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# Job Openings in Information Technology & Decision Sciences: Home Brew Business Intelligence for Fun, Education and Maybe Even Profit

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## ABSTRACT

This project did not begin as a focused research study; so we beg your indulgence for a humble laxity in academic rigor. However, we believe our explorations of online, real-time, job openings data for thirty specialized information technology and decision science job categories over the last five years will keep your interest. When we started this project, we merely wished to see if the market for our majors was improving, identify the high potential job areas, and look at growth areas for future curriculum development. By 2006 the number of majors in our department had shrunk to 120 from a high of nearly 500 majors in 2001 [Becker, et. al., 2006]. We began to collect job openings data the old fashioned way—by hand—from the popular CareerBuilder.com website in mid-January 2006. Using the following key word searches: Analyst, Six Sigma, Lean, and SAS—we recorded our first four job openings within the State of Texas; using job openings that had been posted in the last 30 days. Since then, our database has grown to nearly 1,800 observations. Using relatively simplistic data mining techniques we are now able to produce a number of monthly IT job opening forecasts that keep our students, faculty, Career Center, and advisory board looking for that next update.

## Keywords

Keywords: Job Openings, IT, Business Intelligence, Forecasting, Employment

## INTRODUCTION

For the past 25 years the ITDS department at UNT has granted degrees in both information technology and decision sciences. By 2001 during the surreal Dot.Com economy, the number of majors at the undergraduate, masters and doctoral levels had swelled to over 500 students. After the Dot.Com bubble burst in 2001, our enrollments steadily declined, so that by 2006 there were only approximately 120 majors in the department. There were many of us, who feared that our department might be merged with another department. This was already happening at other IT departments around the country.

As we explored ways to more effectively market our department to new majors, we came to the realization that we should and could be more proactive in finding jobs for our majors. But first, were there any jobs to be had? Downsizing, right-sizing, outsourcing and budget cutbacks had caused unprecedented reductions in the demand for new graduates in both IT and decision sciences. Undaunted and seasoned by years of industry experience, Dr. Dake, boldly decided to start following IT/DS job openings for our students. He challenged himself to personally place as many of our decision science majors in jobs prior to graduation. He discovered CareerBuilder.com was a most helpful tool in this endeavor. In particular CareerBuilder.Com was both easy to use and provided detailed statistics on the number of job openings by relevant job specialties and categories.

Utilizing Career Builder's online job publishing data and using these first key words: Analyst, Six Sigma, Lean, and SAS—we recorded the first four counts for those job openings within the State of Texas. We are now in our 6th year of data collection and the number of job categories has grown to 30 (**See Table 1**), spanning 62 months. Our database has grown from 4 observations to nearly 1,800 data points. Because the data is collected live, online, real-time each month around the 15th of the month. The data collected are for "Jobs Posted in Last 30 Days"; therefore our data provides us with an inherently forward look at what will be happening in the job markets for our students.

Initially CareerBuilder.com was chosen for both its comprehensiveness and its relative ease of use in garnering job openings in target population segments by type of job category and by geographical region (e.g., Texas). CareerBuilder.com maintains that it is the largest U.S. online job site with over 1 million jobs posted. Over 23 million unique visitors come to CareerBuilder.com each month [CareerBuilder.Com]. In an industry where businesses fail nearly as fast as they begin, CareerBuilder.Com, which was founded in 1994, is one of the oldest job posting sites on the World Wide Web. [Wikipedia]

We are keenly aware of the many limitations for serious research of using this public search engine for our data collection tool. However, we find that students, faculty, the UNT Career Center, and our advisory board members alike find the information in our reports timelier and directly applicable to their own personal decision making. We believe that the data and the charts and the analyses we have developed are valuable pedagogical examples of online, real-time data collection, data mining and statistical analysis. We have used these data in classes to demonstrate time series analysis, hypothesis testing etc. and we find our students take a great deal of interest in the data. Dare we say, “This is what Business Intelligence is all about!” Furthermore, one can easily tailor these data collection techniques for the job market of any school’s graduates.

