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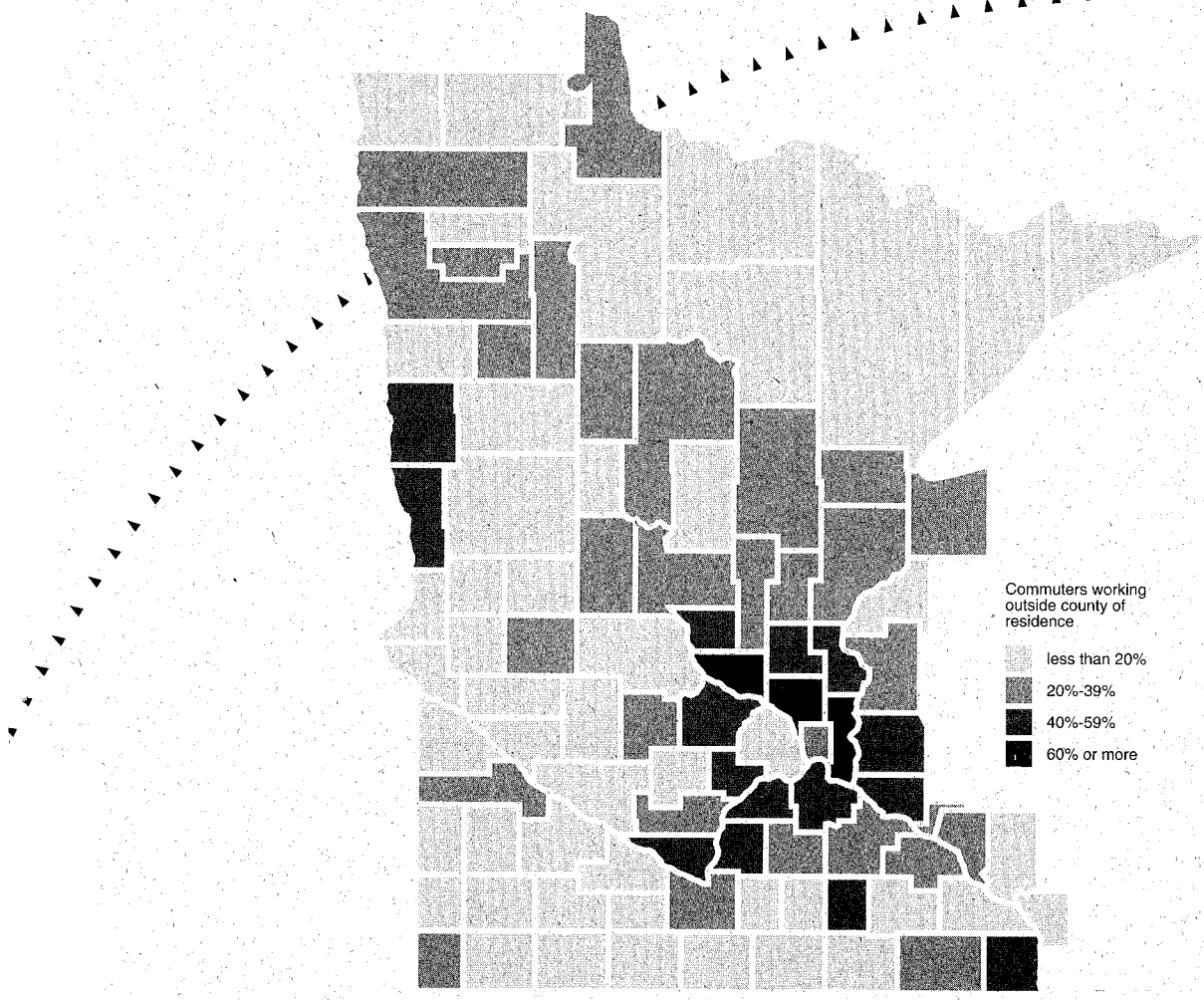

Modeling Commuter Flows Among Local Labor Markets in Minnesota, 1970-1990

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Between 1970 and 1990 the share of Minnesota commuters working outside their county of residence increased from 18 to 29 percent. This study analyzes this trend by examining commuter flows among labor markets in a 120-county study area encompassing Minnesota and counties in adjacent states.

A series of maps and statistical models relate commuter flows to changes in demographic and employment conditions over the past two decades. Commuter flows have strengthened since 1970, becoming more important in declining rural counties as well as growing suburban and exurban labor markets. Longer work journeys in declining rural areas appear to reflect individual coping strategies, as workers search farther afield for opportunities in a regional labor market undergoing a geographic transformation. For most types of jobs, employment growth is dispersing outward from metropolitan cores, while in non-metro areas jobs are consolidated into widely-spaced regional centers. These trends have created a network of diffuse labor markets in which commuter flows link widely-scattered communities of labor deficits to areas with labor surplus, in patterns too complex to be modeled solely in terms of aggregate population and housing variables.

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Modeling Commuter Flows Among Local Labor Markets in Minnesota, 1970-1990

Final Report

prepared by

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Minnesota Department of Transportation
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CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

This study analyzes changes in commuter flows among Minnesota's labor markets during the 1970s and 1980s. After a brief introduction, we examine patterns and trends in the daily flows of workers in a 120-county study area encompassing Minnesota and contiguous counties in adjacent states. Results indicate that cross-county commuter flows are strengthening, and are becoming more common not only in burgeoning suburban and exurban areas, but also in some of the state's declining rural counties. The next section of the study presents a series of statistical models relating commuter flows to various demographic and economic factors. The results of these models suggest that interaction among the state's labor markets does not reflect underlying demographic and economic conditions in any simple, linear fashion. Rather, different sets of factors help explain the growth in commuter flows during the 1970s and the 1980s. In the last twenty years the residential portions of local labor markets have continued to decentralize across suburban and exurban counties. Employment has diffused outward from metropolitan cores to selected suburban corridors, and beyond to exurban communities. In nonmetropolitan Minnesota, employment and basic services have been consolidated into a smaller number of regional centers, leading many workers in rural townships to accept longer commutes to reach more promising opportunities.

I. INTRODUCTION

Minnesota's labor markets are undergoing a geographic transformation. As in other midwestern states, many rural counties and small towns have been losing population for a generation or more, while suburban communities around metropolitan areas continue to grow briskly. Many jobs have followed these demographic shifts, with rapid employment growth in second- and third-ring suburbs linking widely-scattered neighborhoods in complex webs of daily journey-to-work flows. While commuter streams in burgeoning suburbs are the product of new residents and jobs, the interconnections among greater Minnesota's communities result from a more diverse set of processes. In the last thirty years, manufacturing has decentralized away from the cores of the state's largest metropolitan centers, a trend propelled in part by employers' desire to tap new sources of labor, and enabled by cheap fuel and a well-developed highway network. Meanwhile, high-paying jobs in administrative occupations and certain service industries have been concentrating in the Twin Cities and other metropolitan areas, abandoning many of the state's smaller trade centers. Changes in the retail landscape also reflect a shifting hierarchy of towns: as more people are willing to drive farther to take advantage of full-service shopping centers, nearby stores on small-town main streets gradually lose their customer base.

Labor markets usually are analyzed in a non-geographical manner. Yet almost all of the components of the market -- total employment, wages, occupational and industrial structure, and so on -- are affected by changes that are inherently geographical. The rapid residential growth of postwar suburbs around almost every American city pulled many kinds of jobs farther outward from the historic urban cores, gradually bidding up the wages of suburban residents and replacing the traditional "suburb-to-downtown" traffic patterns of the 1950s with more complex "suburb-to-suburb" flows. In declining rural areas, outmigration and retail competition from large, widely-scattered retail centers often leads to a shrinking local

employment base, and relative isolation from regional flows of people, goods, and services. In such regions, the locational decisions of an individual firm often can have an enormous impact on the employment and tax base of a city or county. Local planners thus find themselves competing with one another to attract new businesses or government facilities. When these efforts fail, workers who remain in declining labor markets must search farther afield for jobs--leading to greater integration with neighboring job centers.

This array of complex and often countervailing forces shapes the settlement fabric in ways that defy simplistic explanations. Vigorous growth in outlying suburban communities and gradual depopulation of rural townships are two distinct processes, but in many cases they occur within comparatively short distances of one another. How do these factors combine to shape the region's settlement fabric?

This study analyzes the evolving geography of Minnesota's labor markets between 1970 and 1990. In the second section, we examine patterns and trends in the daily flows of workers among counties in a study area that encompasses Minnesota and contiguous counties in adjacent states (Figure 1). We use data from the U.S. Census Bureau's "Journey-to-Work Frequency Tables" to show that more and more workers hold jobs outside their county of residence, and that in many communities a substantial portion of local employment is held by nonresident workers. In the third section, we develop and test a series of models relating these commuter flows to demographic and economic conditions. We use statistics from *County Business Patterns*, along with the journey-to-work data, to show that commuter flows in the 1970s were associated with a different set of explanatory factors than during the 1980s. Finally, in the fourth section, we offer a few concluding remarks on our main findings and the implications for regional policy and transportation planning. We argue that the spatial extent of the state's labor markets has stretched far beyond the boundaries of existing planning jurisdictions, with the result that current transportation policies are unable to provide

coordinated, long-term plans for the daily flows of people, goods, and information that are becoming ever more important to Minnesota's economy.

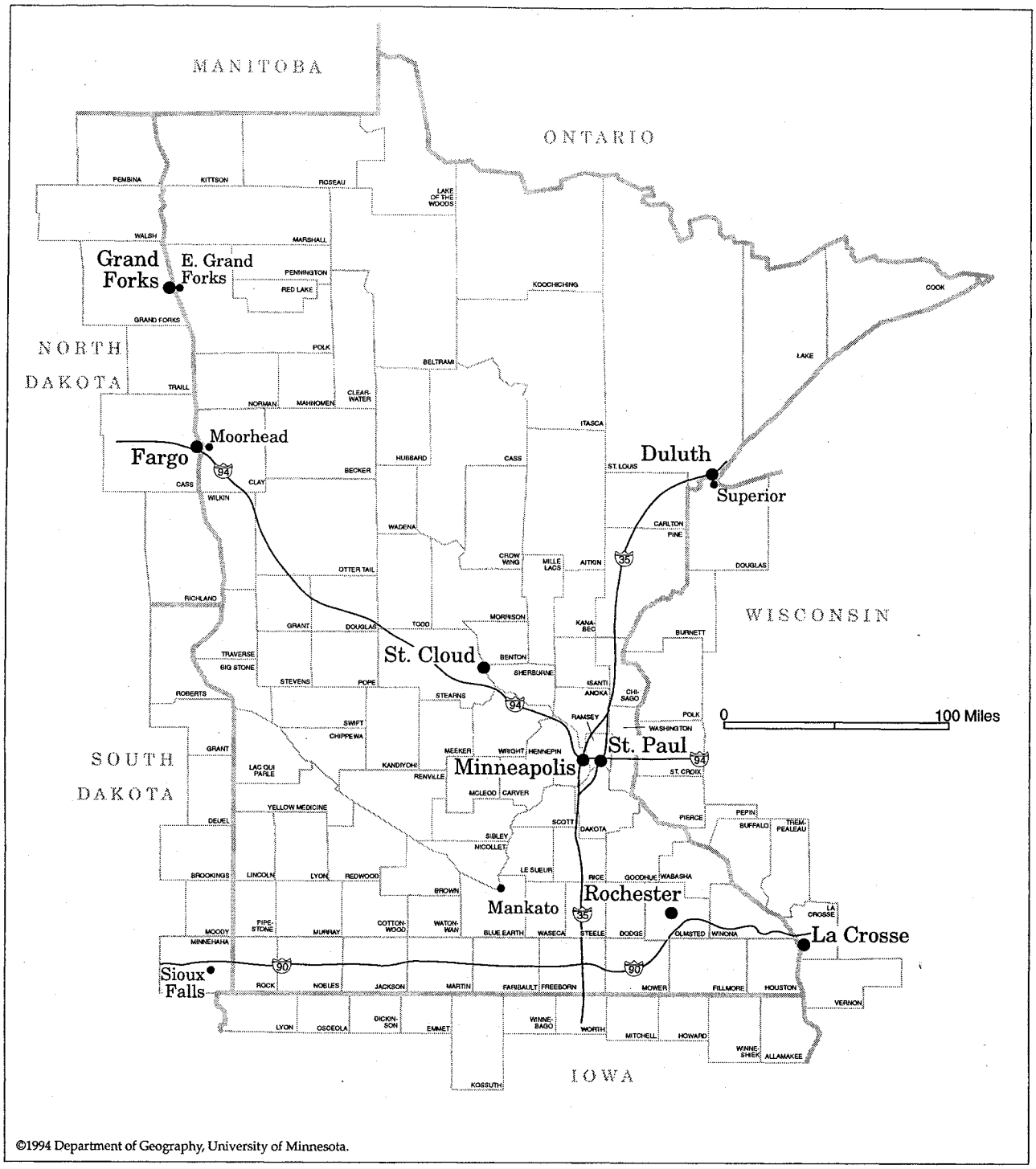


Figure 1. Study Area. To study interaction among Minnesota's local labor markets, we analyzed commuting patterns along with demographic and economic conditions in a study area including the state's 87 counties and 33 counties in adjacent states.

II. MINNESOTA'S EVOLVING COMMUTING FIELDS

By any number of measures, the interconnections among Minnesota's counties have strengthened in the last twenty years. Overall, the state's share of workers who cross a county boundary on their way to work has tripled since 1960, exceeding 28 percent in 1990. We can better appreciate the significance of this growth, however, by measuring different aspects of inter-county commuting, and examining how the patterns vary across the state's local labor markets. First, the share of a county's employed residents who work in another county provides a measure of the significance of a commuter flow for an *origin*. Second, the share of local employment that is taken by workers who live in other counties describes a place's importance as a *destination*. Finally, the difference between these two measures represents the net flow of commuters to or from each county.

A. COMMUTING PATTERNS IN THE 1970S AND 1980S

Inter-county commuting has historically been most pronounced in the tiers of counties surrounding the state's largest metropolitan areas (Figure 2). In 1970, nine counties sent more than 40 percent of their workers to neighboring counties. Within easy commuting distance of metropolitan job centers, a small arc of counties around the Twin Cities, St. Cloud, and Mankato posted large shares of out-commuters in the 1960s, reflecting the early influence of limited-access highways on suburban residential growth. In the two decades since 1970, out-commuting from many counties increased dramatically, and by 1990 a broad arc of counties surrounding metropolitan areas in the southern part of the state sent more than 40 percent of their commuters to neighboring counties (Figure 2).

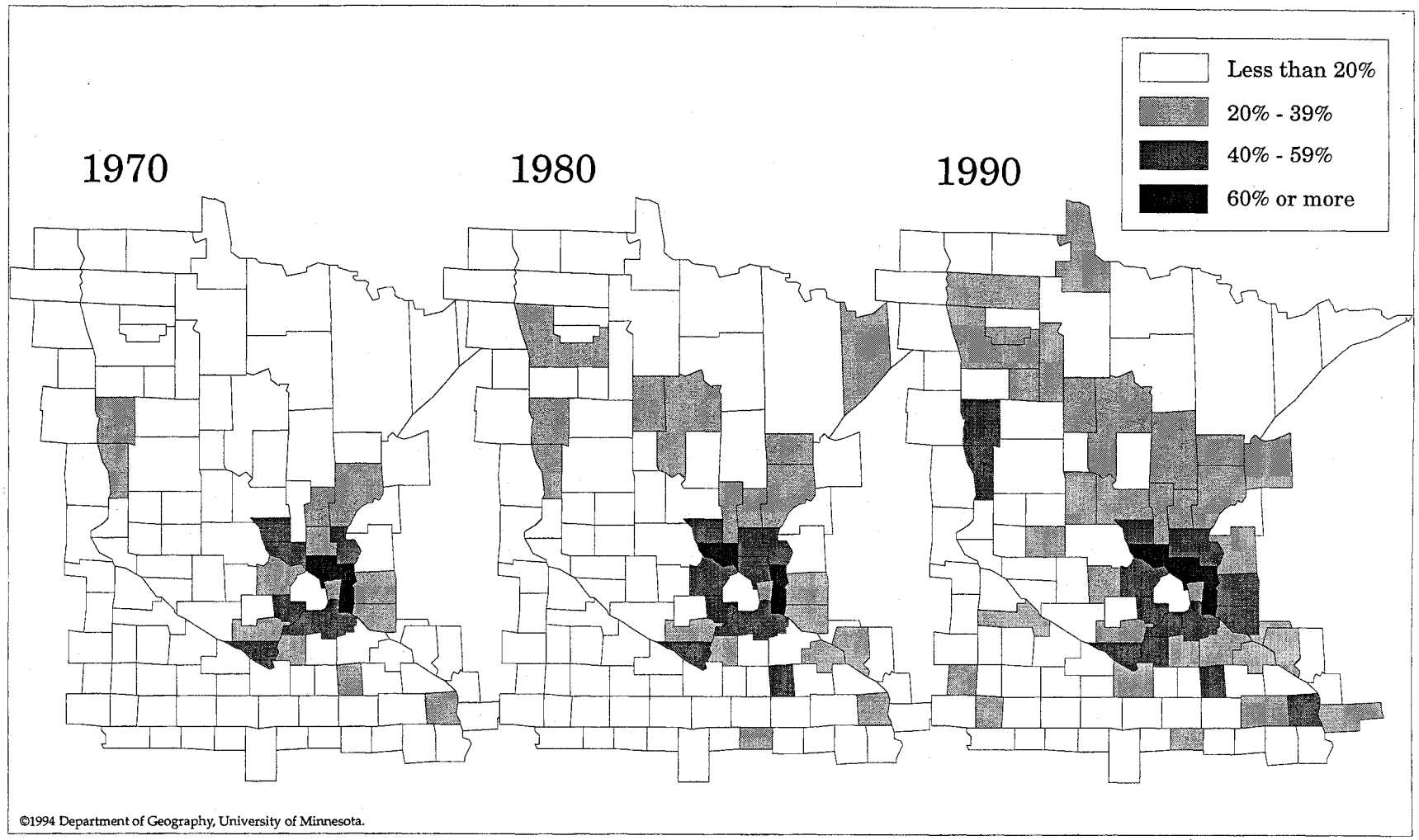


Figure 2. Percentage of Commuters Working Outside County of Residence. High rates of out-commuting were once confined to suburbs within a few miles of metropolitan job centers close to a central city. As employment growth has continued to disperse along suburban highway corridors, out-commuting has expanded farther outward to newer residential 'exurbs.' Out-commuting has also become important in connecting diffuse labor markets in Greater Minnesota. *(Data Source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

A number of rural counties in the north-central part of the state are also being incorporated into regional patterns of interaction. More than a dozen counties in the corridor between Duluth and Grand Forks now send at least a fifth of their commuters to neighboring counties (Figure 2).

