IMPROVING THE OCCUPATIONAL OUTLOOK ACCURACY OF SUB-STATE STAFFING PATTERNS

LONG-TERM EMPLOYMENT PROJECTIONS RESEARCH

Purpose

The standard procedure of using statewide staffing patterns to project growth regionally could be less accurate than utilizing sub-state staffing patterns for long-term projections. How are projections affected when the staffing patterns are changed? This study undertakes the steps discussed below to find out whether sub-state projections can be improved upon by using precise but volatile regional data in place of broad statewide staffing patterns.

Overview

The first step in this study was to estimate employment totals in each region using staffing patterns that varied by geographic detail: a statewide pattern, patterns specific to specific regions, and a pattern constructed by combining several like regions. Analysts also calculated the number of differences due to occupations missing from regional staffing patterns but available at the statewide level.

Next, analysts made occupation projections using these various staffing patterns and then looked at the raw numbers across occupational groups. Analysts calculated employment growth from the base-year numbers to the projected year and compared both absolute change and percent change across occupational groups.

Team members then conducted a test using only one region, Southeast Minnesota. The test example involved taking each detailed occupation and ranking it based on its growth from the base year to the projected value. Each occupation had separate rankings for each staffing pattern and for percent and absolute growth. Analysts divided the occupations into those for which changing the staffing pattern changed the occupation's rank by 25 or less, by between 26 and 100, and by 101 or more. Project analysts compared the size of an occupation to its change in rank between patterns. Next, analysts looked at the quantity of occupations that were in the top 100 occupations for growth using one staffing pattern but not others. Lastly, analysts split the occupations into

quintiles based on growth and determined to what degree occupations shifted across quintiles as the staffing pattern was altered.

Regions and Methodology

Minnesota consists of six planning regions. The largest, the Twin Cities region, has projected 2010 employment of 1.8 million and includes the cities of Minneapolis and St. Paul, along with their surrounding suburbs. The remaining five regions, referred to as "outstate" or Greater Minnesota, have a total of 1.0 million projected employment. The largest of these regions is the Central, with 270,000 projected employment. It includes a medium-sized city and is growing fastest of the outstate regions due to its proximity to the Twin Cities. Southeast Minnesota has projected employment of 250,000 and includes Rochester, a medium-sized city known for technology and medical industries. The Northwest and Southwest regions, with 225,000 and 190,000 projected employment, respectively, are rural with only small cities. Northeast Minnesota has 150,000 projected employment and consists predominantly of the city of Duluth but is otherwise sparsely populated. Each of the six regions has a distinct industrial base; hence, this study might isolate the extent that both size and industry mix influence the use of more specific staffing patterns.

To conduct the study, analysts considered the six regions and analyzed them both separately and by grouping the outstate, mostly rural, regions to contrast with the larger, urban Twin Cities region. Base-year occupational employment was derived from 1999 and 2000 Minnesota Salary Survey SIC/SOC staffing patterns applied to the 1998 SIC industry estimates. The projected occupational employment was attained by using 2000-2010 SIC/SOC BLS national change factors applied to 2000 SIC industry projections. Team members opted to use more recent occupational data in order to utilize SOC data that were not in place when 1998-2008 projections were made, even though this is not the way in which most states make projections. All of these sources were the most recent available data as of the fourth quarter 2001. Analysts used staffing patterns from both 3-digit SIC codes, summed to two digits, and 2-digit SIC codes. Staffing patterns were available for each planning region, the Greater Minnesota aggregation, and statewide.

Analysts eliminated the use of 2-digit staffing patterns when early results showed minor differences between the two, after accounting for various regional patterns.

Findings: All Regions

Using different staffing patterns resulted in regions with nearly unchanged total employment since the same industry totals were used for all the methods. The differences that did exist were caused by industries missing from the smaller areas: missing occupations and varied staffing patterns cause jobs to be reallocated, but total employment does not shrink. In Figure 1, the magnitude (absolute values) of the variances between methods in each region is shown. These raw differences, summed over all occupations, demonstrate how far a sub-state area's employment level deviates from the state 3-digit staffing pattern employment projection. The percent differences indicate the raw difference total divided by the state 3-digit employment for that region. In Minnesota, these differences were between 9.0 and 22 percent in Greater Minnesota and the Twin Cities and between 27 and 37 percent in the outstate regions. The difference between 2- and 3-digit data was between 6.0 and 14 percent.

Differences this large, particularly in the outstate regions, appear to be outside acceptable limits; however, the causes of the large margins are unclear. By merely examining the totals, it is impossible to see whether the cause is a variety of employment patterns throughout the state or just bad regional data as a result of insufficient sample size. Therefore, looking at individual occupations or groups of occupations may help to determine where these differences originate. To maintain focus on regional vs. state staffing patterns, only 3-digit data were used for the remainder of this study.

Figure 1:

State Staffing Pattern Projections vs. Sub-State Staffing Pattern Projections

	Northeast	Southwest	Northwest	Southeast	Central	Outstate Region Total	Greater Minnesota	Twin Cities
Regional 2 digit								
Absolute difference *	43673	72172	74620	78409	86698	355572		
Percent difference **	28%	37%	33%	31%	32%	32%		
Employment	153656	193765	225439	251688	272063	1096611		
Regional 3 digit								
Absolute difference *	41853	69144	72070	72485	82530	338083		
Percent difference **	27%	36%	32%	29%	30%	31%		
Employment	152953	189923	222035	248368	265455	1078734		
Greater/Twin Cities 2 digit								
Absolute difference *	30639	36840	42028	55301	56271	221080	194610	205533
Percent difference **	20%	19%	19%	22%	21%	20%	18%	11%
Employment	153675	194536	225443	251693	272091	1097438	1097438	1835931
Greater/Twin Cities 3 digit								
Absolute difference *	26465	33552	39024	44857	50131	194029	188052	173890
Percent difference **	17%	17%	17%	18%	18%	18%	17%	9%
Employment	153490	193812	224753	249203	271434	1092692	1092692	1834611
Statewide 2 digit								
Absolute difference *	19762	27232	29153	34743	32166	143056	100511	104790
Percent difference **	13%	14%	13%	14%	12%	13%	9%	6%
Employment	154426	194685	226045	251807	272488	1099451	1099451	1838888
State 3-Digit Employment	154318	194247	225395	249887	271945	1095793	1095793	1837948

* Absolute difference is defined as the aggregation of each occupation's difference between the state 3-digit employment and regional employment

** Percent difference is the absolute difference for the region divided by state 3-digit employment

Number of Occupations

The 767 occupations given by the BLS staffing patterns include many that are rolled up for projections due to their small size and similarities to each other. Therefore, the resulting aggregation for Minnesota includes 686 occupations.

At the 686-occupation level, even using the statewide data, some regions report projections of zero workers in certain occupations. At the sub-state level, more occupations are missing. Using state staffing patterns, the Twin Cities has all 686 occupations, and Greater Minnesota has 684. Those larger regions are only missing nine and 12 occupations, respectively, when regional staffing patterns are used. Each of the outstate regions has about the same number of statewide- and Greater Minnesota-pattern occupations. The number of missing occupations at the regional level varies between 62 and 95, with region size and missing occupations uncorrelated. When Greater Minnesota as a whole is compared to its individual regions, there are between 10 and 30 more occupations included in the combined area. Using staffing patterns from larger areas may thus include occupations that in reality do not exist in a particular region.

However, these missing occupations do not represent a large fraction of the raw employment differences. All but a few of the missing occupations are small; so, even at the regional level, the most jobs accounted for in one region is under 3,500— 5.0 percent of the total differences. Nearly all of these occupations are very small: only one to four of each region's missing occupations project employment of more than 100. Hence, the absolute sums of the occupational employment differences cannot be attributed largely to gaps in occupational coverage that vary by which geographic staffing pattern is utilized.

Figure 2: Number of Occupations
State Staffing Pattern vs. Sub-State Staffing Patterns

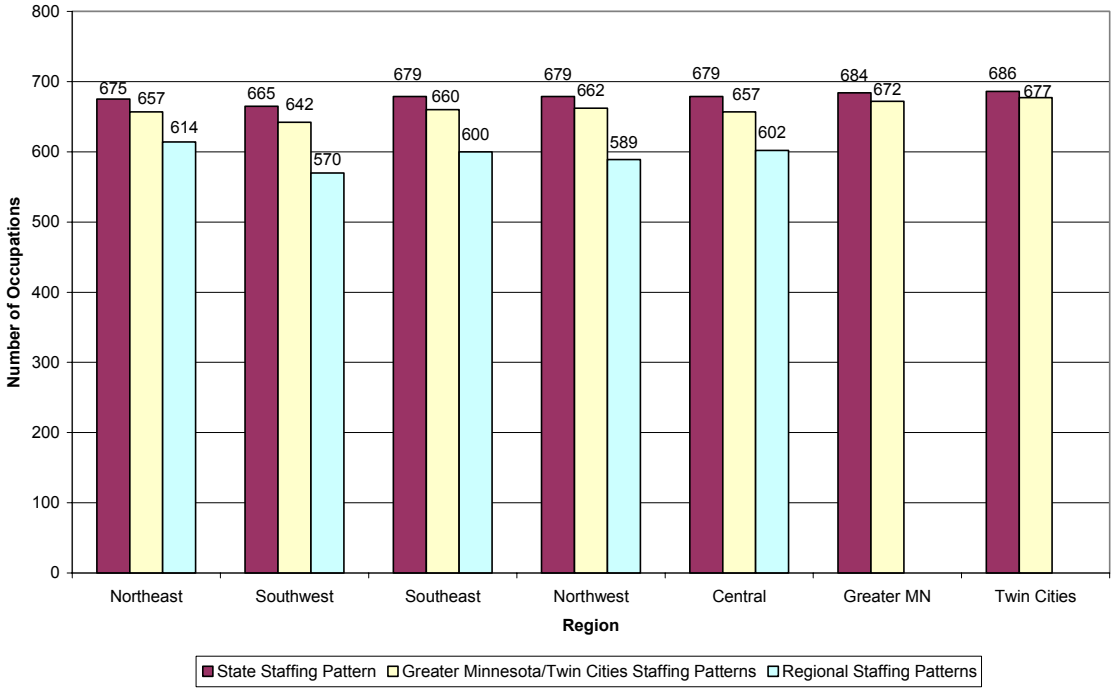


Figure 3: Number of Excluded Occupations
State vs. Sub-State Staffing Patterns

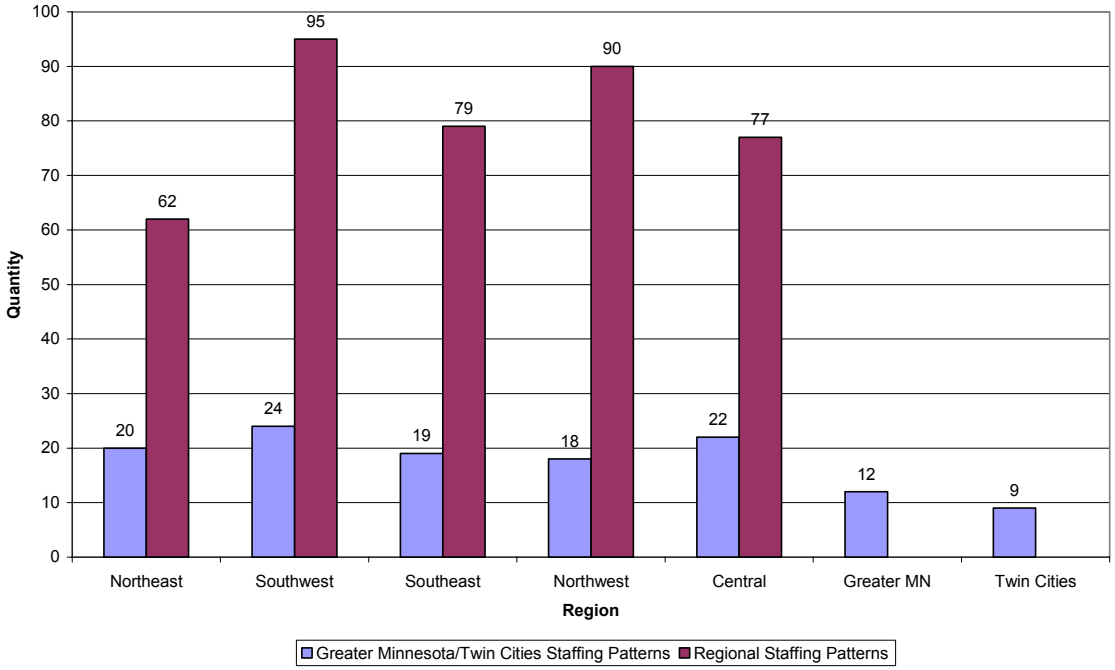


Figure 4: Excluded Occupations: State vs. Sub-State Staffing Patterns (pgs. 8, 9, 10)