The job category that is probably of the utmost importance to our majors is that of “Systems” Analyst (**See Chart 1**). This term includes jobs for which both our Business Computing and Information Systems majors and our Decision Sciences majors are qualified. Picking the correct job category search term is part art and science. Generally we would experiment with several terms to see if the number of the results varied very much. Next, we inspected the actual job openings that appear to determine if they were relevant to our graduates or someone with those skill sets. Once we were convinced we have a “good” search term from the CareerBuilder.Com lexicon of search terms, we added it to our monthly data collection process. As an aside, the data can be collected manually in under 30 minutes each month. We believe that personal and manual collection and inspection of the data is imperative for the data quality. On occasion CareerBuilder.com appears to adjust its category definitions; when this occurs, search terms are adjusted accordingly.

Two categories (**See Table 1**) that require special adjustment each month are #28 IT Project Management (Excludes Engineers) and #29 Quality (Excludes Nurses). Both search terms generate a large number of job openings. CareerBuilder.Com displays subcategories of these categories along with the count and position descriptions data. There are significant subgroups of various types of Engineers that turn up under the IT Project Management category each month. The jobs in these subgroups include mechanical engineers, civil engineers, etc. We elected to subtract this subcategory from the total IT Project Management count. Similarly a large number of nursing positions is included in the Quality search term; we likewise subtract their number from the category total count.

## DATA ANALYSIS

In January of 2006 we became interested in anticipating the job opportunities for our majors in our Information Technology & Decision Sciences department. Most of our students come from Texas and a large percentage of our students take jobs in Texas. We started tracking Jobs posted within “the last 30 days” (a search option feature), using CareerBuilder and we began with only four categories to track and quickly expanded to 13 categories within the first year primarily due to the interest of other faculty members (**See Table 1 above**). As we moved forward other categories have been added as new areas of interest have evolved in our Decision Sciences & IT world. Currently we are tracking 30 categories. Please note that these categories are not independent. Our methodology is quite simple; but has served us well. Each month we extract data from CareerBuilder on the number of jobs posted in the last 30 days by job category. We extract these numbers near the middle of each month.

Initially CareerBuilder.com was chosen for its ease of use in garnering job openings data segmented by type of job category and geographical region. And while there are many top rated job opening search engines available, CareerBuilder.com is consistently ranked in the top five by many surveys of this type [see subsection below]. CareerBuilder.com claims to be “... the U.S.'s largest online job site ... [which] puts over 1 million jobs in front of poised job seekers wherever they are - at home or at work - in print and on the Internet. More than 23 million unique visitors come to the site every month to check out the opportunities in every industry, field and job type.” [CareerBuilder.com]

CareerBuilder is one of the oldest job search engines. Founded as NetStart, Inc. in 1994 by Robert J. McGovern, it was initially marketed as software sold to companies for listing job openings on their Web sites and for managing the incoming e-mails those listings generated. McGovern next transported this software to its own web address, at first listing the job

openings from the companies who utilized the software. In 1998 NetStart Inc. changed its name to CareerBuilder. [Wikipedia]

Series No.	Date Series Added	Job Categories (ABBREVIATIONS)	Full Name of Category or Description
1	Jan-06	ANALYST	Analyst
2	Jan-06	6 SIGMA	Six Sigma
3	Jan-06	LEAN	Lean; Quality
4	Jan-06	SAS	SAS
5	May-06	DATA	Data Mining
6	May-06	BI	Business Intelligence
7	May-06	SAP	SAP
8	May-06	ORACLE	Oracle
9	May-06	FORECAST	Forecast
10	May-06	PERFORMANCE	Performance Management
11	Jun-06	MRO	Materials Requirements & Operations
12	Jun-06	SUPPLY	Supply Chain
13	Jun-06	LOGISTICS	Logistics
14	Feb-07	VIRTUAL	Virtual Computing
15	Mar-07	BUDGET	Budget
16	May-07	PLANNING	Planning
17	May-07	STRATEGY	Strategy
18	May-07	CONSULTING	Consulting
19	Jun-07	INNOVATION	Innovation
20	Aug-07	SCORECARD	Scorecard
21	Dec-07	GRAPHICAL	Graphical
22	Dec-07	VISUAL	Visual
23	Jun-08	GIS	Geographic Information System
24	Feb-09	CLOUD	Cloud Computing
25	May-09	INFO TECH	Information Technology
26	Jul-09	LIFECYCLE	Lifecycle
27	Jul-09	ENT ARCH	Enterprise Architecture
28	Sep-09	IT PROJ MGT	IT Project Management (Less Engineers)
29	Oct-09	QUALITY	Quality (Less Nurses)
30	Mar-10	PROC IMPROVE	Process Improvement