This pattern suggests that metropolitan cross-border flows are no longer confined to densely-populated counties. Rather, daily flows of workers are beginning to play an important role in linking places on the lower end of the urban hierarchy. Suburban areas with well-developed connections to large metropolitan job centers are developing employment bases of their own, providing intervening opportunities for local workers. In outlying rural townships, declining local job bases lead many workers to accept longer commutes to reach more promising employment in surrounding communities. As a consequence, even those counties with the lowest percentage of their commuters working elsewhere have posted substantial increases since the 1970s (Tables 1 and 2).

In-commuting has also increased substantially in the last twenty years, reflecting the vigorous growth of suburban employment centers. In 1970, only two counties -- Anoka and Washington, both within the seven-county Twin Cities Metropolitan Area -- hosted nonresident workers comprising more than 40 percent of total county employment (Figure 3). By 1990, five counties fell into this category, and nonresident workers comprised more than 20 percent of county employment in a broad zone around the state's metropolitan centers (Figure 3). Fully half the jobs in Washington and Benton counties are now taken by nonresident workers (Tables 3 and 4).

It is helpful to analyze patterns of in- and out-commuting simultaneously. For each county in the study area, we calculated the difference between the number of local residents working elsewhere (outcommuters) and the number of local jobs taken by nonresidents

Table 1. Counties with the Highest and Lowest Percentages of their Commuters Working in Other Counties.

Counties with the highest percentage of their commuters working in other counties.

1970		1980		1990	
1. Anoka	66.8 %	1. Washington	68.0 %	1. Washington	68.6 %
2. Washington	65.8	2. Sherburne	65.8	2. Sherburne	67.6
3. Sherburne	58.4	3. Anoka	59.9	3. Anoka	60.4
4. Dakota	58.3	4. Benton	56.2	4. Scott	59.0
5. Benton	49.7	5. Dakota	55.2	5. Benton	58.0
6. Carver	45.9	6. Carver	53.6	6. Dakota	55.1
7. Chisago	44.5	7. Scott	49.7	7. Chisago	54.5
8. Scott	41.6	8. Wright	48.5	8. Carver	53.8
9. Nicollet	41.5	9. Chisago	45.3	9. Wright	53.1
10. Isanti	38.0	10. Nicollet	44.6	10. Isanti	51.5

Counties with the lowest percentage of their commuters working in other counties.

1970		1980		1990	
1. Minnehaha, SD	0.3 %	1. Minnehaha,SD	0.7 %	1. Minnehaha, SD	0.9 %
2. Koochiching	2.5	2. Roseau	1.6	2. Roseau	2.2
3. Roseau	2.8	3. LaCrosse, WI	2.3	3. Koochiching	3.2
4. Lyon	2.9	4. Kossuth, IA	2.3	4. LaCrosse, WI	3.4
5. Pipestone	2.9	5. Koochiching	2.7	5. Cook	4.2
6. Winnebago, IA	3.1	6. Brookings, SD	2.8	6. Brookings, SD	4.3
7. Olmsted	3.2	7. Olmsted	3.0	7. Olmsted	4.7
8. Brookings, SD	3.2	8. Lyon	3.7	8. Lyon	5.1
9. Stevens	3.3	9. Nobles	3.9	9. Winnebago, IA	5.3
10. Grand Forks, ND	3.5	10. Winnebago, IA	4.2	10. Grand Forks, ND	5.9

Source: U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.

Table 2. Counties with the Largest Rates of Change in the Share of their Commuters Working in Other Counties.

Counties with the highest rates of increase.

	1970 - 1980		1980 - 1990
1. Wilkin	+14.4 %	1. Wabasha	+15.7 %
2. Wright	+14.3	2. Buffalo, WI	+15.3
3. Dodge	+13.5	3. Meeker	+13.4
4. Lake of the Woods	+11.3	4. Marshall	+13.3
5. Carlton	+11.2	5. Rock	+12.7
6. Lake	+11.0	6. Pierce, WI	+12.0
7. Le Sueur	+10.9	7. Polk, WI	+11.9
8. Hubbard	+10.2	8. Todd	+11.2
9. Clearwater	+8.9	9. Cass	+11.1
10. St. Croix, WI	+8.8	10. Pope	+11.1

Counties with the lowest rates of increase, or with decreases.

	1970 - 1980		1980 - 1990
1. LaCrosse, WI	-10.9 %	1. Cook	-5.8 %
2. Anoka	-6.9	2. Lake	-3.7
3. Burnett, WI	-3.4	3. Grant, SD	-0.5
4. Douglas, WI	-3.4	4. Dakota	-0.1
5. Dakota	-3.1	5. Nicollet	+0.1
6. Kossuth, IA	-1.9	6. Minnehaha, SD	+0.2
7. Norman	-1.1	7. Carver	+0.2
8. Roseau	-1.1	8. Anoka	+0.4
9. Pembina, ND	-1.1	9. Itasca	+0.5
10. Nobles	-0.5	10. Dickinson, IA	+0.5

Source: U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.

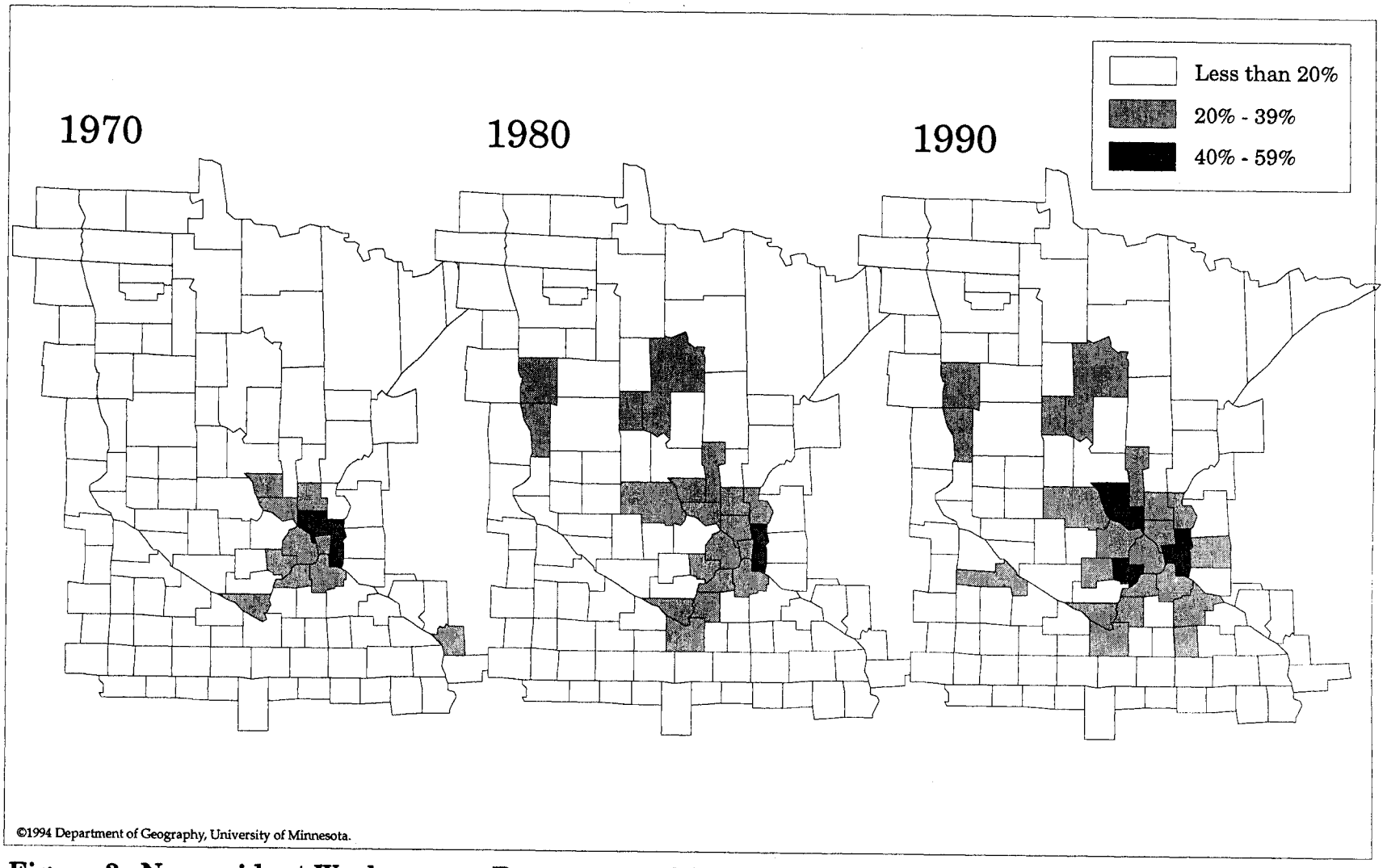


Figure 3. Nonresident Workers as a Percentage of County Employment. In-commuting is most common within the well-integrated labor markets around metropolitan job centers, but during the 1970s and 1980s several regional centers in Greater Minnesota began to attract greater shares of nonresident workers. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

Table 3. Counties with the Highest and Lowest Percentages of Nonresident Workers.

Counties with the highest percentages of jobs taken by nonresident workers.

1970		1980		1990	
1. Washington	40.7 %	1. Washington	42.9 %	1. Benton	50.0 %
2. Anoka	40.1	2. Ramsey	39.2	2. Washington	49.4
3. Dakota	36.7	3. Benton	38.5	3. Ramsey	45.6
4. Ramsey	33.3	4. Sherburne	38.1	4. Carver	43.9
5. Scott	28.2	5. Anoka	34.5	5. Sherburne	42.1
6. Sherburne	27.3	6. Scott	33.5	6. Dakota	39.3
7. Benton	26.5	7. Dakota	33.4	7. Scott	38.6
8. Nicollet	22.7	8. Nicollet	32.0	8. Anoka	37.1
9. Carver	21.9	9. Wilkin	30.4	9. Nicollet	36.6
10. Isanti	21.5	10. Carver	25.8	10. Hennepin	31.8

Counties with the lowest percentages of jobs taken by nonresident workers.

1970		1980		1990	
1. Kossuth, IA	1.0 %	1. Kossuth, IA	1.2 %	1. Kossuth, IA	2.4 %
2. Lyon, IA	1.0	2. Minnehaha, SD	1.6	2. Minnehaha, SD	3.2
3. Minnehaha, SD	1.4	3. Cook	2.6	3. Roberts, SD	3.7
4. Brookings, SD	1.6	4. Lyon, IA	3.0	4. Brookings, SD	3.9
5. Lac Qui Parle	1.9	5. Roberts, SD	3.3	5. Vernon, WI	5.1
6. Koochiching	2.0	6. Lac Qui Parle	3.4	6. Lake of the Woods	5.9
7. Winneshiek	2.2	7. Brookings, SD	3.5	7. Winneshiek, IA	5.9
8. Roberts, SD	2.3	8. Koochiching	3.5	8. Lyon, IA	6.3
9. Osceola, IA	2.6	9. Murray	3.8	9. Mitchell, IA	6.3
10. Martin	2.7	10. Deuel, SD	4.1	10. Deuel, SD	6.3

Source: U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.

Table 4. Counties with the Largest Rates of Change in the Share of Nonresident Workers.

Counties with the highest rates of increase in the share of jobs taken by nonresident workers.

	1970 - 1980		1980 - 1990
1. Wilkin	+17.5 %	1. Carver	+18.0 %
2. Lake	+13.6	2. Benton	+11.5
3. Benton	+11.9	3. Clay	+9.9
4. Sherburne	+10.8	4. Grant	+9.5
5. Nicollet	+9.3	5. St. Croix, WI	+8.6
6. Cass	+8.8	6. Houston	+8.0
7. Redwood	+8.6	7. Winnebago, IA	+7.9
8. Wadena	+7.9	8. Chisago	+7.9
9. Chisago	+7.7	9. Mille Lacs	+7.3
10. Dodge	+7.6	10. Wadena	+7.2

Counties with the lowest rates of increase (or with decreases) in the share of jobs taken by nonresident workers.

	1970 - 1980		1980 - 1990
1. LaCrosse, WI	-9.3 %	1. Lake	-3.4 %
2. Anoka	-5.5	2. Redwood	-3.3
3. Dakota	-3.3	3. Itasca	-2.4
4. Burnett, WI	-2.7	4. Swift	-2.2
5. Winnebago, IA	-2.1	5. Red Lake	-1.4
6. Cook	-2.0	6. Faribault	-0.6
7. Kanabec	-2.0	7. Emmet, IA	-0.5
8. Murray	-0.7	8. Wilkin	-0.5
9. Grand Forks, ND	-0.5	9. Carlton	+0.3
10. Lake of the Woods	-0.4	10. Roberts, SD	+0.3

Source: U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.

(incommuters). When expressed as a percentage of the local employed population, this "net flow" index provides a good measure of each county's role in the networks connecting local labor markets.

A number of counties have been net contributors of commuters for many decades (Figure 4). Typically, these places are located adjacent to metropolitan areas, such that local employment is dwarfed by nearby opportunities: communities around Moorhead send workers across the river to Fargo, North Dakota; North Mankato and other townships in Nicollet County send commuters south across the Minnesota River to jobs around Mankato; and a broad arc of counties between St. Cloud, the Twin Cities, and Rochester send workers to nearby metropolitan jobs.

Counties with regional or metropolitan centers attract net flows of commuters (Figure 5). In some cases a city's suburban residential growth does not cross a county boundary, however, so workers in these areas remain hidden from our analysis (for example, Duluth and Superior, and Hennepin County's suburbs).

Patterns of net commuter flows suggest a striking reorganization of connections among Minnesota's labor markets. By 1990, more than a dozen counties in the densely-settled southern part of the state are net contributors to the regional system focused on the Twin Cities, St. Cloud, Rochester, and Mankato (Figure 4). While there is significant variation in the character of different places in each of these counties, there is little doubt that the metropolitan economy has expanded its sphere of influence considerably over the last twenty years. As in other midwestern states, many of Minnesota's small towns founded in the nineteenth century rail era have abandoned their roles as agricultural processing and trade centers, as suburban and exurban development draws them into sprawling metropolitan regions.

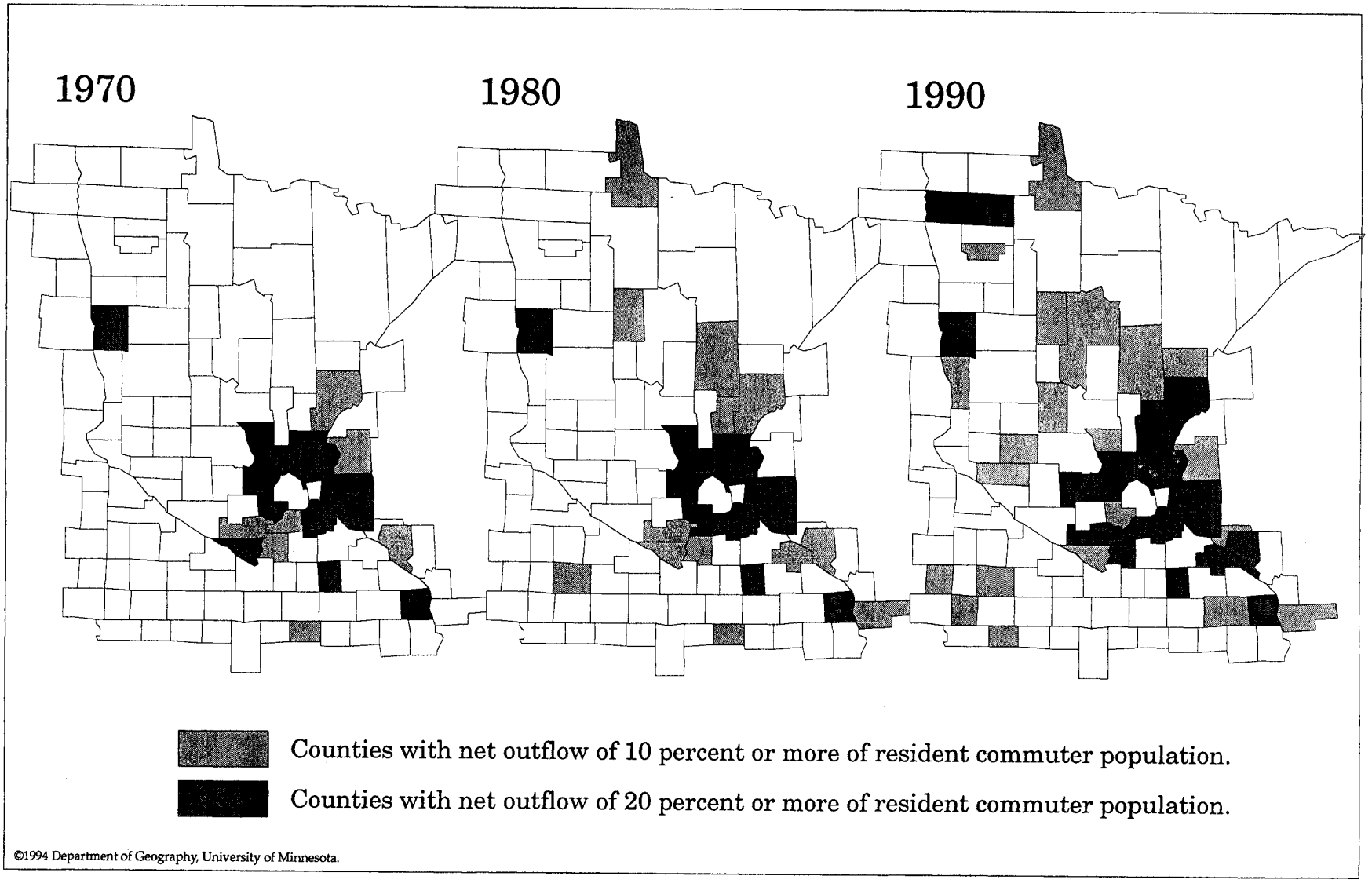


Figure 4. Counties Generating Net Outflows of Commuters. Counties with more resident workers than jobs generate net outflows of commuters. Historically confined to residential suburbs within easy access to metropolitan employment, net outflows have become more common as many types of jobs have dispersed outward from metropolitan cores, and as workers in Greater Minnesota search farther afield for opportunities. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

Labor markets in greater Minnesota have also been reorganized as certain manufacturing and trade functions have concentrated in regional centers. By 1990 more than a dozen counties in the northern part of the state contribute net flows of commuters, many to manufacturing centers in Roseau, Thief River Falls, Warroad, and Wadena (Figures 4 and 5).[1]

Patterns of interaction among Minnesota's local labor markets appear to have changed considerably over the last few decades, as people and jobs have left rural areas and older urban cores. Yet it is important to recognize the inertia of the region's historic settlement patterns. Today's densely-populated suburban and exurban corridors are landscapes of dynamic growth and change, but their location has deep roots in the networks laid down in the late nineteenth century. The initial paths of European-American settlement followed corridors that provided the easiest transportation routes and the most productive natural resources. Decades of investment in railroads, factories, and homes in these corridors influenced later locational decisions, so that today's Interstate automobile traffic between Minneapolis and Moorhead mirrors commodity flows on the railroads of the 1880s, and passenger trains until the late 1950s.[2] Only in the last decade have technological advances in communications presented a serious challenge to these locational attractions, allowing people and businesses to locate in isolated areas while maintaining connections to the regional economy. Still, for most industrial sectors and most individual occupations, today's patterns of interaction and investments in infrastructure will shape regional labor markets for several decades.

