JULY 2018

PRIVATE PASSENGER AUTOMOBILE INSURANCE:

A REVIEW OF THE MARKET IN MISSOURI

MISSOURI DEPARTMENT OF INSURANCE, FINANCIAL INSTITUTIONS
& PROFESSIONAL REGISTRATION

STATISTICS SECTION

DIFP Department of Insurance, Financial Institutions & Professional Registration

The Missouri Department of Insurance, Financial Institutions & Professional Registration (DIFP) last released a significant report on the Missouri market for private passenger automobile insurance in 2005. This report updates and expands upon that earlier research. Of particular concern are questions of affordability and availability of automobile insurance, questions currently being pursued by the US Department of Treasury[1] as well as the NAIC's Auto Insurance (C/D) working group[2]. As with earlier DIFP reports, no evidence of systematic pricing differences *per unit of risk* between population segments is identified. However, some aspects of market suggest that further research may be warranted. In addition, it should be emphasized that some important features of the market are excluded from analysis due to a lack of data. Most notably, insurer underwriting practices, or criteria used to determine whether to issue coverage, are not filed with the department. The DIFP hopes this report can inform public policy choices pursued by regulators, office-holders and other interested parties.

Findings indicate that:

1. Statewide, the cost of coverage has declined in real (inflation-adjusted) terms since 1998. Between 1998 and 2017, the cost of full coverage (liability, collision and comprehensive) has declined from $834 to $706 (2017 dollars).
2. The cost of coverage declined across all income and minority groups over the same time period.
3. As may be expected, insurance costs are highest in core urban areas, decline in the periphery of urban areas, and are lowest in rural areas.
4. It is estimated that 13.7 percent of licensed vehicles in Missouri lack mandatory liability coverage. This estimate is very likely biased upward, but is comparable to estimates produced by the Insurance Research Council (IRC) of 14 percent. The IRC estimate employs a different methodology than did the DIFP estimates.
5. Estimates of uninsured vehicles vary widely across the state. Twenty-seven counties have an estimated rate of over 20 percent, and 13 counties over 25 percent of registered vehicles are estimates to lack liability insurance.
6. Statistical estimates at the ZIP code level indicate that a few areas of the state have uninsured rates in excess of 50 percent.
7. The cost of liability coverage tended to be lower in low income areas overall, but significantly higher in core urban areas with higher concentrations of minorities.
8. Territory rating factors have a small but statistically significant inverse relationship to median household income, and a strongly positive relationship to minority concentration.
9. Territories appear to be actuarially justified. To the extent there was any pattern detected across territories, it appears that higher territory rating factors are associated with *higher* loss ratios, indicating that they are not overcharged relative to risk compared to lower territory factors.
10. Statistical analysis strongly suggests that any actuarial method based solely on geographic risk will produce rating territories that significantly segregate along racial/ethnic lines.

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[1] Federal Insurance Office, US Department of the Treasury. January, 2017. **Study on the Affordability of Personal Automobile Insurance.**

[2] A report should be forthcoming from the working group. See http://www.naic.org/cmte_c_d_auto_insurance_wg.htm

11. Replicating earlier findings, complaints against insurers were registered at significantly higher rates in high minority areas. This is true whether rates are measured as complaints per exposure (or *car year)* or as claims-related complaints to the number of claims. For the second measure, complaint rates were 228 percent higher in high minority areas than low minority areas. Such differentials suggest a relatively greater degree of dissatisfaction with service in high minority areas, but in the absence of additional data, no definitive conclusions can be reached.
12. In the past, agent location has been used by the DIFP to measure the level of available services in an area. High minority areas have less than half the agents per capita as elsewhere in the state.
13. Areas with high minority populations as well as lower income areas have higher concentrations of higher risk (non-preferred) insureds as determined by insurer underwriting standards.
14. Market concentration is one indicator of competitiveness. By FTC anti-merger standards, measures of market concentration indicate that the Missouri market is highly competitive. No correlation with competitiveness and minority concentration or median area income has been noted.

This report focuses on both statewide trends, as well as market issues in subsections of the state. In the context of mandatory liability coverage, historical concern has been focused on poorer regions of the state, as well as areas with higher minority concentrations, typically in core urban areas that experience significantly elevated insurance costs. In Missouri, there are 44 ZIP codes with minority concentrations of over 50 percent, as follows:

Missouri ZIP Codes with > 50 Percent Minority Residents

ZIP Code	Area Name	County	Population	% Minority	Median Family Income	Income Quartile
63033	Florissant	Saint Louis	42,434	70.4%	$60,694	3
63034	Florissant	Saint Louis	17,840	66.6%	$88,987	4
63101	Saint Louis	Saint Louis City	3,303	61.5%	$53,932	3
63102	Saint Louis	Saint Louis City	2,314	57.9%	$47,697	2
63103	Saint Louis	Saint Louis City	7,265	55.1%	$56,563	3
63104	Saint Louis	Saint Louis City	20,320	51.9%	$61,921	3
63106	Saint Louis	Saint Louis City	11,989	96.7%	$18,642	1
63107	Saint Louis	Saint Louis City	10,437	89.0%	$25,713	1
63111	Saint Louis	Saint Louis City	21,380	59.3%	$32,563	1
63112	Saint Louis	Saint Louis City	19,982	77.6%	$49,120	2
63113	Saint Louis	Saint Louis City	11,270	97.8%	$30,028	1
63115	Saint Louis	Saint Louis City	18,446	99.1%	$29,477	1
63118	Saint Louis	Saint Louis City	28,810	65.0%	$37,195	1
63120	Saint Louis	Saint Louis City	9,158	98.2%	$30,650	1
63121	Saint Louis	Saint Louis	25,276	86.5%	$44,785	2