Table 1: The Current 30 IT & Decision Science Job Categories

### Top 10 Job Search Engines

In preparation for this paper, we reviewed the validity and acceptable of using CareerBuilder.com as our only job search engine for this study. Several recent technology pundits consistently ranked the following job posting sites as the most popular, comprehensive, or easiest to use (Listed alphabetically): 1) CareerBuilder.com; 2) Craigslist; 3) Dice.com; 4) Ladders.com; 5) LinkIn.com; 6) LinkUp.com; 7) Monster.com; 8) SimplyHired.com; 9) USAJobs.gov (OPM); and 10) Yahoo HotJobs.com [Boswell, 2011]; [ConsumerSearch, 2010]; [Gansel, 2009]; [Pomoni, 2010]; [TopJobSearch, 2010]. Both CareerBuilder.com and Monster.com compete for the #1 job search engine title. While using some combination of one or more of these other job search engines may provide more “accuracy” and “validity”, the whole point of using this public online, real-time source of data is to provide more timely “intelligence” that we cannot easily obtain elsewhere. We will elaborate on this next.

### NEXT GENERATION ANALYTICS: REAL-TIME PREDICTIVE ANALYTICS

Historically it was difficult to obtain timely information concerning job vacancies or job openings for the U.S. economy or even for regions of the U.S. The Bureau of Labor Statistics (BLS) was tasked with the job of procuring this data from many sources, including local newspapers, job clearing houses, and individual firms. With the advent of the World Wide Web in the early 1990’s and subsequent development of online job placement services, the private sector became a popular, more timely, though less rigorously managed and less secure location for job seekers and job providers to meet. Starting in 2000 the BLS began conducting its Job Openings and Labor Turnover Survey (JOLTS) each month [Klemmer, 2009]. The data from this survey is downloadable by many job categories according to NAICS (North American Industry Classification System) codes. However, the data is only available by four regions: Northeast, South, Midwest and West. Finally, the data is published two months after the collection date. Our data is available immediately!