B. CHANGES IN INTER-COUNTY COMMUTING SINCE 1970

Geographic patterns in Minnesota's settlement system reflect the inertia of previous decades, but there have been significant internal changes in many local and regional networks. During the 1970s many counties began to send much larger shares of their workers to adjacent

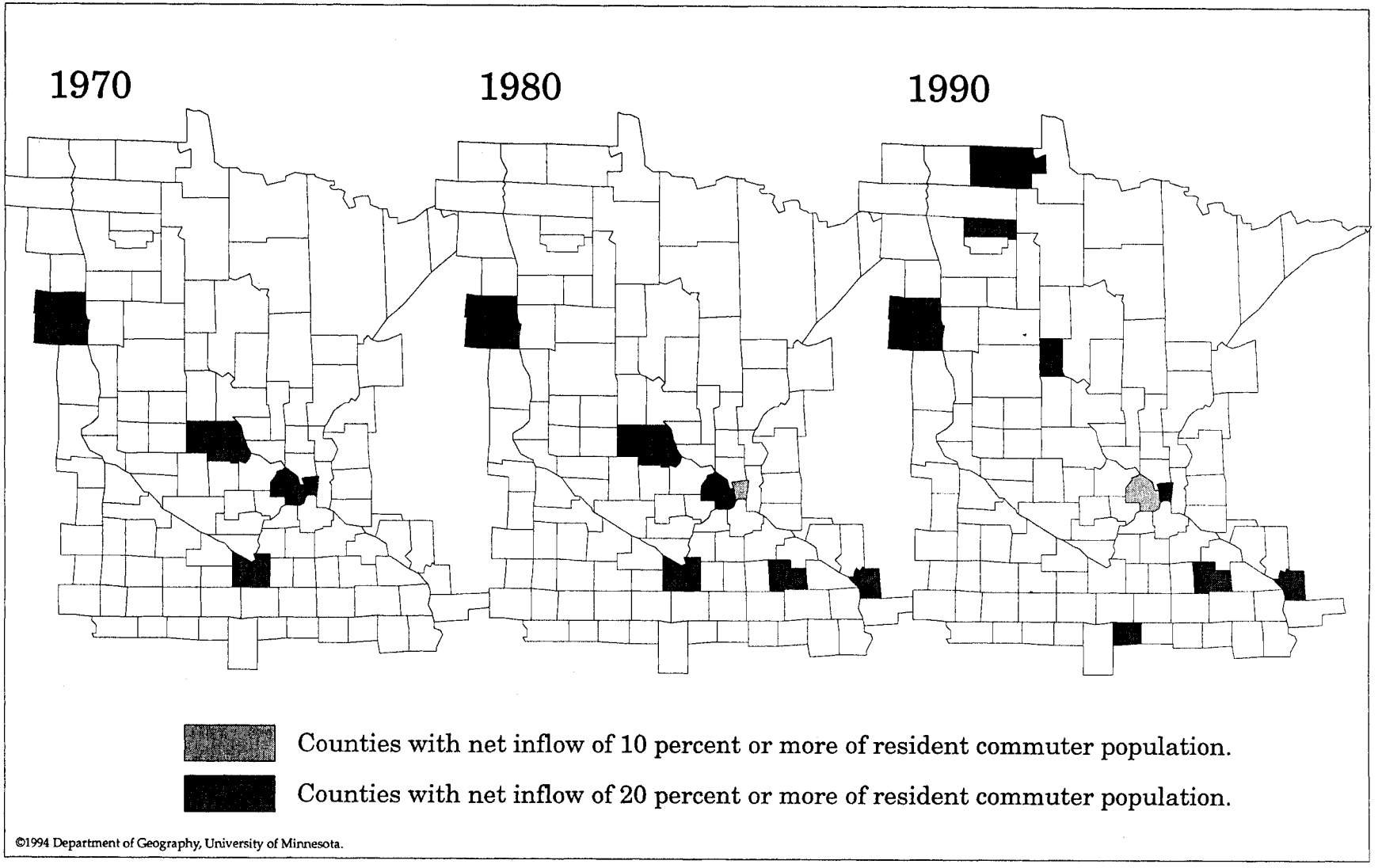


Figure 5. Counties Attracting Net Inflows of Commuters. Counties with more jobs than resident workers attract net inflows of commuters. Metropolitan counties attract the greatest number of commuters, but in the last twenty years manufacturing and retail employment has dispersed outward from metropolitan areas even while jobs have been consolidated into regional centers in the state's less-densely populated labor markets. The consequence has been a net inflow of commuters into several nonmetropolitan counties. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

job centers, while a few counties began to attract greater numbers of nonresident workers (Figures 6 and 8). Counties with the largest rates of increase fell into three categories: exurban, peripheral, and rural.

Exurban counties such as Wright, LeSueur, and Dodge posted large increases in out-commuting because of rapid residential growth. LeSueur and Dodge had increases of more than 20 percent in the population over age 15, while Wright's growth exceeded 60 percent. These areas became closely integrated with nearby metropolitan labor markets, and by 1980 more than 40 percent of their employed residents worked in other counties. Some exurban counties such as Benton and Sherburne grew even more rapidly (40 and 70 percent, respectively) but were situated better to attract jobs from the metropolitan economy. These counties began to attract greater numbers of nonresident workers in the 1970s (Figure 8).

Peripheral counties include Wilkin (south of Moorhead) and Carlton and Lake (adjacent to the Duluth-Superior metropolitan area) (Figures 6 and 8). These counties are on the fringe of metropolitan areas that had insufficient growth to support rapid exurban development, so population growth fell short of 20 percent (less than 1 percent for Wilkin). In these areas out-commuting appears to be the result of stagnating local labor markets in the 1970s, although in-commuting trends suggest a few growing employment centers in Wilkin and Lake counties.

Two rural counties in north-central Minnesota, Lake of the Woods and Hubbard, sent increasing shares of their workers to adjacent counties during the 1970s. Hubbard's population grew more than 40 percent over the decade, stimulating increased commuter flows north to Bemidji and east into Cass County. In contrast, Lake of the Woods grew only 3 percent, and its growth in out-commuting may be attributed to expanded manufacturing operations in Roseau.

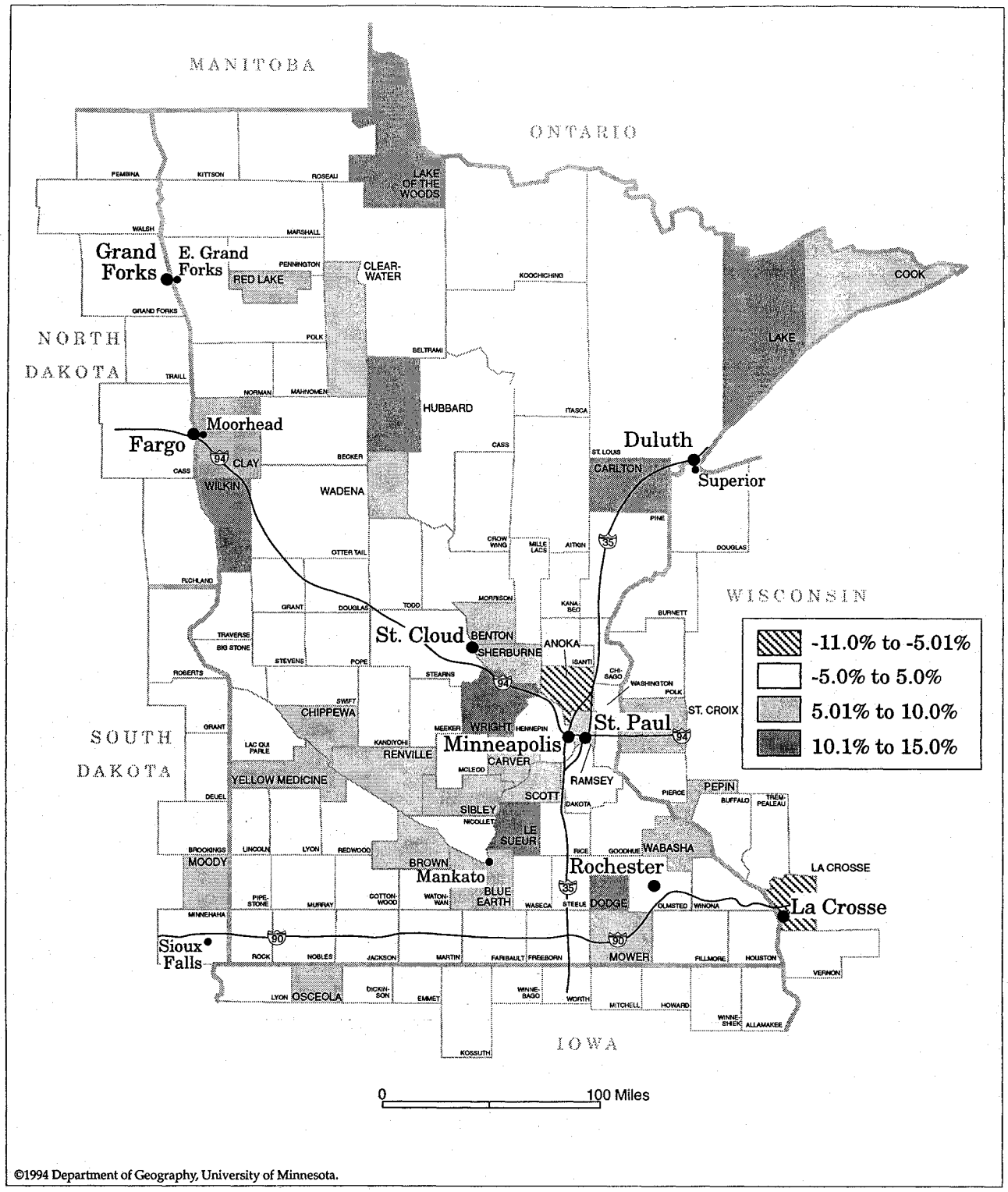


Figure 6. Change in Share of Commuters Working Outside County of Residence, 1970-1980. Most counties with brisk growth rates of out-commuting in the 1970s were located on the outskirts of metropolitan areas. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

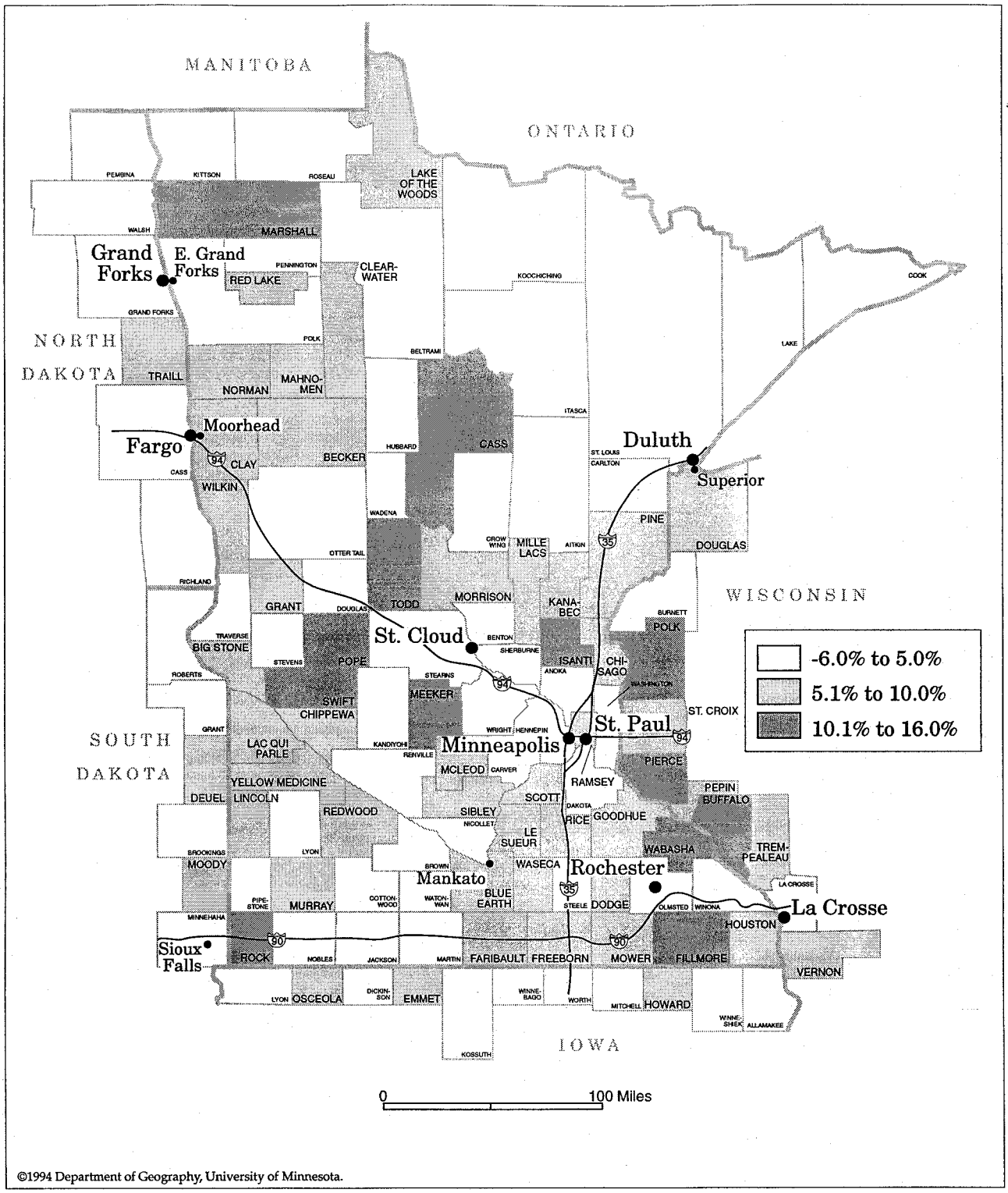


Figure 7. Change in Share of Commuters Working Outside County of Residence, 1980-1990. Rapid growth in out-commuting was more widespread during the 1980s than in the previous decade, and many of the most pronounced increases were in nonmetropolitan counties. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

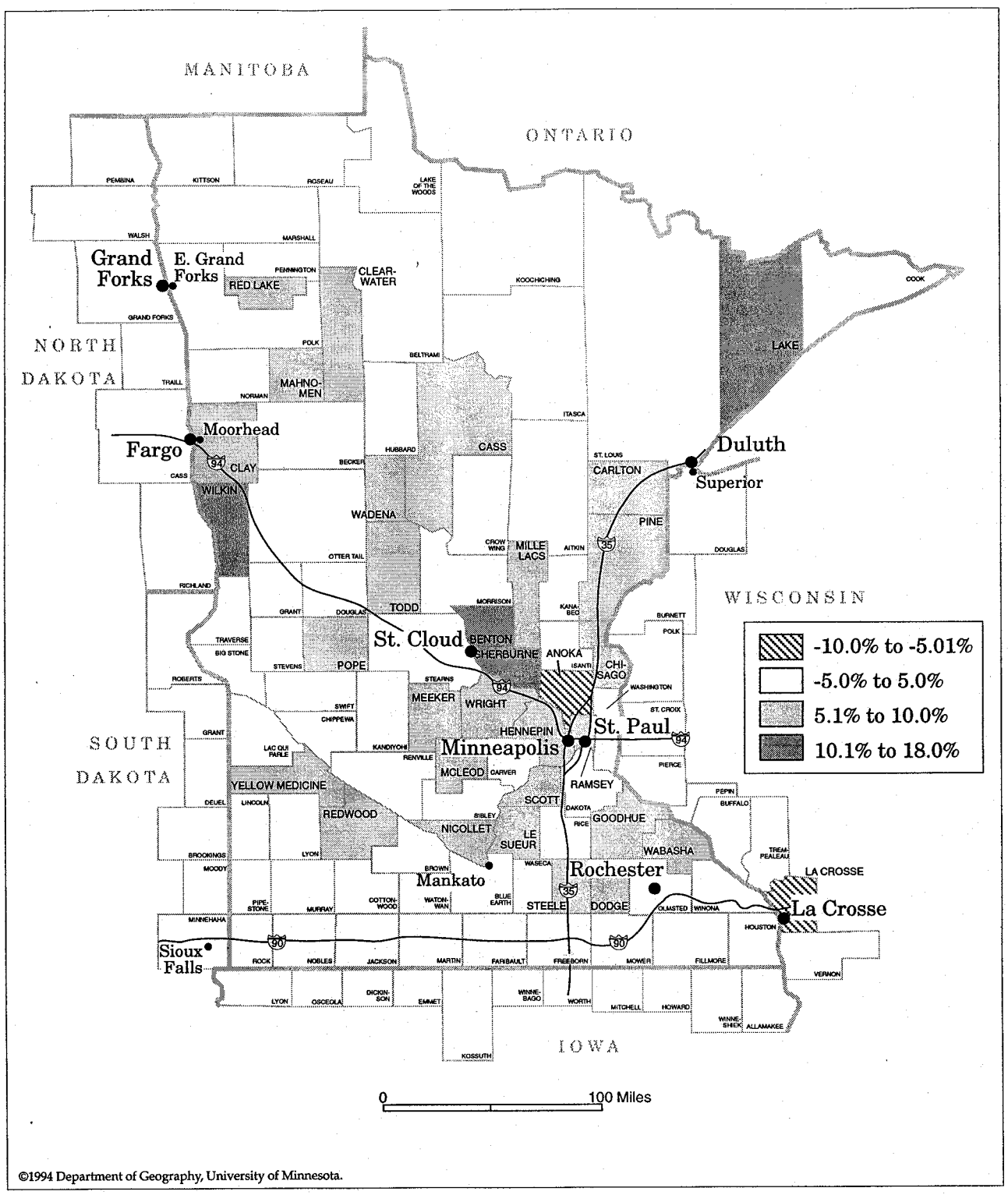


Figure 8. Change in Share of Jobs Taken by Nonresident Workers, 1970-1980 During the 1970s in-commuting expanded most rapidly in counties near metropolitan areas and regional centers. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

Inter-county commuting trends in the 1980s represent a considerable departure from geographical patterns of previous years (Figures 7 and 9). Counties with the highest growth rates in the 1970s stabilized somewhat, while metropolitan commuting fields reoriented growth along new residential corridors and suburban employment centers. Residential growth in the U.S. Highway 10 corridor between Minneapolis and St. Cloud continued, for instance, but the already high levels of interaction among local labor markets increased only slightly at the county level. Meanwhile, townships north of the Twin Cities along State Highway 65 began to send more commuters into Anoka County, and residential exurbs continued to spread farther into western Wisconsin (Figure 7). East of St. Cloud, Sauk Rapids continued to claim more of the metro area's employment, although Benton County's 20 percent growth in local employment during the 1980s was a dramatic slowdown from the 100 percent growth of the previous decade. Still, Benton continues to attract greater numbers of nonresident workers (Figure 9).

