MEASURING TRANSITIONS INTO THE WORKFORCE AS A FORM OF ACCOUNTABILITY

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ABSTRACT

This paper explores the relationship between student major and industry of employment and its application to higher education accountability. Data provided by statewide longitudinal data systems (SLDS) has enabled state educational agencies and colleges to follow students into the workforce. While most studies have focused on wage outcomes, this shows how to use SLDS data to understand the correlation between major and industry. The transition into the workforce is an important outcome since it is an assessment of a college's ability to develop specific, targeted sectors of the economy. We use SLDS data from Iowa to follow community college alumni from 2002 through 2008.

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February 17, 2011

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I would like to thank Kiyokazu Matsuyama for his assistance and participants of the sessions at American Educational Research Association Annual Meeting 2010, Association for Institutional Research Annual Forum 2010, Mid-America Association for Institutional Research Annual Conference 2009, and Association for Institutional Research in the Upper Midwest Conference 2009.

Introduction

Workforce outcomes are growing in importance in the evaluation of college performance. Researchers are extending the assessment of college programs from tradition measures of persistence and graduation into employment and wages. Workforce education programs have required states to report employment outcomes for participants. For instance, the U.S. Department of Education has also proposed rule changes to reflect the growing emphasis on employment for private, for-profit universities and colleges (Epstein, 2010). So far, these new assessment criteria's have justifiably focused on measuring wages.

Yet, there are other important workforce-based measures that have not been fully explored. One such area for exploration is the link between a student's major and industry of employment. A strong link between these two is valuable to ensure workforce programs not only lead to workforce development, but development of targeted sectors of the economy.

This paper explored the link between student major and industry of employment using a statewide longitudinal data system (SLDS). SLDS' have grown due to the strong support of federal grants supporting their implementation and notable pieces of legislation that require states to longitudinally follow students through education into the workforce. Often, these SLDS can be used to follow students into the workforce, revealing important outcomes for graduates and leavers.

An analysis of data from Iowa community colleges revealed several key findings. First, we discover a strong relationship between student major and industry of employment for select majors. Second, we find that most of the immediate labor supply is from *non-workforce* majors. Nearly half of the labor supply for each sector is from majors that are primarily intended to transfer. These results have an impact on program evaluation, workforce development, and post-graduate expectations.

We used a unique graphing technique to display the relationship between majors and industry of employment. The software package used to create the diagram, *Circos*, was originally developed to display the chromosomal relationship between various species. We found this graphing technique was an effective tool to communicate results to various stakeholders.

Importance of Workforce Outcomes

A clear, causal link has been established between education and workforce outcomes. Descriptive data shows earnings for colleges continually outpace earnings for high school graduates and dropouts. In 2009, the median earnings for a Bachelor's degree recipient was $1,025 per week, compared to $626 for a high school graduate (Bureau of Labor Services, 2010).

Even after considering college tuition costs, higher education leads to a substantial return on investment. The returns also appear to be causally related (as opposed to high ability students self-selecting into higher education). Card (1999) and dozens of other studies estimate each year of education yields, on average, a 10% wage premium.[2] A similar pattern has also been established outside the United States (Psacharopoulos, 1994; Psacharopoulos & Patrinos, 2004).

A growing body of education policy is beginning to utilize wage outcomes for accountability purposes. The Workforce Investment Act and the Carl D. Perkins Career and Technical Education Improvement Act of 2006 requires state agencies to track and report employment outcomes for participants in either program (see ACTE & Brustein, 2006). In 2010, the U.S. Department of Education proposed rules to require "gainful employment" of graduates from private, for-profit colleges and universities (U.S. Department of Education, 2010). While the proposed rules have been controversial, it signals a growing emphasis on ensuring higher

[2] See Heckman, Lochner, & Todd (2005) for a review of the literature.

education provides a benefit that is at least proportional to the cost and reduces default rates on student loans.

Wage outcomes are a compelling accountability measure. Wages indicate whether students receive financial gain and is also an indication of performance in the workforce. Educated students are often better prepared for the workforce, which allows them to be more adaptive and productive than their less-educated counterparts.[3] A worker's productivity sets the upper limit of his wages since firms are unlikely to pay workers more than their revenues. Thus, productive workers effectively allow firms to earn more revenue based on their labor.