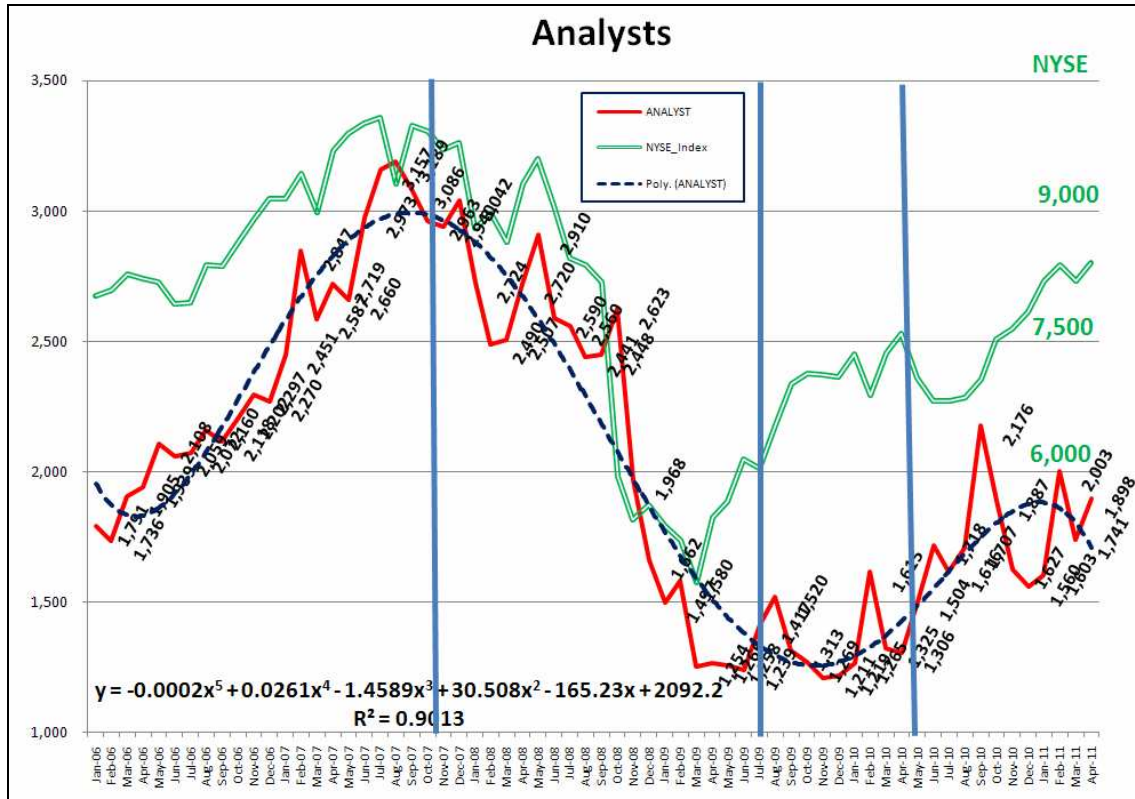


Chart 1: Job Openings in Texas for Analysts: January 2006 – April 2011

Several studies have pointed to the emergence of so-called *next generation analytics*. One study [Economist, 2010] described how some businesses gathered online public data, so that they could oftentimes identify trends before official industry or government statistics were released. Monster Worldwide, an online job service that publishes an employment index tracking jobs, posted on its own and other sites that jobs fell sharply in 2007 before official numbers showed employment in America weakening (see Chart 2).

Google has said its search data may also provide useful early-warning signals: it is exploring whether searches for terms such as “unemployment insurance” are a good way to predict future increases in joblessness. There is even a new term for these economic indicators from the web: “Dotconomy” [Economist, 2010]

“A second reason that web firms’ indicators are gaining popularity is the detailed data that underpin them. “A second reason that web firms’ indicators are gaining popularity is the detailed data that underpin them. The Zillow Home Value Index draws on the site’s individual valuations of 72 m[illion] houses across America.

Some economists caution that web firms’ data have big handicaps. Many of the indices have only a short history, which means they are of little value to policymakers interested in long-term trends. And they often measure only online transactions, which limits their appeal. Both caveats carry some weight. But as more economic activity moves online, the notion of using bits and bytes to measure booms and busts will surely become more attractive.” [Economist, 2010]”

Finally, Dignan [2010] observed that companies need to develop "operational analytics" to make predictions and use data mashups. "There's value in very current information. We are now shifting our focus to start doing simulations and modeling to predict the future," .... These simulations would ultimately be run on smartphones and other devices to provide real-time forecasts.



**Chart 2: Monster Worldwide Employment Index**  
 BLS Official employment, millions  
 Monster Employment Index

**JOB OPENINGS CYCLES: AN ECONOMIC BAROMETER**

Job openings data like most other economic data follows cycles that are generally tied to the overall economy. We expected to find that job openings would rise as the economy improved, and similarly would fall as the economy declined. What we did not expect was that job openings data might be a leading or coincident indicator of Stock Market performance, which itself is a leading indicator of overall economic performance. In order to compare the Job Openings trends with the overall economy we super-imposed the NYSE Index. We will now offer several prognostications based upon our very rudimentary job openings charts.

Referring back to **Chart 1**, it appears that we have progressed through four economic cycles in the last five years. This is affirmed by Klemmer (2009) (See **Chart 3**) and by JOLTS data (**Chart 4**) that was downloaded from the BLS website for the Information Industry [<http://www.bls.gov/jlt/>]. Excel is one of the premier DSS tools, which permits pedagogically interesting options such as displaying polynomial trend lines. Students are encouraged to experiment with n-order polynomials to optimize goodness of fit (R-squared).

