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# Labor Mobility in Illinois: Industry by Occupation Analysis

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## Abstract

This paper explores whether Covid-19 could have increased the likelihood of job changes of an extreme sort; Illinoisans may have taken jobs outside their interests and below their capacities. Employment data from the Bureau of Labor Statistics and the US Census Bureau were used to gain insights into the issue. Results of data analysis suggest that job-to-job moves declined in 2021, from 240,747 moves in 1<sup>st</sup> quarter, 2020 to 219,949 moves in 1<sup>st</sup> quarter, 2021, but the Covid-19 pandemic did not result in random job changes. Another outcome of the research is the transition matrix for occupations by industry; it shows, for example, the likelihood of one moving from an “outdoor” job to a “technology” job.

## Introduction

This paper explores job changes of Illinoisans during 1<sup>st</sup> quarter, 2021, phase 4 of the Covid-19 pandemic<sup>2</sup>, and compares it to a pre-Covid-19 baseline, 1<sup>st</sup> quarter, 2020. In general, job changes are likely to follow the ‘neighboring hypothesis’ – the recognition that labor mobility would most often be within the same industry, sometimes with contiguous industries, and least often between the most widely separated industries<sup>3</sup>.

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<sup>2</sup> Athiyaman, A. (2021). Covid-19 Pandemic: Effects on Minority-Owned Businesses in Illinois. *Research Brief*, 3(6), April 6, 1-10. Available online: [http://www.iira.org/wp-content/uploads/2021/04/ResBrief6\\_Minority\\_Apr2021.pdf](http://www.iira.org/wp-content/uploads/2021/04/ResBrief6_Minority_Apr2021.pdf).

<sup>3</sup> Nauta, M. M. (2010). The Development, Evolution, and Status of Holland’s Theory of Vocational Personalities: Reflections and Future Directions for Counseling Psychology, *Journal of Counseling Psychology*, 57(1), 11-22.

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However, Covid-19 could have increased the likelihood of job changes of an extreme sort, people may have taken jobs outside their interests and below their capacities<sup>4</sup>. Did Covid-19 nullify the ‘neighboring hypothesis’?

### Conceptual Framework<sup>5</sup>

People choose occupations that are compatible with their personality. According to a prominent vocational theory<sup>6</sup>, most people resemble a combination of six vocational personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. Likewise, work environments can be

categorized by their resemblance to a combination of personality types, for example, occupations in engineering place little or no importance on interpersonal or social relations. For empirical purposes, it is customary to cluster occupations into eight groups, according to the primary focus of activity in the occupation<sup>7</sup> (Table 1). These eight groups can be arranged in a hexagonal structure, reflecting two underlying vocational-interest dimensions: Data – Ideas, People – Things (Figure 1); job switches are probable from any group to the one adjacent to it and become less likely for distant groups.

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<sup>4</sup> See for evidence, Athiyaman, A., and Boulay, D. (2021). Some empirical aspects of the manufacturing sector during the Covid-19 pandemic. *Rural Research Report*, 31(1), 1-12. Available online: [http://www.iira.org/wp-content/uploads/2021/02/RRR\\_Jan2021\\_Feb12.pdf](http://www.iira.org/wp-content/uploads/2021/02/RRR_Jan2021_Feb12.pdf).

<sup>5</sup> Author's theorizing based on psychological studies of occupations.

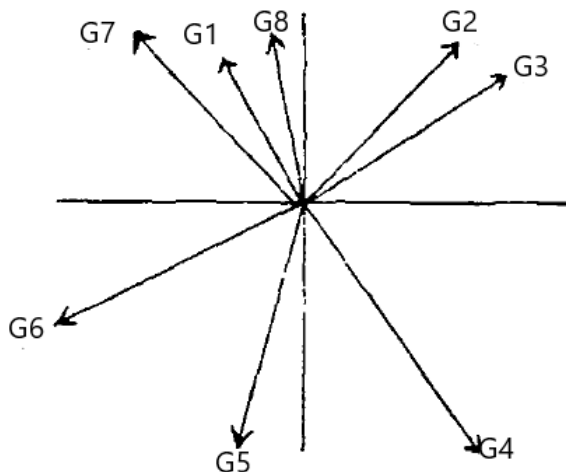
<sup>6</sup> Spokane, A. R., & Cruza-Guet, M. C. (2005). Holland's theory of vocational personalities in work environments. *Career development and counseling: Putting theory and research to work*, 24.