Non-Pecuniary Workforce Goals

Numerous articles, including those by this author (Schenk, 2012; Schenk & Matsuyama), make a compelling case to measure pecuniary gains for accountability. Yet, like many measures in accountability, there are short-comings to these wage studies. Namely, wages are unable to indicate whether colleges are substantially contributing to key economic sectors.

The defining characteristic of progressing economic system is better defined by the development of industries. Industrial economies rely on manufacturing, while post-industrial nations—like the United States—have increasing reliance on information technology, scientific research, and service sectors. Tracking students into industries, therefore, helps audiences understand and evaluate high education's contribution to economic progress.

Along the same lines, states and local regions may hope to implement new majors to develop specific industries, such as high-tech manufacturing, finance, or health. The goal of

[3] Huffman (1974) provides an empirical illustration of the impact of education on the productivity of farmers and profit.

these programs is not to necessarily develop high-paying wages—although they often do—but to specifically increase the size of specific industrial sectors.

Wage studies, however, are unable to assess how well majors are able to develop targeted sectors. Students could complete majors and earn valuable skills, but eventually gain employment in unrelated sectors. Wage studies will reveal an assessment of wage gains, but wouldn't capture the programs (in)ability to develop the desired industry.

Measuring Transitions into the Workforce

The significant difficulty, however, is obtaining the requisite data. Fortunately, the increasing sophistication of SLDS has permitted researchers to follow students from higher education into the workforce. Most of these studies have focused on measuring pecuniary outcomes (see Sanchez & Laanan, 1998 and other articles in the same journal issue). But the same SLDS data also contains information on the industry of employment, which can be used to measure the relationship between student's major and industry of employment.

Workforce data is often collected through unemployment insurance (UI) records maintained by workforce development offices. Despite the name, UI records actually contain a record of wages earned each quarter for workers in most industries within the state. UI records also contain an employee's social security number (often used to match with education records), the industrial sector, employer, employer's address, and year. A limited number of states also have elements related to the individual's occupation or the number of hours worked.

The industrial sector is captured by the North American Industry Classification System (NAICS) code. Each company is given a NAICS code based on their operations. It is a "drill-down" coding system which offers twenty industrial sectors defined by a two-digit code. A

three-digit code provides further information, while a six-digit code provides the most specific information. For instance, 31 contains all manufacturing industries, 311 is a category of food manufacturing, 3112 defines food manufacturing using grain and oilseed milling, and 311225 is fats and oils refining and blending.

NAICS codes are analogous to the ubiquitous Classification of Instructional Programs (CIP) codes used in education. Each CIP is upwards of a six-digit number to classify postsecondary majors. Each pair of digits conveys some information about the majors. The first two digits describes the program area, for instance, 01 denotes agriculture and agriculture operations programs. The next two digits—the third and fourth digit—denotes sub-program areas with more specific, but still general description. The CIP 01.02 are agriculture mechanization programs. The final two digits denote the specific program. The CIP 01.0204 denotes agriculture power machinery operation programs.

The CIP and NAICS code will be the mechanism which researchers can use to track the transition from major into industry of employment. The "drill-down" structure of each system will permit the data to be aggregated to a high-level or broken into a finer detail for deeper analysis.

Data Set & Methodology

This paper demonstrates the analysis of transitions into the workforce using data from Iowa community colleges. The Iowa Department of Education maintains the Community College MIS, which contains student and faculty information for all community college students within the state. Meanwhile, Iowa Workforce Development maintains unemployment insurance records which contain social security number, quarterly wages, and industrial sector for employees in

most sectors of the economy.[4] The Iowa Department of Education and Iowa Workforce Development have teamed-up to form the Training and Employment Outcomes System (TEOS), which combines education and workforce records into a single dataset (Iowa Department of Education and Iowa Workforce Development, 2010).

This study uses a cohort of completers and leavers from the 2005-06 academic year (herein the 2006 cohort). Completers are students who graduated from an Iowa community with an Associate's certificate, or diploma. Leavers are students who left community college before completing a degree.[5]

Both completers and leavers are matched with UI records between July 1, 2006 and June 30, 2008. The Iowa Department of Education uses the National Student Clearinghouse to remove any student who enrolled in postsecondary education after completing or leaving a community college. Even though student transfer is a notable or even desirable outcome (Porter, 2002), these students have not truly entered the workforce and should not be tracked yet.