The following four cycles related to significant economic events during 2006-2011:

1. Market upswing -- Jan 2006 to Oct 2007

“In December 2008, the National Bureau of Economic Research (NBER) announced that the current recession had begun in December 2007. The downward trend in job openings, hires, and quits, and the upward trend in layoffs and discharges are consistent with recessionary trends in other economic statistics. Recessionary trends are evident in increasing unemployment and declining employment levels. For example, the unemployment rate, 4.9 percent in December 2007, climbed to 7.2 by of December 2008. Also, since December 2007, nonfarm employment dropped from 138 million to 135 million for the month of December 2008, a net employment loss of approximately 3 million over the course of 2008. Chart 1 shows JOLTS total private job openings compared to CES total private employment levels since December 2000. The job openings leveled off and began to fall prior to December 2007 when employment levels began to fall.” [Klemmer, 2009, p. 32]

2. Market collapse -- November 2007 to June 2009 readily apparent from our small sample.

The seeds for this economic downturn were sown by the Housing and Banking Market Collapse and the subsequent emergency TARP (Troubled Asset Relief Project) Bailout

3. Market “bottom” -- July 2009 – March 2010

While the market turnaround has been painful and elongated, there is some evidence that the Federal Stimulus Bill is having some positive impact on both the overall economy and job openings.