<sup>7</sup> Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of vocational behavior*, 21(3), 259-287.

**Table 1: Holland's Occupational Groups**

Group Number	Group Label	Description
G1	Service	These occupations are concerned with situations in which one person is helping another; for example, social work.
G2	Business contact	Occupations that require face-to-face sale of goods and services; for example, real estate.
G3	Organization	White-collar jobs; primary focus is on ideas.
G4	Technology	Occupations related to production, maintenance, and transportation of commodities; for example, occupations in engineering and crafts. Focus is on dealing with "things".
G5	Outdoor	Agriculture, mining, and other similar occupations. Interpersonal relations are mostly irrelevant.
G6	Science	Occupations concerned with basic and applied research; for example, marketing researchers; primary focus is on data.
G7	General Cultural	Occupations concerned with preservation and transmission of cultural heritage; for example, educational professionals.
G8	Arts and entertainment	Occupations in creative arts and entertainment; the focus is on a relationship between one person and a more general public.

**Figure 1: Correlations among the Eight Occupational Groups – The Hexagonal Structure**



**Note:** The factors are: X: Data-Ideas and Y: People-Things; for example, Group 1 is person-oriented and its opposite is Group 5, "things" oriented. Similarly, Group 6 deals with data and Group 3 with ideas. If the neighboring hypothesis is correct, job switching should be minimal among groups that are positioned on the opposite side of the axis, for example, labor mobility should be nil between Group 1 and Group 5.

## Methodology

Major occupations listed in the Standard Occupational Classification (SOC) system<sup>8</sup> were reclassified to match the Holland's occupational groups (Table 2); the matching was done by the author based on a rational analysis of the two occupational classifications. To learn

about the salience of occupational types within each NAICS, 2-digit industries, occupational employment data were sourced from the Bureau of Labor Statistics (BLS)<sup>9</sup>. The salient occupational groups of each of the NAICS 2-digit sectors were deduced by computing the modal value(s) of the employment data.

**Table 2: SOC Equated to Holland's Occupational Groups**

OCC Code	OCC Title	Holland's Groups, see Table 1
11-0000	Management Occupations	Organization
13-0000	Business and Financial Operations Occupations	Business Contact
15-0000	Computer and Mathematical Occupations	Science
17-0000	Architecture and Engineering Occupations	Technology
19-0000	Life, Physical, and Social Science Occupations	General Cultural
21-0000	Community and Social Service Occupations	Service
23-0000	Legal Occupations	Business Contact
25-0000	Educational Instruction and Library Occupations	General Cultural
27-0000	Arts, Design, Entertainment, Sports, and Media Occupations	Arts & Entertainment
29-0000	Healthcare Practitioners and Technical Occupations	General Cultural
31-0000	Healthcare Support Occupations	Science
33-0000	Protective Service Occupations	Service
35-0000	Food Preparation and Serving Related Occupations	Service
37-0000	Building and Grounds Cleaning and Maintenance Occupations	Outdoor
39-0000	Personal Care and Service Occupations	Service
41-0000	Sales and Related Occupations	Business Contact
43-0000	Office and Administrative Support Occupations	Organization
45-0000	Farming, Fishing, and Forestry Occupations	Outdoor
47-0000	Construction and Extraction Occupations	Outdoor
49-0000	Installation, Maintenance, and Repair Occupations	Technology
51-0000	Production Occupations	Technology
53-0000	Transportation and Material Moving Occupations	Technology

<sup>8</sup> See, [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2a\\_hUKEwjnubSMrZ73AhXQWc0KHV63CasQFnoE\\_CAgQAQ&url=https%3A%2F%2Fwww2.census.gov%2Fprograms-](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2a_hUKEwjnubSMrZ73AhXQWc0KHV63CasQFnoE_CAgQAQ&url=https%3A%2F%2Fwww2.census.gov%2Fprograms-)

[surveys%2Fdemo%2Fguidance%2Findustry-occupation%2Fstem-census-2010-occ-code-list.xls&usg=AOvVaw0LEn-oV1oY2ZywCYI2NdG0](https://www.bls.gov/OES/surveys%2Fdemo%2Fguidance%2Findustry-occupation%2Fstem-census-2010-occ-code-list.xls&usg=AOvVaw0LEn-oV1oY2ZywCYI2NdG0).