TEOS only includes alumni who work at least one quarter in every year between 2006 and 2008. It is common for alumni to have several employers simultaneously or over the course of several years. Often, these employers are across multiple sectors. We determine alumni's "principal employment" by finding the highest paying employer for each alumni. The employer's industry is then also noted.

Community college majors are tracked through CIP numbers. Majors are aggregated into 17 categories—16 career-oriented clusters and a cluster representing transfer-oriented college

[4] UI records systematically exclude several industries: federal employees, members of the armed forces, the self-employed, proprietors, unpaid family workers, church employees, railroad workers covered by the railroad unemployment insurance, and students employed in a college or university as part of a financial aid package.
[5] In this study, leavers left at the *end* of the 2004-05 academic year, completers earned an award sometime *during* the 2005-06 academic year.

parallel programs.[6] Aggregating majors into 17 clusters is specific enough to be informative, but also broad enough not to be overwhelming. Industries are aggregated into 20 sectors based on the two-digit NAICS. We follow the recommendation to group the manufacturing (31-33), retail trade (44-45), and transportation and warehouse (48-49) in single sectors.

Displaying Results: *Circos*

The raw results (shown in appendix A) are shown in a 16-row by 20-column table. This large table does not effectively communicate the results to most audiences. There are several issues with utilizing a table in this study. Namely, a table devotes the same amount of space for each major and industry, even though some majors and industries and quite small while others are quite large. For instance, there are less than fifty education and training majors but over nine-thousand college parallel majors—both with the same amount of space on the table. Subsequently, it is also difficult to identify significant points of transition. Readers are essentially left to find the biggest number in the table in order to see the most significant results.

The table also does not easily or quickly convey a sense of proportion. College parallel and health sciences were the largest majors and, thus, stand out. Yet, it is difficult to tell where most of the students were employed. Conversely, it is difficult to easily understand the origin major from the industry perspective.

Displaying the results in a table can be informative, but ultimately discourages audiences from looking and understanding the data. Unfortunately, the audiences most likely to be discouraged from an oversized table are the members educators need to reach the most.

[6] See careerclusters.org for the CIPs which belong in each career cluster.

Kryzwinksi et al. (2009) introduced *Circos*, a data visualization software designed to show the chromosomal relationships between various species.[7] However, the software is also an effective means of showing other data. We reinterpret the software to show the relationship between major and industry of employment.

[FIGURE 1 ABOUT HERE]

Figure 2 shows the results while figure 1 aids in the interpretation.[8] The left side of the diagram—the areas with a colorful base—represents the students major. Each major was aggregated to 17 clusters. Each career cluster is represented as a bar, the length of which represents the number of students who transitioned from that career cluster to Iowa's workforce.

The right side of the diagram—the area with a uniform gray base—aggregates various industries to the two-digit NAICS code. The result is a picture of the 20 industrial groupings. Again, each sector is represented by a bar, the length of which represents the number of students who were employed there after leaving or completing community college.

Hundreds of ribbons connect the left side of the diagram to the right side. These ribbons illustrate the transition from career cluster to the industry of principal employment. The width of each ribbon shows the number of students who majored within each career cluster and transitioned to a particular sector of the economy.

Results

Over 20,000 students transitioned from an Iowa community college into the workforce in 2006. Most, 9,850 students, transitioned from college parallel programs into the workforce.

[7] Also see Ostrander (2007) and Kryzwinksi (2009) for additional illustrations of *Circos*.
[8] Specifics regarding the creating of the diagram are not described here, but interested programming-oriented readers can read more at Schenk (2009).

Subsequently, college parallel majors were the largest source of employment in almost every industry.

Health majors almost universally transitioned into jobs within the health care and social assistance industry. Although these occupations may not be aligned with their majors, the data provides an indication of success within the program. The health sector received 2,333 students from community colleges as employees. Besides health majors, college parallel students were the second largest source of labor, 1,657 students, coming from Iowa Community colleges into the health industry.