Missouri ZIP Codes with > 50 Percent Minority Residents						
ZIP Code	**Area Name**	**County**	**Population**	**% Minority**	**Median Family Income**	**Income Quartile**
63132	Saint Louis	Saint Louis	13,861	53.6%	$61,197	3
63133	Saint Louis	Saint Louis	7,507	93.8%	$27,859	1
63134	Saint Louis	Saint Louis	13,801	73.2%	$42,837	1
63135	Saint Louis	Saint Louis	21,512	66.7%	$47,404	2
63136	Saint Louis	Saint Louis	44,982	93.2%	$36,048	1
63137	Saint Louis	Saint Louis	20,460	82.4%	$38,981	1
63138	Saint Louis	Saint Louis	19,944	81.2%	$45,620	2
63140	Saint Louis	Saint Louis	308	89.9%	$24,375	1
63147	Saint Louis	Saint Louis City	10,164	95.0%	$33,483	1
63851	Hayti	Pemiscot	3,868	58.0%	$33,210	1
64030	Grandview	Jackson	25,102	56.4%	$51,306	2
64101	Kansas City	Jackson	309	54.4%		
64106	Kansas City	Jackson	9,092	64.9%	$18,214	1
64108	Kansas City	Jackson	7,428	54.5%	$53,015	3
64109	Kansas City	Jackson	9,243	67.3%	$45,971	2
64110	Kansas City	Jackson	16,179	52.6%	$65,938	4
64123	Kansas City	Jackson	8,048	61.4%	$42,208	1
64124	Kansas City	Jackson	9,862	72.6%	$37,091	1
64126	Kansas City	Jackson	6,253	77.4%	$25,590	1
64127	Kansas City	Jackson	14,980	84.5%	$30,246	1
64128	Kansas City	Jackson	12,027	91.4%	$31,764	1
64129	Kansas City	Jackson	8,920	57.5%	$42,221	1
64130	Kansas City	Jackson	20,590	92.4%	$35,317	1
64131	Kansas City	Jackson	22,104	53.3%	$55,865	3
64132	Kansas City	Jackson	14,304	86.1%	$29,615	1
64134	Kansas City	Jackson	23,771	73.7%	$43,379	1
64138	Kansas City	Jackson	27,028	60.0%	$57,780	3
64147	Kansas City	Jackson	639	64.2%		
65623	Butterfield	Barry	35	60.0%	$42,500	1

Source: Bureau of the Census, American Community Survey, 2016, Five-Year File. Some cells are blank because the Census Bureau suppresses some estimates for smaller ZIP codes to ensure respondent confidentiality.

The percentage of minority residents in an area is calculated based on individuals who identified themselves as anything other than non-Hispanic Caucasian on the 2016 American Community Survey (ACS). The statewide percentages are as follows:

Missouri Population, ACS, 2016	
Race/Ethnicity	**% of Population**
Hispanic / Latino	3.9%
Non-Hispanic	
White, Non-Hispanic	80.0%
African-American	11.5%
Asian	1.8%
Native American	0.4%
Hawaiian / Pacific Islander	0.1%
Person reporting some other race	0.1%
Person reporting two or more races	2.2%
Total Population	**6,059,651**

Cost of coverage

In real (inflation-adjusted) terms, the cost of all primary automobile coverages has declined over the past two decades. The annual cost of liability coverage declined from $385 to $377 between 1998 and 2017. For full coverage,[3] costs declined by nearly 17 percent since 1998, decreasing from $848 to $706. A slight increase is evident over the most recent three years, primarily due to increases in liability premium rates. It is too early to ascertain whether this might mark the beginning of a longer term trend.

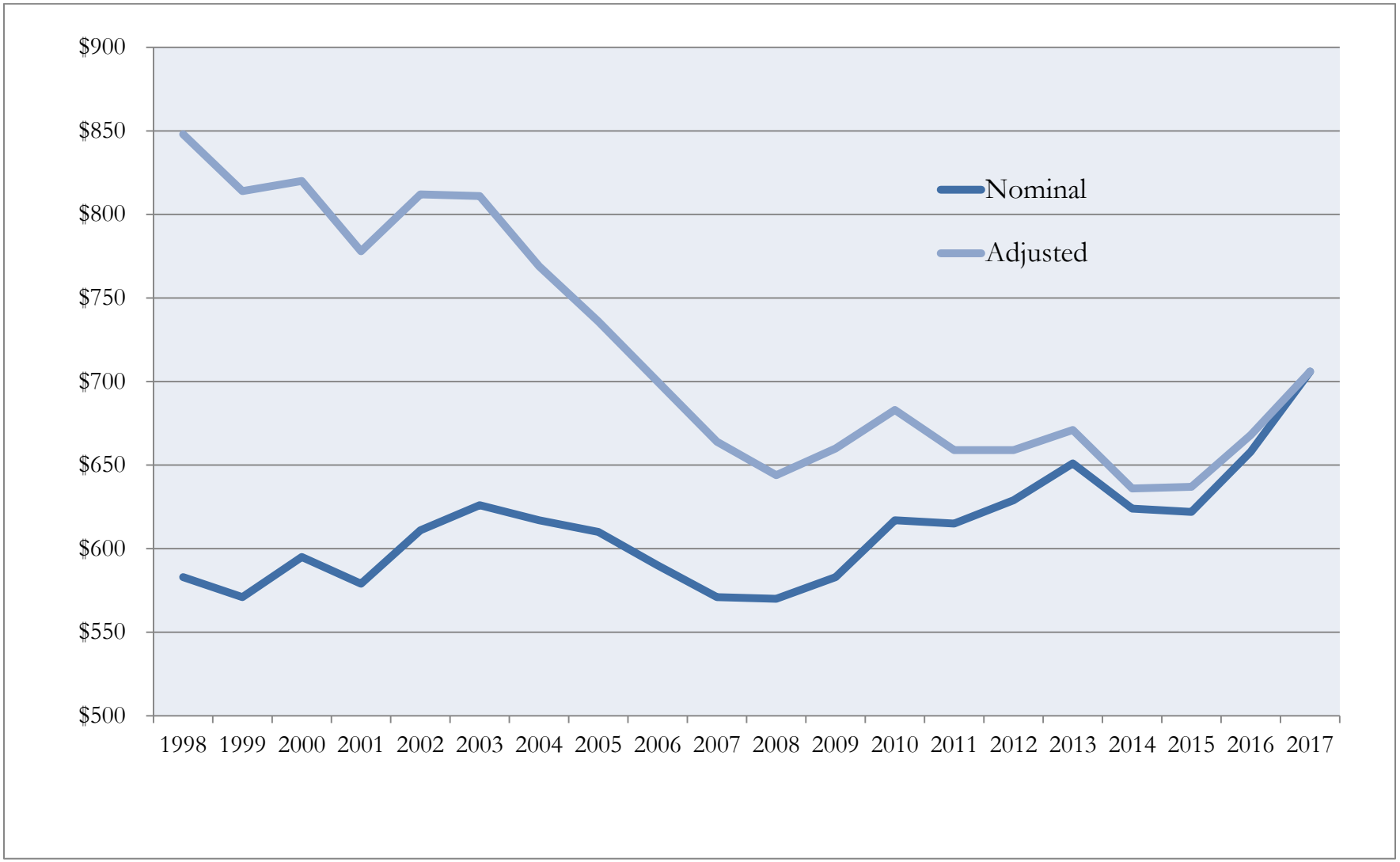
Table 1: Average Annual Premium by Coverage
Nominal and Inflation-Adjusted
$50k/$100k liability limits, PD limits of $13,000