		NE-Reg	NE-Gr	SW-Reg	SW-Gr	NW-Reg	NW-Gr	SE-Reg	SE-Gr	Cen-Reg	Cen-Gr
Farm, ranch, and other agric	119011			9						2	
Gaming managers	119071							14			
Agents and business manag	131011	2		3							
Claims adjusters, examiners	131031					167					
Insurance appraisers, auto d	131032			6		4				5	
Computer and information s	151011					19					
Actuaries	152011	9		11						11	
Mathematicians	152021	6		4		5				7	
Operations research analyst	152031					60					
Statisticians	152041	9								14	
Mathematical technicians	152090			8		8				9	
Landscape architects	171012					16					
Cartographers and photogra	171021	4		3				4			
Aerospace engineers	172011			2		3		4			
Agricultural engineers	172021									1	
Biomedical engineers	172031			2							
Mining and geological engine	172151			5				6			
Petroleum engineers	172171					1	1			1	1
Aerospace engineering and	173021					9					
Biochemists and biophysicis	191021	1		3		2			5	3	3
Medical scientists	191040			14						17	
Physicists	192012	2	2	4	4	2	2	4		5	5
Atmospheric and space scie	192021					2		5		3	
Materials scientists	192032								4	2	2
Geoscientists, except hydrol	192042			3		5				6	
Hydrologists	192043			22						36	
Economists	193011									9	
Survey researchers	193022	7	7	8	8	9	9	5		6	6
Social scientists, other	193097			6	5					7	7
Geological and petroleum te	194041	1	1			1	1		1	3	3
Forensic science technicians	194092	2	2			2	2	1	1	2	2
Directors, religious activities	212021	98								246	
Administrative law judges, a	231021	2	2	1		2	2	2	2	2	2
Arbitrators, mediators, and c	231022	10									
Judges, magistrate judges, a	231023			27		49		44			
Court reporters	232091	27		20							
Law clerks	232092	99									
Vocational education teache	252023					344		258			
Adult literacy, remedial educ	253011	20									
Farm and home managemer	259021									10	
Fine artists, including painter	271013	8						14			
Multimedia artists and anima	271014					28					
Fashion designers	271022			1		3					
Set and exhibit designers	271027					4		2			
Actors	272011			38		78		34			
Athletes and sports competit	272021			3		5		4		5	
Umpires, referees, and other	272023			8				9		13	
Dancers	272031					72		58			
Choreographers	272032					20		16			
Music directors and compos	272041							28		39	
Musicians and singers	272042					271		190			
Radio operators	274013			18							
Sound engineering technicia	274014									12	
Camera operators, television	274031							15			
Film and video editors	274032			18				8		9	
Optometrists	291041	27									
Podiatrists	291081	8						17			
Radiation therapists	291124					25					
Psychiatric technicians	292053			10		14				15	
Orthotists and prosthetists	292091	6	6	5	5	7	7	10	10		8
Psychiatric aides	311013	20	20	18	18	21	21	27	27	24	24
Occupational therapist aides	312012							.		14	
Fish and game wardens	333031			5		9		8			
Transit and railroad police	333052			11		16		11		13	
Animal control workers	339011									4	
Gaming surveillance officers	339031			17		32		25			
Pest control workers	372021	36				26		38		44	
Pesticide handlers, sprayers	373012	11									
Slot key persons	391012							63			
Animal trainers	392011	1		1		1		2			
Embalmers	394011			2				2		3	
Barbers	395011							13		10	
Manicurists and pedicurists	395092			41							

Shampooers	395093	1		1				1			
Skin care specialists	395094			14		21					
Concierges	396012			12		28					
Flight attendants	396031	59	59	13	13	17	17	17	17	23	23
Transportation attendants, e	396032	56		14		46		15			
Residential advisors	399041							28			
Real estate brokers	419021	19				41					
Gaming cage workers	433041							40			
Reservation and transportati	434181							63			
Forest and conservation wor	454011					27		22			
Fallers	454021							9			
Logging equipment operator	454022			4						22	
Log graders and scalers	454023			2							
Boilermakers	472011			25						51	
Stonemasons	472022	21		18							
Carpet installers	472041			18							
Floor layers, except carpet, v	472042	8		8							
Floor sanders and finishers	472043	7		6		7					
Tile and marble setters	472044			8		15					
Terrazzo workers and finishe	472053	8	8			15		11		22	
Piledriver operators	472072					7					
Piledriver operators	472072									9	
Piledriver operators	472072							5			
Reinforcing iron and rebar w	472171	15		10		11		8			
Helperspainters, paperhange	473014			19							
Helpersroofers	473016									33	
Elevator installers and repair	474021	45	45	29	29	30	30	22	22	47	47
Fence erectors	474031			3		3		2			
Railtrack laying and mainten	474061			3		7		4		6	
Septic tank servicers and se	474071							18			
Rotary drill operators, oil and	475012	7						8		36	
Explosives workers, ordnanc	475031									1	1
Continuous mining machine	475041									5	
Radio mechanics	492021	2	2	2	2	2	2			2	
Avionics technicians	492091					3		2		3	
Electrical and electronics ins	492093	15	15	6	6	15	15	7	7	14	14
Electrical and electronics rep	492095									40	
Electronic equipment installe	492096					2		3		6	
Security and fire alarm syste	492098			20		23					
Rail car repairers	493043	6		11		15		41			
Motorboat mechanics	493051			20							
Mechanical door repairers	499011			6		7					
Camera and photographic e	499061					2				8	
Musical instrument repairers	499063							10		8	
Watch repairers	499064			2		3					
Precision instrument and equ	499069	3				5		6			
Riggers	499096			23							
Aircraft structure, surfaces, r	512011					46				3	
Coil winders, tapers, and fini	512021	36									
Timing device assemblers, a	512093	4	4			25		18			
Slaughterers and meat pack	513023	8				268					
Rolling machine setters, ope	514023	17									
Milling and planing machine	514035	15									
Metalrefining furnace operat	514051					16					
Model makers, metal and pla	514061					12					
Patternmakers, metal and pl	514062	5		5						8	
Foundry mold and coremake	514071	45									
Heat treating equipment sett	514191	9									
Layout workers, metal and p	514192	4		8							
Bookbinders	515012	9						12			
All other printing workers	515099	79									
Pressers, textile, garment, a	516021			52							
Shoe and leather workers ar	516041			13		4					
Shoe machine operators and	516042	21				1	1			4	
Sewers, hand	516051			12		24					
Textile bleaching and dyeing	516061									2	
Textile cutting machine sette	516062									25	
Textile knitting and weaving	516063			2		3					
Extruding and forming mach	516091			1	1	1	1	2	2	3	3
Upholsterers	516093					22		9			
Textile, apparel, and furnishi	516099	28		20							
Model and pattern makers, v	517031			19							
Nuclear power reactor opera	518011	14		5		12		8			
Chemical plant and system c	518091					13					

Gas plant operators	518092							3			
Petroleum pump system ope	518093					3	3				
Cutters and trimmers, hand	519031	13									
Jewelers and precious stone	519071			8							
Medical appliance technician	519082	3				4					
Ophthalmic laboratory techn	519083			9				15			
Photographic processing ma	519132			54							
Semiconductor processors	519141	50	50	325	325	40	40	1903	1903	1035	1035
Cleaning, washing, and meta	519192							18			
Cooling and freezing equipm	519193	2				10				21	
Molders, shapers, and caste	519195			79							
Paper goods machine setter	519196					124					
Tire builders	519197	7		11				14		19	
Airline pilots, copilots, and fli	532011					17		19		14	
Commercial pilots	532012									7	
Air traffic controllers	532021			10		19					
Airfield operations specialists	532022	2	2					2	2	1	1
All other air transportation w	532099			6						6	
Locomotive engineers and fi	534010			13	13	52		10	10		
Rail yard engineers, dinkey c	534013	4	4	1	1	3	3	1	1	2	2
Railroad brake, signal, and s	534021	5	5	1	1	4	4	1	1	2	2
Railroad conductors and yar	534031	83	83	17	17	67	67	13	13	44	44
Rail transportation workers,	534098			9	9	37	37	7	7	24	24
Sailors and marine oilers	535011					3		3			
Ship engineers	535031			1	1	1				3	3
All other water transportatior	535099			1	1	5				2	
Bridge and lock tenders	536011			4		7				8	
Parking lot attendants	536021			67							
Traffic technicians	536041	1	1	1	1			1	1	1	
Transportation inspectors	536051	12	12	11	11	10	10	29	29	20	20
Transportation workers, all o	536099									26	
Gas compressor and gas pu	537071			5		6		3		4	
Pump operators, except well	537072					2		3			
Tank car, truck, and ship loa	537121							12			
Tally of Missing Occs		64	19	91	20	93	21	78	20	78	24
Regional Totals		1164	330	1424	471	2555	275	3389	2065	2232	1282
Raw Employment Difference		41853	26465	69144	33552	72070	39024	72485	44857	82530	50131
% of Missing Generated by Missing Occ		3%	1%	2%	1%	4%	1%	5%	5%	3%	3%

Projections of Occupation Groups

Rolling up projections data to the 22 occupational groups is the easiest way to comprehend what may be driving the differences among statewide, Greater Minnesota, and regional staffing patterns.

By inspecting the projections at the occupational group level, it is possible to check for data abnormalities. Any groups where all regions (in this case, the Twin Cities and Greater Minnesota) are over- or under-projected statewide are cause for concern. Here, this process helped team analysts determine that one occupation had an impossibly high projection statewide— which threw off an entire occupational group. Another important test is to look for occupations that project zero employment using state staffing patterns but have a non-zero regional projection. Analysts found occupations with old OES codes being used at the regional level (in addition to the current SOC codes) with the result that those occupations were being double counted. The old codes had been eliminated from state staffing patterns but not from sub-state patterns. Any occupation with substantial (over 100) regional employment and zero statewide employment is a data error that needs to be corrected.

In general, the professional occupations are underestimated, and manufacturing occupations are overestimated in the Twin Cities (Figure 5) when state staffing patterns are used; by contrast, the opposite occurs in nearly all of the Greater Minnesota regions (Figures 6-10). These results were expected given the urban vs. rural nature of the regions. The state-to-region differences are as much as 35 percent (demonstrated in agricultural occupations), but in the Twin Cities all other differences are under 10 percent. By looking at occupational groups, it is possible to intuitively determine where data might be flawed. Any data corrections should be made at this point before further work is undertaken.

When Greater Minnesota's regions are considered (Graphs 6-10), the volatility between their regional patterns and statewide staffing patterns is considerably larger but still isn't necessarily incorrect. The occupational groups with smaller regional projections are usually Business and Financial; Computer and Mathematical; Architecture and Engineering; and Art, Entertainment, and Media— all occupations that would be expected to be lower. In Greater Minnesota, Farming, Construction, and

Installation tend to have higher regional projections. These statements are true for all but Southeast Minnesota, which has higher estimated projections than statewide for nearly all of those categories. Rochester's technical corporations skew the Southeast area towards those types of occupations, so the projections using that area's staffing patterns are as expected.