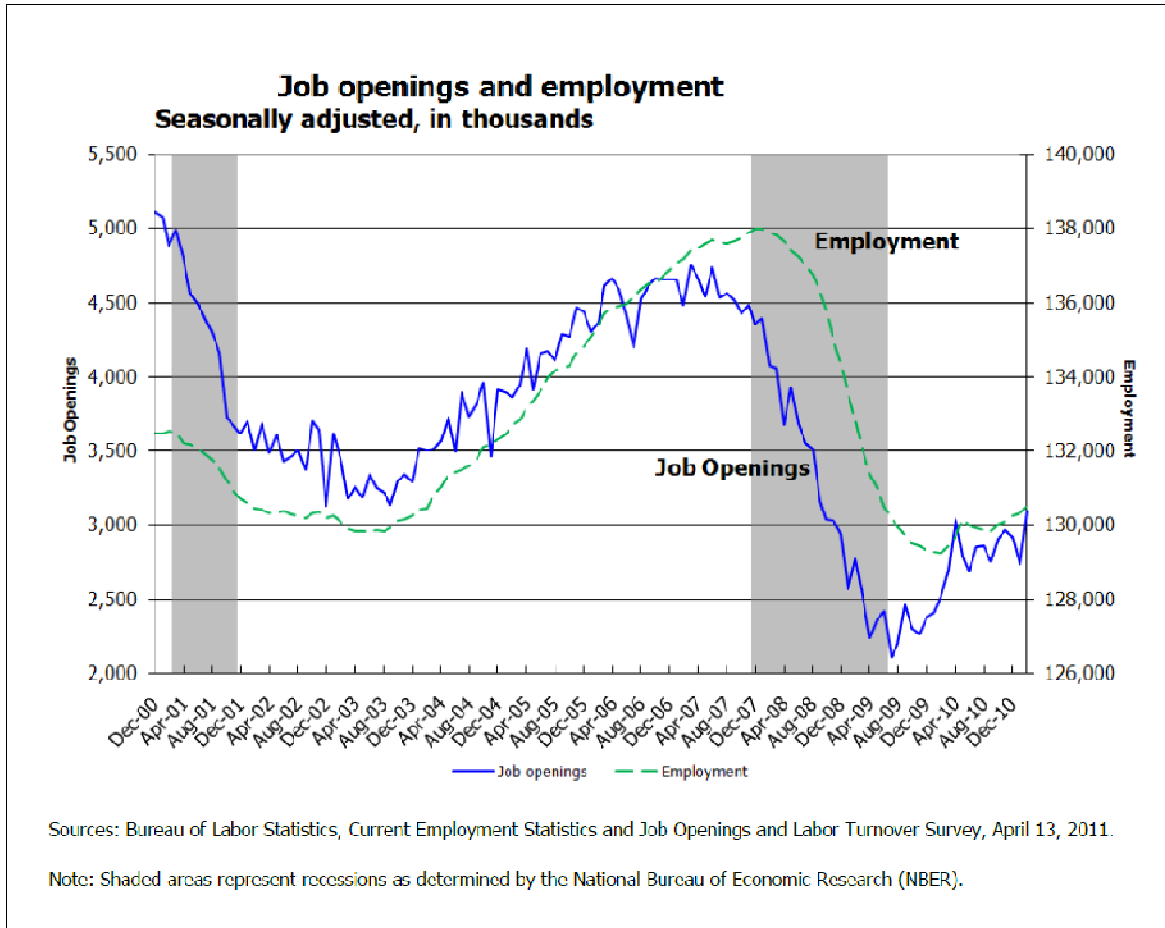


Chart 3: JOLTS total private job openings and total private employment, December 2000 – December 2010

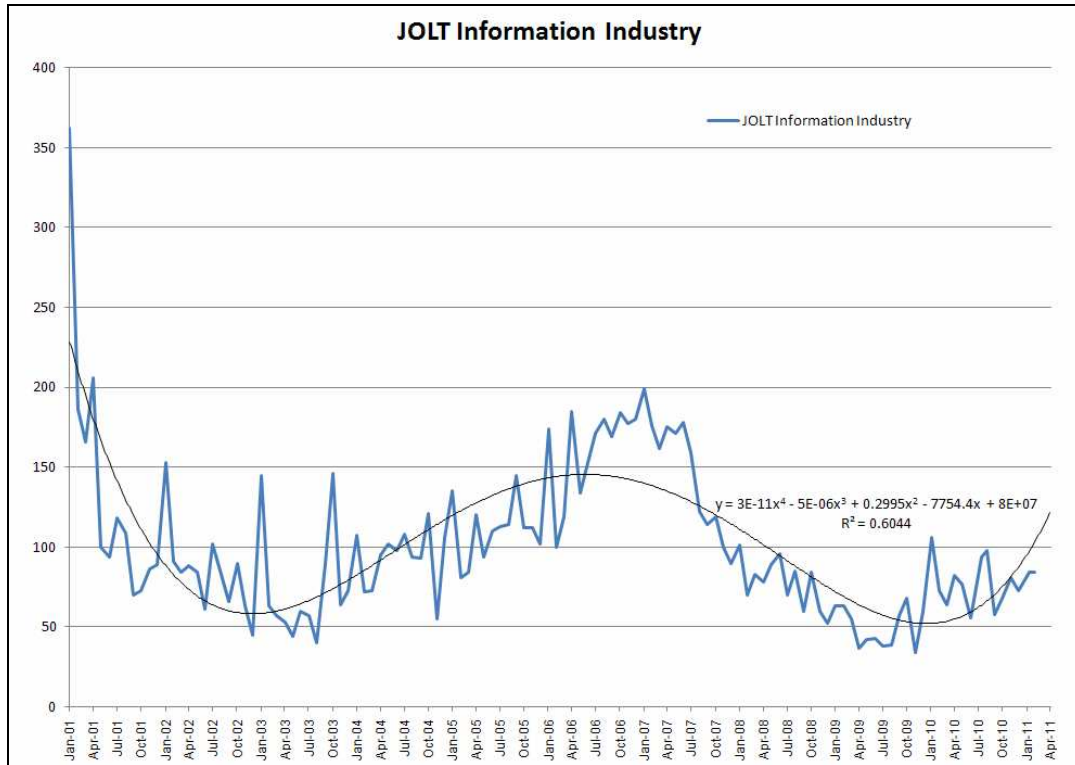
4. Market recovery: April 2010 – present?

Clearly employers are not as convinced as investors that the recovery is truly sustainable. Job openings continue to lag behind the stock market surge since April 2010.