Manufacturing is the largest industry in Iowa. While Iowa is often associated with agriculture, the reality is 21 percent of the state's gross domestic product is dependent upon manufacturing (Eller & Eckoff, 2009). Farming, as a percentage of total personal income, has dropped below six percent (Oppendahl, 2011). Manufacturing is the second-largest industrial sector for community college alumni. Fifty-eight of the manufacturing majors from community college are employed in that sector.

[FIGURE 3 ABOUT HERE]

Figure 3 displays the same information on a faceted plot (Wilkinson, 2005). Each career cluster is broken-out and shown in isolation. It is readily apparent that college parallel is a substantial portion of the labor supply from community colleges. In fact, nearly half of the labor supply *in each sector* comes from college parallel majors.

College parallel majors are unique to two-year colleges. The intention is for these majors to take predominately liberal arts courses and then transfer to a four-year university or college to finish a Bachelor's degree. But recall, we've removed any student who transferred since they have not fully transitioned into the workforce. Thus, the college parallel students shown here are

those who did not transfer and entered the workforce instead.[9] It is especially illuminating to find a predominate share of workforce development actually emanates from a transfer-oriented major.

The data can be interpreted from the perspective of colleges and from the perspective of employers. Note the transition of architecture and construction majors into the workforce. A third of these students are employed in their corresponding industry—construction. But also note the architecture and construction majors only comprise 19 percent of the total employment hired from community college.

From the dean's perspective, he will be pleased to see many of the architecture and construction graduates are employed in a related industry. However, the employers may lament that there are not enough graduates and must resort to other, perhaps less qualified, majors. The asymmetry is a healthy reminder to researchers there can be differences between an acceptable education outcome and acceptable workforce development outcome.

Discussion

Transitions into the workforce research can also be combined with pecuniary outcomes research to get a fuller understanding of workforce outcomes. For instance, sixty percent of health major transition into their related health care and social assistance industry—a positive outcome. They also received large pecuniary awards (Schenk & Matsuyama, 2009). On the contrary, college parallel majors are spread over all sectors and have relatively low wages. Thus, the results for health majors are quite positive, but college parallel results (for those who don't transfer) is disconcerting.[10]

[9] Students who enrolled in a postsecondary institution, and thus excluded from this analysis, will be included in future iterations of research.

[10] It should be noted that two-thirds of college parallel *completers* in Iowa typically transfer to a four-year university after graduation (Laanan, Starobin, Compton, Eggleston, & Duree, 2007). It is students who do not transfer or complete that face low wages and unfocused workforce development.

The results also permit us to see which sectors community colleges are developing. More graduates obtain primary employment in the health sectors, followed by manufacturing, and retail trade. In a broad context, colleges are achieving their goals of supplying substantial labor to the health and manufacturing sectors.

This study uses community college data, but can easily be expanded to include similar analysis by four-year universities or high school graduates. Workforce records often use social security number as the primary identifier. The ability to perform matching of educational and workforce records is whether student records contain social security numbers. Colleges and states will also need to form an agreement to exchange data. The specifics of the arrangement depend on the organizational structure of state agencies; however, the Data Quality Campaign maintains a database of similar data sharing agreements used in the United States.

There are limitations to this study. Namely, UI records only contain data for a given state. This can be problematic for colleges or states that are close to or share large borders. These states will need to form interstate agreements to conduct similar research. In addition, states with large shares of federal employees or military personnel will also need to incorporate FEDES data to cover these sectors (Stevens, 2008).

This analysis does not always lead to a clear normative interpretation. Simple questions like “is there enough majors going into an industry?” cannot be answered with this data alone. Survey of business needs, occupation projections, and laborshed studies can provide context, but have significant difficulties in practice.

This paper also highlights the need to visually display the data and offers one approach. The author has found audiences to be interested in this technique for, if nothing else, sparking

questions, such as “what is that?”. Data visualization helps improve the communication of results, but also sparks interest in the material in a way tables cannot achieve.