On the western edge of the Twin Cities, Eden Prairie's vigorous growth has steadily marched west into Carver County along State Highway 5 to Chanhassen, and south to Chaska. Some of this growth is led by residential development for workers commuting to the Twin Cities, but local employment has grown even more rapidly. Due mostly to growth in manufacturing operations tied to the metropolitan economy, Carver County's employment base doubled in the 1970s and again in the 1980s, while the rise in the population over age 15 fell short of 50 percent in each decade. The result has been a steady rise in the share of local jobs taken by nonresident workers (Figure 9). Twenty years ago Carver County could be described as a network of small towns and rural areas interspersed with a few commuter suburbs on its eastern edge, but today the county is taking on an exurban employment role of its own.

Even more striking is the growth in inter-county commuting in nonmetropolitan Minnesota. A broad arc of counties between the Minnesota River and Grand Rapids increased

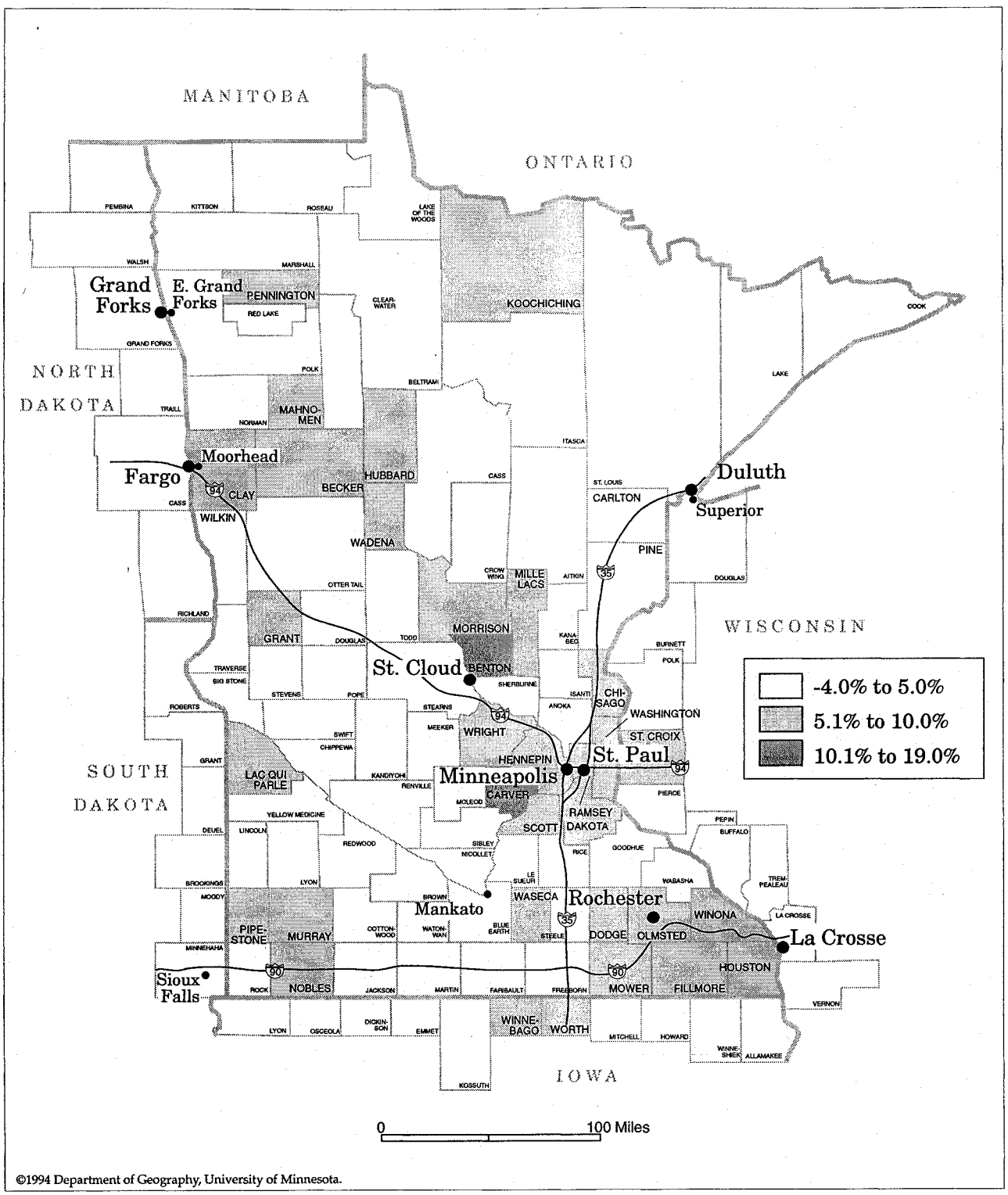


Figure 9. Change in Share of Jobs Taken by Nonresident Workers, 1980-1990. In-commuting continued to expand in metropolitan counties during the 1980s. In Greater Minnesota, though, growth of in-commuting was distributed in a pattern different from the 1970s. *(Data source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.)*

their out-commuting by more than 10 percent in the 1980s; similar growth rates occurred north of Grand Forks and southwest of St. Cloud (Figure 7). In most cases, these changes affect only a few hundred workers, as rural communities become integrated into regional or metropolitan labor markets for the first time. In townships with small populations, however, such commuter flows can exert a significant influence on local employment and retail conditions.

Flows of workers among labor markets in greater Minnesota often reflect the changing fortunes of specific industries -- and in some cases, individual firms. Marshall County, a sparsely-settled community of 4,300 workers in 1990, began to send increasing numbers of workers to nearby manufacturing centers in the last decade (Figure 7). Many of these changes are associated with the labor requirements of nearby manufacturing plants. In Roseau, Polaris Industries expanded its snowmobile, watercraft, and ATV manufacturing operations over the last decade, and now employs more than 1,000 workers -- a number representing more than a tenth of the county's entire workforce.[3] In Warroad, recent expansion has made Marvin Windows the region's largest employer at 3,200 workers -- in a town with a total population of only 1,700. In contrast, Thief River Falls has had to diversify its job base in the wake of scaled-down production at the local snowmobile manufacturer.[4] Such changes have stimulated increased interaction among counties between Grand Forks and the Canadian border, and several counties now contribute net flows of workers to Roseau and Thief River Falls (Figure 4).

III. MODELING COMMUTER FLOWS AMONG MINNESOTA'S LOCAL LABOR MARKETS

The geographical structure of local labor markets reflects a complex locational interdependency between workers and firms. On the one hand, workers typically choose residences so as to minimize their overall commuting costs, balancing this with other locational considerations such as the characteristics of the housing unit and its surrounding neighborhood.[5] Consequently, the residences of workers are located in close proximity to employment opportunities matching their skills and wage requirements. Rapid growth in industries within easy commuting distance of a community, therefore, may attract other workers and influence a variety of statistics describing the importance of the neighborhood as an *origin*: working-age population, labor force participation rate, and occupied housing units (Table 5).

On the other hand, employers must seek out locations accessible to a suitable labor force, balancing such considerations with other important locational factors (land availability, access to inputs and markets, etc.).[6] Vigorous residential growth in a certain area may thus attract certain types of businesses to a community, reflected in statistics which describe the importance of the place as a *destination*: total employment, number of business establishments, and workers in local businesses (Table 5).

A. METHODOLOGY: STEPWISE MULTIPLE REGRESSION

To analyze the flows of workers among Minnesota's regional labor markets, we developed and tested a series of multiple regression models relating commuter flows to demographic and economic variables (Table 5). We used a technique known as 'stepwise regression,' which is an iterative routine for choosing independent variables that best explain

Table 5. Independent Variables used in Multiple Regression Analyses.

Origin and destination models:

1. Population aged 16 and over.
2. Change in population aged 16 and over.
3. Change in local employment.
4. Change in labor force participation ratio.
5. Change in number of occupied housing units.
6. Change in number of local business establishments.
7. Change in number of employees in local business establishments.

Origin change and destination change models:

1. Share of commuters working outside county of residence (at end of decade).
2. Share of jobs taken by nonresident workers (at end of decade).
3. Population aged 16 and over.
4. Change in population aged 16 and over.
5. Change in local employment.
6. Change in labor force participation ratio.
7. Change in number of occupied housing units.
8. Change in number of local business establishments.
9. Change in number of employees in local business establishments.

Data source: U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.

the variance of a dependent variable. Stepwise regression is used to select variables for input to the more familiar multiple regression procedures, and nearly all of today's computer statistical packages include routines for various kinds of stepwise analysis.

The stepwise routine is rather straightforward, and involves building a multiple regression model in an iterative fashion. First, we specify the dependent variable, along with a list of independent variables that we think will help explain the dependent variable. In this study we wish to explain various aspects of work journey flows across the state, so for several different models we specified independent variables to measure the rate (and rate of change) of inter-county commuting; we then specified several demographic and economic conditions typically associated with changing commuter flows (Table 5). Next, the stepwise routine adds independent variables one by one to the model, selecting only those that pass a test of statistical significance (we can specify the minimum significance level required for a variable to enter the model).

Adding independent variables, however, has the effect of altering the relations among variables that have been added in previous steps -- which can reduce the significance of the entire model. After each iteration, therefore, significance tests are performed on all variables in the model, and those failing to meet a specified threshold are excluded. This is an important part of stepwise analysis, since many multiple regression models suffer from considerable levels of intercorrelation among independent variables. The stepwise routine stops when all significant variables are included in the model.

For our purposes, stepwise regression offers two main advantages over models specified in an *a priori* fashion. First, stepwise models include only those variables that are statistically significant, imposing an extra measure of rigor on the conclusions drawn from the results. Second, stepwise analysis provides a logical method for comparing the relative explanatory power of variables in different time periods. One purpose of this study is to determine whether

variables that are significant in explaining commuting trends in the 1970s are also relevant in the 1980s.

In order to compare the explanatory power of different variables over time, we constructed several sets of models. We calibrated separate equations to analyze the share of commuters working outside their county of residence (an *origin model*) and the share of local jobs taken by nonresident workers (a *destination model*). We calibrated separate models for 1980 and 1990, as well as for the rates of change during the 1970s and 1980s (the latter comprising *origin change* and *destination change* models). A total of eight regression equations were estimated, yielding the results summarized in Tables 6 and 7.

To illustrate how the results of these models should be interpreted, consider Table 6.[7] The left column of numbers presents the results of the origin model for 1980, in which we try to predict each county's share of commuters working in other counties (the dependent variable) on the basis of changes in population, housing, and employment (independent variables) during the 1970s. Aside from a constant value (4.65), there are only two independent variables which contribute in any significant manner: change in population aged 16 and over, and change in the number of local business establishments. For each of these variables, two values are listed: a regression coefficient and, in parentheses, a partial correlation coefficient.

The *regression* coefficient measures the response of the dependent variable to each unit of change in the respective independent variable. Each one-percent increase in a county's population aged 16 and over, for example, had a positive effect of 0.43 percent on the share of commuters working in other counties in 1980. The *partial correlation* coefficient ranges from 0 to 1, and measures how much of the variation in the dependent variable can be explained by the respective independent variable, holding other independent variables constant. In this case, population growth during the 1970s explains a full 44 percent of the county-to-county variation in rates of out-commuting in 1980. In contrast, the partial correlation for the number of

Table 6. Determinants of Share of Commuters Working Outside County of Residence and Share of Jobs Taken by Nonresident Workers.

Dependent variables:	**Origin model:** Share of commuters working outside county of residence		**Destination model:** Share of jobs taken by nonresident workers	
	1980	1990	1980	1990
Independent variables:				
Constant	4.65	86.72	-14.00	14.74
Population aged 16 and over (log)		**-6.13** (0.08)	**2.22** (0.04)	
Change in population aged 16 and over	**0.43** (0.44)	**1.39** (0.33)		
Change in number of local business establishments	**0.16** (0.02)		**0.18** (0.35)	
Change in number of employees in local business establishments		**-0.32** (0.06)		**-0.17** (0.08)
Change in number of occupied housing units				**0.69** (0.42)
R^2	0.46	0.47	0.39	0.51

Notes:
1. Coefficients significant at $P < 0.05$ are shown in boldface.
2. All coefficients are unstandardized.
3. Partial correlation coefficients from stepwise analysis shown in parentheses.

Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.

Table 7. Determinants of Change in Share of Commuters Working Outside County of Residence and Change in Share of Jobs Taken by Nonresident Workers.

Dependent variables:	**Origin change model:** Change in share of commuters working outside county of residence		**Destination change model:** Change in share of jobs taken by nonresident workers	
	1970-1980	1980-1990	1970-1980	1980-1990
Independent variables:				
Constant	11.65	4.79	9.91	1.01
Share of commuters working outside county of residence (at end of decade)	**0.17** (0.14)	**0.22** (0.12)		
Share of jobs taken by nonresident workers (at end of decade)		**-0.19** (0.10)	**0.33** (0.21)	**0.18** (0.29)
Population aged 16 and over (log)	**-0.95** (0.03)		**-0.98** (0.06)	
Change in number of local business establishments	**-0.07** (0.18)	**-0.08** (0.19)	**-0.08** (0.15)	**-0.04** (0.04)
Change in number of employees in local business establishments	**-0.02** (0.02)		**0.02** (0.01)	**0.04** (0.03)
Change in labor force participation ratio			-0.07 (0.01)	
Change in number of occupied housing units	0.06 (0.02)			
R^2	0.38	0.40	0.46	0.36

Notes:

1. Coefficients significant at $P < 0.05$ are shown in boldface.
2. All coefficients are unstandardized.
3. Partial correlation coefficients from stepwise analysis shown in parentheses.

Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.

business establishments (0.02) makes this variable almost useless for predicting out-commuting. Finally, the *multiple coefficient of determination* (R^2=0.46) measures the explained proportion of the variation in the dependent variable, incorporating all the significant independent variables. In this case, 46 percent of the county-to-county variation in out-commuting may be explained by population and employment conditions.

B. MODEL RESULTS

Overall, the models fail to predict commuter flows with any degree of precision, and the best models explain only about half of the total variation in their respective independent variables (Tables 6 and 7). These results suggest that interaction among local labor markets need not reflect (or cause) changes in underlying demographic or economic conditions -- at least not in any simple linear fashion. Such a conclusion is fully consistent with recent work by geographers and planners, which shows that the locational interdependencies between residences and employment centers has been relaxed over the past generation.[8] The result has been a dispersal of work-related travel across diffuse, low-density labor markets in patterns that are too complex to be modeled in terms of aggregate population and housing variables.[9]

Despite their lackluster predictive ability, these models do provide significant findings on the geographical structure of the state's local labor markets. Calibrating several sets of models allows us to compare the utility of separate factors in explaining different kinds of commuter flows, and to see how these relationships change over time. Careful inspection of the regression equations summarized in Tables 6 and 7 provides a number of substantive findings.

1. Origin model. Our first set of models analyzes the factors which explain variation in the shares of workers who commute outside their county of residence. As expected, the single most important variable is population growth over the previous decade, which explains more than a third of the variance in both 1980 and 1990 (Table 6). On average, a one-percent increase

in a county's population over age 15 during the 1970s was associated with a share of outbound commuters that was one-half percentage point higher than in a no-growth county. During the 1980s this effect strengthened, so that a one-percent increase in population augmented the share of outcommuters by 1.4 percent.

The coefficients for the origin model suggest a slight realignment of commuter flows down the urban hierarchy. While the coefficient for population *growth* is positive and significant in both years, total population aged 16 and over has a negative sign in 1990. This result is a consequence of the logarithmic transformation of the total population variable, combined with changes in the most heavily populated metropolitan counties. Still, the model suggests that commuter flows are increasingly important in some of the state's nonmetropolitan labor markets. Most of the model's underpredictions were in rapidly growing exurban counties in the 1970s, but ten years later many rural counties had much higher rates of out-commuting than predicted (Figure 10).

2. Origin change model. Our second set of models analyzes the factors influencing the rate of change in out-commuting from different places. As expected, the coefficients for the rate of out-commuting at decade's end are positive and significant, confirming that counties with well-developed connections to regional commuting fields tended to strengthen these ties in the 1970s and 1980s (Table 7). The coefficients for the number of local business establishments are also as expected, negative and significant for both decades. An increasing number of local business establishments in a county provided intervening opportunities for local residents, but the low value of these coefficients indicates that the effect on inter-county flows is rather small, and the overall relationship has exceptions in both metro and non-metro counties (Figure 12).