Figure 5: Twin Cities Projections
Percent Difference between Twin Cities and State Staffing Patterns

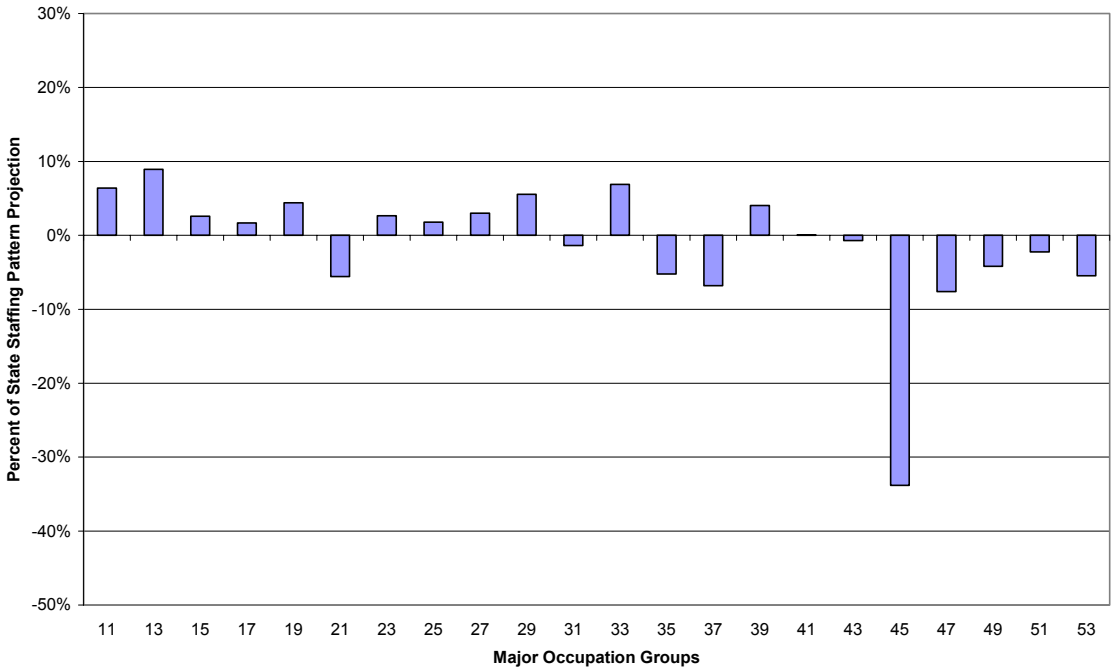


Figure 6: Central Minnesota Projections
Percent Difference between both Central Minnesota and Greater Minnesota Staffing Patterns and State Staffing Pattern

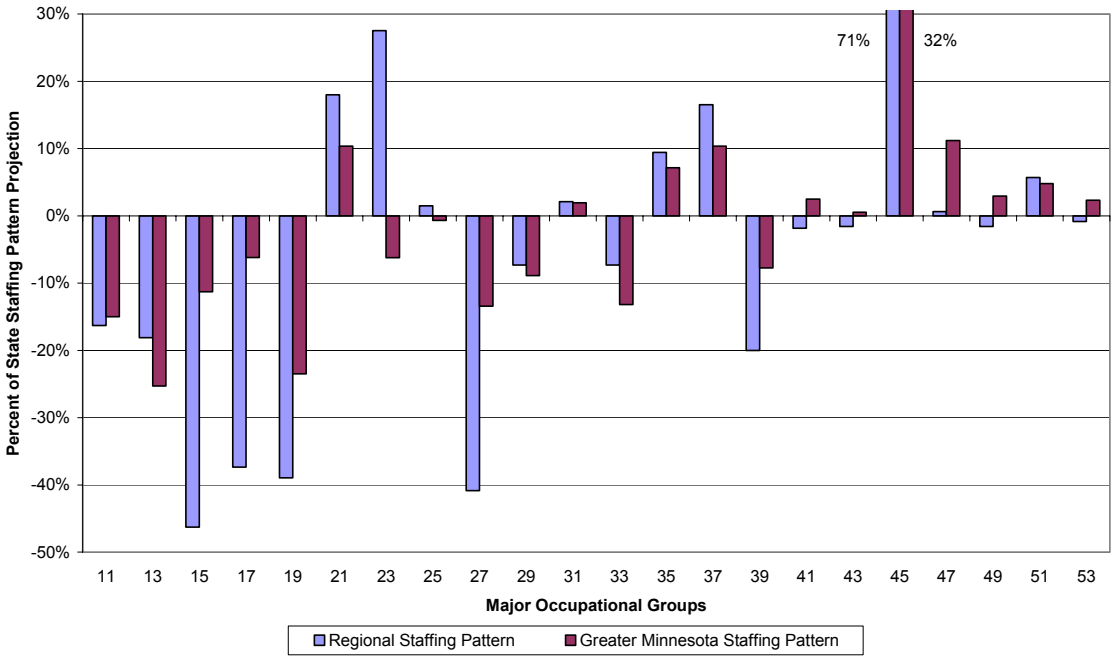


Figure 7: Southeast Minnesota Projections
Percent Difference between both Southeast Minnesota and Greater Minnesota Staffing Patterns and State Staffing Pattern

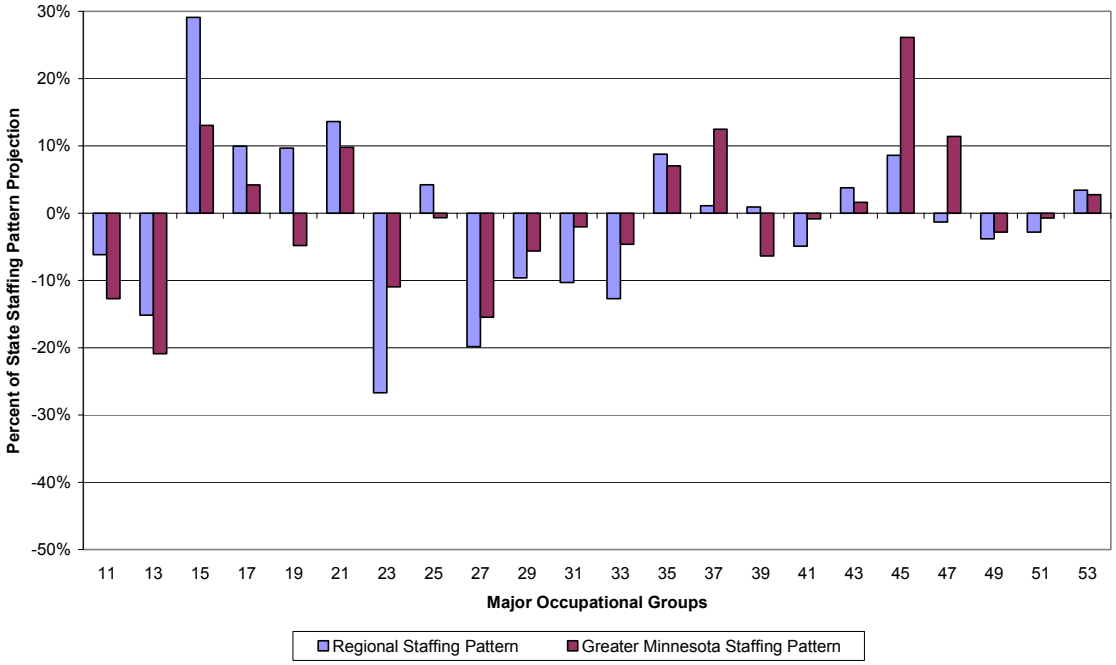


Figure 8: Northwest Minnesota Projections
Percent Difference between both Northwest Minnesota and Greater Minnesota Staffing Patterns and State Staffing Pattern

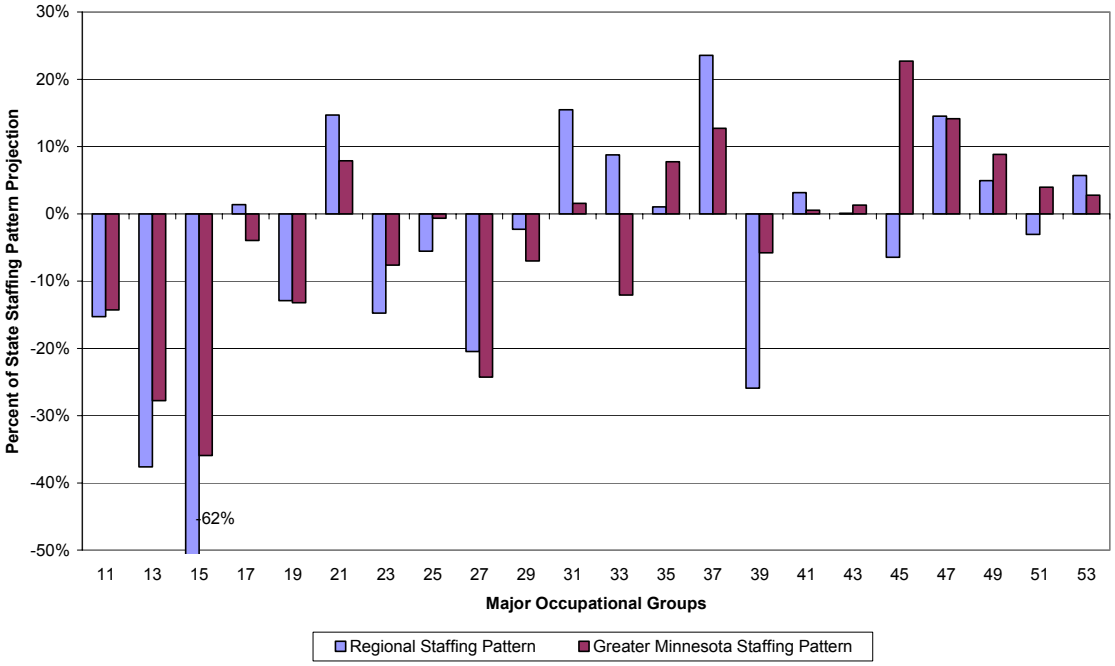


Figure 9: Southwest Minnesota Projections
Percent Difference between both Southwest Minnesota and Greater Minnesota Staffing Patterns and State Staffing Pattern

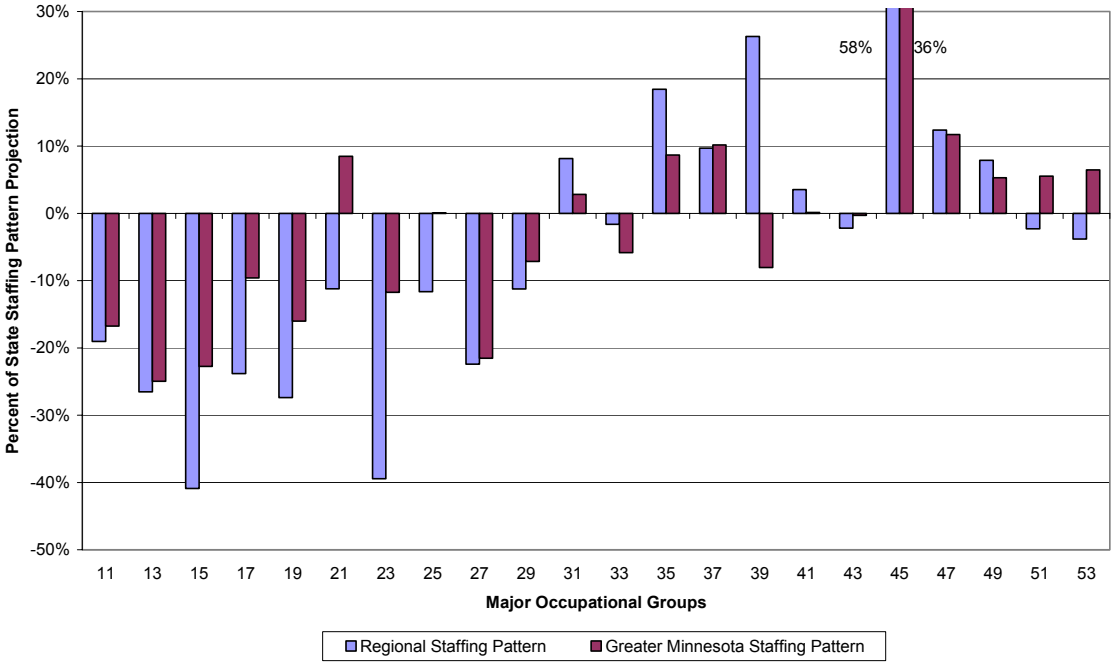
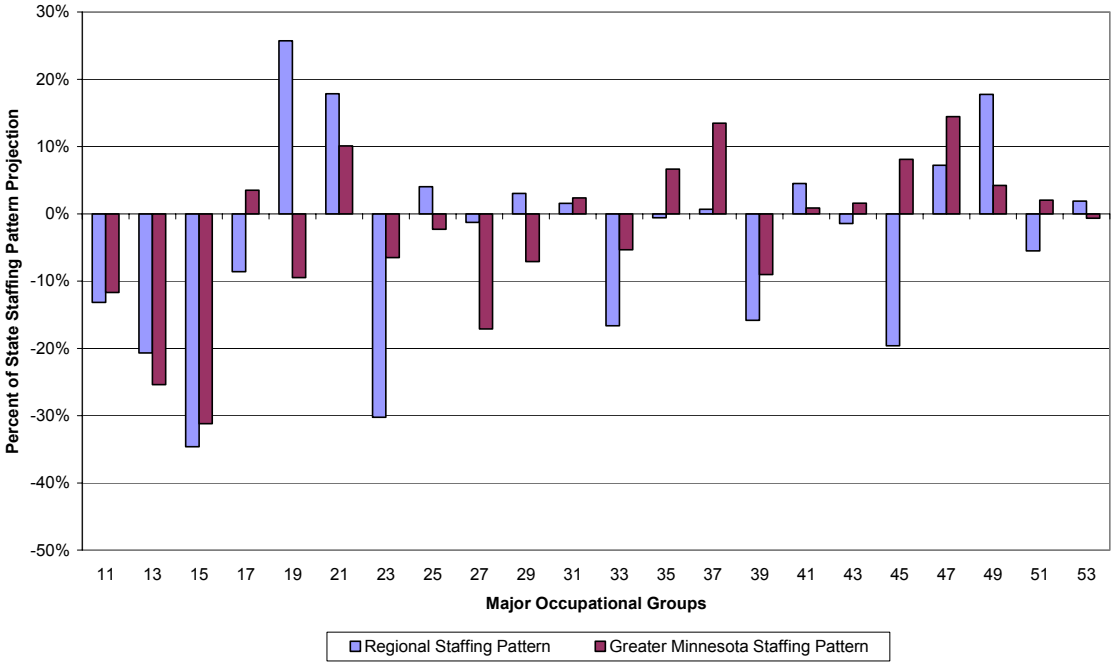


Figure 10: Northeast Minnesota Projections
Percent Difference between both Northeast Minnesota and Greater Minnesota Staffing Patterns and State Staffing Pattern



Occupational Group Growth

Projections alone do not tell us how the state and regional estimates of occupational growth differ. Since the key use of projections data is to see which occupations are growing fastest and by how much, if large differences in growth occur between the different methods, this needs to be taken into consideration. Staffing patterns using base-year data and no change factors are used to create base data. Growth patterns are then created by comparing percent growth from base to projected occupational group employment. All major occupational groups show growth in each region, but the different methods predict varying amounts of growth.