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Figure 1: Circos Illustration

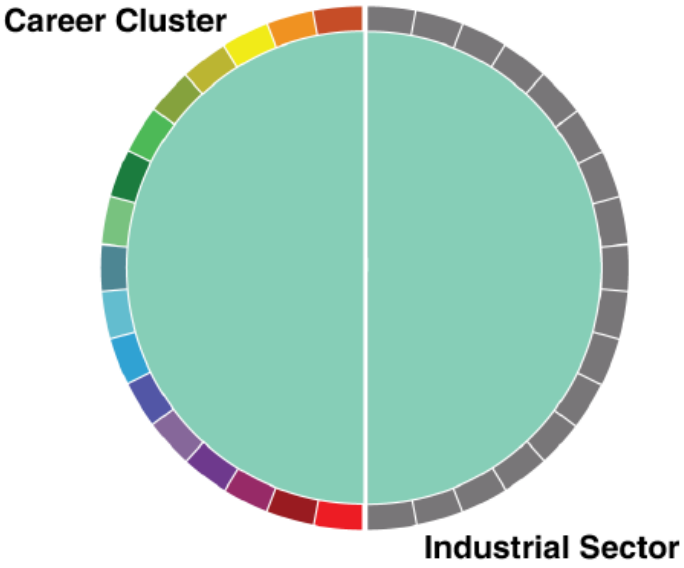
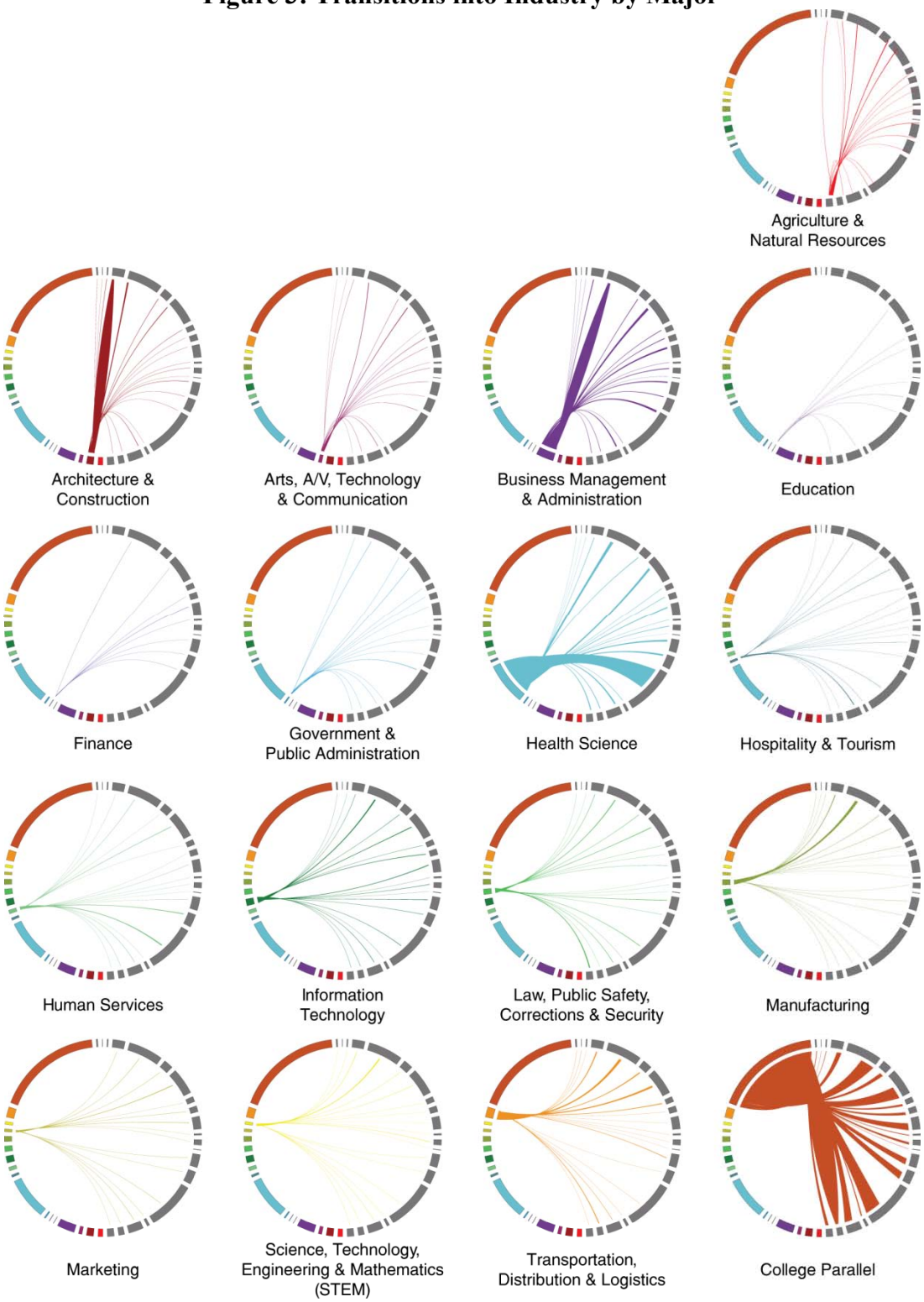