	Nominal (unadjusted)																			
Coverage	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Liability	$264	$255	$256	$263	$284	$300	$301	$298	$298	$295	$292	$300	$311	$304	$311	$321	$316	$321	$349	$377
Collision	$217	$217	$232	$217	$223	$220	$211	$207	$193	$179	$180	$182	$199	$205	$210	$216	$194	$191	$201	$213
Comprehensive	$101	$99	$107	$99	$104	$106	$106	$104	$99	$97	$98	$101	$108	$106	$109	$113	$113	$110	$108	$116
Combined	**$583**	**$571**	**$595**	**$579**	**$611**	**$626**	**$617**	**$610**	**$590**	**$571**	**$570**	**$583**	**$617**	**$615**	**$629**	**$651**	**$624**	**$622**	**$658**	**$706**
	Inflation-Adjusted (2017 dollars)*																			
Liability	$385	$363	$353	$354	$378	$388	$375	$360	$354	$343	$330	$340	$343	$326	$326	$331	$323	$329	$355	$377
Collision	$316	$309	$319	$291	$296	$285	$262	$250	$228	$208	$204	$206	$220	$220	$219	$223	$198	$195	$204	$213
Comprehensive	$147	$141	$148	$133	$138	$138	$132	$126	$118	$113	$110	$114	$119	$114	$114	$117	$115	$113	$109	$116
Combined	**$848**	**$814**	**$820**	**$778**	**$812**	**$811**	**$769**	**$736**	**$700**	**$664**	**$644**	**$660**	**$683**	**$659**	**$659**	**$671**	**$636**	**$637**	**$668**	**$706**

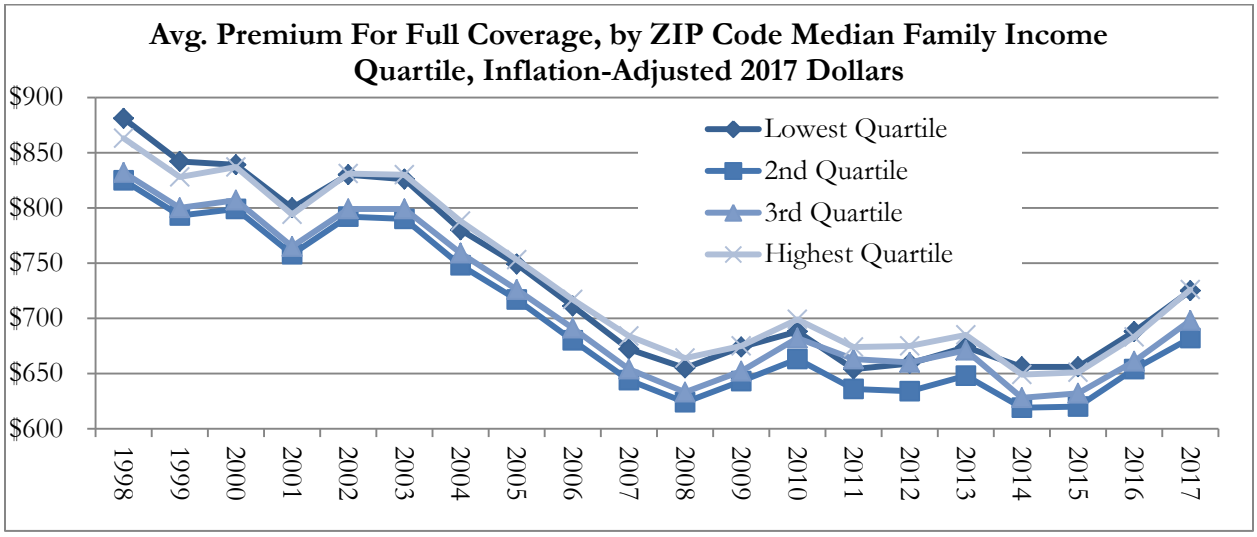
*Adjusted using the Consumer Price Index (CPI)– All Urban Consumers for St. Louis.