Overall, the origin change model provides results in line with our expectations. The explained variation is distributed among several different variables in the 1970s, though, complicating the interpretation somewhat (Table 7). More notably, though, the coefficient for

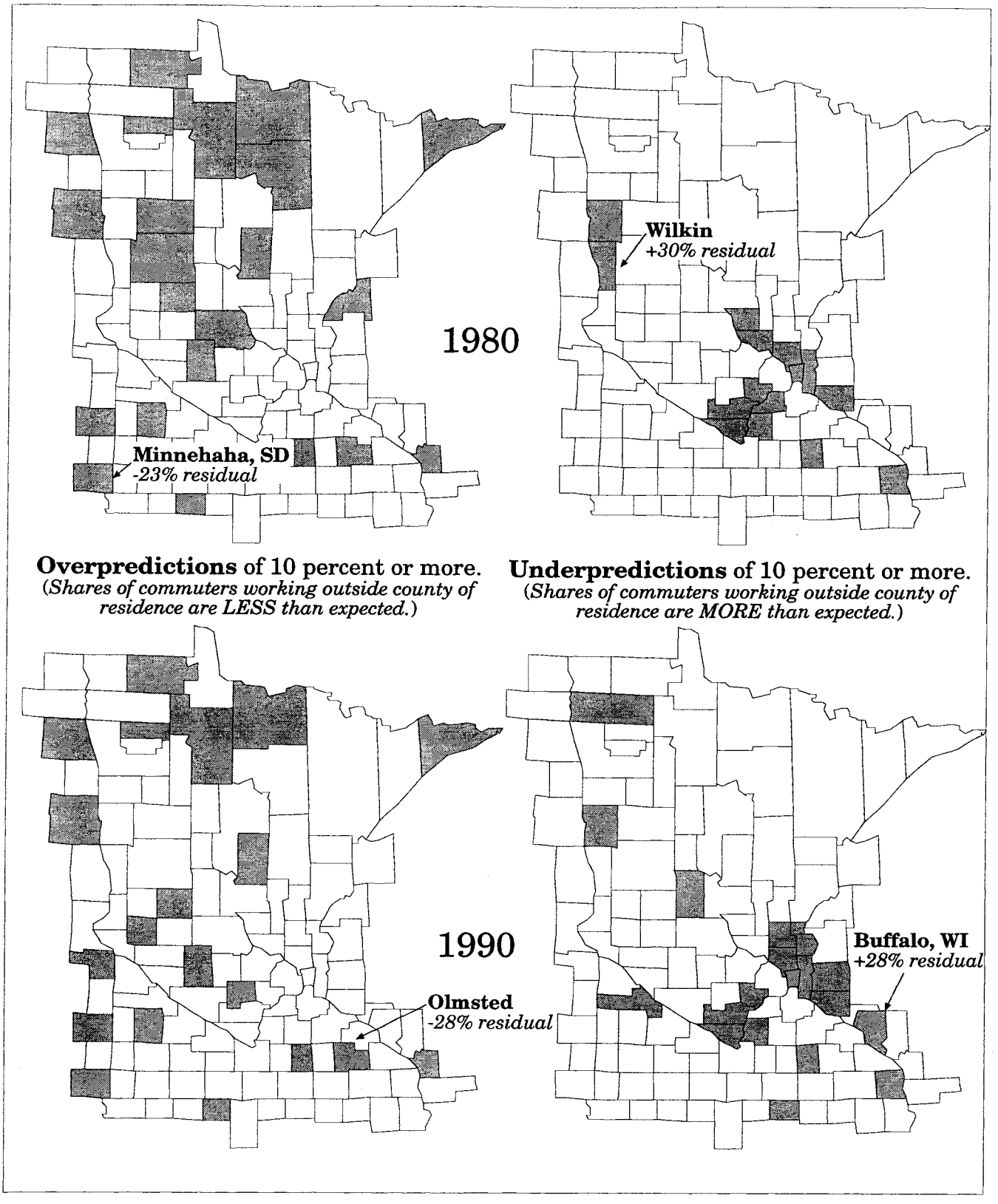


Figure 10. Unstandardized Residuals, Origin Model. *(Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.)*

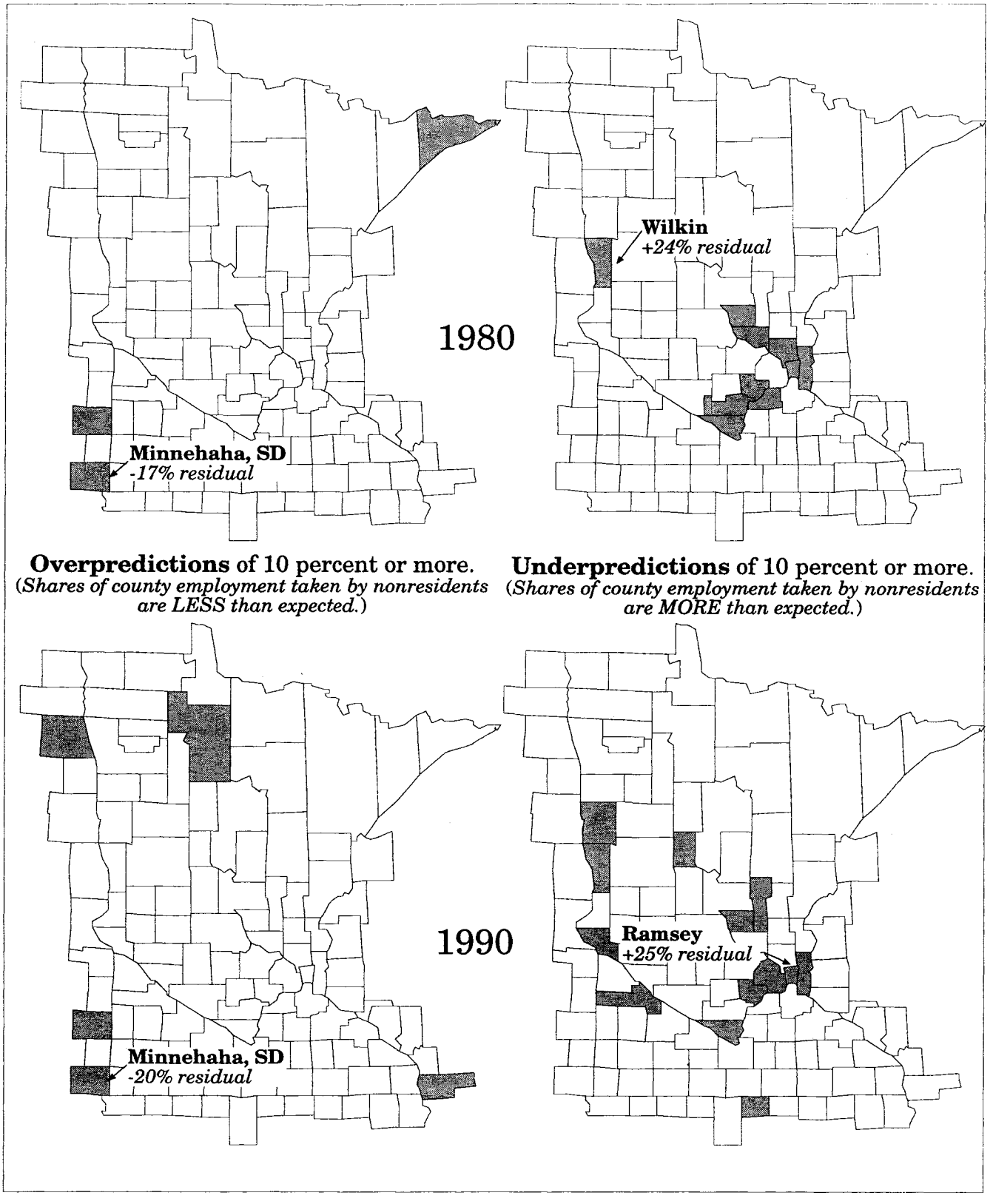


Figure 11. Unstandardized Residuals, Destination Model. *(Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.)*

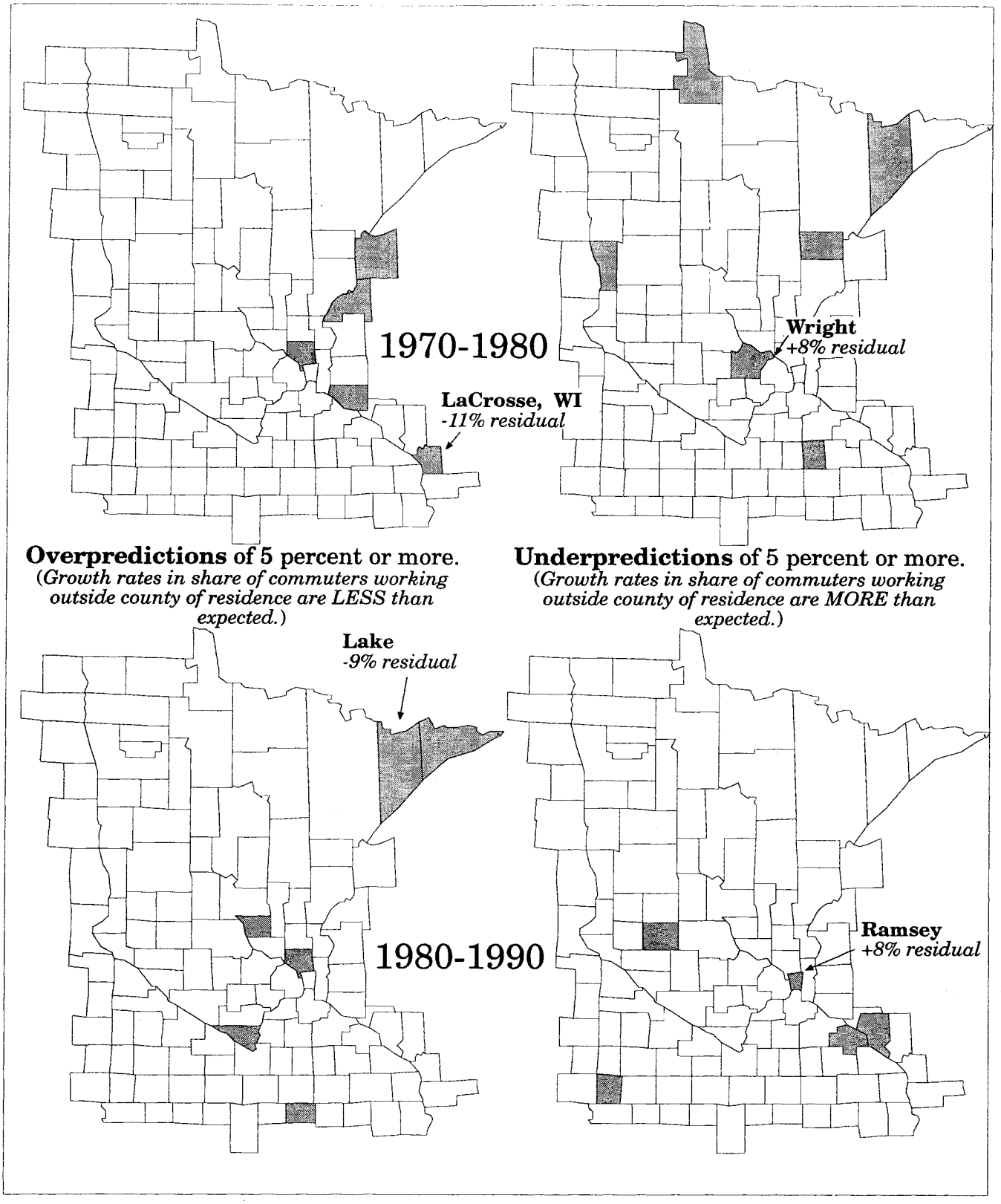


Figure 12. Unstandardized Residuals, Origin Change Model. *(Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.)*

the nonresident-worker variable is negative and significant in the 1980s. On average, a one percent difference in the share of nonresident workers in 1990 corresponded to a one-fifth percent differential in the growth rate of out-commuting over the 1980s (Table 7). While any interpretation of this finding must necessarily remain speculative, such results are fully consistent with the notion that regional labor markets have become more functionally differentiated since 1970. Counties without significant locational attractions are losing many of their roles as providers of basic goods and services, leading to a greater reliance on nearby regional centers for employment. Meanwhile retail trade, services, and manufacturing have diffused outward from metropolitan cores at the same time nonmetropolitan markets are being consolidated into selected regional centers.

3. Destination model. The third set of models examines factors influencing the share of jobs taken by nonresident workers. As expected, jobs in local business establishments play the most important role in 1980, explaining fully one-third of the total variation (Table 6). Ten years later, however, this factor is not significant, and in-commuting rates are most strongly correlated with growth in the local housing stock (which explains more than 40 percent of the total variation) (Table 6). This result appears counterintuitive at first, implying as it does that residential development generates more work-related travel than business expansion. In fact, this finding portrays a gradual maturation of suburban labor markets, a process that has been underway for several decades. Rapid residential growth in outlying areas continues to pull people and purchasing power farther away from densely-developed urban cores, creating powerful incentives for employers to seek out suburban locations. At the same time, certain manufacturing operations have dispersed even farther to exurban townships along major highways, and these areas are also attracting subdivisions with inexpensive homes. The consequence is a close statistical association between housing growth and increased shares of

nonresident workers (Table 6) and a broad zone of higher-than-predicted rates of in-commuting around the Twin Cities (Figure 11).

4. Destination change model. Our final set of models examines trends in nonresident workers during the 1970s and 1980s. As anticipated, counties with well-developed connections at the end of the decade saw these links strengthened (Table 7). The smaller magnitude of the coefficient for the nonresident-worker variable in the 1980s, though, suggests that growth in in-commuting also affected counties that were less tightly integrated into the regional system. Overall, however, the destination change model yielded few extreme under- and over-predictions (Figure 13).[10]

Taken together, the origin- and destination-change models provide results that are in line with many of our expectations. Significantly, though, there have been subtle changes in the way that growth rates in one decade shape future commuter flows. The share of a county's residents working elsewhere is only moderately useful in predicting growth in out-commuting, and its utility is declining (partial correlations fell from 0.14 to 0.12; Table 7). In contrast, a county's share of nonresident workers is reasonably well correlated with growth rates in in-commuting, and the relation is strengthening (partial correlations rose from 0.21 to 0.29; Table 7). While any sweeping interpretation of this trend is necessarily risky, it appears that residential portions of the state's labor markets are continuing to decentralize, while employment is consolidated into suburban metropolitan counties and nonmetropolitan regional centers.

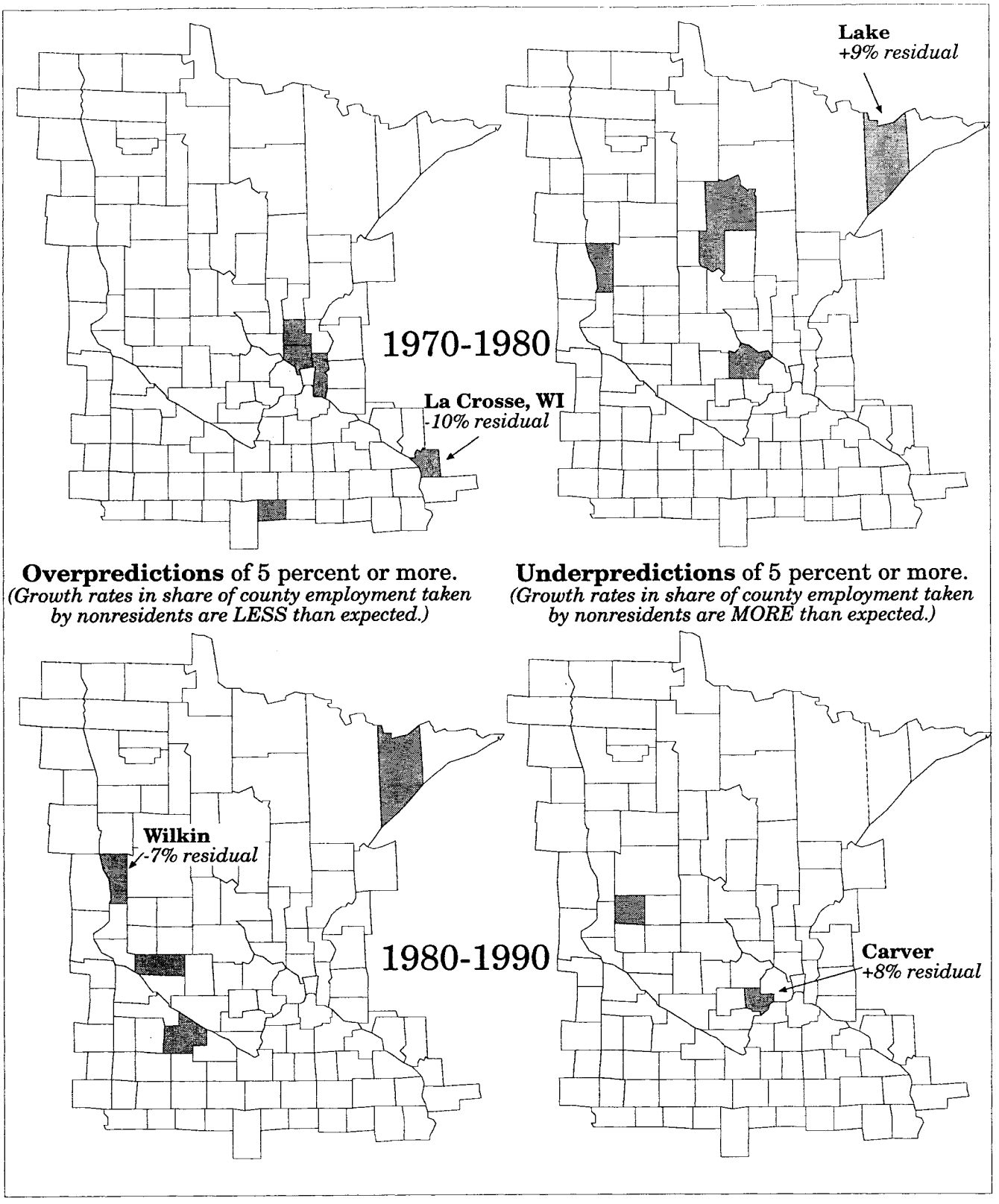


Figure 13. Unstandardized Residuals, Destination Change Model. *(Source: Results of multiple regression analyses. Data based on special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables; Bureau of Economic Analysis data; and County Business Patterns.)*

IV. CONCLUSIONS

Commuting patterns around many American cities today mirror the spatial reorganization of the early postwar period, when population and employment first began to spill outside central city limits. By the 1970s this scenario was being played out on an expanded spatial scale, as decentralized growth laid down several rings of residential suburbs. Further growth spilled into unincorporated townships across county and metropolitan boundaries, a trend which (along with inter-urban migration movements) prompted some geographers hastily to proclaim an era of "counterurbanization."[11] Within a few years the suburbs closed yet another frontier in American settlement, and for the first time a majority of the nation's population was classified as suburban. As one prominent geographer noted, by the late 1980s, "the outer city [was] no longer 'sub' to the 'urb.'"[12]

The results of this study suggest continued changes in the fine-grained network of local labor markets in Minnesota. In the region's densely-settled metropolitan areas, population continues to disperse; market-reliant employment recentralizes along selected suburban corridors; and other firms are attracted to inexpensive, accessible exurban and small-town locations that provide a highly skilled labor force at low wages.[13]

Together, these trends have strengthened the interdependence of the region's local labor markets. By 1990, more than 70,000 workers commuted to jobs in the Twin Cities from residences outside the Metropolitan Council's jurisdiction.[14] Flows of this magnitude may be negligible compared to the hundreds of thousands of metropolitan residents, but in rural and exurban townships even a commuter stream of a few dozen can play an important role in the local community -- just as suburban gridlock and daily traffic reports have come to occupy an important place in the mind of most American suburbanites.[15]

The findings of this study suggest that an increasing share of Minnesota's residents are tied into diffuse regional labor markets that rely on cheap automobile transportation to link areas with deficits and surpluses of labor. In some cases workers have made explicit choices to trade driving time for residential amenities, but in other situations the work journey represents more of survival strategy to cope with declining local opportunities. In either case, it is important to recognize the considerable inertia associated with the investment in roads, industries, and homes in labor markets that sprawl outward from established population centers.[16] Many parts of settlement systems laid down in one era are discarded as unprofitable within a few generations, due to the changing costs of factors of production, different transport and communication technologies, or the fortunes of particular regions and industries.[17] Such changes require, at the very least, coordinated planning efforts among the fragmented political units of metropolitan and greater Minnesota.

