352	1.41	4532	1.32%
6112	1.30	3344	1.28%
4232	1.21	8113	0.92%
3162	1.21	3366	0.89%
3364	1.13	3372	0.77%
3114	1.05	4521	0.66%
4243	1.00	4244	0.62%
8113	0.95	3361	0.59%
5111	0.94	4243	0.48%
8112	0.91	4512	0.44%
3113	0.64	3131	0.29%
7112	0.64	3391	0.19%
3345	0.63	3121	0.17%
3121	0.40	8112	0.12%
4244	0.38	5241	0.10%
3366	0.32	5221	0.08%
6113	0.31	5111	-1.02%
3391	0.30	3114	-1.47%
6216	0.25	3345	-1.55%
4248	0.15	3113	-2.02%
8139	0.12	3352	-2.36%
5241	0.09	3364	-2.74%
5621	0.02	3343	-4.61%
3254	-0.17	3132	-7.54%
6221	-0.23	3151	-9.46%
6233	-0.29	3152	-10.92%
5221	-0.53	3162	-12.02%

tries combine the desirable characteristics of higher-than-average growth and lower-than-average employment volatility.

Acceptable Target Industries: High Growth/ High Volatility meet the criteria of (1) their employment growth has exceeded the total nonfarm average growth of 1.49 percent, and (2) their betas are more than 1.0. These industries provide higher growth at a price, the price being higher employment volatility.

Less Acceptable Target Industries: Low Growth/Low Volatility meet the criteria of (1) their employment growth is less than the national average of 1.49 percent and (2) employment betas are less than one. These industries have slower growth (and some have employment declines), but they do exhibit low employment volatility.

Unacceptable Target Industries: Low Growth/ High Volatility meet the criteria of (1) low employment growth (less than 1.49 percent) and (2) unfortunately, they also have higher employment volatility as evidenced by their betas greater than one.

Analyzing the Industry Groupings

The employment growth/employment beta groupings described here are displayed in Table 2. There are eight Highly Desirable target industries, 10 Acceptable industries, 13 Less Acceptable industries, and 17 Unacceptable target industries. Within each grouping, the industries are displayed in descending order of growth. A careful review of the table provides some valuable insights for development strategies.

The Desirable Target Industry group: Seven of the eight provide significantly higher employment growth and excellent employment stability (betas are substantially less than 1.0). Considering employment criteria only, these are ideal target industries. It was surprising that the NAIC with the highest employment growth in the sample did NOT make it into the Desirable group. Computer systems design and related services, NAIC 5415, had employment growth of 7.63 percent per year, but its high employment beta of 4.38 pushed it down into the next lower group, the Acceptable group.

The Acceptable Target Industries: All 10 of these industries show good growth, significantly above average, but they all bring along a high degree of employment variability. Beware of the substantial increase in employment volatility shown by the Acceptable group. A "growth above all else" strategy might pursue this group of high growth industries and achieve newsworthy short term successes. In the next business downturn, the news could be quite different.

The Less Acceptable Target Industries: The highest growth industry in this group is NAIC 6221, Hospitals. It has employment growth just below the national average, 1.45 percent versus 1.49 percent, and a very low employment beta. It just missed making the Desirable Industry category. (Economic planners know that hospitals have numerous other desirable characteristics). The other NAICs in the group showed slow growth or declines in employment but they do offer less volatility in employment. An area that had just suffered major employment declines in volatile industries might accept the slower growth and welcome the stability provided by this group.

The Unacceptable Group: Among the industries studied here, these industries should be pursued last. Again, the top industry in this group was a "near-miss"; NAIC 4232 – Apparel/Piece Goods Wholesalers came close to average growth and average volatility. It too was reasonably close to the Desirable group. The other industries in this group showed significantly lower growth and higher employment volatility. Eight of them experienced declines in employment. Many of these industries have lost jobs to the low labor cost areas of the world. Low growth and high volatility industries are generally not desirable target industries.

SUMMARY AND CONCLUSIONS

This research has developed the *employment beta* to aid economic development decision making. The employment beta is calculated with logic quite similar to that of the well known common stock beta. Using the employment beta, planners and developers will be able to assess an industry's employment volatility alongside its employment growth. Combining growth and volatility information (as measured by the employment beta), a sample set of 48 industries was simultaneously screened for employment growth and employment volatility. The 48 industries were grouped into the four relative desirability groups analyzed here.

This research has developed the **employment beta** to aid economic development decision making. The employment beta is calculated with logic quite similar to that of the well known common stock beta.

We recommend that target industry selection processes now include the employment beta as a selection criteria. Our research has demonstrated that a strategy of pursuing employment growth without considering volatility could add considerable risk to an area's economic well being.