<sup>9</sup> See, [www.bls.gov/OES](http://www.bls.gov/OES).

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Data on job-to-job movements of Illinoisans, by NAICS 2-digit industry codes, were obtained from the Us Census Bureau<sup>10</sup>. Data analysis involved computations of frequencies, correlations, and ‘effective number’ as a measure of source diversity<sup>11</sup>. Effective number was used to test job-to-job movements of an extreme nature during stage 4 of the Covid-19 pandemic 1<sup>st</sup> quarter, 2021. Since effective number is new to economic developers, a brief review of the methodology is given below.

*Effective Number.* In descriptive statistics, the number of sources and destinations can be misleading when used as a measure of diversity. For example, a community developer may claim that she has obtained ten community-development grants though previously she had only five. This twofold increase in input resources, diversification, can be misleading if the

grants are unequal. If most resources come from the original five grantors, then the validity of using the actual number of grantors as a measure of diversification is questionable.

The effective number computation overcomes this limitation. It is the inverse of the probability,  $P$ , that any two units selected at random, sequentially with replacement, from a population of units come from the same source:

$$P = \frac{\sum_{j=1}^n x_j^2}{(\sum_{j=1}^n x_j)^2}$$

where,  $x_j$  is the number of units from the  $j^{\text{th}}$  source having  $n$  sources altogether.

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<sup>10</sup> Job-to-job moves for the period Quarter 1, 2020 and Quarter 1, 2021 were obtained. See, <https://lehd.ces.census.gov/>. Variable definitions can be obtained from, Athiyaman, A. (2022). Job-to-Job Flows in Illinois, 2000-2021. *Research Brief*, 4(7), April 7, 1-14. Available

online: <http://www.iira.org/wp-content/uploads/2022/04/rb47-Job-to-Job-Hires.pdf>.

<sup>11</sup> Robertson, A. (1953). A numerical description of breed structure. *Journal of Agricultural Science*, 43(July), 334.

## Findings

Job-to-job moves declined in 2021 (Table 3). However, the tendency of the workforce to move jobs within the same industry prevailed, it validates the neighboring hypothesis. Workforce involved in the construction industry were the most loyal to the sector, almost 2 out of 3 construction workers moved jobs within the sector. In contrast, people who manage companies seldom stayed in the same sector, only 1 in 20 stayed in the sector from which she moved.

Table 4 shows the transition matrix for occupations by industry; Figure 2 presents the data as a heatmap. The numbers are probabilities expressed in percentages, for example, the likelihood of moving from an “outdoor” job (G5) to a “technology” job (G4), for an employee in the agriculture industry (NAICS 11) is .16, or 16%. The columns of Table 4 are organized according to Figure 1; the larger the distance between occupations, the lower is the probability of move. Thus, for example, a worker in manufacturing moving to work in the service industry is less than 1%.