Ideally, occupational growth shows similar patterns, implying that the choice of staffing pattern used is inconsequential. The difficult cases are those where certain occupational groups have growth patterns that change abruptly when a different staffing pattern is used. For instance, a red flag goes up when Greater Minnesota data show a group as growing more than does state data, while regional data show the group growing less than does state data (or vice versa). In these cases, that occupational group would dramatically change placement on any growth charts, depending on which method is used.

Differences are acceptable so long as they can be explained and the most reasonable staffing pattern is selected. In the Twin Cities (Figure 11), the similarities between statewide and regional growth are clear. The differences in growth using the two approaches are under 4.0 percent for all occupational groups. **In the Twin Cities (and probably any similar metro area that represents a large percent of a state's labor force), it doesn't seem to matter whether regional or state staffing patterns predict occupational growth because both methods forecast such close results.**

In the five outstate regions, occupational growth that is projected using region-specific patterns deviates slightly more from both the state and Greater Minnesota staffing pattern applications. When Greater Minnesota staffing patterns are used in the regions, the difference from state data remains small— only two occupational groups in all the regions vary by more than 10 percent, and those are still under 20 percent. The regional staffing patterns usually differ from the state by less than 5.0 percent, but they occasionally differ by more than 10 percent. Those higher differences occur in

occupational groups 15 (Computer and Mathematical), 17 (Architecture and Engineering), and 33 (Protective Services).

The two smallest regions, Southwest and Northeast Minnesota (Figures 15-16), have no occupational groups that vary by 10 percent or more from state growth predictions. Both these regions have projections where the methods show differences of 30 percent or more. This means that from the base year to the projected time, all the staffing patterns show similar amounts of growth even though the base data vary. For instance, in the Southwest, Agriculture is projected to be 58 percent larger in 10 years using a regional staffing pattern than it is using the state pattern. However, the regional and statewide patterns have only a 1.0 percent difference in growth between base and projected years: regional staffing patterns say Agriculture will grow 13 percent while state data say it will grow 12 percent. The regional data have both larger base and projected Agriculture employment. **For these regions, it seems irrelevant whether state, Greater Minnesota, or regional data are used when creating lists of top growth occupations; but regional staffing patterns might generate more accurate results in terms of employment size.**

In Northwest Minnesota (Figure 14), the only occupational group with noticeable variations in growth using different methods is group 33, Protective Services. Both regional and state methods predict growth of near 27 percent while Greater Minnesota staffing patterns predict growth of 12 percent. This discrepancy can be narrowed down to a single occupation: 33-9032 (Security Guards). When that occupation is removed, each of the methods projects between 10 and 13 percent growth. Of the industries that employ security guards, it is Miscellaneous Business Services that causes the discrepancy. Each method approximately doubles the quantity of security guards; however, statewide and regional include much higher base amounts than Greater Minnesota, so the absolute growth is significantly higher in those cases. Thus, when security guards from all industries are summed, the Greater Minnesota method has smaller growth. Since all other occupational groups are within reasonable limits of the state growth, using regional staffing patterns in Northwest Minnesota nearly always produces similar growth while giving more accurate projections of size. When aggregated, it appears that the entire group is off. However, disaggregation shows that

the problem is with only a single occupation. This is an instance where displaying occupation groups instead of individual occupations misrepresents the overall data. Checking potential problems such as this will help eliminate any real problems. As long as errant occupations are few and isolated, regional data should still be usable.

Southeast Minnesota (Figure 13) contains the only occupational group with a difference of over 15 percent from state growth patterns: Computer and Mathematical. Its remaining occupational groups have differences under 10 percent. The absolute growth is fairly constant between the methods— around 2,000 regionally, 1,800 with Greater Minnesota data, and 2,200 using state data. Due to the region's strong technology industries, the regional data give both the highest base and projected value for group 15. The state data have the lowest values. Hence, the similar absolute growth means that the smallest base has the highest percent growth. When each of the occupations that make up group 15 is examined, there is no extreme outlier affecting the data. Some occupations show the regional data producing highest growth, and some show the state data producing it. The relatively small number of occupations making up the group paired with high change factors make Computer and Mathematical a highly volatile category. Despite regional and Greater Minnesota data showing 20 percent smaller growth, they still give growth of over 30 percent, which is in the top tier of high-growth occupational groups. Hence, while the difference seems large, it does not stop the category's occupations from being amongst the highest growing. Analysts performed this check using Southeast Minnesota, which will further clarify possible problems that could result from this difference. However, since only one occupational group varies from the state data and those differences are not as extreme as the graph makes them appear, it seems safe to use Greater Minnesota or regional staffing patterns, both of which give similar growth results.

Central Minnesota (Figure 12) has three occupational groups with growth varying by 10 percent between state and regional data— Protective Services (33), Computer and Mathematical (15), and Architecture and Engineering (17). Protective service projects state growth 10 percent higher than both regional and Greater Minnesota data. The same problem that occurred in Northwest Minnesota is exhibited here— Miscellaneous Business Services has higher base numbers using the state method, which causes the

doubling of Security Guards, and this throws off the entire occupational group. That one occupation alone is the problem.

Similarly, for group 15 in Central Minnesota, just as in Southeast Minnesota, the large change factors in the computing occupations cause the group to be volatile, with some of its occupations having larger regional growth and some with higher state growth. On average, regional had higher and Greater Minnesota had lower growth than the state data projected. However, each method caused growth to the extent that few other occupational groups were even close to the same growth percentages. Whether Greater Minnesota's 32 percent growth or regional's 55 percent, only groups 21 (Community and Social Service) and 39 (Personal Care and Service) had growth of 30 percent or higher using each method. (Groups 31 and 33 had growth of just over 30 percent using one or two of the methods.) So, despite group 15's volatility, its occupations remain at the highest growth numbers, regardless of the method used.

In Central Minnesota, both groups 15 and 17 have significantly smaller regional than state and Greater Minnesota base numbers. Even though their regional projections are also smaller, their regional growth is larger than with the other methods. In the case of group 17, two industries with little growth do not have regional data. Hence, when the same occupations have more growth (using all methods) in other industries, it causes the regional data to show a higher percent growth. Two of the occupations within group 17 where this is occurring are in "All Other" occupations, which means that in this region, engineers and technicians were specified but in other regions they were lumped into broad categories. This causes staffing patterns to not exist at the regional level even though dozens of workers are listed using state patterns. Those same workers exist in the regional patterns but are listed under more specific occupations. The specific occupations are shown as having higher growth, but the broad categories are not—possibly because the specific categories have more accurate change factors. Thus, engineers are listed as having higher growth regionally, which is probably more accurate.

When the three outlier occupational groups in Central Minnesota are looked into, their discrepancies are either very isolated (Security Guards), don't affect rankings (group 15), or are more accurate than state predictions (group 17). Thus, even this tricky region is barely affected by the use of sub-state staffing patterns;

however, analysts must research the few examples of such variations and adjust results as needed.

Figure 11: Twin Cities Projected Growth by Major Occupational Group
Twin Cities vs. State Staffing Pattern

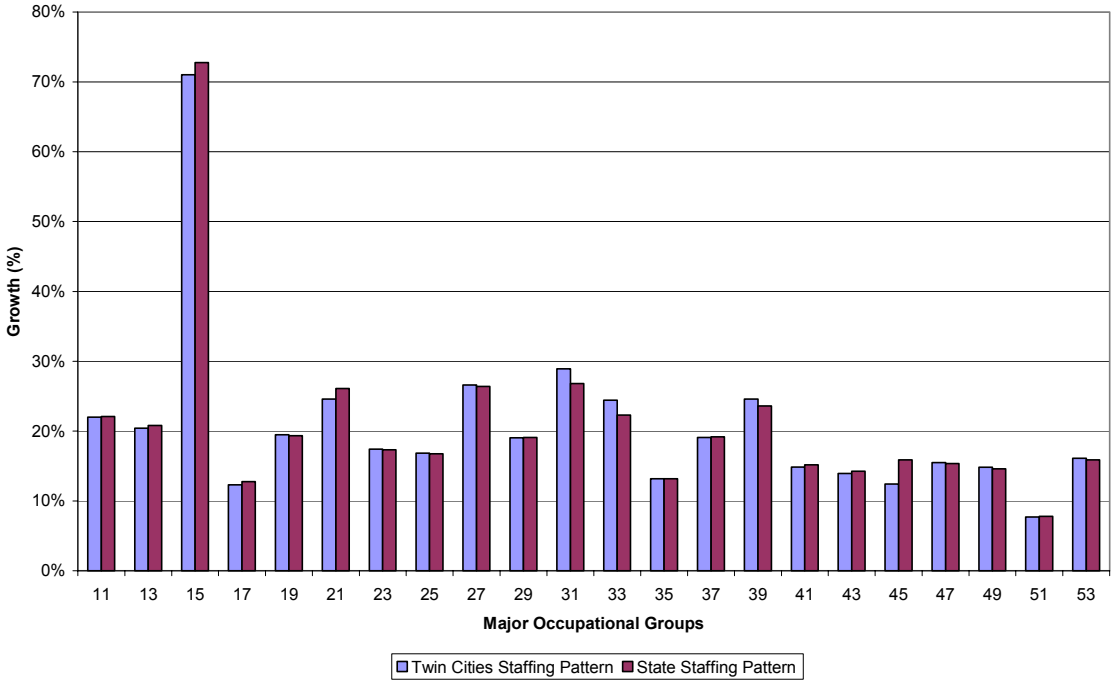


Figure 12: Central Minnesota Projected Growth by Major Occupational Group
Central Minnesota, Greater Minnesota, and State Staffing Patterns

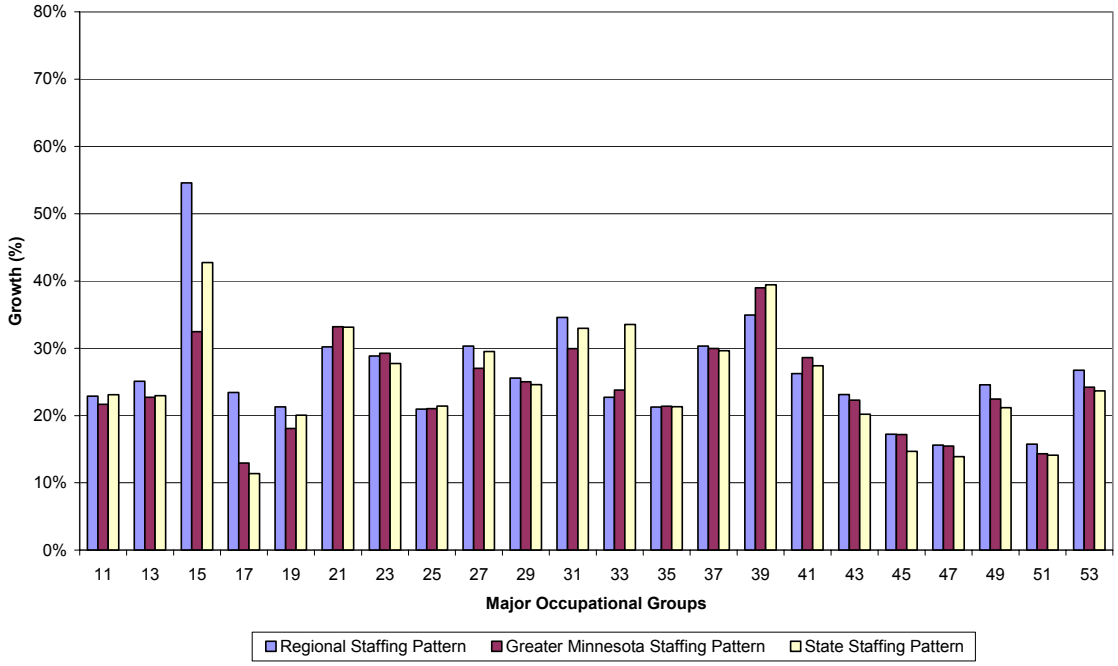


Figure 13: Southeast Minnesota Projected Growth by Major Occupational Group
Southeast Minnesota, Greater Minnesota, and State Staffing Patterns