Figure 3: Transitions into Industry by Major

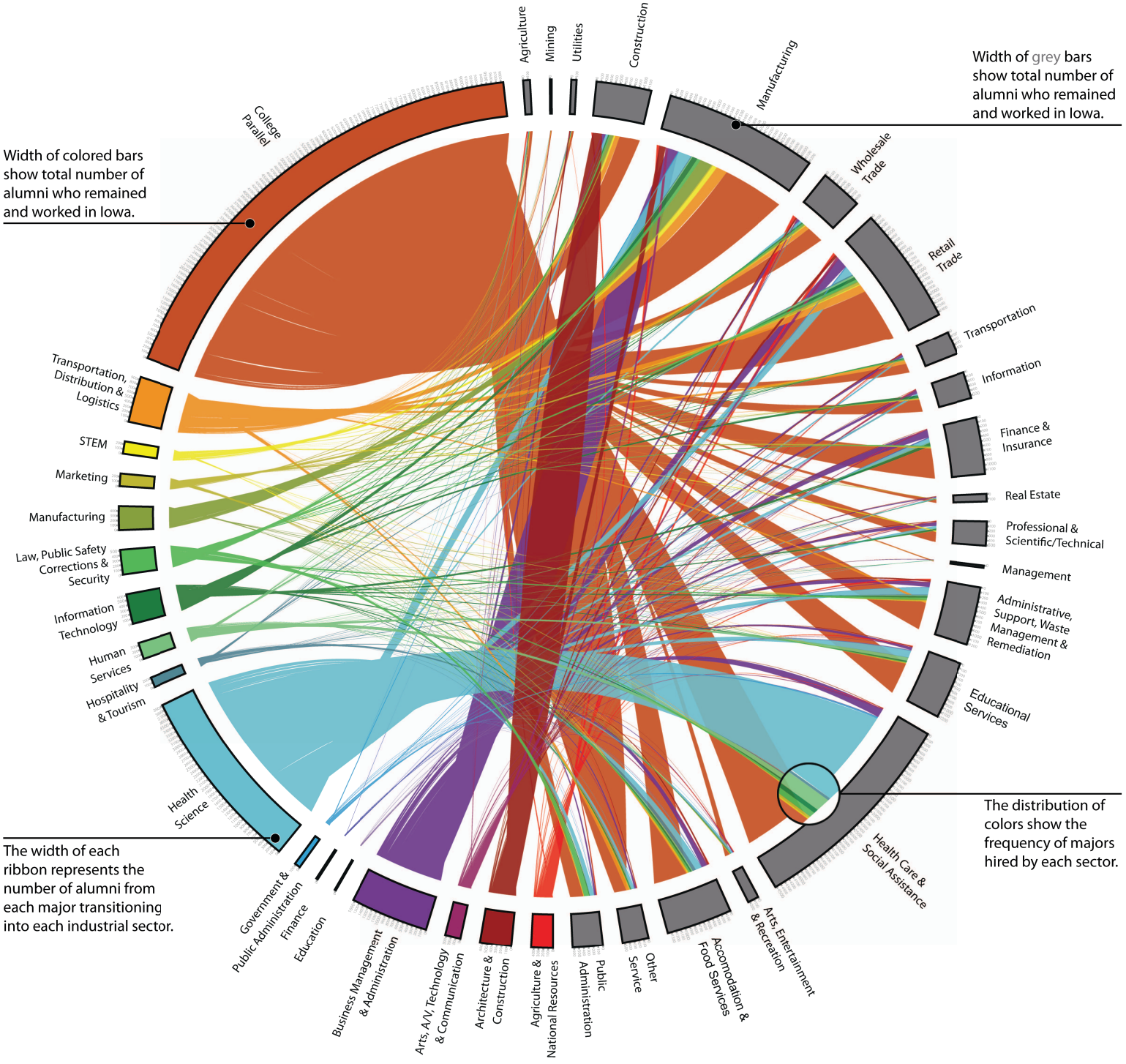


Appendix A: Table of Transitions from Major into Industry of Employment

Industrial Sector	Agriculture, Food, and Natural Resources	Architecture & Construction	Arts, AV, & Communication	Business, Management, and Administration	Education and Training	Finance	Government and Public Administration	Health Sciences	Hospitality and Tourism	Human Services	Information Technology	Law, Public Safety, and Security	Manufacturing	Marketing, Sales, and Service	STEM	Transportation, Distribution and Logistics	College Parallel	Total
Agriculture	26	9	1	9	0	0	0	9	1	1	3	5	7	0	2	11	59	143
Mining	0	3	0	5	0	0	0	1	0	0	0	0	2	0	0	12	14	37
Utilities	3	29	2	8	0	0	0	9	0	0	3	1	5	0	4	3	43	110
Construction	33	219	13	76	0	0	3	49	5	4	22	31	69	14	31	107	481	1,157
Manufacturing	65	150	61	248	0	5	19	301	18	22	122	77	292	24	105	260	1,454	3,223
Wholesale Trade	84	33	19	60	0	0	8	57	8	1	27	28	27	17	13	105	394	881
Retail Trade	65	58	65	246	3	1	20	222	27	44	73	57	23	59	20	190	1,285	2,458
Transportation & Warehousing	19	20	4	53	0	0	4	32	4	1	20	15	17	7	4	78	217	495
Information	10	4	31	64	1	2	2	43	5	2	60	8	2	20	4	10	291	559
Finance & Insurance	6	6	16	175	1	18	3	96	5	14	71	23	1	33	1	5	714	1,188
Real Estate	1	6	6	22	0	1	0	22	1	3	8	1	3	3	2	4	75	158
Professional, Scientific, & Technical Services	13	14	17	80	0	0	1	58	1	4	37	5	5	6	25	2	242	510