References

[1] Net flows of commuters to Roseau and Pennington counties appear to result from employment growth in local manufacturing, but this interpretation is less clear in the case of Wadena County (see Figure 5, right panel). Residential growth around the city of Wadena has begun to spill westward into Otter Tail County, so even as Wadena County's population has declined (from 10,300 over age 16 in 1980 to 9,800 ten years later) the net inflow of commuters has strengthened. Over the 1980s, Wadena County gained only 150 jobs.

[2] See Borchert, J. R., and N. C. Gustafson (1980). *Atlas of Minnesota Resources and Settlement*. Minneapolis: Center for Urban and Regional Affairs.

[3] Company officials describe their recent decision to move some operations to Iowa in terms of conditions in the local labor market: "Employment growth at our Roseau facility, as well as other northwest Minnesota-based manufacturers, has limited the rate of growth that can be achieved in this region." Petersen, S. E. (1994). "Polaris Industries will soon move some operations to Spirit Lake, Iowa." *Star-Tribune* (Minneapolis), 25 June, 18D. See also *Star-Tribune* (Minneapolis) (1994). "Go Northwest, young men: Warroad, Roseau in enviable position of having more jobs than people." 6 July, 1D.

[4] Thief River Falls's largest employer in 1980, a snowmobile manufacturer, restructured in the early 1980s. By 1990 it was classified in the 500-to-749-employee category, while the local Occupational Development Center had expanded to become the second-largest employer. Unless otherwise noted, all figures on local employers are from selected annual editions of the *Minnesota Directory of Manufacturers*. Burnsville, MN: National Information Services, Inc.

[5] Alonso, W. (1964). *Location and Land Use: Toward a General Theory of Land Rent.* Cambridge, MA: Harvard University Press.

[6] Scott, A.J. (1988). *Metropolis: From the Division of Labor to Urban Form.* Berkeley: University of California Press.

[7] What follows is a simplified discussion of how to interpret multiple regression results. Readers interested in technical details, statistical assumptions, and other applications should consult the following texts: Abler, R. F., J. S. Adams and P. R. Gould (1971). *Spatial Organization: The Geographer's View of the World.* Englewood Cliffs, NJ: Prentice-Hall; and Johnston, R. J. (1978). *Multivariate Statistical Analysis in Geography: A Primer on the General Linear Model.* London: Longman.

[8] Hanson, S., and G. Pratt (1988). "Reconceptualizing the links between home and work in urban geography." *Economic Geography* 64(4), 299-321; Giuliano, G. (1993). "Is jobs-housing balance a transportation issue?" *Transportation Research Record* 1305, 305-12.

[9] It should be noted, however, that our study relies on data that have been aggregated to a considerable degree. The models summarized in Tables 6 and 7 relate each county's commuter flows to a series of independent variables, but *do not differentiate between different origins and destinations.* While we have not calibrated models of the latter type, it is highly likely that such a gravity-model approach would yield better overall predictive results.

[10] The destination change model explained little more than a third of the total variation in the dependent variable. Most of the model's residuals are within a few percentage points of the observed values of the dependent variables, though, so Figure 13 shows only a few counties with extreme residuals.

[11] Berry, B. J. L., ed. (1976). *Urbanization and Counter-Urbanization.* Beverly Hills, CA: Sage Publications.

[12] Muller, P. (1989). "The transformation of bedroom suburbia into the outer city: An overview of metropolitan structural change since 1947." In Kelly, B., ed. *Suburbia Re-Examined.* New York: Greenwood Press, p. 43.

[13] Hart, J. F. (1993). "Small town and demographic crisis." In *Rural Investment Guide: Programs and Policies for Rural Minnesota.* St. Paul: Minnesota Department of Trade and Economic Development, pp. 18-19.

[14] Adams, J. S., and E. K. Wyly (1994). *Commuter Linkages Among Counties in the Twin Cities and Greater Minnesota.* Report No. MN/RC-94/02. St. Paul: Minnesota Department of Transportation.

[15] See, for example, Cassano, D. (1994). "Growing pains: swelling of metro fringe areas puts squeeze on residents." *Star Tribune* (Minneapolis), 4 July, 1A.

[16] Borchert, J. R., and W. Casey (1994). *Real Property Value in the Heart of the Upper Midwest.* Minneapolis: Center for Urban and Regional Affairs.

[17] Hudson, J. (1991). "New grain networks in an old urban system." In Hart, J. F., ed. *Our Changing Cities.* Baltimore, MD: Johns Hopkins University Press.

Appendix A

Data Sources

APPENDIX A

Data Sources

This study is based on data derived from three sources:

(1) **Population and housing** figures were derived from the regular decennial census reports of the U.S. Bureau of the Census for 1970, 1980, and 1990. For 1970, we used Table 60 of *Detailed Housing Characteristics*, Tables 121 and 122 of *General Social and Economic Characteristics*, and Table 60 of *Detailed Housing Characteristics*. For 1980, we used Table A6 of *General Housing Characteristics*, and Table 176 of *General Social and Economic Characteristics*. For 1990, we used Table 6 of *Summary Social, Economic, and Housing Characteristics* and Table 7 of *Summary Population and Housing Characteristics*.

(2) Information on **employment and business establishments** was taken from the U.S. Department of Commerce reports, *County Business Patterns* , for 1970, 1980, and 1990.

(3) **County-to-county commuter flows** were derived from tabulations of the U.S. Bureau of the Census journey-to-work frequency tables. For 1990, we obtained machine-readable "County of Residence by County of Work Data Files" directly from the Journey-to-Work and Migration Statistics Branch of the Census Bureau's Population Division. For 1970 and 1980, we used tabulations that were edited by the Bureau of Economic Analysis (BEA) as part of its "Regional Economic Information System." There are small discrepancies between the original census tabulations and the BEA figures, for two reasons. First, the BEA corrected coding errors discovered in the census figures. Second, the BEA figures are based on more detailed tabulations of census figures than are most summary-level reports. Many of these reports present information only on the most important destinations for each county's workers, and ignore minor commuter flows.

Appendix B

Commuter Flows Among Minnesota Counties, 1970-1990

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part I. Outbound Commuting.

County	Total commuters			Residents working in other counties			Percent of residents working in other counties			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Aitkin	2,912	3,748	4,318	390	676	958	13.4	18.0	22.2	Aitkin
Anoka	55,043	89,086	130,496	36,785	53,406	78,792	66.8	59.9	60.4	Anoka
Becker	6,903	9,542	11,142	720	1,194	1,952	10.4	12.5	17.5	Becker
Beltrami	7,775	10,402	13,601	334	744	1,226	4.3	7.2	9.0	Beltrami
Benton	6,952	10,226	14,737	3,456	5,745	8,553	49.7	56.2	58.0	Benton
Big Stone	2,611	2,664	2,610	172	238	482	6.6	8.9	18.5	Big Stone
Blue Earth	17,575	21,602	27,148	1,592	3,076	5,706	9.1	14.2	21.0	Blue Earth
Brown	9,806	11,846	12,652	463	537	1,015	4.7	4.5	8.0	Brown
Carlton	8,066	9,758	11,619	1,215	2,560	3,226	15.1	26.2	27.8	Carlton
Carver	9,862	16,247	25,579	4,526	8,705	13,762	45.9	53.6	53.8	Carver
Cass	4,333	5,597	7,517	819	1,260	2,530	18.9	22.5	33.7	Cass
Chippewa	4,890	5,150	5,820	361	655	1,102	7.4	12.7	18.9	Chippewa
Chisago	4,473	10,068	13,699	1,990	4,556	7,460	44.5	45.3	54.5	Chisago
Clay	15,990	20,891	23,842	5,406	8,162	10,802	33.8	39.1	45.3	Clay
Clearwater	2,461	2,439	2,825	95	312	590	3.9	12.8	20.9	Clearwater
Cook	1,201	1,492	1,673	47	150	71	3.9	10.1	4.2	Cook
Cottonwood	4,670	5,809	5,434	271	493	691	5.8	8.5	12.7	Cottonwood
Crow Wing	9,818	12,952	17,849	493	956	1,455	5.0	7.4	8.2	Crow Wing
Dakota	50,235	88,628	150,548	29,271	48,890	82,888	58.3	55.2	55.1	Dakota
Dodge	4,693	5,900	7,590	1,265	2,387	3,798	27.0	40.5	50.0	Dodge
Douglas	7,764	10,706	12,637	314	631	1,156	4.0	5.9	9.1	Douglas
Faribault	5,998	6,963	7,107	333	577	1,033	5.6	8.3	14.5	Faribault
Fillmore	7,583	8,544	9,322	914	1,416	2,498	12.1	16.6	26.8	Fillmore
Freeborn	12,545	14,276	14,489	633	973	2,018	5.0	6.8	13.9	Freeborn
Goodhue	12,381	16,107	19,191	1,798	2,994	4,802	14.5	18.6	25.0	Goodhue
Grant	2,282	2,359	2,590	238	280	466	10.4	11.9	18.0	Grant

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part I. Outbound Commuting (continued).

County	Total commuters			Residents working in other counties			Percent of residents working in other counties			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Hennepin	384,245	453,800	557,411	42,188	53,403	78,829	11.0	11.8	14.1	Hennepin
Houston	6,359	7,136	8,817	2,049	2,623	3,940	32.2	36.8	44.7	Houston
Hubbard	2,725	4,234	5,709	445	1,124	1,752	16.3	26.5	30.7	Hubbard
Isanti	5,075	8,770	11,720	1,931	3,571	6,031	38.0	40.7	51.5	Isanti
Itasca	9,196	12,839	14,869	744	1,484	1,790	8.1	11.6	12.0	Itasca
Jackson	4,290	5,429	4,971	532	793	951	12.4	14.6	19.1	Jackson
Kanabec	3,544	4,177	5,418	728	1,025	1,741	20.5	24.5	32.1	Kanabec
Kandiyohi	10,473	14,880	17,648	443	813	1,346	4.2	5.5	7.6	Kandiyohi
Kittson	2,209	2,378	2,373	149	274	374	6.7	11.5	15.8	Kittson
Koochiching	5,003	6,032	7,037	127	161	225	2.5	2.7	3.2	Koochiching
Lac qui Parle	3,665	4,030	3,669	273	351	646	7.4	8.7	17.6	Lac qui Parle
Lake	4,102	4,588	4,192	460	1,020	778	11.2	22.2	18.6	Lake
Lake of the Woods	1,361	1,521	1,853	74	254	423	5.4	16.7	22.8	Lake of the Woods
Le Sueur	6,749	8,964	10,735	1,750	3,297	4,931	25.9	36.8	45.9	Le Sueur
Lincoln	2,701	3,111	2,871	198	364	566	7.3	11.7	19.7	Lincoln
Lyon	8,408	10,724	11,706	242	394	600	2.9	3.7	5.1	Lyon
McLeod	9,674	12,798	15,659	963	1,217	2,528	10.0	9.5	16.1	McLeod
Mahnomen	1,586	1,662	1,645	186	247	368	11.7	14.9	22.4	Mahnomen
Marshall	3,729	4,426	4,295	533	751	1,299	14.3	17.0	30.2	Marshall
Martin	8,210	9,986	10,182	505	575	805	6.2	5.8	7.9	Martin
Meeker	6,091	7,920	9,160	895	1,566	3,036	14.7	19.8	33.1	Meeker
Mille Lacs	4,633	6,367	7,754	866	1,442	2,441	18.7	22.6	31.5	Mille Lacs
Morrison	8,136	9,642	12,002	776	1,243	2,402	9.5	12.9	20.0	Morrison
Mower	14,964	15,674	16,064	1,051	2,054	3,039	7.0	13.1	18.9	Mower
Murray	3,717	4,097	4,049	396	597	794	10.7	14.6	19.6	Murray
Nicollet	8,339	11,333	14,316	3,457	5,051	6,394	41.5	44.6	44.7	Nicollet
Nobles	6,417	8,822	9,057	279	342	731	4.3	3.9	8.1	Nobles

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part I. Outbound Commuting (continued).

County	Total commuters			Residents working in other counties			Percent of residents working in other counties			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Norman	2,905	3,108	3,153	325	312	617	11.2	10.0	19.6	Norman
Olmsted	31,705	43,532	56,266	1,012	1,324	2,636	3.2	3.0	4.7	Olmsted
Otter Tail	14,654	18,035	21,663	902	1,573	2,613	6.2	8.7	12.1	Otter Tail
Pennington	4,817	5,982	5,569	229	274	410	4.8	4.6	7.4	Pennington
Pine	5,206	6,372	7,845	1,181	1,697	2,521	22.7	26.6	32.1	Pine
Pipestone	3,973	4,182	4,375	115	252	444	2.9	6.0	10.1	Pipestone
Polk	11,044	12,568	13,664	2,177	2,696	3,382	19.7	21.5	24.8	Polk
Pope	3,726	4,073	4,419	386	525	1,062	10.4	12.9	24.0	Pope
Ramsey	181,290	208,943	247,095	38,383	55,035	88,196	21.2	26.3	35.7	Ramsey
Red Lake	1,472	1,574	1,722	193	311	464	13.1	19.8	26.9	Red Lake
Redwood	6,206	7,048	7,503	456	644	1,072	7.3	9.1	14.3	Redwood
Renville	6,892	7,327	7,359	812	1,273	1,438	11.8	17.4	19.5	Renville
Rice	14,654	18,526	24,055	1,521	2,826	4,907	10.4	15.3	20.4	Rice
Rock	3,662	4,435	4,395	323	414	968	8.8	9.3	22.0	Rock
Roseau	3,490	4,306	7,036	96	71	154	2.8	1.6	2.2	Roseau
St. Louis	71,523	81,333	81,536	2,762	4,607	5,438	3.9	5.7	6.7	St. Louis
Scott	10,537	18,452	30,088	4,382	9,166	17,756	41.6	49.7	59.0	Scott
Sherburne	5,567	11,419	20,102	3,251	7,511	13,589	58.4	65.8	67.6	Sherburne
Sibley	5,463	6,191	6,625	1,161	1,631	2,268	21.3	26.3	34.2	Sibley
Stearns	29,643	42,800	58,118	2,377	5,057	8,979	8.0	11.8	15.4	Stearns
Steele	10,058	12,945	15,279	663	999	1,825	6.6	7.7	11.9	Steele
Stevens	3,490	4,192	4,616	114	275	365	3.3	6.6	7.9	Stevens
Swift	4,135	4,999	4,397	265	405	829	6.4	8.1	18.9	Swift
Todd	6,564	8,881	9,309	786	1,397	2,504	12.0	15.7	26.9	Todd
Traverse	2,041	1,884	1,751	133	195	238	6.5	10.4	13.6	Traverse
Wabasha	5,937	7,611	9,037	868	1,773	3,521	14.6	23.3	39.0	Wabasha
Wadena	3,625	4,326	5,152	310	360	965	8.6	8.3	18.7	Wadena

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part I. Outbound Commuting (continued).

County	Total commuters			Residents working in other counties			Percent of residents working in other counties			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Waseca	5,545	7,398	8,489	539	888	1,633	9.7	12.0	19.2	Waseca
Washington	27,209	49,403	75,029	17,898	33,597	51,472	65.8	68.0	68.6	Washington
Watonwan	3,885	4,648	5,257	320	492	751	8.2	10.6	14.3	Watonwan
Wilkin	2,965	2,988	3,194	614	1,048	1,383	20.7	35.1	43.3	Wilkin
Winona	15,656	18,663	23,401	738	1,564	2,882	4.7	8.4	12.3	Winona
Wright	13,245	22,955	33,420	4,536	11,140	17,762	34.2	48.5	53.1	Wright
Yellow Medicine	4,661	4,934	4,831	329	687	1,054	7.1	13.9	21.8	Yellow Medicine
State total	1,341,868	1,714,375	2,146,967	246,298	389,628	613,890	18.4	22.7	28.6	State total

Notes:

1. Residents working in other counties: excludes residents working in counties outside the study area.

Data Source: Special tabulations of the U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data; calculations by the authors.

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part II. Inbound Commuting.