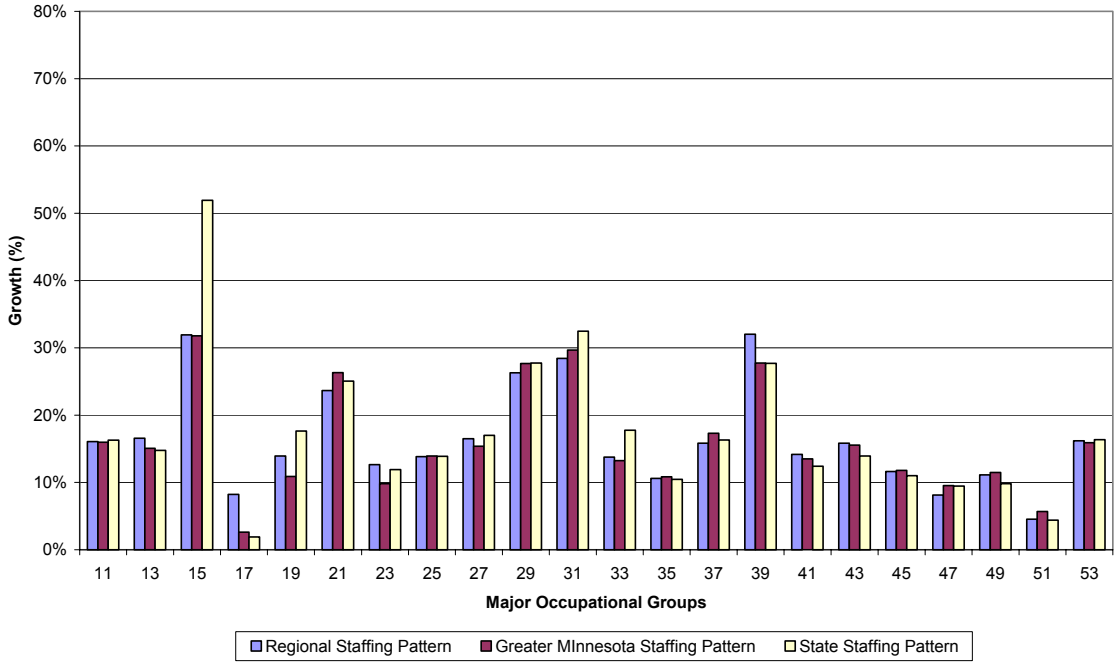


Figure 14: Northwest Minnesota Projected Growth by Major Occupational Group
Northwest Minnesota, Greater Minnesota, and State Staffing Patterns

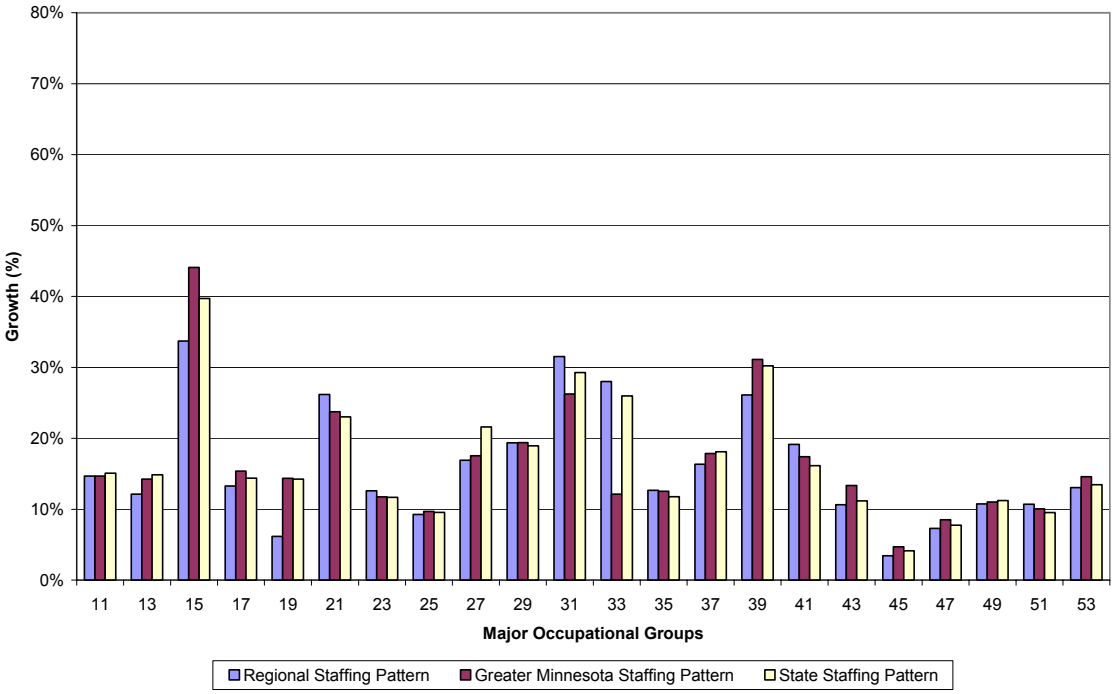


Figure 15: Southwest Minnesota Projected Growth by Major Occupational Group
Southwest Minnesota, Greater Minnesota, and State Staffing Patterns

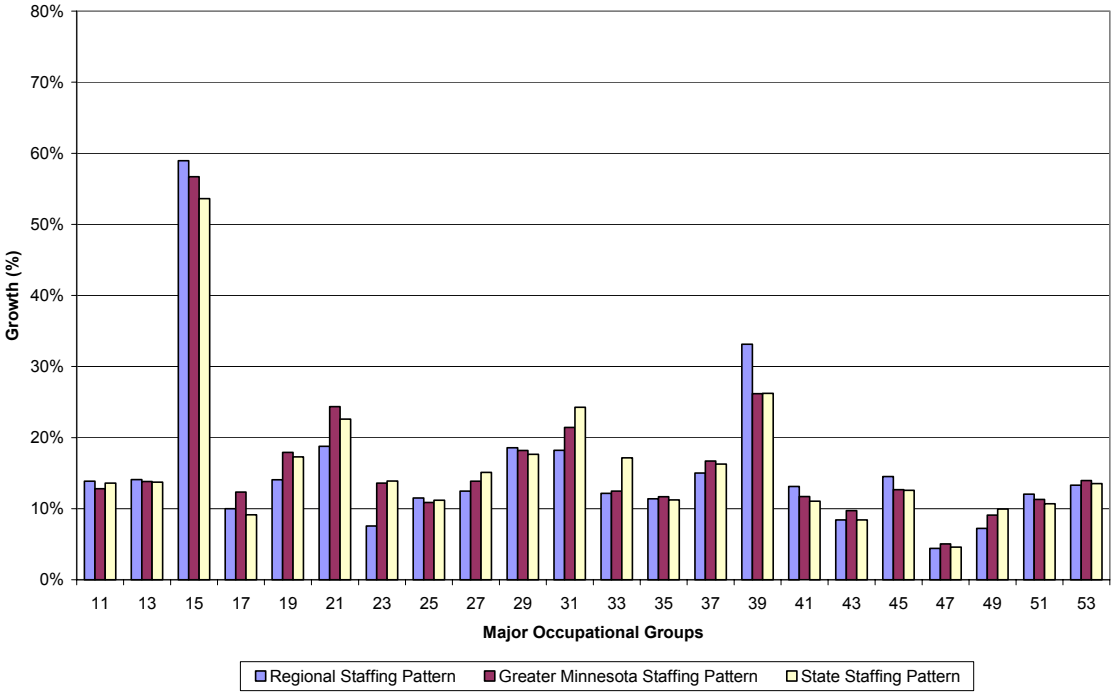
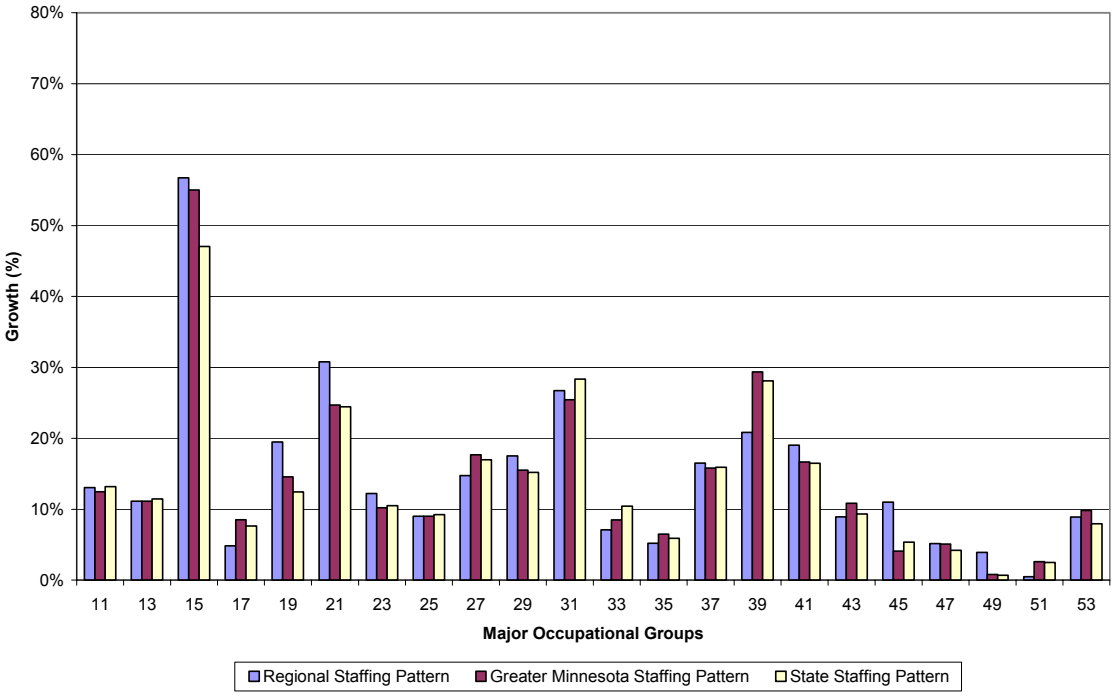


Figure 16: Northeast Minnesota Projected Growth by Major Occupational Group
Northeast Minnesota, Greater Minnesota, and State Staffing Patterns



Findings from Case Study: Southeast Minnesota's Occupation Growth Rankings

At this point analysts conducted a more detailed check on Southeast Minnesota data and looked at occupations individually. This region was chosen because it differs from the other outstate regions since it contains Rochester, a technology center, which has the potential to make Greater Minnesota data more inaccurate than would be the case for other regions. The goal of this data check was to isolate effects on specific occupations in order to evaluate methods of reporting occupational projections to the public.

As discussed earlier, even at the aggregated level, not all occupations are included regionally. The effect of missing occupations has already been explained. Analysts removed any occupations not included in all three staffing pattern methods for the case study. Since very small occupations are rarely publishable, analysts also removed all occupations with projected employment (using state staffing patterns) under 20. These reductions brought the number of occupations down from 686 to 537. Analysts used six methods of rank changes: state to Greater Minnesota, state to Southeast, and Greater Minnesota to Southeast, all ranked by both percent and absolute growth. Analysts focused on growth ranking changes because occupations with highest growth are often considered most important by educators and job counselors. If different occupations are high or low on the list, it would probably affect training and other policy areas.

Rank Change Volatility

Analysts first split the occupations into three groups based on how much their rank changed— 25 or less, between 26 and 100, and more than 100. The absolute difference data have smaller rank changes than do the percent data, which is reasonable given that absolute differences clearly are correlated to occupation size. With the absolute state to Greater Minnesota data, over half the occupations remain ranked within 25 places of their original positions, and only 6.0 percent of occupations change over 100 places. State to Southeast and Greater Minnesota to Southeast are less steady, with approximately the same number of occupations staying within 25 or moving between 26 and 100 spots. More occupations move at least 100 places in the state to Greater Minnesota rankings— about 15 percent for both methods.