SOME RESEARCH NOTES AND STATISTICAL OBSERVATIONS

- The authors recognize that target industries are not selected using only employment growth and stability factors. Our employment growth and beta results are offered as useful criteria to be included in the profession's overall industry selection processes, where numerous other criteria will be considered as well. A striking

TABLE 2

INDUSTRY GROUPINGS BY EMPLOYMENT GROWTH AND BETA

DESIRABLE TARGET INDUSTRIES: High Growth/Low Volatility

NAIC	GROWTH	BETA	DESCRIPTION
6216	3.77%	0.25	home healthcare services
6223	3.55%	0.29	community care facilities for the elderly
6113	3.48%	0.31	colleges, universities, and professional schools
5621	3.07%	0.02	waste collection
7112	2.67%	0.64	spectator sports
3254	2.39%	0.17	pharmaceutical and medicines manufacturing
8139	2.10%	0.12	business, professional, labor, political and similar organizations
4248	1.58%	0.15	beer, wine, distilled alcoholic beverage merchant wholesalers

ACCEPTABLE TARGET INDUSTRIES: High Growth/High Volatility

NAIC	GROWTH	BETA	DESCRIPTION
5415	7.63%	4.38	computer systems design and related services
7132	5.25%	3.94	gambling industries
6112	4.87%	1.30	junior colleges
5121	3.84%	1.71	motion picture and video industries
4541	3.35%	3.60	electronic shopping and mail order houses
5614	3.00%	1.52	business support services
3342	2.88%	4.30	boiler, tank, and shipping containers manufacture
7131	2.87%	1.98	amusement parks and arcades
3322	2.16%	2.24	cutlery and hand tools manufacture
5112	2.16%	3.22	software publishers

LESS ACCEPTABLE TARGET INDUSTRIES: Low Growth/Low Volatility

NAIC	GROWTH	BETA	DESCRIPTION
6221	1.45%	-0.23	general medical and surgical hospitals
8113	0.92%	0.95	commercial and industrial machinery and equipment
3336	0.89%	0.32	engine, turbine, and power transmission equipment manufacture
4244	0.62%	0.38	grocery and related products
4243	0.48%	1.00	apparel, piece goods and notion merchant wholesalers
3391	0.19%	0.30	medical equipment and supplies
3121	0.17%	0.40	beverage manufacturing
8112	0.12%	0.92	electronic and precision equipment repair and maintenance
5241	0.10%	0.09	insurance carriers
5221	0.08%	0.53	depository credit intermediation
5111	-1.02%	0.94	newspaper, periodical, book and directory publishers
3345	-1.55%	0.63	navigational, measuring, electrical and control instruments
3113	-2.02%	0.64	sugar and confectionery products

UNACCEPTABLE TARGET INDUSTRIES: Low Growth/ High Volatility

NAIC	GROWTH	BETA	DESCRIPTION
4232	1.37%	1.21	furniture merchant wholesalers
5418	1.35%	2.38	advertising and related services
4532	1.32%	1.94	office supplies, stationery and gift stores
3344	1.28%	4.07	semiconductor and other electronic components
3372	0.77%	3.14	office furniture (including fixtures) manufacture
4521	0.66%	1.54	department stores
3361	0.59%	6.15	motor vehicle manufacture
4512	0.44%	2.59	book, periodical and music stores
3131	0.29%	2.82	fiber, yarn and thread mills
3114	-1.47%	1.05	fruit and vegetable preserving and specialty food
3352	-2.36%	1.41	household appliances manufacture
3364	-2.74%	1.13	aerospace products and parts
3343	-4.61%	1.82	audio and video equipment manufacture
3132	-7.54%	2.84	fabric mills
3151	-9.46%	2.85	apparel knitting mills
3152	-10.92%	2.02	cut and sew apparel
3162	-12.02%	1.21	footwear manufacture

example of this point is Motor Vehicle Manufacturing, NAIC 3361. This industry's low growth and high volatility place it in the "Undesirable" industry category, *when considering these two criteria only*. Of course, when motor vehicle manufacturing's large number of jobs and large tax base are considered, it becomes a more desirable target industry.

- The industries included in this 48 industry "demonstration run" were informally selected from perusal of NAIC listings, with attention paid to industries recently exhibiting: significantly high or low growth, vulnerability to foreign outsourcing of production, sensitivity to swings in the business cycle, and recent economic/stock market news impact. Further research efforts will expand the NAIC coverage.
- The authors agree that there may not be any such thing as an "unacceptable" new job to an area suffering economic blight. Our research is offered to provide new information to help those areas prevent the blight from reoccurring.
- For the econometrician, we note that the employment beta regression results exhibit very much the same statistical test results as do common stock beta regressions. The coefficient of determination (R^2) numbers were typically low. The significance levels of the beta coefficients are acceptable, with F tests significant at the 5 per cent level. Detailed results are available upon request.
- In the investments research literature, it has been noted that the common stock beta is constructed using historical information, yet used to construct stock portfolios targeted at future performance goals. Rigorous research has shown that individual stock betas do change over time. However, portfolio average betas show much better stability. We are comfortable that employment changes are generally less volatile than stock price changes, so employment betas will be more stable than stock betas. We recommend periodic updating of the beta and growth calculations to keep them timely.

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