**ADDITIONAL JOB OPENINGS TRENDS**

There is not enough space to show all of the interesting job opening trends for all 30 job categories. Given the interest of this paper in predictive analytics, a.k.a, Business Intelligence (BI), we would be remiss not to include our chart for BI job openings (See Chart 5). While the number of positions is still relatively small, there has been a steady growth, with less attenuated cycles, in this time period.

Finally, we have been tracking a number of specialized niche job categories, e.g.: Cloud Computing, GIS, Enterprise Architecture, Balanced Scorecard, etc. We are among the first to report that Enterprise Architecture as an important job category seems to have finally taken off (see **Chart 6**). We are curious whether this is just an outlier, a local Texas phenomenon, a regional trend, or a serious new national mega-trend. Check back next month for our update!



**Chart 4: JOLTS Data for Information Industry; US Economy; Job Opening in (000s)**  
**January 2001 to April 2011**

**FUTURE DIRECTIONS**

Needless to say, exploring the area of online real-time job openings is both fun, interesting, and maybe even profitable. In order to turn this research into “real” research there are a number of approaches, which we might pursue. We could approach this issue from a detailed econometric forecasting perspective. We could expand this model to include other market indexes besides the NYSE Index, or investigate the root economic causes of job opening creation. Greater attention could be paid to measuring the lead-time advantage of online real-time public databases.

From a fun and interesting perspective, we could continue to focus on additional niche job categories, perform more frequent sampling, and compare CareerBuilder.Com with other popular job posting search engine databases.

We could expand our coverage and analysis to geographical region trends outside of Texas, or even to smaller areas, such as Metroplex areas, like DFW, Houston, Los Angeles, New York City, etc.

It would be possible to even develop an online mobile application for monitoring job openings real-time and sending the result to paying subscribers—perhaps for profit!

**SUMMARY**

We believe our explorations of online, real-time, job openings data for thirty specialized information technology and decision science job categories over the last five years shows great promise for use by educators, students, practitioners, and career counselors. Data that is carefully and systematically collected from reputable sources may provide more timely information than that which is available from traditional industry and government reporting agencies. The exercise of the techniques discussed in this paper is relatively easy to perform and provides virtually unlimited pedagogical opportunities for teachers of business courses, where data analysis is required. Finally, as the availability of more databases such as those discussed in this paper become accessible, because of developments such as the Semantic Web, greater attention will be paid to extracting the predictive analytical data and information that can be discovered therein.