The percent growth rankings have slightly fewer occupations staying within 25 to 51 percent for state to Greater Minnesota, 32 percent for state to Southeast, and 45 percent for Greater Minnesota to Southeast. The number of occupations moving between 26 and 100 is higher for state to Southeast— 42 percent of occupations— but less than the number of stable occupations using the other two methods. The percent of occupations moving at least 100 places varies between 13 percent for state to Greater Minnesota and 26 percent for state to Southeast. Using all methods, it appears that 10 to 20 percent of occupations have significant ranking changes. This is a cause for concern, especially if those are large occupations or would be listed in growth ranking charts. Since one does not know from this analysis what traits the volatile occupations have, one needs to look further.

Figure 17: Changes in Percent Growth Rankings under Various Staffing Patterns

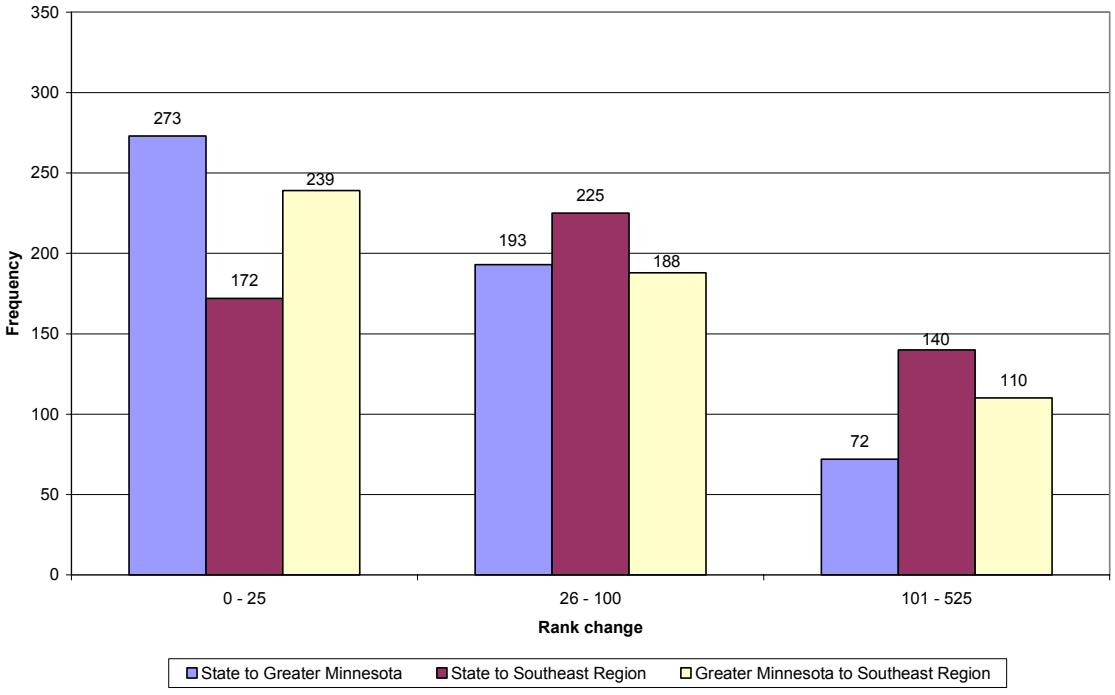
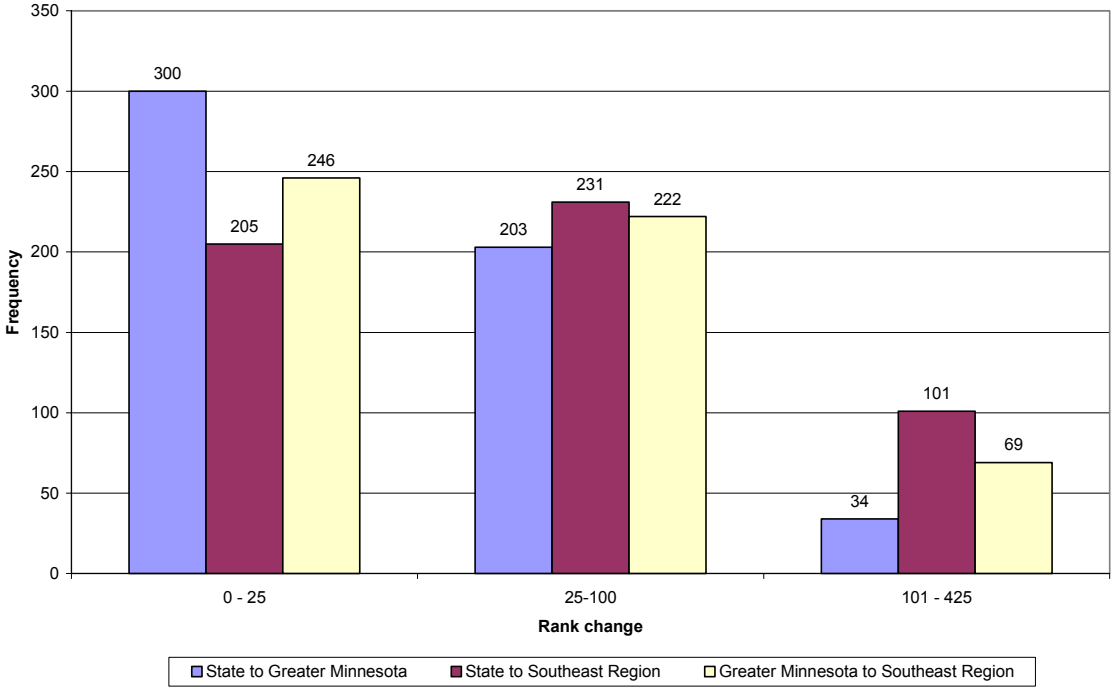


Figure 18: Changes in Absolute Growth Rankings under Various Staffing Patterns



Occupation Group Percent Growth Rankings

Analysts next tested for volatile occupational groups by averaging the absolute change in rank for occupations in each occupational group. The project team then conducted a regression of rank change using projected occupation size as the explanatory variable. This was done in three ways— state to Greater Minnesota, state to Southeast region, and Greater Minnesota to Southeast rank changes. Only rank change with percent change was done, as absolute change would be strongly cross-correlated to employment size. The result was that average projection size and rank change were loosely correlated. That is, occupational groups with many small occupations tended to be the most volatile while groups with mostly large occupations remained steadier. None of the occupational groups varied wildly when average size of the occupations in the group was removed as a factor. There were also no categories of occupational groups (such as manufacturing groups) that were more volatile than others. Hence, it was determined that volatility in Southeast Minnesota could not be isolated within a few errant occupational groups. The occupations must be considered individually in order to gain more information.

Occupational Rank Change as a Function of Projected Size using Percent Growth

Next, analysts tested occupations separately to see how closely size correlated with volatility. If the volatile occupations are mostly small, rank changes are less relevant. When the rank changes were plotted as a function of projected occupation size, all three staffing pattern methods showed similar results. Nearly all occupations that changed dramatically (300 places or more) were small— 400 employees or less. The largest occupations— 2,000 employees or more— had only isolated cases where the rank change was over 100 places.

When these rank changes are clustered by occupational group, it is possible to see whether some occupational groups or categories have larger rank changes than others. Each of the staffing pattern methods showed that the volatile occupations (those whose rank changed the most) were not isolated in a particular group. Many of the groups had only rare occupations with large ranking changes. However, even if a few groups show more volatility in a region, it's likely that other groups would have noticeable rank changes. Since relatively few medium-to-large occupations were highly volatile with

only two years of data, using regional staffing patterns appears reasonable as long as some care is taken to check for wayward data.

Figure 19: Southeast Minnesota--Change in Percent Growth Ranking by Size of Occupation
Greater Minnesota compared to State Staffing Pattern

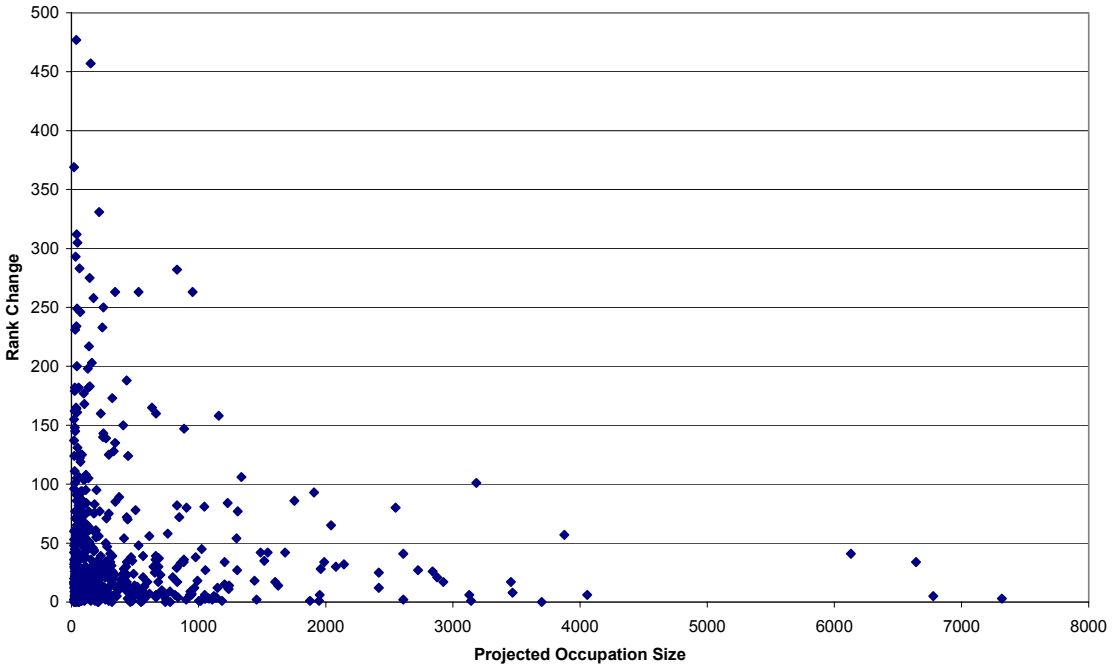


Figure 20: Southeast Minnesota--Change in Percent Growth Ranking by Size of Occupation
Southeast Region compared to State Staffing Pattern

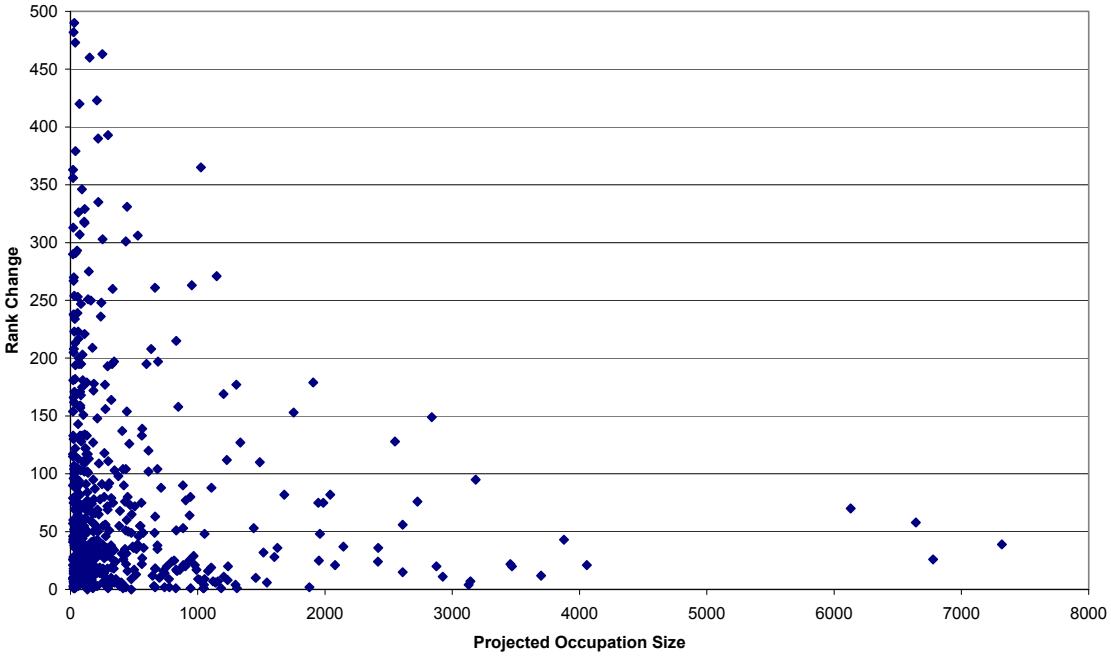
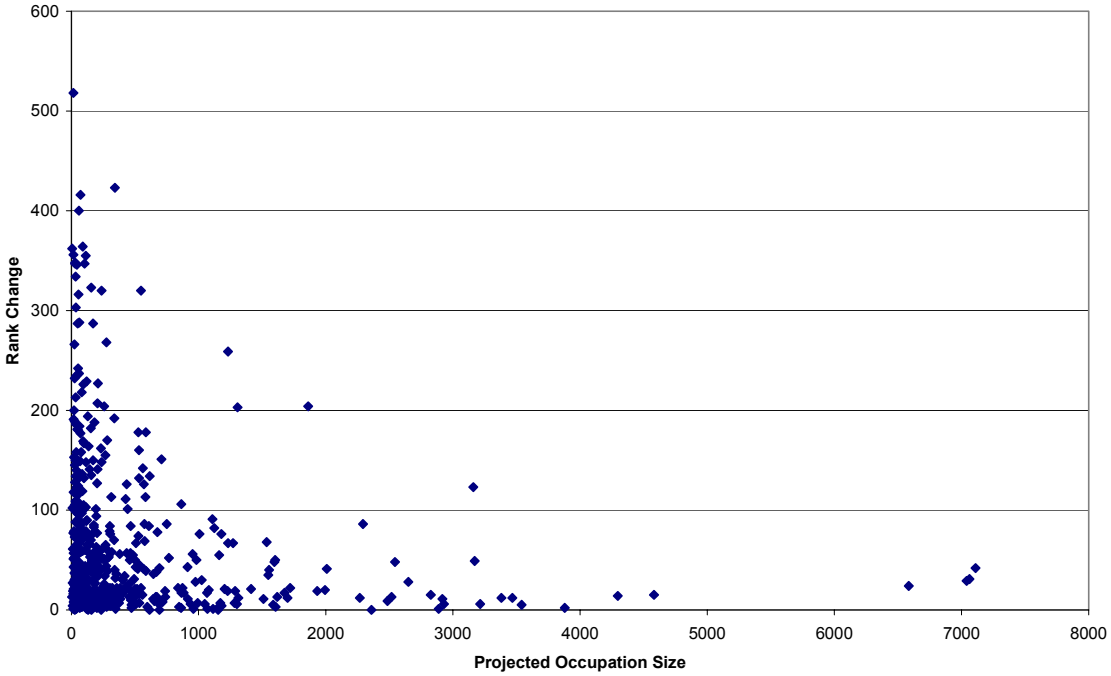