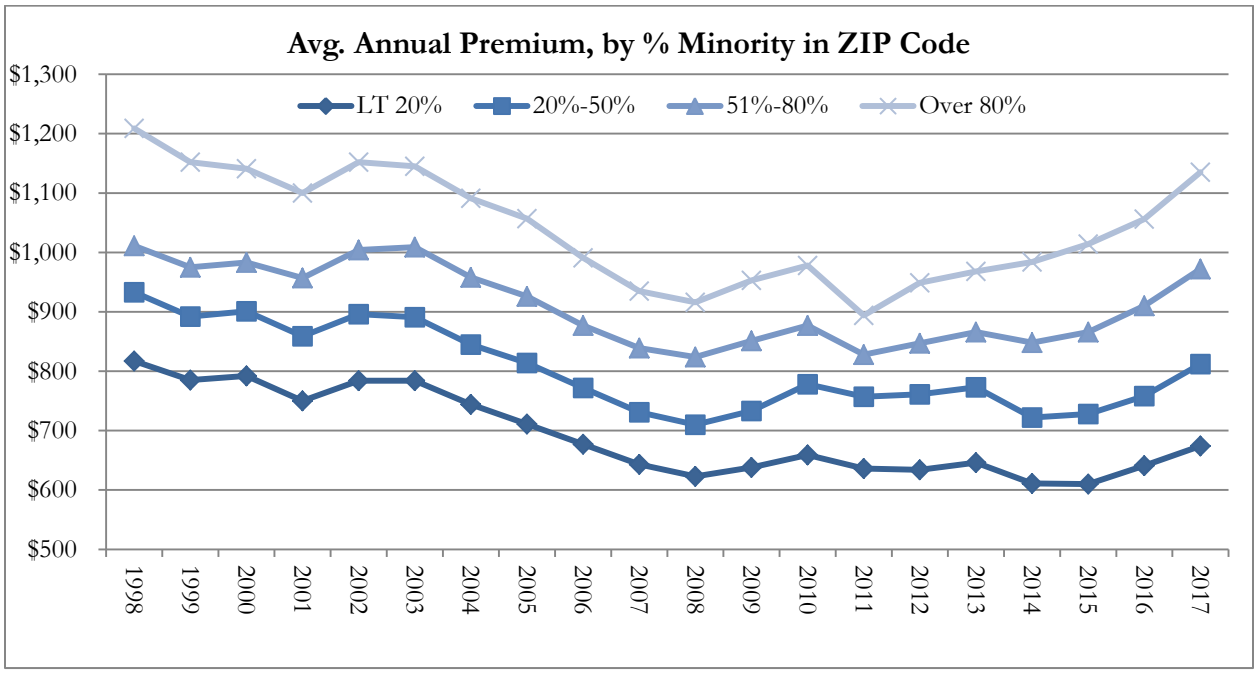
[3] Excluding legally mandated uninsured motorist coverage. Data for this coverage is not collected at the ZIP code level. Based on statewide data, the DIFP estimates that the required UM coverage adds an additional $40 per year to the cost of liability coverage.

Average Annual Premium for Full Coverage (liability, collision and comprehensive)
$50k/$100k liability limits, PD limits of $13,000



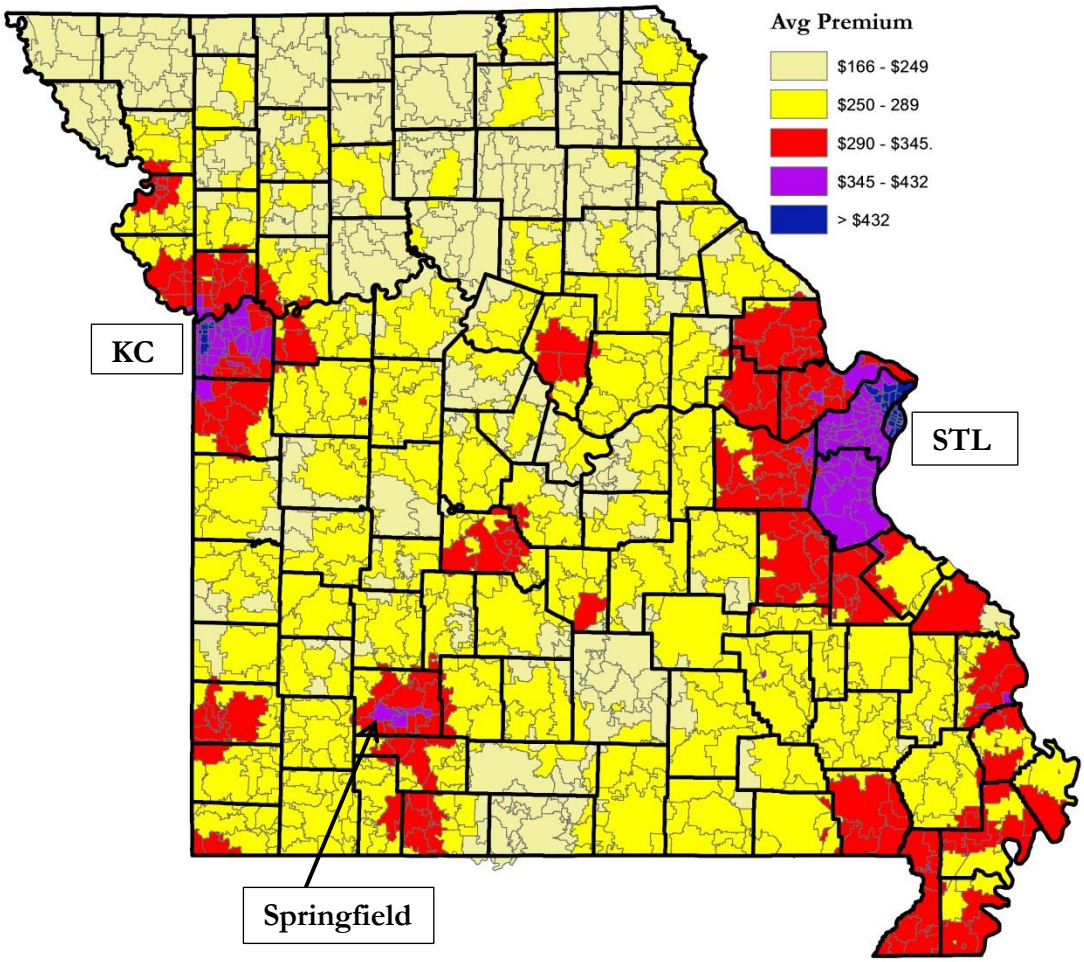
Cost trends over time are broadly similar across all regions of the state examined. The charts below display average premiums by income quartile and minority concentration in a ZIP code.