County	Total commuters			Nonresident workers			Percent of local jobs filled by nonresident workers			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Aitkin	2,912	3,748	4,318	172	286	328	5.9	7.6	7.6	Aitkin
Anoka	55,043	89,086	130,496	12,212	18,827	30,515	22.2	21.1	23.4	Anoka
Becker	6,903	9,542	11,142	360	619	1,297	5.2	6.5	11.6	Becker
Beltrami	7,775	10,402	13,601	522	998	1,854	6.7	9.6	13.6	Beltrami
Benton	6,952	10,226	14,737	1,263	2,803	6,178	18.2	27.4	41.9	Benton
Big Stone	2,611	2,664	2,610	277	347	431	10.6	13.0	16.5	Big Stone
Blue Earth	17,575	21,602	27,148	3,542	5,275	7,357	20.2	24.4	27.1	Blue Earth
Brown	9,806	11,846	12,652	989	1,485	1,973	10.1	12.5	15.6	Brown
Carlton	8,066	9,758	11,619	967	1,634	1,947	12.0	16.7	16.8	Carlton
Carver	9,862	16,247	25,579	1,500	2,625	9,233	15.2	16.2	36.1	Carver
Cass	4,333	5,597	7,517	449	1,092	1,466	10.4	19.5	19.5	Cass
Chippewa	4,890	5,150	5,820	328	577	917	6.7	11.2	15.8	Chippewa
Chisago	4,473	10,068	13,699	465	1,690	2,847	10.4	16.8	20.8	Chisago
Clay	15,990	20,891	23,842	1,807	3,279	5,685	11.3	15.7	23.8	Clay
Clearwater	2,461	2,439	2,825	107	226	316	4.3	9.3	11.2	Clearwater
Cook	1,201	1,492	1,673	56	36	113	4.7	2.4	6.8	Cook
Cottonwood	4,670	5,809	5,434	454	645	743	9.7	11.1	13.7	Cottonwood
Crow Wing	9,818	12,952	17,849	814	1,092	2,473	8.3	8.4	13.9	Crow Wing
Dakota	50,235	88,628	150,548	12,174	19,936	43,788	24.2	22.5	29.1	Dakota
Dodge	4,693	5,900	7,590	224	560	996	4.8	9.5	13.1	Dodge
Douglas	7,764	10,706	12,637	557	782	1,387	7.2	7.3	11.0	Douglas
Faribault	5,998	6,963	7,107	446	769	688	7.4	11.0	9.7	Faribault
Fillmore	7,583	8,544	9,322	694	757	1,243	9.2	8.9	13.3	Fillmore
Freeborn	12,545	14,276	14,489	686	1,241	1,325	5.5	8.7	9.1	Freeborn
Goodhue	12,381	16,107	19,191	1,420	2,749	4,115	11.5	17.1	21.4	Goodhue
Grant	2,282	2,359	2,590	148	192	465	6.5	8.1	18.0	Grant

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part II. Inbound Commuting (continued).

County	Total commuters			Nonresident workers			Percent of local jobs filled by nonresident workers			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Hennepin	384,245	453,800	557,411	86,647	137,283	222,719	22.5	30.3	40.0	Hennepin
Houston	6,359	7,136	8,817	382	402	942	6.0	5.6	10.7	Houston
Hubbard	2,725	4,234	5,709	209	418	841	7.7	9.9	14.7	Hubbard
Isanti	5,075	8,770	11,720	863	1,414	2,031	17.0	16.1	17.3	Isanti
Itasca	9,196	12,839	14,869	724	1,224	1,039	7.9	9.5	7.0	Itasca
Jackson	4,290	5,429	4,971	207	517	666	4.8	9.5	13.4	Jackson
Kanabec	3,544	4,177	5,418	375	342	602	10.6	8.2	11.1	Kanabec
Kandiyohi	10,473	14,880	17,648	454	974	2,076	4.3	6.5	11.8	Kandiyohi
Kittson	2,209	2,378	2,373	75	127	211	3.4	5.3	8.9	Kittson
Koochiching	5,003	6,032	7,037	99	214	652	2.0	3.5	9.3	Koochiching
Lac qui Parle	3,665	4,030	3,669	67	128	299	1.8	3.2	8.1	Lac qui Parle
Lake	4,102	4,588	4,192	171	788	586	4.2	17.2	14.0	Lake
Lake of the Woods	1,361	1,521	1,853	63	56	90	4.6	3.7	4.9	Lake of the Woods
Le Sueur	6,749	8,964	10,735	935	1,554	1,869	13.9	17.3	17.4	Le Sueur
Lincoln	2,701	3,111	2,871	116	202	298	4.3	6.5	10.4	Lincoln
Lyon	8,408	10,724	11,706	585	1,078	1,733	7.0	10.1	14.8	Lyon
McLeod	9,674	12,798	15,659	1,152	2,381	3,304	11.9	18.6	21.1	McLeod
Mahnomen	1,586	1,662	1,645	66	183	262	4.2	11.0	15.9	Mahnomen
Marshall	3,729	4,426	4,295	203	358	357	5.4	8.1	8.3	Marshall
Martin	8,210	9,986	10,182	216	537	911	2.6	5.4	8.9	Martin
Meeker	6,091	7,920	9,160	420	919	1,005	6.9	11.6	11.0	Meeker
Mille Lacs	4,633	6,367	7,754	639	1,347	2,145	13.8	21.2	27.7	Mille Lacs
Morrison	8,136	9,642	12,002	563	705	1,573	6.9	7.3	13.1	Morrison
Mower	14,964	15,674	16,064	611	905	1,725	4.1	5.8	10.7	Mower
Murray	3,717	4,097	4,049	158	139	334	4.3	3.4	8.2	Murray
Nicollet	8,339	11,333	14,316	1,437	2,962	4,574	17.2	26.1	32.0	Nicollet
Nobles	6,417	8,822	9,057	548	912	1,573	8.5	10.3	17.4	Nobles

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part II. Inbound Commuting (continued).

County	Total commuters			Nonresident workers			Percent of local jobs filled by nonresident workers			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Norman	2,905	3,108	3,153	168	242	335	5.8	7.8	10.6	Norman
Olmsted	31,705	43,532	56,266	3,218	6,509	12,091	10.1	15.0	21.5	Olmsted
Otter Tail	14,654	18,035	21,663	495	906	1,537	3.4	5.0	7.1	Otter Tail
Pennington	4,817	5,982	5,569	537	739	1,162	11.1	12.4	20.9	Pennington
Pine	5,206	6,372	7,845	155	490	831	3.0	7.7	10.6	Pine
Pipestone	3,973	4,182	4,375	253	364	637	6.4	8.7	14.6	Pipestone
Polk	11,044	12,568	13,664	1,120	1,821	2,435	10.1	14.5	17.8	Polk
Pope	3,726	4,073	4,419	97	313	413	2.6	7.7	9.3	Pope
Ramsey	181,290	208,943	247,095	71,369	99,422	133,139	39.4	47.6	53.9	Ramsey
Red Lake	1,472	1,574	1,722	135	245	220	9.2	15.6	12.8	Red Lake
Redwood	6,206	7,048	7,503	413	1,155	874	6.7	16.4	11.6	Redwood
Renville	6,892	7,327	7,359	301	603	774	4.4	8.2	10.5	Renville
Rice	14,654	18,526	24,055	1,227	1,738	3,361	8.4	9.4	14.0	Rice
Rock	3,662	4,435	4,395	258	345	354	7.0	7.8	8.1	Rock
Roseau	3,490	4,306	7,036	156	355	873	4.5	8.2	12.4	Roseau
St. Louis	71,523	81,333	81,536	5,074	6,151	9,199	7.1	7.6	11.3	St. Louis
Scott	10,537	18,452	30,088	2,412	4,687	7,746	22.9	25.4	25.7	Scott
Sherburne	5,567	11,419	20,102	871	2,409	4,732	15.6	21.1	23.5	Sherburne
Sibley	5,463	6,191	6,625	305	434	615	5.6	7.0	9.3	Sibley
Stearns	29,643	42,800	58,118	5,454	9,812	14,632	18.4	22.9	25.2	Stearns
Steele	10,058	12,945	15,279	713	1,657	2,776	7.1	12.8	18.2	Steele
Stevens	3,490	4,192	4,616	271	424	692	7.8	10.1	15.0	Stevens
Swift	4,135	4,999	4,397	305	631	389	7.4	12.6	8.8	Swift
Todd	6,564	8,881	9,309	420	1,040	1,116	6.4	11.7	12.0	Todd
Traverse	2,041	1,884	1,751	89	164	239	4.4	8.7	13.6	Traverse
Wabasha	5,937	7,611	9,037	429	987	1,237	7.2	13.0	13.7	Wabasha
Wadena	3,625	4,326	5,152	519	741	1,675	14.3	17.1	32.5	Wadena

Appendix B. Commuter Flows Among Minnesota Counties, 1970-1990.

Part II. Inbound Commuting (continued).

County	Total commuters			Nonresident workers			Percent of local jobs filled by nonresident workers			County
	1970	1980	1990	1970	1980	1990	1970	1980	1990	
Waseca	5,545	7,398	8,489	705	919	1,450	12.7	12.4	17.1	Waseca
Washington	27,209	49,403	75,029	6,383	11,882	23,043	23.5	24.1	30.7	Washington
Watonwan	3,885	4,648	5,257	294	392	707	7.6	8.4	13.4	Watonwan
Wilkin	2,965	2,988	3,194	347	846	773	11.7	28.3	24.2	Wilkin
Winona	15,656	18,663	23,401	1,376	1,875	3,675	8.8	10.0	15.7	Winona
Wright	13,245	22,955	33,420	1,015	2,472	4,966	7.7	10.8	14.9	Wright
Yellow Medicine	4,661	4,934	4,831	488	831	1,001	10.5	16.8	20.7	Yellow Medicine
State total	1,341,868	1,714,375	2,146,967	227,616	354,596	554,093	17.0	20.7	25.8	State total

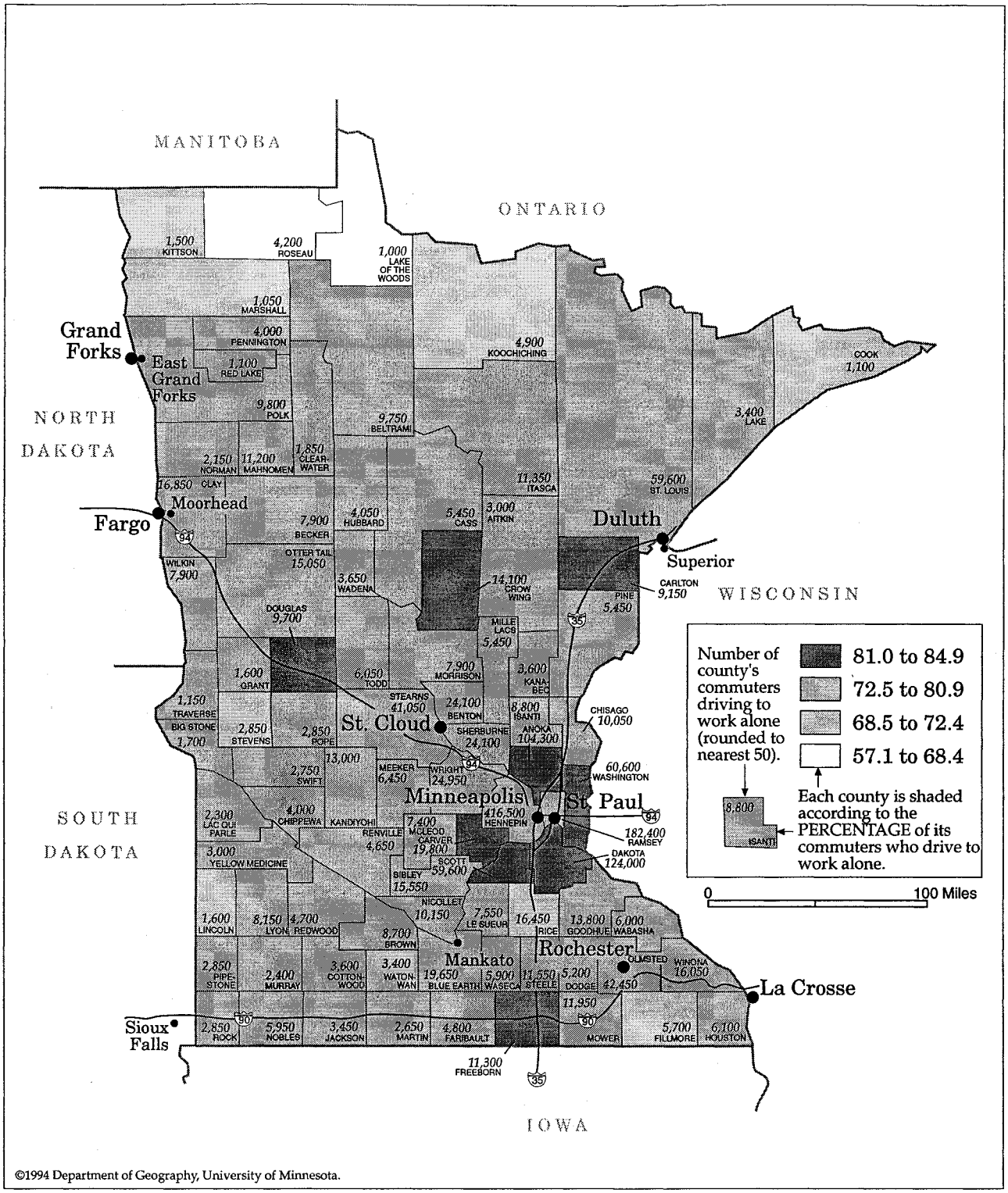
Notes:

1. Nonresident workers: excludes workers residing outside the study area.
2. State totals for inbound and outbound commuting do not match due to commuter flows with counties outside the study area.

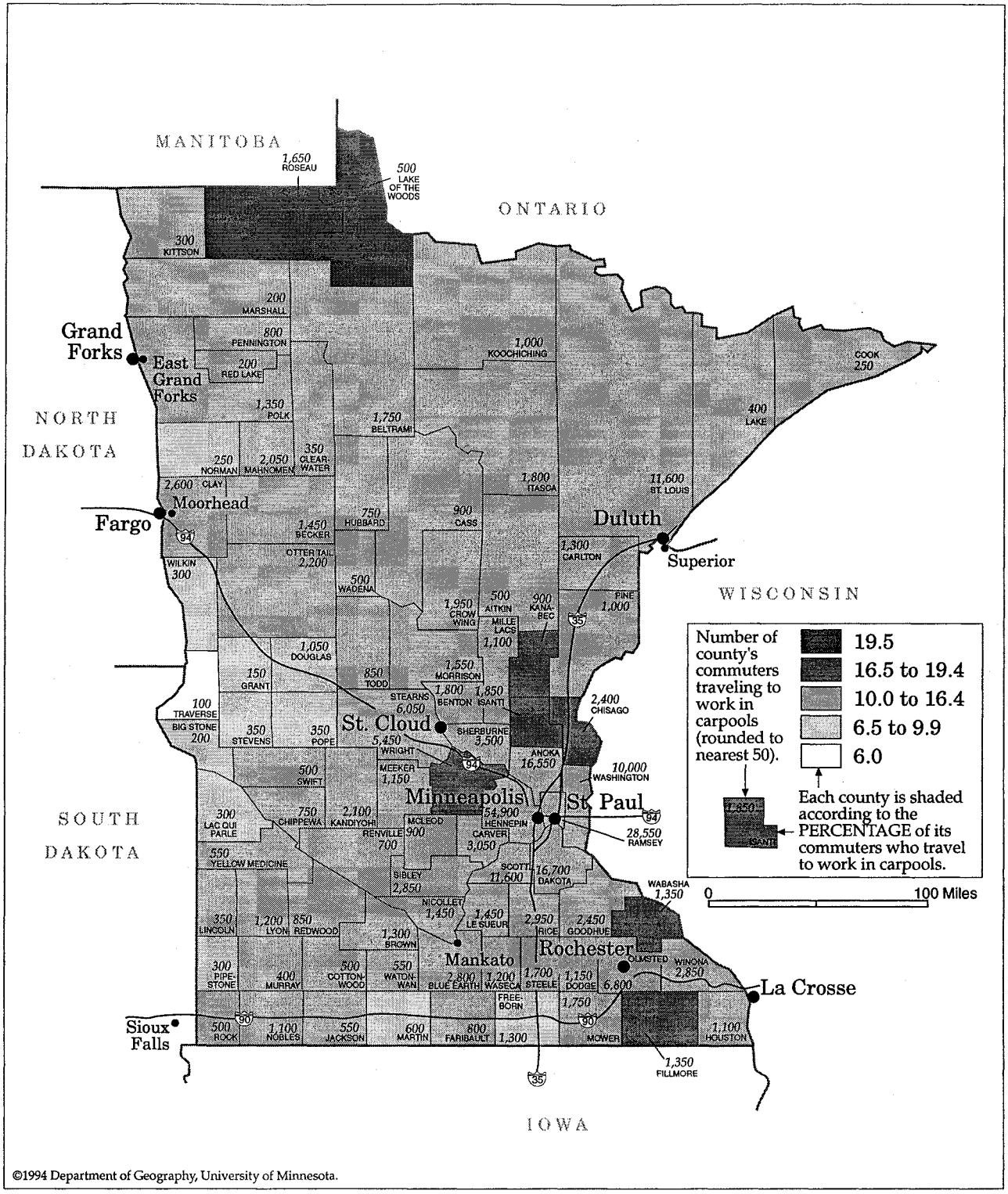
Data Source: Special tabulations of the U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data; calculations by the authors.