Figure 21: Southeast Minnesota--Change in Percent Growth Ranking by Size of Occupation
Southeast Region compared to Greater Minnesota Staffing Pattern



Occupational Rank Change as a Function of Projected Size using Absolute Growth

When the same analysis was done with absolute growth rankings, similar results were obtained, but the ranking changes were smaller. Occupations with 1,500 employees rarely showed rank changes of more than 50. Occupations with up to 700 employees occasionally had rank changes of up to 300, although the majority of changes were under 150 spots. Hence, the correlation between volatility and occupation size stands. Further work is not warranted given the obvious connection between occupational size and the change in absolute growth.

Figure 22: Southeast Minnesota--Change in Absolute Growth Ranking by Size of Occupation
Greater Minnesota compared to State Staffing Pattern

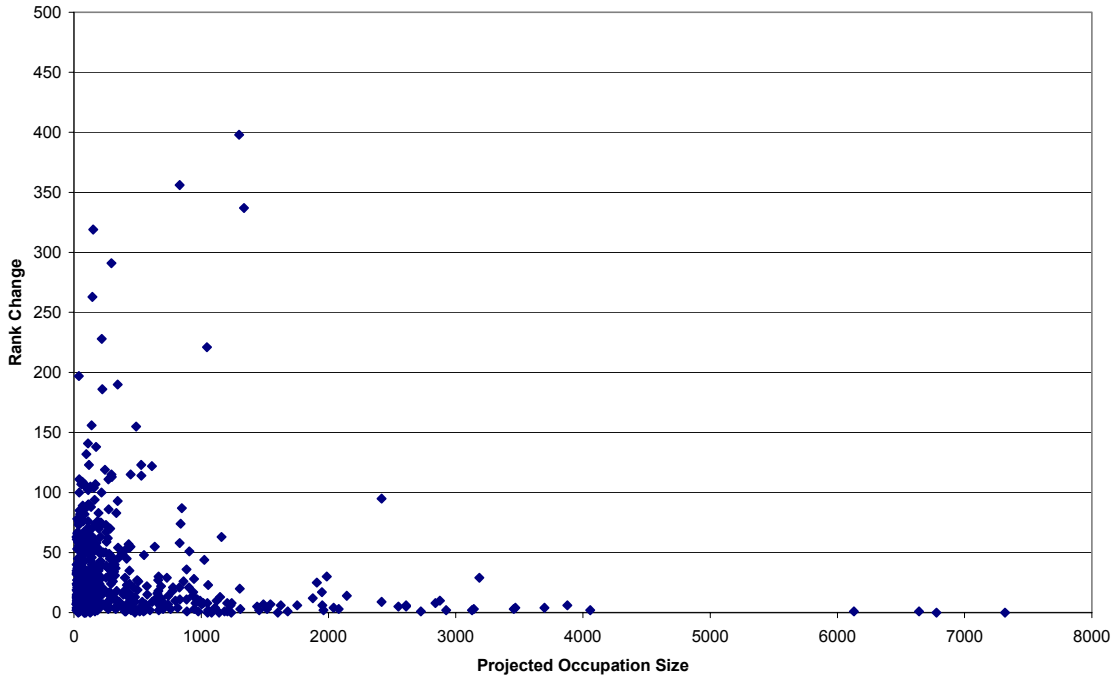


Figure 23: Southeast Minnesota--Change in Absolute Growth Ranking by Size of Occupation
Southeast Region compared to State Staffing Pattern

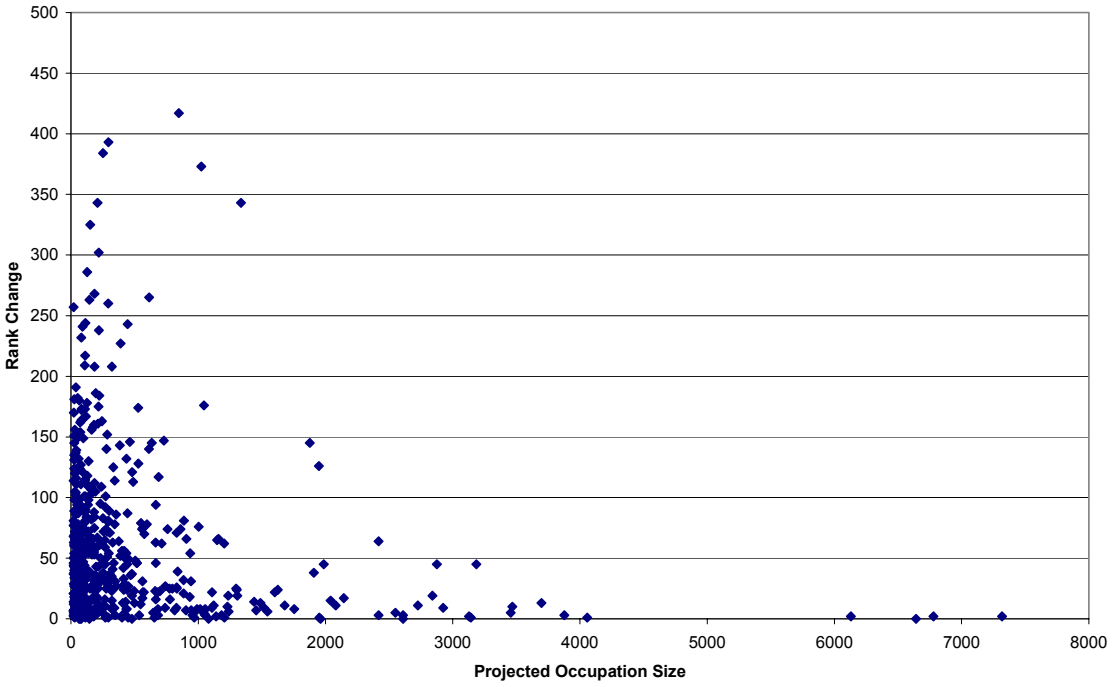
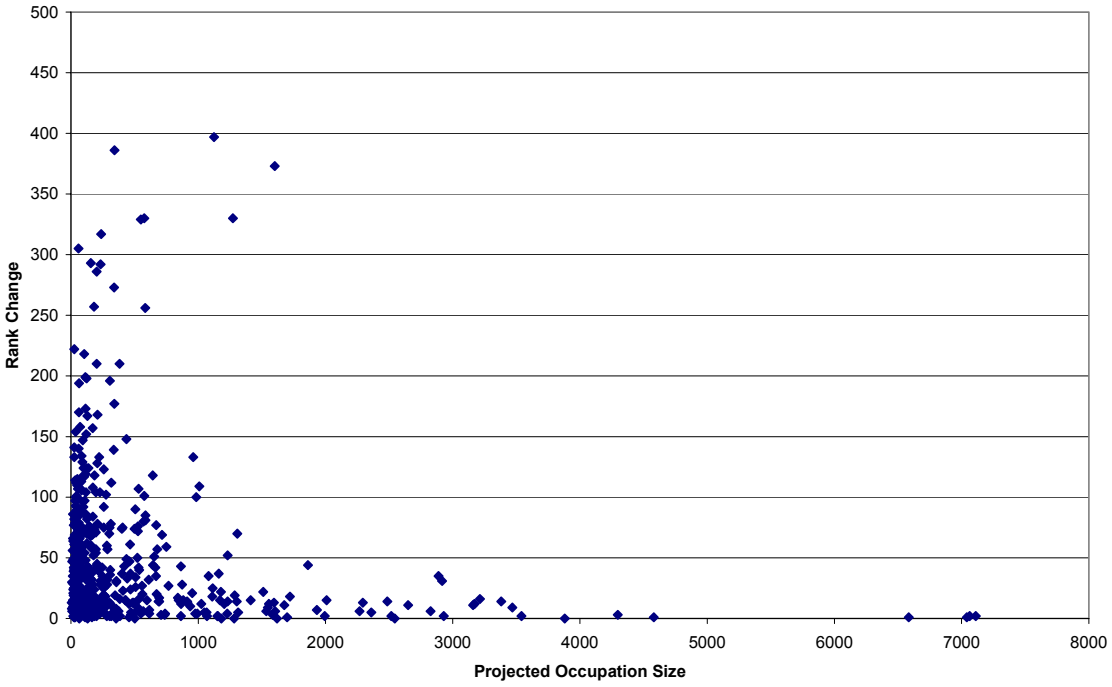


Figure 24: Southeast Minnesota--Change in Absolute Growth Ranking by Size of Occupation
Southeast Region compared to Greater Minnesota Staffing Pattern



Growth Rankings that Leave the Top 100 Occupations

As a further exploration of the most typical way in which staffing pattern changes might impact the published end results, analysts studied the top 100 (according to both percentage and numerical) growth occupations. If these lists varied wildly using different staffing patterns, that would be sufficient reason to continue using the more stable state data. Analysts created six lists of occupations that leave the top 100 using the methods described earlier. Using percent growth as the ranking metric and state to Greater Minnesota staffing pattern comparisons, 22 occupations leave the top 100. Of those, only seven move to a ranking of 200 or more, and only six have rankings in the top two-thirds of the statewide list. No occupational groups stand out. When those with percent growth and state to Southeast data are considered, there are 35 occupations that leave the top 100; 15 of these are beyond the top 200. No occupational groups are over-represented. The Greater Minnesota to Southeast list has 23 occupations— 13 of which also leave the top 200. Groups 29 (Healthcare Practitioners) and 39 (Protective Services) have more occupations leaving than do the others.

For the lists of absolute growth, state to Greater Minnesota data have 13 occupations leaving the top 100; many of these are in group 11 (Management). Only one occupation leaves the top 200, and of the 13, only one is ranked between numbers one and 60 statewide. State to Southeast's list comprises 26 occupations, six of which also leave the top 200. Twenty of the 26 occupations are listed according to statewide rankings between 60 and 100. This list does not have any dominant occupational groups. Greater Minnesota to Southeast has 19 occupations that leave the top 100; four of these also leave the top 200— without any over-represented occupational groups.