Management	0	2	0	6	0	0	0	4	2	1	4	1	0	0	1	1	24	46
Administrative & Support	40	29	17	111	1	1	6	172	19	14	41	46	14	17	10	50	631	1219
Educational Services	23	12	8	65	12	2	5	167	5	78	30	15	7	9	5	3	761	1207
Health Care & Social Assistance	12	8	20	202	3	4	36	2333	21	117	37	44	3	18	6	5	1657	4526
Arts, Entertainment, & Recreation	15	1	4	18	0	0	1	35	11	2	5	8	1	6	3	2	122	234
Accommodation & Food Services	14	31	27	119	4	0	7	146	76	24	35	35	6	20	12	30	793	1379
Other Services	9	10	12	34	0	0	4	62	2	12	17	5	7	7	4	79	282	546
Public Administration	16	11	1	36	1	0	4	97	2	4	13	113	8	4	6	5	311	632
Total	**454**	**655**	**324**	**1,637**	**26**	**34**	**123**	**3,915**	**213**	**348**	**628**	**518**	**499**	**264**	**258**	**962**	**9,850**	**20,708**

Source: Iowa Department of Education, Bureau of Community Colleges, Community College MIS and Iowa Workforce Development, Regional Research and Analysis Bureau. Iowa Department of Education & Iowa Workforce Development (2010).

Figure 2: Visualizing Transitions into the Workforce



Width of grey bars show total number of alumni who remained and worked in Iowa.

Width of colored bars show total number of alumni who remained and worked in Iowa.

The distribution of colors show the frequency of majors hired by each sector.

The width of each ribbon represents the number of alumni from each major transitioning into each industrial sector.