Average Annual Premium for Liability Coverage (cost of insuring one vehicle for one year).

Insurance costs vary significantly across the state. Mapping liability average premiums produces a typical pattern. Residents of urban areas of St. Louis, KC and Springfield have the highest average premiums. The very core of St. Louis and KC have the highest average premiums in the state. Premiums decrease (by more than half) the further one moves from the urban centers. The high cost of coverage in core urban areas has raised concern among regulators regarding the affordability of the mandatory coverage. As discussed in the next section, urban areas have rates of uninsured vehicles significantly above the statewide average, and this is likely associated with the high costs of such coverage.



Uninsured Vehicles

In 2017, Missouri private automobile insurers paid out over $107 million to compensate individuals who were injured by an uninsured motorist. Like nearly all states, Missouri requires that drivers obtain liability coverage and may impose significant financial penalties and loss of licensure to individuals that drive while uninsured. However, consistent with experience in other states, measures to reduce the number of uninsured drivers have met with mixed success.

The DIFP does not typically produce estimates of uninsured vehicles, primarily due to deficiencies in the data that make estimates somewhat speculative. Estimates are presented here – with the appropriate caveats.

The DIFP estimates that 13.7 percent of registered private (or non-commercial) vehicles in Missouri lack liability insurance. While, for reasons discussed below, this figure is most likely somewhat of an overestimate, it does suggest that a significant portion of the driving public is in violation of Missouri law. While the uninsured rate is not relatively high compared to other states, some areas of the state have uninsured rates significantly higher than the statewide rate.

In the tables that follow, estimates for uninsured rates are derived by matching DIFP ZIP Code-level insurance data with county-level vehicle registration data obtained from the Missouri Department of Revenue. The match is imperfect, as the registration data do not distinguish between commercial and non-commercial vehicles, while the insurance data consists only of non-commercial coverages. Registrations are available by vehicle-type, such that vehicles types that are most obviously commercial can be removed (very large trucks, buses, etc). However, any vehicle type may be insured under a commercial policy. To the degree that commercial vehicles remain in the data, the uninsured rate will be overestimated.

A series of estimates for each state is also produced by the Insurance Research Council (IRC). The IRC estimates consist of the ratio of uninsured motorist injury claims to liability injury claims. However, this method too will unquestionably overestimate the percentage of uninsured vehicles, since it assumes that uninsured drivers have injury producing accidents at the same rate as insured drivers, which is highly unlikely to be the case. Uninsured drivers are known to be, on average, higher risk than insured drivers.[4] As such, they will produce disproportionately more injuries than their percentage in the overall pool of cars on the highway.

However, the IRC estimate is remarkably close to the DIFP estimate. For Missouri, the IRC estimated that 14 percent of vehicles lack insurance (with MO ranking 17th highest among the states), compared to the DIFP estimate of 13.7 percent. While recognizing that this overestimates the true rate of uninsured vehicles to an unknown degree, the estimate is still useful for comparing areas within Missouri, since the data limitations are not expected by to significantly vary by geography. Fifteen Missouri counties have uninsured rates estimated to exceed 25 percent: Andrew,

[4] Indeed, one reason drivers may be uninsured is precisely *because* they are high risk and are therefore unable to find affordable coverage.

Chariton, Dallas, Hickory, Knox, Maries, Miller, New Madrid, Newton, Pemiscot, Ralls, Ray, Scotland, Shannon, and Washington, and four counties have uninsured rates exceeding 30 percent.

Estimates of Uninsured Vehicles, by County, 2017			
County FIPS Code	**County**	**Licensed Vehicles (cars and light trucks)**	**% Uninsured**
001	Adair	20,324	21.5%
003	Andrew	17,479	35.2%
005	Atchison	5,902	11.5%
007	Audrain	21,020	15.5%
009	Barry	32,804	8.7%
011	Barton	11,830	16.5%
013	Bates	17,628	4.9%
015	Benton	19,552	13.3%
017	Bollinger	11,692	17.8%
019	Boone	130,686	10.8%
021	Buchanan	67,180	6.5%
023	Butler	34,525	18.9%
025	Caldwell	9,413	8.6%
027	Callaway	39,613	13.9%
029	Camden	43,476	16.1%
031	Cape Girardeau	66,158	14.1%
033	Carroll	9,824	10.1%
035	Carter	6,089	12.4%
037	Cass	94,279	14.2%
039	Cedar	13,021	13.1%
041	Chariton	8,914	25.0%
043	Christian	73,525	8.2%
045	Clark	7,104	20.0%
047	Clay	203,773	8.8%
049	Clinton	21,145	6.0%
051	Cole	67,133	7.5%
053	Cooper	15,765	11.7%
055	Crawford	23,913	24.3%
057	Dade	8,132	15.0%
059	Dallas	15,664	26.0%
061	Daviess	8,258	11.0%

Estimates of Uninsured Vehicles, by County, 2017			
County FIPS Code	**County**	**Licensed Vehicles (cars and light trucks)**	**% Uninsured**
063	DeKalb	9,476	20.6%
065	Dent	14,386	16.0%
067	Douglas	12,930	24.0%
069	Dunklin	23,897	14.8%
071	Franklin	93,774	3.7%
073	Gasconade	16,865	8.7%
075	Gentry	6,704	10.4%
077	Greene	230,987	15.6%
079	Grundy	8,922	10.6%
081	Harrison	8,644	17.2%
083	Henry	21,364	6.5%
085	Hickory	9,519	29.1%
087	Holt	5,207	13.9%
089	Howard	8,956	15.4%
091	Howell	36,303	8.9%
093	Iron	10,133	11.8%
095	Jackson	545,577	18.4%
097	Jasper	98,083	0.0%
099	Jefferson	189,025	17.9%
101	Johnson	42,111	8.5%
103	Knox	4,480	25.0%
105	Laclede	32,177	11.0%
107	Lafayette	31,820	10.8%
109	Lawrence	34,481	19.9%
111	Lewis	9,943	10.7%
113	Lincoln	53,331	18.7%
115	Linn	12,567	5.8%
117	Livingston	13,182	16.6%
119	McDonald	19,134	19.3%
121	Macon	15,396	11.2%
123	Madison	12,034	16.1%
125	Maries	8,793	32.6%
127	Marion	25,352	9.5%
129	Mercer	3,979	24.4%
131	Miller	23,734	28.1%