**Table 3: Job-to-Job Moves, Same Industry**

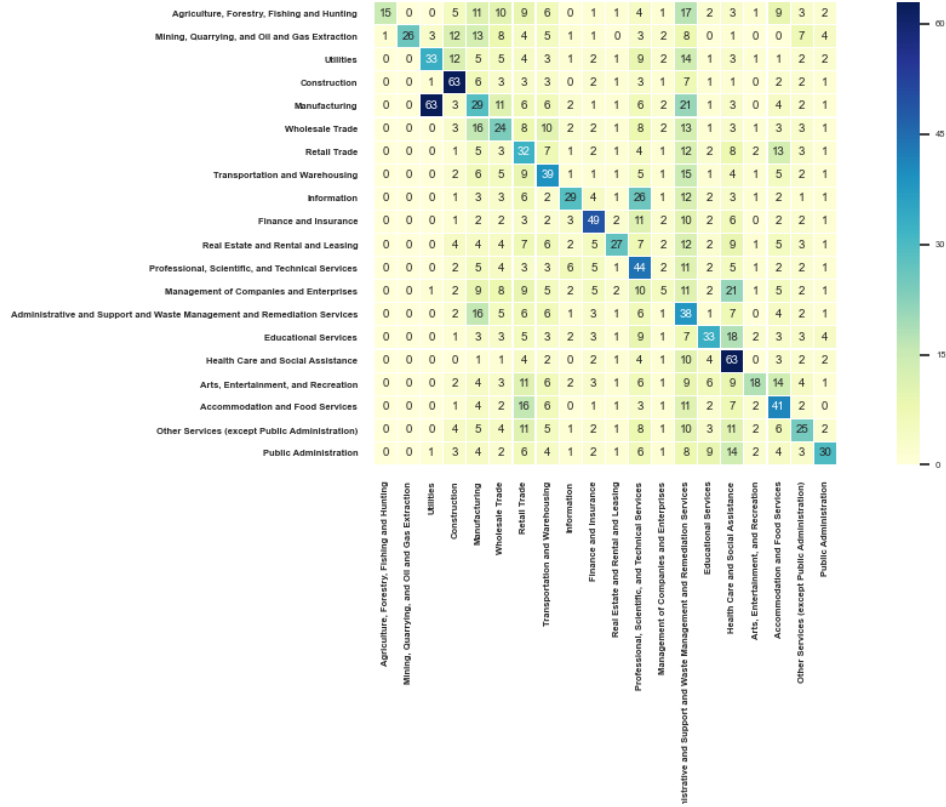
Sector	2020		2021	
	% Same Industry	N	% Same Industry	N
Agriculture, Forestry, Fishing and Hunting	19%	1074	15%	851
Mining, Quarrying, and Oil and Gas Extraction	34%	404	26%	225
Utilities	20%	339	33%	359
Construction	64%	11602	63%	11163
Manufacturing	30%	15089	29%	13570
Wholesale Trade	24%	8983	24%	8579
Retail Trade	36%	30142	32%	30370
Transportation and Warehousing	36%	13511	39%	12835
Information	26%	3988	29%	3639
Finance and Insurance	51%	7897	49%	7552
Real Estate and Rental and Leasing	25%	3169	27%	2913
Professional, Scientific, and Technical Services	42%	16976	44%	16225
Management of Companies and Enterprises	6%	3358	5%	3081
Administrative and Support and Waste Management	35%	43892	38%	40432
Educational Services	36%	7041	33%	4951
Health Care and Social Assistance	62%	29485	63%	27723
Arts, Entertainment, and Recreation	16%	4838	18%	3063
Accommodation and Food Services	42%	29765	41%	24127
Other Services (except Public Administration)	23%	6669	25%	6025
Public Administration	34%	2525	30%	2266

**Table 4: Transition Matrix: Likelihood of Job-to-Job Moves: Holland's Occupational Categories; unit = %**

NAICS Sector	G7	G1	G8	G2	G3	G4	G5	G6
Agriculture, Forestry, Fishing and Hunting	1.02	1.64	0	0.82	7.2	16.49	<b>71.71</b>	0
Mining, Quarrying, and Oil and Gas Extraction	2.32	0.36	0.06	6.69	15.85	34.25	<b>39.32</b>	1.15
Utilities	1.97	1.08	0.38	10.35	21.97	<b>53.9</b>	6.8	3.54
Construction	0.24	0.11	0.14	7.53	16.51	14.98	<b>60.21</b>	0.26
Manufacturing	1.25	0.93	0.69	8.01	14.15	<b>70.15</b>	2.46	2.36
Wholesale Trade	0.91	0.25	1.63	28.86	25.45	<b>38.19</b>	1.76	2.93
Retail Trade	3.63	4.53	0.97	<b>52.64</b>	12.35	24.11	1.17	0.63
Transportation and Warehousing		0.13		1.11	23.96	<b>69.49</b>	1.16	
Information	0.9	1.92	15.06	22.58	<b>24.32</b>	10.95	0.37	23.9
Finance and Insurance	1.07	0.48	0.33	44.81	<b>45.13</b>	0.35	0.14	7.69
Real Estate and Rental and Leasing	0.2	2.97	0.78	27.75	<b>34.14</b>	26.19	7.05	0.74
Professional, Scientific, and Technical Services	6.28	0.8	3.55	<b>29.98</b>	26.85	12.56	1.31	18.66
Management of Companies and Enterprises	3.53	2.41	1.92	29.29	<b>41.43</b>	8.01	0.72	12.64
Administrative and Support and Waste Management and Remediation Services	2.82	10.45	0.58	10.39	21.63	<b>24.78</b>	24.49	4.56
Educational Services	<b>62.15</b>	8.75	1.92	3.25	14.4	3.52	3.88	2.13
Health Care and Social Assistance	<b>36.09</b>	10.92	0.17	2.37	16.93	1.82	2.06	29.63
Arts, Entertainment, and Recreation	2.75	<b>46.71</b>	7.52	10.94	16.68	6.2	8.51	0.68
Accommodation and Food Services	0.05	<b>80.17</b>	0.09	4.53	6.83	4.37	3.86	0.1
Other Services (except Public Administration)	2.14	25.08	2.06	11.51	22.03	<b>32.08</b>	2.59	2.51
Federal, State, and Local Government, excluding state and local schools and hospitals and the U.S. Postal Service	10.16	27.8	0.74	14.81	<b>22.38</b>	12.95	6.91	4.25