Appendix C

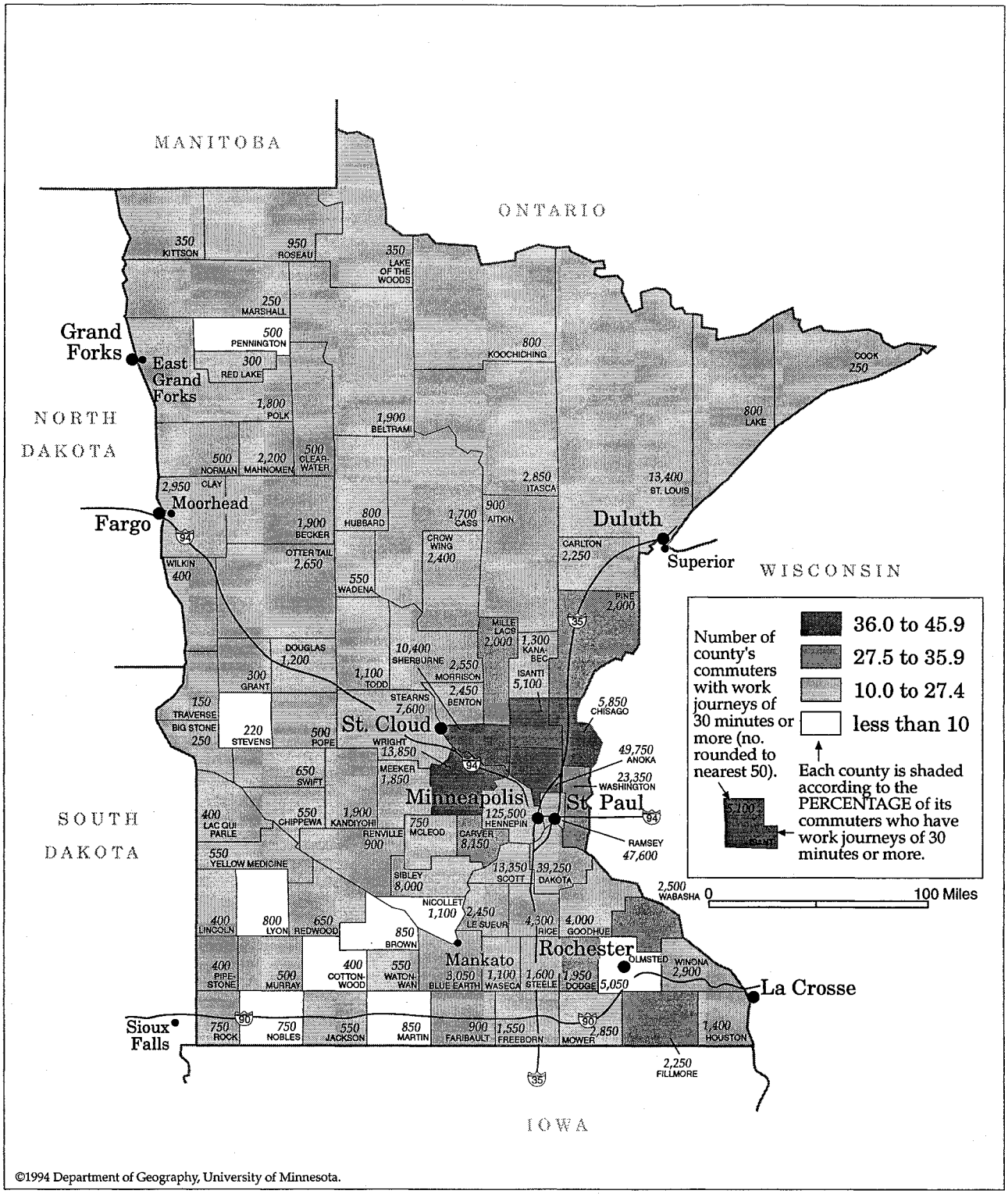
Transportation-Related Measures for Minnesota Counties, 1990: Six Reference Maps



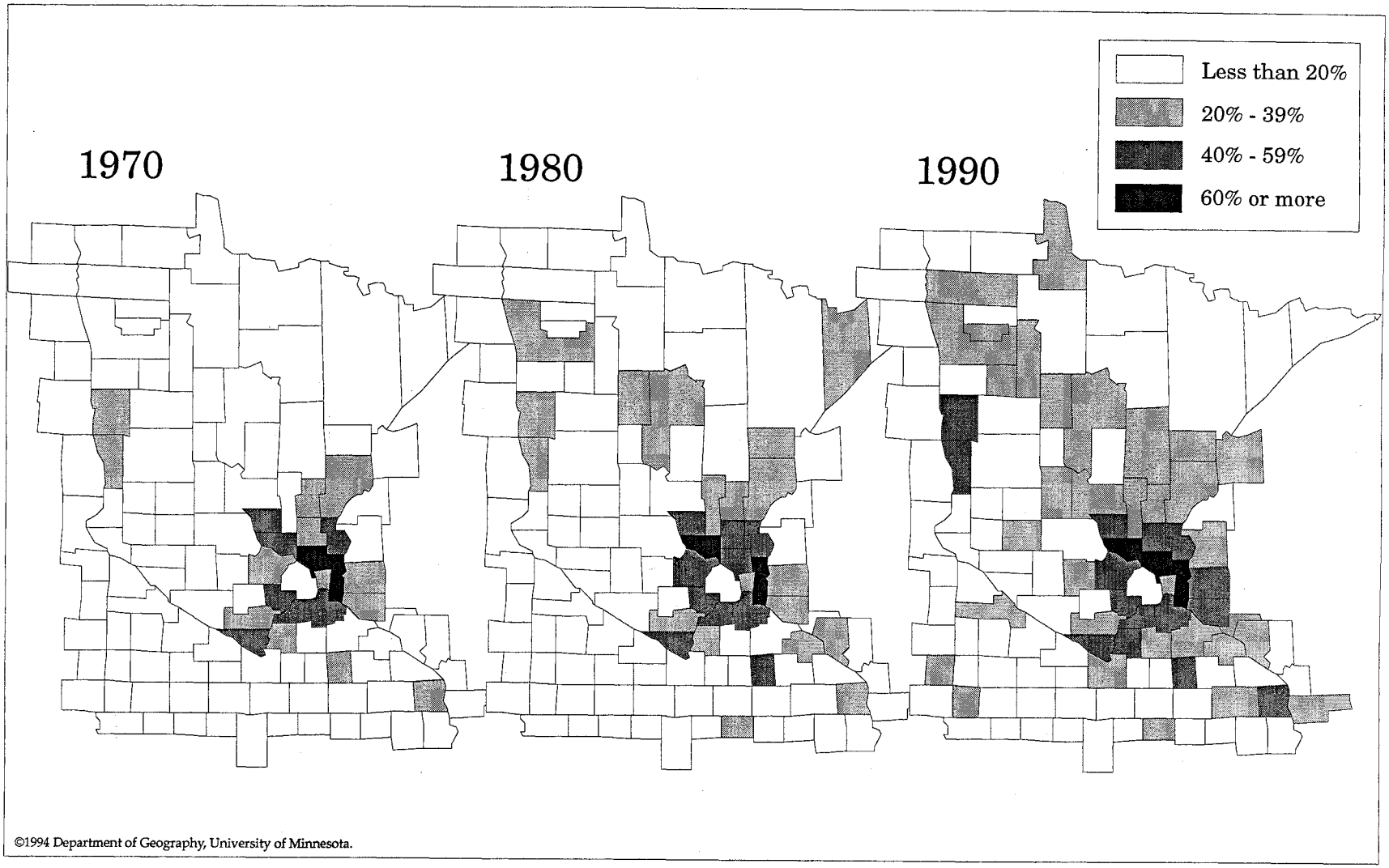
Reference Map 1. Commuters Driving to Work Alone, Minnesota Counties, 1990. *(Data Source: U.S. Bureau of the Census, Summary Tape File 3.)*



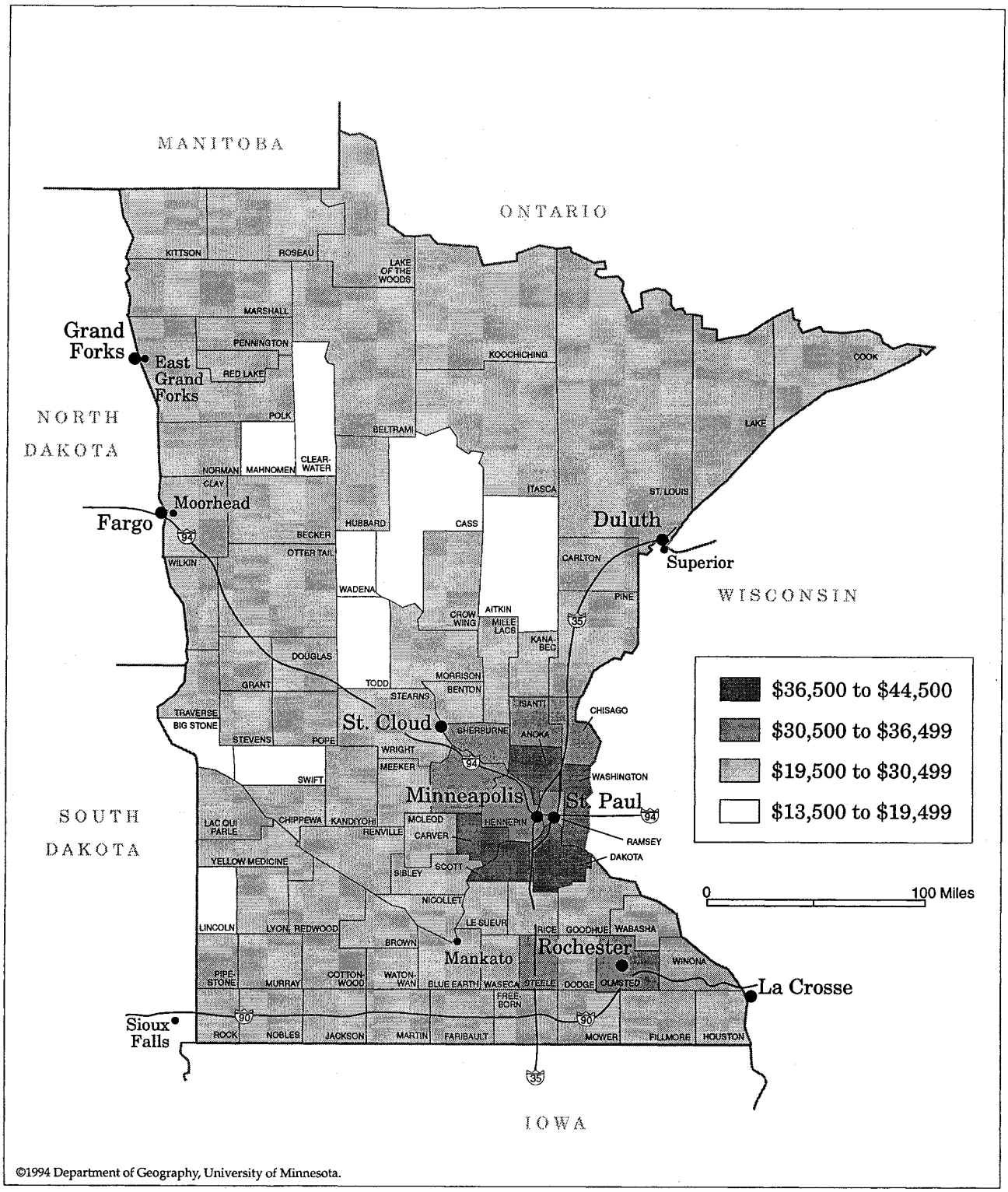
Reference Map 2. Commuters Traveling to Work in Carpools, Minnesota Counties, 1990. *(Data Source: U.S. Bureau of the Census, Summary Tape File 3.)*



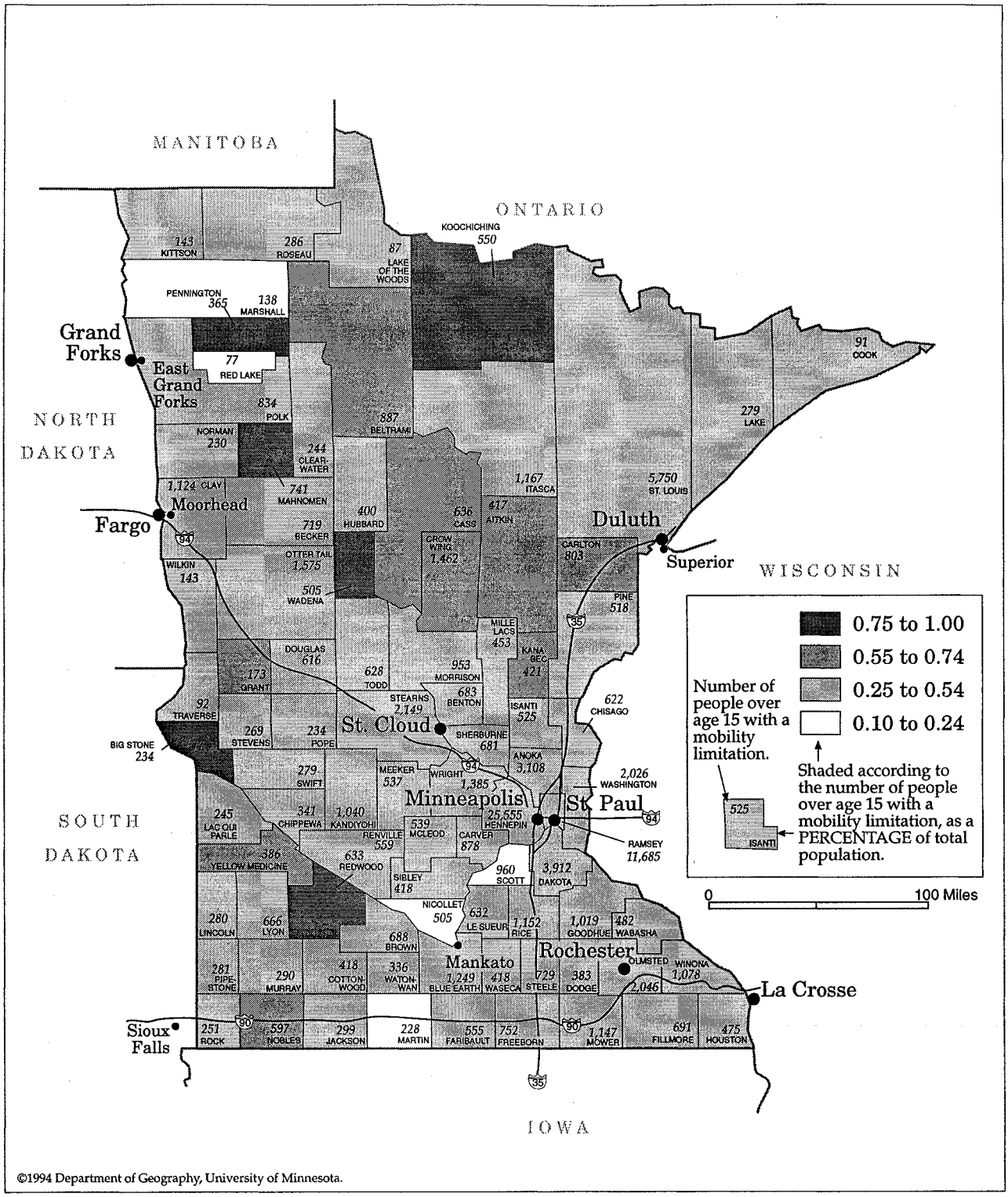
Reference Map 3. Commuters with Work Journeys of 30 Minutes or More, Minnesota Counties, 1990. *(Data Source: U.S. Bureau of the Census, Summary Tape File 3.)*



Reference Map 4. Percentage of Commuters Working Outside County of Residence, 1970 to 1990. *(Data Source: Special tabulations of U.S. Bureau of the Census Journey-to-Work Frequency Tables, and Bureau of Economic Analysis data.*



Reference Map 5. Median Household Income, Minnesota Counties, 1990.
(Data Source: U.S. Bureau of the Census, Summary Tape File 3.)



Reference Map 6. Limited Mobility Population, Minnesota Counties, 1990.
(Data Source: U.S. Bureau of the Census, Summary Tape File 3.)

Other Research Reports in This Series:

LONG-DISTANCE COMMUTING IN MINNESOTA

Workers making long daily commutes in the 1950s were understood as those best able to afford amenities normally available outside the "urban core"--that is, the downtown central business district (CBD) plus adjacent transportation-industrial zones and high density residential neighborhoods within "central cities" such as Minneapolis and St. Paul. This report examines characteristics of Minnesota workers residing in Minnesota's metropolitan and non-metropolitan areas who made long duration (more than 30 minutes one way) commutes in 1990, concluding that early metropolitan-based models today lack much if not all of their former applicability.

Minnesota's average commute of 19.1 minutes fell below the national average of 19.7, but more than 450,000 Minnesota workers spent more than 30 minutes commuting each way. Long duration work journeys were not restricted to the stereotypical upper income suburban family. In all geographic categories, the largest group of long duration commuters came from two person households, whose commuting may reflect compromises between two job locations.

In a five county "exurban" (i.e., beyond continuously built-up suburban areas) study area between Minneapolis and St. Cloud, average auto commuting time was the state's highest, at nearly 26 minutes. Blue collar workers reported commuting times longer than professionals. Findings have implications for policy proposals such as highway improvements, toll roads, or new energy taxes.

TRANSPORTATION-BASED CLASSIFICATIONS OF MINNESOTA'S COUNTIES AND METROPOLITAN STATISTICAL AREA TRACTS USING MEASURES FROM THE 1990 CENSUS OF POPULATION AND HOUSING

Census measures are used to classify Minnesota counties and metropolitan area census tracts according to demographic, journey-to-work, and mobility characteristics in 1990. Counties differ regarding scores calculated with respect to Population Mass--reflecting measures such as numbers of persons, of commuters, and of vehicles available for personal use; and a general Commuting tendency--reflecting proportions of commuters traveling more than 30 minutes, average commute time, and average number of vehicles per household. Three other basic characteristics of counties--average Socioeconomic Status of residents, degree of Mobility Impairment of residents; and Solo Commuting tendency--provide scores further differentiating counties. County scores are used to group Minnesota's 87 counties into six diverse clusters: 1) Hennepin (Minneapolis); 2) Ramsey (St. Paul); 3) Anoka and Dakota (Twin Cities suburbs); 4) St. Louis (Duluth); Olmsted (Rochester), Stearns (St. Cloud), Washington (Twin Cities); and 6) all others.

The second analysis examines 833 census tracts in the Minnesota's five MSAs, classifying them with the procedures used for counties. Resulting classifications illustrate that relationships between travel activity and socioeconomic characteristics vary considerably for different metropolitan contexts. As a demonstration of potentially useful methods applied to census data for Minnesota, the study provided results. On other grounds, its value is more limited.

DATA SOURCES FOR USE IN CONDUCTING TRAVEL BEHAVIOR RESEARCH

This study demonstrates the applicability of two distinct data sources for travel behavior research. Questions relating to reverse-commuting are raised with respect to all working residents, and working residents in low-income households located in Minneapolis.

Census of Population and Housing, 1990 Public Use Microdata Sample (PUMS) and the Twin Cities Metropolitan Council Travel Behavior Inventory (TBI) provide details on aspects of commute and travel patterns. Examining organization and methods of analysis appropriate to determining particular travel-related information presents a unique perspective on the advantages and shortcomings of each data set.

PUMS data provide detailed household and work-journey information. To answer reverse-commuting questions posed in this study, we consider household income, worker occupation, state and Public Use Microdata Area of employment, number of persons in each household, means of transportation used for the journey to work, and work journey duration.

TBI data contain a wealth of information on both the work journey and other trips, but lack the depth of socioeconomic data available in the PUMS file. The value of TBI data in responding to this series of questions lies in the details provided about trip location and purpose.