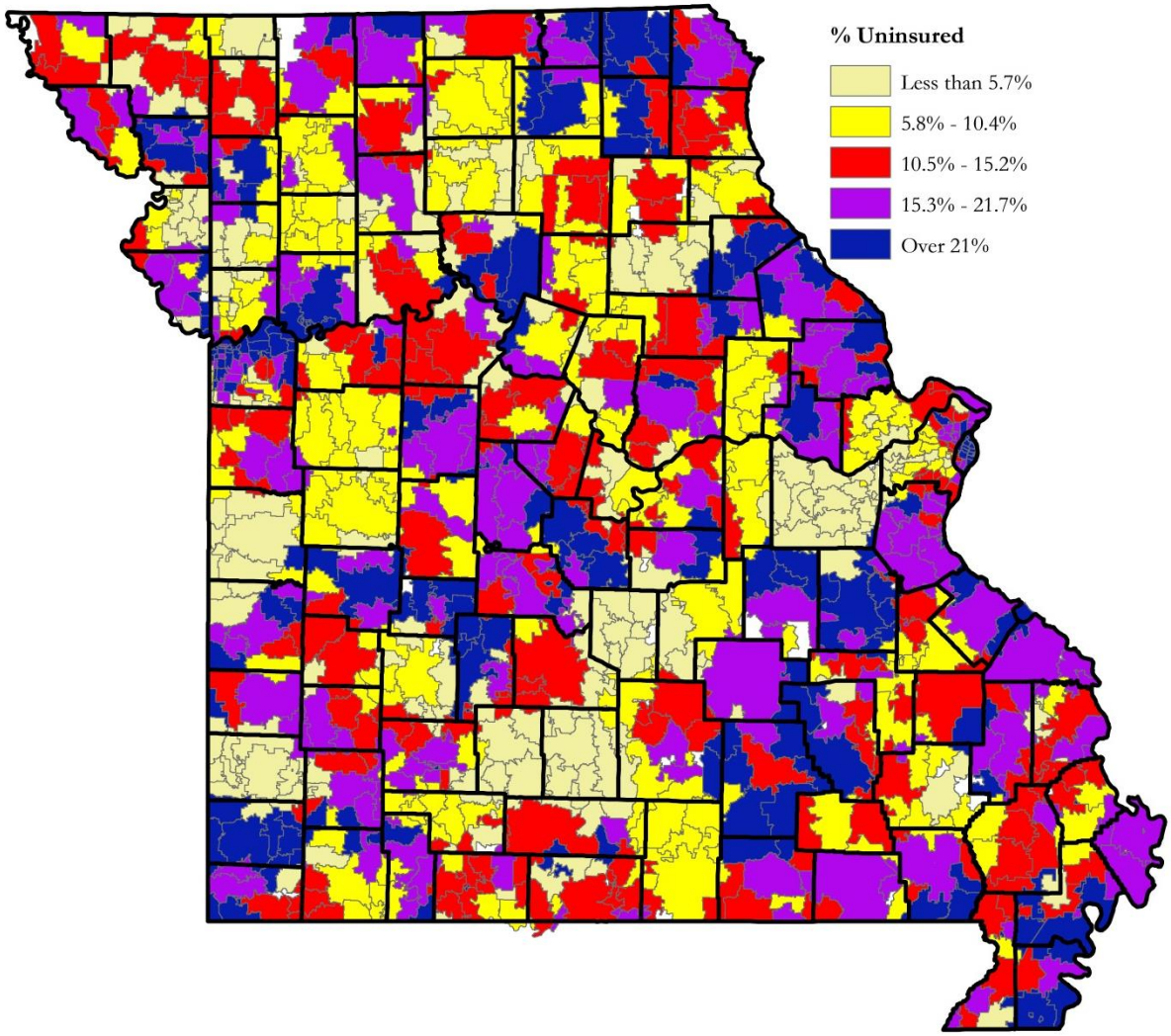
Estimates of Uninsured Vehicles, by County, 2017			
County FIPS Code	**County**	**Licensed Vehicles (cars and light trucks)**	**% Uninsured**
133	Mississippi	10,302	16.9%
135	Moniteau	14,096	14.4%
137	Monroe	9,286	2.8%
139	Montgomery	12,605	7.7%
141	Morgan	20,199	19.0%
143	New Madrid	14,296	26.1%
145	Newton	50,659	33.9%
147	Nodaway	18,133	11.4%
149	Oregon	9,493	16.8%
151	Osage	14,608	13.5%
153	Ozark	9,249	13.0%
155	Pemiscot	12,677	25.0%
157	Perry	19,315	17.5%
159	Pettis	35,919	16.6%
161	Phelps	35,964	8.5%
163	Pike	16,414	19.0%
165	Platte	97,492	21.2%
167	Polk	26,995	5.9%
169	Pulaski	34,885	0.0%
171	Putnam	5,108	13.6%
173	Ralls	11,143	39.6%
175	Randolph	21,417	9.6%
177	Ray	23,405	25.2%
179	Reynolds	6,649	23.5%
181	Ripley	11,854	15.0%
183	Saint Charles	326,911	7.9%
185	Saint Clair	9,850	23.4%
186	Sainte Genevieve	18,431	19.0%
187	Saint Francois	54,433	11.3%
189	Saint Louis	815,828	11.5%
195	Saline	19,727	11.9%
197	Schuyler	4,391	22.2%
199	Scotland	5,221	27.9%
201	Scott	35,229	11.2%
203	Shannon	7,988	27.6%