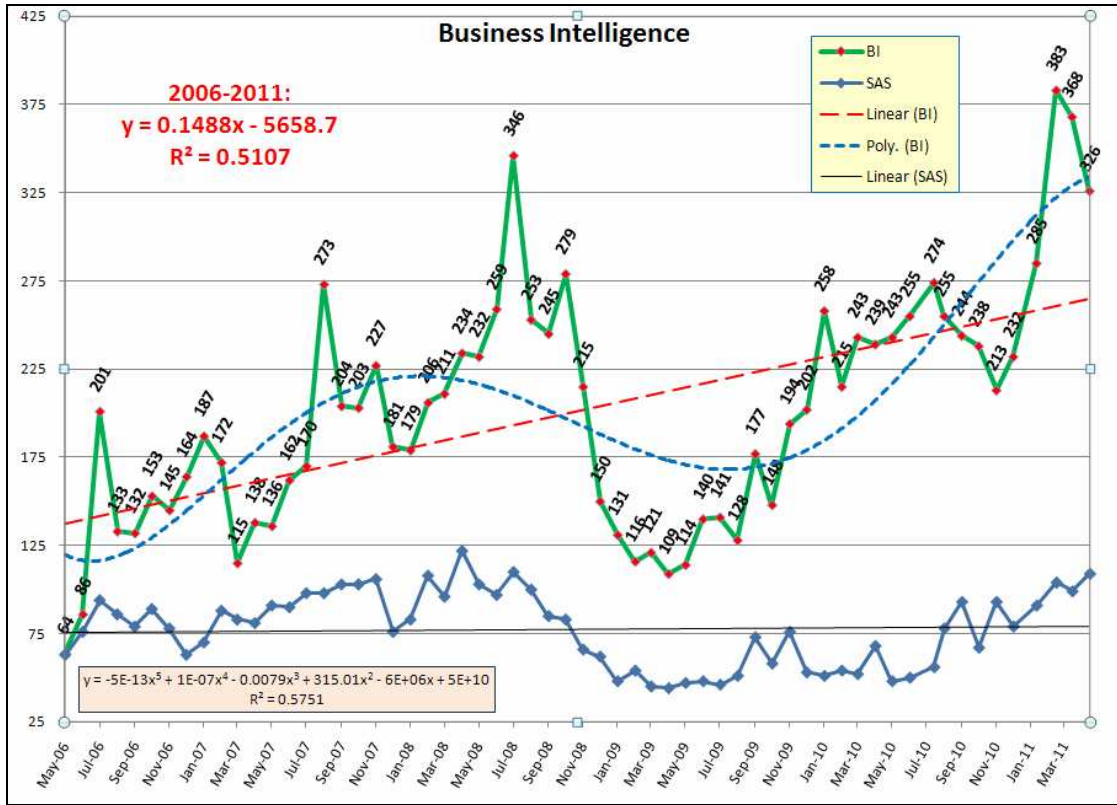


Chart 5: Business Intelligence Job Openings

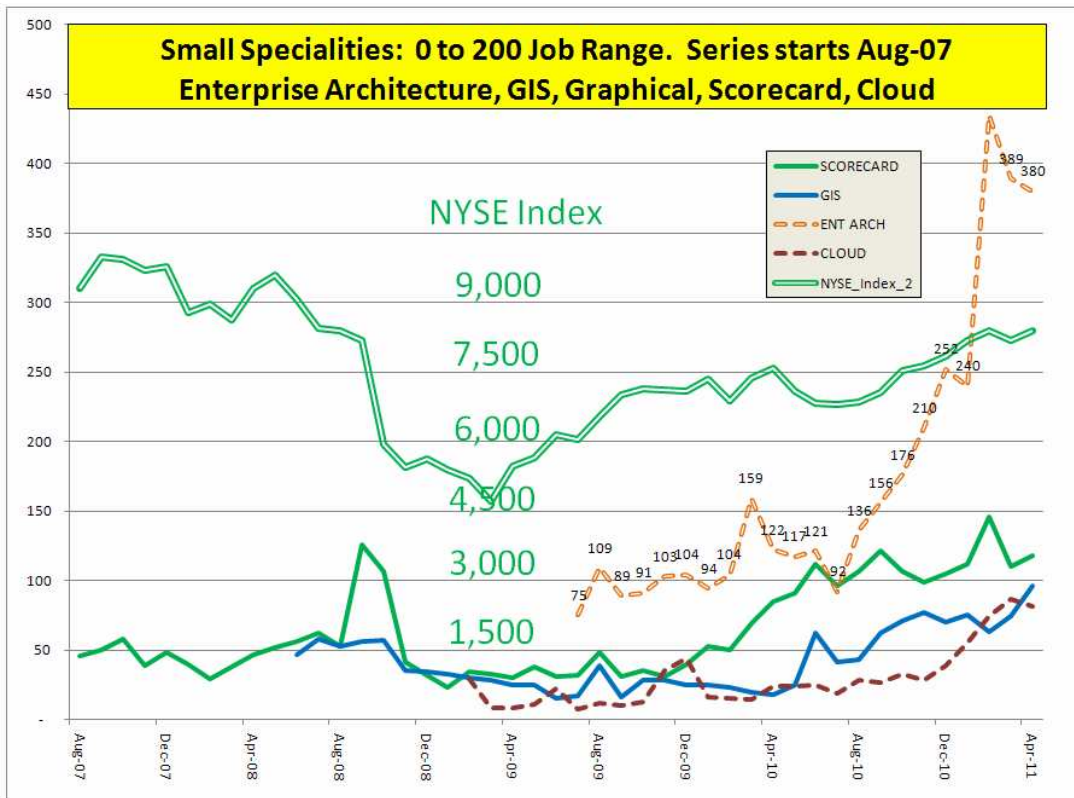


Chart 6: Enterprise Architecture Job Openings

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