**Note:** Modal values are in bold; mode signifies the salient occupation in the NAICS sector.

Figure 2: Heatmap of Job-to-Job Transition Probabilities





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To further explore the validity of neighboring hypothesis, effective numbers were computed for each of the sectors and tested for differences between 2020 and 2021 metrics. As shown in Appendix 1, the results did not refute the neighboring hypothesis. In other words, Covid-19 did not result in random job-to-job moves.

### Summary and Conclusion

This paper explores the validity of the 'neighboring hypothesis' during the Covid-19 pandemic. The neighboring hypothesis states that labor mobility would most often be within the same industry, sometimes with contiguous industries, and least often between the most widely separated industries. However, Covid-19 could have increased the likelihood of job changes of an extreme sort, people may have taken jobs outside their interests and below their capacities.

Data from the US Census Bureau on job-to-job moves were used to gain insights into the effects of Covid-19 on job changes. Results of data analysis suggest that:

1. Job-to-job moves declined in 2021, from 240,747 moves in 2020 to 219,949 moves in 2021;

2. The proportion of job-to-job movers in different industries did not differ for the two time periods, 1<sup>st</sup> quarter, 2020 and 1<sup>st</sup> quarter, 2021;
3. People employed in outdoor occupations such as agriculture seldom move to other occupations;
4. Federal, state, and local government employees have a higher probability of transition to business and technology positions; and
5. Information sector employees, predominantly employed in scientific occupations, exhibit a strong preference for positions in the arts and entertainment sector.

There are two takeaways or conclusions: (i) the Covid-19 pandemic did not influence people to take jobs randomly and (ii) the Holland's occupational classification and the transition matrix given in Table 4 should help economic developers to understand the dynamics of occupational choices in their community. In addition, the effective number should be used to assess or track performances in creation and attraction of businesses; for example, the method can be used to calculate the effective number of investments in a community.

## Appendix 1: Effective Number Analysis of Job-to-Job Moves

Sector	Effective Number, 2020	Effective Number, 2021
Agriculture, Forestry, Fishing and Hunting	8.59	9.03
Mining, Quarrying, and Oil and Gas Extraction	2.83	7.25
Utilities	10.45	8.18
Construction	2.31	2.27
Manufacturing	5.13	5.28
Wholesale Trade	8.02	7.86
Retail Trade	4.81	4.39
Transportation and Warehousing	5.00	5.89
Information	7.39	6.37
Finance and Insurance	5.58	4.52
Real Estate and Rental and Leasing	9.32	7.98
Professional, Scientific, and Technical Services	5.73	5.44
Management of Companies and Enterprises	10.74	11.44
Administrative and Support and Waste Management and Remediation Services	4.77	4.72
Educational Services	6.60	7.26
Health Care and Social Assistance	3.00	2.80
Arts, Entertainment, and Recreation	7.25	7.21
Accommodation and Food Services	3.03	3.34
Other Services (except Public Administration)	9.13	8.45
Public Administration	9.29	8.49

Note: t-test was not significant

	2020	2021
Mean	6.447647	6.407385
Variance	6.896991	5.421726
Observations	20	20
Pearson Correlation	0.869066	
Hypothesized Mean Difference	0	
df	19	
t Stat	0.138506	
P(T<=t) one-tail	0.445649	