Estimates of Uninsured Vehicles, by County, 2017			
County FIPS Code	**County**	**Licensed Vehicles (cars and light trucks)**	**% Uninsured**
205	Shelby	7,244	9.9%
207	Stoddard	26,893	11.1%
209	Stone	29,574	18.6%
211	Sullivan	6,567	8.8%
213	Taney	45,287	12.6%
215	Texas	23,247	14.9%
217	Vernon	18,259	17.7%
219	Warren	33,232	20.7%
221	Washington	21,641	26.9%
223	Wayne	12,674	8.9%
225	Webster	33,774	0.0%
227	Worth	2,419	6.9%
229	Wright	17,157	0.0%
510	Saint Louis City	168,492	24.3%
999	**Statewide**	**5,105,719**	**13.7%**

Since licensure data were only available at the county level, additional statistical modeling was required to produce ZIP Code-level estimates. For this purpose, a constrained regression model was employed to estimate ZIP code-level rates from the county-level estimates. The model employed liability insurance cost, income and several other socio-economic variables obtained from the American Community Survey (ACS). The estimates across ZIP codes were constrained to sum to the county-level uninsured totals.[5] The results are displayed below. In addition to core urban areas, many rural areas of the state are estimated to have high rates of uninsured vehicles. In a few ZIP codes, more than half of licensed automobiles are estimated to lack insurance.

[5] Such methods for "small area estimation" have been shown to be fairly statistically robust across a variety of applications. See, for example, Zhang, X, et. Al. 2015. Validation of multilevel regression and poststratification methodology for small area estimates of health indicators from behavior risk factor surveillance system. **American Journal of Epidemiology.** 182(2): 127-137.

Estimated % of Licensed Vehicles without Mandatory Liability Insurance



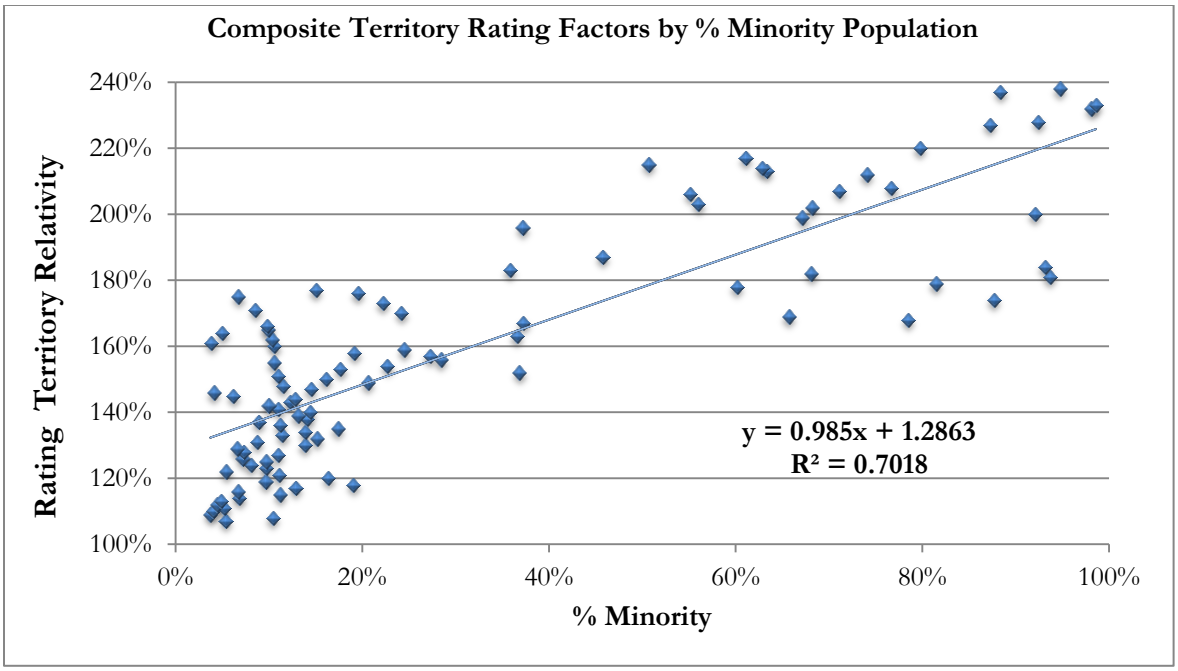
Rating Territories

While many rating factors employed by insurers have been said to contribute to elevated costs in in urban areas, probably no rating factor is more directly implicated in high rates in core urban areas than are geographic rating territories. Ideally, a geographic rating territory is constructed to measure the unique or discrete risk associated with *place,* as opposed to risks associated with the individuals that reside in a given place. For any given individual risk, the territory rate factor represents the rate difference that would result solely from moving from Point A to Point B while all other individual risk factors remain unchanged. Insurers attempt to statistically isolate geographic risk factors on historical losses using complex models which statistically *control* for individual-level factors. For example, physical features such as traffic congestion and infrastructure characteristics contribute to the crash risk within a given area.

The graph below depicts composite rating factor relativities[6] for each ZIP code across 9 companies representing 65 percent of the private automobile insurance market.[7] Relativities are strongly correlated with the percent of minorities residing in an area. The regression equation for the linear trend line is displayed in the graph. The equation indicates that across all companies, rating factors are on average nearly twice as high in the areas with the highest concentration of minorities compared to low minority areas. The high R^2 value (.7018) indicates that minority concentration is a very good predictor of territorial rate factor.