There are five occupations that are listed in the top 15 on one or both of the statewide and Greater Minnesota percent growth lists which are not in the top 100 on the Southeast list. Occupations such as these have the highest chance of being misrepresented when various staffing patterns are used. It is important to find out why their rankings vary so much. Three of these occupations, 151011, 272099, and 472011, barely made the size cutoff and have extremely small numbers when projected using the regional staffing pattern. Given their small size, it is not surprising that they do not show high growth. Two additional occupations, 393011 and 412012, have projected size in the

100's using the statewide staffing pattern but, regionally, have both base and growth year estimates under 50. For all of these occupations, regional staffing patterns estimated a noticeably smaller number of workers in both the base and projected years— which ultimately skewed the data because very small occupations show more volatile growth. With the lists of absolute growth, only one occupation falls into this category, 319092. Just as with the percent growth occupations, the regional staffing pattern shows significantly smaller base and projected data. However, this occupation's percent growth is nearly identical using all three staffing patterns; so it appears that in the Southeast region, this is just a smaller occupation than the average statewide. Since there are only a few occupations in which serious differences pop up, they do not affect the lists dramatically. However, this shows the danger of using lists of top growth with any staffing pattern— and the possible inaccuracies. It seems that when using any of the methods, while up to one-third of the top 100 occupations leave, very few are dropping to ranks considerably lower. Analysts can learn more by looking at all the occupations, divided into rank quintiles, and then by seeing whether high- or low-ranked occupations remain steady.

Figure 25: Southeast Region– Changes in Top 100, Percent Growth Rankings

State Compared to Greater Minnesota Staffing Pattern *

Occupation	Statewide Pattern Ranking	Greater Minnesota Pattern Ranking
132071	67	107
132099	92	119
211022	88	103
232093	100	122
273042	55	174
292011	57	181
319011	94	225
331099	71	120
339032	97	255
434081	99	123
434161	87	128
436013	81	126
472011	6	483
472211	85	157
499052	77	327
514052	95	121
514122	17	160
514199	93	228
516021	42	499
519022	64	168
533011	96	152
536099	82	124

* The occupations listed are in the top 100 percent growth using the statewide staffing pattern, but are not in the top 100 using the Greater Minnesota staffing pattern.

Figure 26: Southeast Region– Changes in Top 100, Percent Growth Rankings

State Compared to Southeast Region Staffing Pattern *

Occupation	Statewide Pattern Ranking	Southeast Minnesota Pattern Ranking
112011	84	157
112022	91	146
132071	67	180
132099	92	161
151011	37	527
151099	18	120
211022	88	163
232093	100	262
271026	63	398
272099	14	227
291060	28	103
291123	66	102
292011	57	388
292032	98	269
292081	56	165
319011	94	152
331099	71	141
339032	97	104
393011	15	208
412012	12	436
434081	99	130
434161	87	179
436013	81	446
472011	6	479
472211	85	189
499052	77	380
499091	54	235
514052	95	112
514122	17	480
514199	93	127
516021	42	502
519022	64	124
519071	19	121
533011	96	257
536099	82	305

* The occupations listed are in the top 100 percent growth using the statewide staffing pattern, but are not in the top 100 using the Southeast regional staffing pattern.

Figure 27: Southeast Region—Changes in Top 100, Percent Growth Rankings

Greater Minnesota Compared to Southeast Region Staffing Pattern *

Occupation	Greater Minnesota Pattern Ranking	Southeast Minnesota Pattern Ranking
112011	100	157
112022	81	146
151011	9	527
151099	74	120
173012	95	441
271026	43	398
272099	36	227
273099	96	108
291060	27	103
291123	90	102
292032	92	269
292081	71	165
393011	16	208
396011	91	439
399098	88	158
412012	12	435
474095	55	342
499091	22	235
512099	99	225
514081	84	248
516011	94	139
519071	45	121
533099	98	325

* The occupations listed are in the top 100 percent growth using the Greater Minnesota staffing pattern, but are not in the top 100 using the Southeast region staffing pattern.

Figure 28: Southeast Region—Changes in Top 100, Absolute Growth Rankings

State Compared to Greater Minnesota Staffing Pattern *

Occupation	Statewide Pattern Ranking	Greater Minnesota Pattern Ranking
111011	84	102
112022	79	127
113031	100	118
119198	71	122
151021	70	426
151099	48	170
193060	85	138
211021	63	121
292011	81	196
472211	94	129
515023	93	148
516031	96	183
537081	98	114

* The occupations listed are in the top 100 absolute growth using the statewide staffing pattern, but are not in the top 100 using the Greater Minnesota staffing pattern.

Figure 29: Southeast Region—Changes in Top 100, Percent Absolute Rankings

State Compared to Southeast Region Staffing Pattern *

Occupation	Statewide Pattern Ranking	Southeast Minnesota Pattern Ranking
111011	84	109
112022	79	158
113031	100	106
119198	71	137
151099	48	188
193060	85	127
211021	63	134
219099	67	129
253999	83	157
291060	10	136
292011	81	324
319092	5	150
339032	35	101
393011	88	348
419041	87	135
433011	69	115
433021	42	104
436013	41	414
472211	94	148
493031	97	114
499042	95	117
512041	89	297
512099	75	156
515023	93	238
516031	96	513
537081	98	128

* The occupations listed are in the top 100 absolute growth using the statewide staffing pattern, but are not in the top 100 using the Southeast regional staffing pattern.

Figure 30: Southeast Region—Changes in Top 100, Absolute Growth Rankings

Greater Minnesota Compared to Southeast Region Staffing Pattern *

Occupation	Greater Minnesota Pattern Ranking	Southeast Minnesota Pattern Ranking
219099	72	129
253999	80	157
291060	27	136
292041	99	133
319092	17	150
339032	98	101
359099	100	112
393011	75	348
412012	73	459
419041	61	135
433011	68	115
433021	34	104
436013	85	414
472061	89	189
493031	94	114
499042	95	117
512041	87	297
512092	82	113
512099	76	156

* The occupations listed are in the top 100 absolute growth using the Greater Minnesota staffing pattern, but are not in the top 100 using the Southeast region staffing pattern.

Growth Ranking Quintiles

The 537 occupations were divided into quintiles and charted based on the quintile in which the second staffing pattern placed them. Using all six ranking methods, analysts then had six figures showing the percent of occupations and their average size. State to Greater Minnesota has the most stable rankings, with about two-thirds of occupations staying in their original quintile. Only about **8.0 percent of occupations move two or more quintiles** using percent growth, and the absolute growth list has under 3.0 percent that move to that extent. Between 50 and 60 percent of occupations stay in their original quintiles using both methods of state to Southeast data collection. Absolute growth shows about 10 percent of occupations move two quintiles while **percent growth gives 16 percent with that degree of movement**. Greater Minnesota to Southeast shows that about three-fourths of occupations listed in either the top or bottom quintiles stay there, while the middle quintiles retain half of their occupations using both methods. Percent growth averages 12 percent of occupations switching two or more quintiles while absolute growth has less than 6.0 percent changing that much.

Those occupations that switch multiple quintiles also tend to be significantly smaller than those that remain. Hence, while there is quite a bit of switching between growth rankings, there aren't very many occupations that change drastically, and the ones that do are usually the smaller occupations. In this instance, utilizing a Greater Minnesota staffing pattern results in little impact while adopting the Southeast pattern is more challenging. Again, with a third year of OES staffing pattern data, those smaller occupations, along with the others, could be noticeably stabilized.

Figure 31: Percent Growth:State to Greater MN Quintile Changes

Percent of Occs		St Quintile 1	2	3	4	5
Gr Quintile	1	78%	14%	3%	5%	0%
	2	14%	64%	18%	4%	1%
	3	3%	14%	55%	26%	2%
	4	2%	7%	19%	56%	17%
	5	3%	1%	6%	10%	81%
Average Projection Size		**St Quintile 1**	**2**	**3**	**4**	**5**
Gr Quintile	1	493.6	171.0	456.0	142.6	0.0
	2	259.5	545.8	683.5	71.0	218.0
	3	516.7	383.6	672.4	579.5	131.0
	4	603.0	216.5	369.0	568.0	542.4
	5	69.7	831.0	74.7	503.5	241.6

Figure 32: Percent Growth: State to Regional Quintile Changes						
Percent of Occs		St Quintile				
		1	2	3	4	5
Reg Quintile	1	66%	21%	8%	4%	1%
	2	17%	42%	22%	12%	6%
	3	7%	17%	51%	20%	5%
	4	4%	15%	11%	44%	26%
	5	7%	6%	7%	19%	62%
Average Projection Size		St Quintile				
		1	2	3	4	5
Reg Quintile	1	553.8	215.1	180.7	160.8	25.0
	2	266.1	665.7	853.2	529.1	116.4
	3	70.7	460.6	633.6	737.9	81.8
	4	467.5	284.1	370.9	533.1	413.0
	5	246.3	78.7	64.4	357.2	275.3

Figure 33: Percent Growth:Greater MN to Regional Quintile Changes						
Percent of Occs		Gr Quintile				
		1	2	3	4	5
Reg Quintile	1	75%	17%	5%	3%	0%
	2	11%	50%	24%	10%	4%
	3	6%	18%	54%	19%	4%
	4	3%	9%	15%	52%	21%
	5	5%	6%	2%	17%	71%
Average Projection Size		Gr Quintile				
		1	2	3	4	5
Reg Quintile	1	480.4	230.4	227.0	37.7	0.0
	2	210.5	761.6	635.7	320.6	62.3
	3	159.5	325.9	743.7	469.4	75.0
	4	163.7	267.0	178.7	675.3	223.7
	5	87.4	188.0	109.0	210.0	319.1

Figure 34: Absolute Growth:State to Greater MN Quintile Changes						
Percent of Occs		St Quintile				
		1	2	3	4	5
Gr Quintile	1	87%	13%	0%	0%	0%
	2	12%	70%	16%	1%	1%
	3	0%	13%	64%	21%	2%
	4	1%	2%	18%	61%	19%
	5	0%	2%	3%	17%	79%
Average Projection Size		St Quintile				
		1	2	3	4	5
Gr Quintile	1	1646.2	694.9	-	-	-
	2	551.6	378.2	176.9	1045.0	1336.0
	3	-	304.9	148.5	107.9	256.5
	4	831.0	141.5	158.1	66.2	83.8
	5	-	724.5	93.0	58.4	149.2

Figure 35: Absolute Growth: State to Regional Quintile Changes						
Percent of Occs		St Quintile				
		1	2	3	4	5
Reg Quintile	1	77%	21%	2%	0%	0%
	2	16%	53%	21%	3%	6%
	3	2%	19%	47%	24%	8%
	4	3%	5%	22%	43%	28%
	5	2%	2%	7%	31%	58%
Average Projection Size		St Quintile				
		1	2	3	4	5
Reg Quintile	1	1730.7	468.0	258.5	-	-
	2	815.0	453.3	160.7	166.0	414.0
	3	409.0	291.2	148.3	84.3	81.9
	4	587.7	262.2	163.7	60.8	87.5
	5	549.5	179.5	104.1	104.9	164.5

Figure 36: Absolute Growth:Greater MN to Regional Quintile Changes						
Percent of Occs		Gr Quintile				
		1	2	3	4	5
Reg Quintile	1	81%	19%	0%	1%	0%
	2	15%	59%	19%	4%	3%
	3	1%	16%	51%	29%	3%
	4	2%	4%	24%	45%	25%
	5	1%	3%	6%	21%	69%
Average Projection Size		Gr Quintile				
		1	2	3	4	5
Reg Quintile	1	1745.1	399.9	-	1272.0	-
	2	906.0	340.0	185.3	268.0	621.0
	3	202.0	300.2	140.6	113.9	42.0
	4	443.0	160.0	164.3	61.5	78.3
	5	342.0	645.3	163.5	68.5	160.9

Conclusion

Regional, multi-regional, and statewide staffing patterns produce noticeably different results. For Minnesota, up to 100 occupations included in statewide data don't exist at the regional level. Two-thirds of jobs are placed differently when regional data are used; half place differently with Greater Minnesota data. However, the missing jobs are all very small and those displaced jobs may be more accurately considered using the sub-state patterns.

The projections show that statewide data are dramatically overestimating professional occupations in outstate Minnesota. These lucrative positions need to be accurately represented to schools and career counselors so that students and jobseekers know what their prospects for employment are. Nearly all occupational groups show similar amounts of growth regardless of the staffing pattern used. Those that differ are either biased by single errant occupations or have such high growth numbers that the differences don't affect their rankings. In Southeast Minnesota, individual occupations do change rankings, but rarely by large amounts. A number of difficulties occur when regional staffing patterns are used, some due to data problems, but as long as data are carefully checked for errors before and after analysis, these problems should be able to be resolved.

In the smallest regions, there are greater chances for sampling problems, so pooling multi-region data may be prudent— especially if there are no dominant industries. However, with regions such as Central and Southeast Minnesota, which vary from other rural regions but are, nevertheless, not entirely urban, specific regional data most closely represent the actual employment— with minimal negative repercussions on the projected change. Problems can be lessened by data editing, by applying stricter size cutoffs, and by broader categorization.