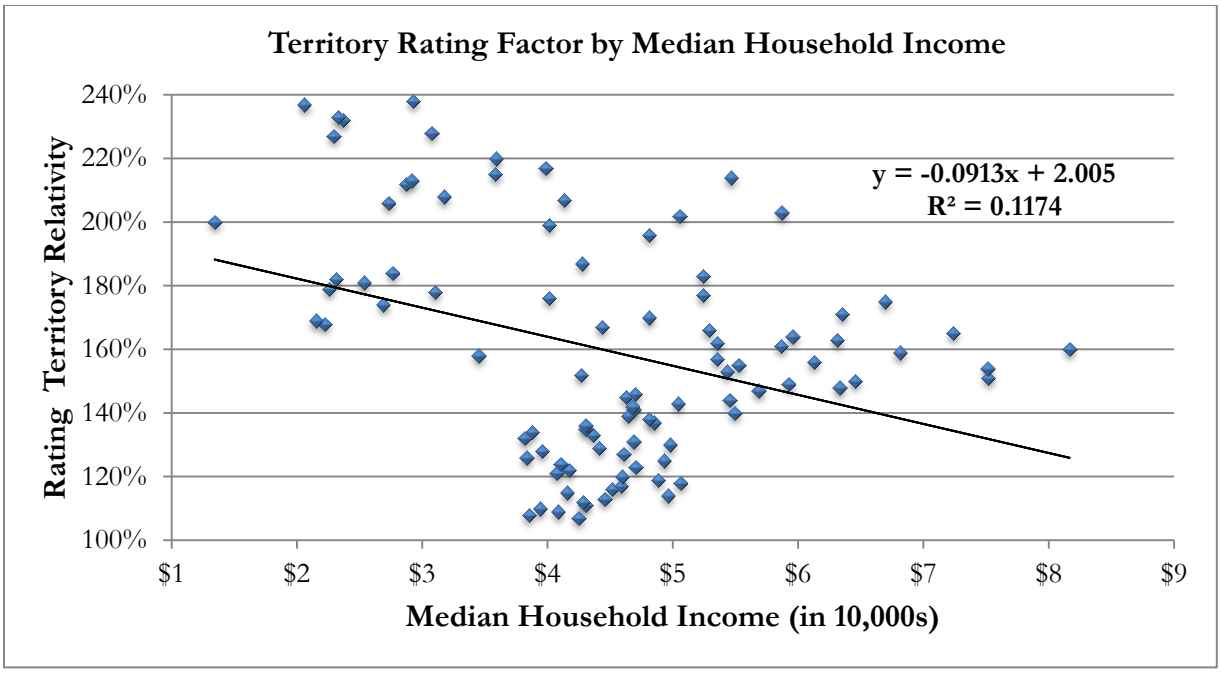
[6] The territory relativities displayed on the y-axis are simply the rate impact of the territory compared to the lowest rated territory. For example, a relative of 200 percent indicates that insureds residing within the territory are surcharged at twice the rate as the lowest rated territory.

[7] For each ZIP code, the composite territory factor is simply the weighted average of territory factors across insurers.



The same graph of factors by income such a much more modest relationship. The low R^2 value indicates that little of the variation in territory factors is "explained" by income alone.[8] This is unsurprising, since many rural ZIP codes have lower median incomes, but are sparsely populated and of lower crash risk. They therefore have a moderating influence on the overall statistical relationship.

[8] As is apparent from the wide scatter pattern around the trend line.



Rate relativities have been a significant concern to consumer groups, regulators and other analysists, given the fear that high insurance costs could price some drivers out of the insurance market.[9] Of significant concern is whether the higher rates are justified by higher crash risks. While some studies have purported to find evidence of price differences not justified by risk, the DIFP cannot confirm such findings.[10] No evidence was found that would indicate that higher rated territories are charged more *relative to risk* than lower-rated territories. A simple measure of price-to-risk is the loss ratio, or simply the ratio of losses / premium. Lower loss ratios indicate that insureds are charged less *per unit of risk* (overcharged) than higher loss ratios (indicating relatively undercharged). If there is any pattern apparent across territories, the highest-rated territories tended to have higher loss ratios across the study-period. Risk, as indicated by "pure premium" (losses averaged over all insured vehicles) is strongly correlated with territory rating factor.

Experience of Liability Insurance
By Territory Factor Relativity Decile

[9] See Federal Insurance Office, op. cit.

[10] For a recent example, see ProPublica, April 5th, 2017. Minority neighborhoods pay higher car insurance premiums than white areas with the same risk, available at https://www.propublica.org/article/minority-neighborhoods-higher-car-insurance-premiums-white-areas-same-risk. Departmental analysts believe this study is marked by profound methodological deficiencies. Indeed, due to the gravity of the implications of the study, the ProPublica study is subject to an entirely separate analysis, which is currently under review for publication in a peer-reviewed journal. It will merely be noted here that ProPublica got the analysis entirely wrong.

2011-2016 Pooled Data				
Territory Relativity Deciles	**Car Years**	**Average Annual Premium***	**Loss Ratio**	**Pure Premium (Range 2)**
1	656,423	$245	48.7%	$121
2	964,488	$257	53.5%	$147
3	2,060,399	$273	58.5%	$164
4	1,669,941	$269	60.8%	$171
5	1,105,328	$277	65.2%	$173
6	2,342,484	$287	60.6%	$171
7	1,531,333	$294	62.9%	$180
8	3,502,278	$319	63.2%	$217
9	5,425,936	$340	63.9%	$239
10	6,422,059	$399	65.9%	$291

**Premium calculated for policy limits of $50,000/$100,000.*

A somewhat speculative method was employed to assess whether territories produced by purely statistical methods would reproduce the strong correlation between rating relativities and demographic factors. Observed geographic differences are the net outcome to two separate factors – the nature of the geographic itself (traffic density, etc) *plus* differences in the risk profiles of individuals who reside in each area. Because only aggregate data are available, there is no direct way to control for individual factors that might account for differences across geographic areas –

(individual-level risk) + (geographic risk) = observed losses

A method common in epidemiological studies (which also often lack individual-level data) was employed to estimate geographic or territorial risk.

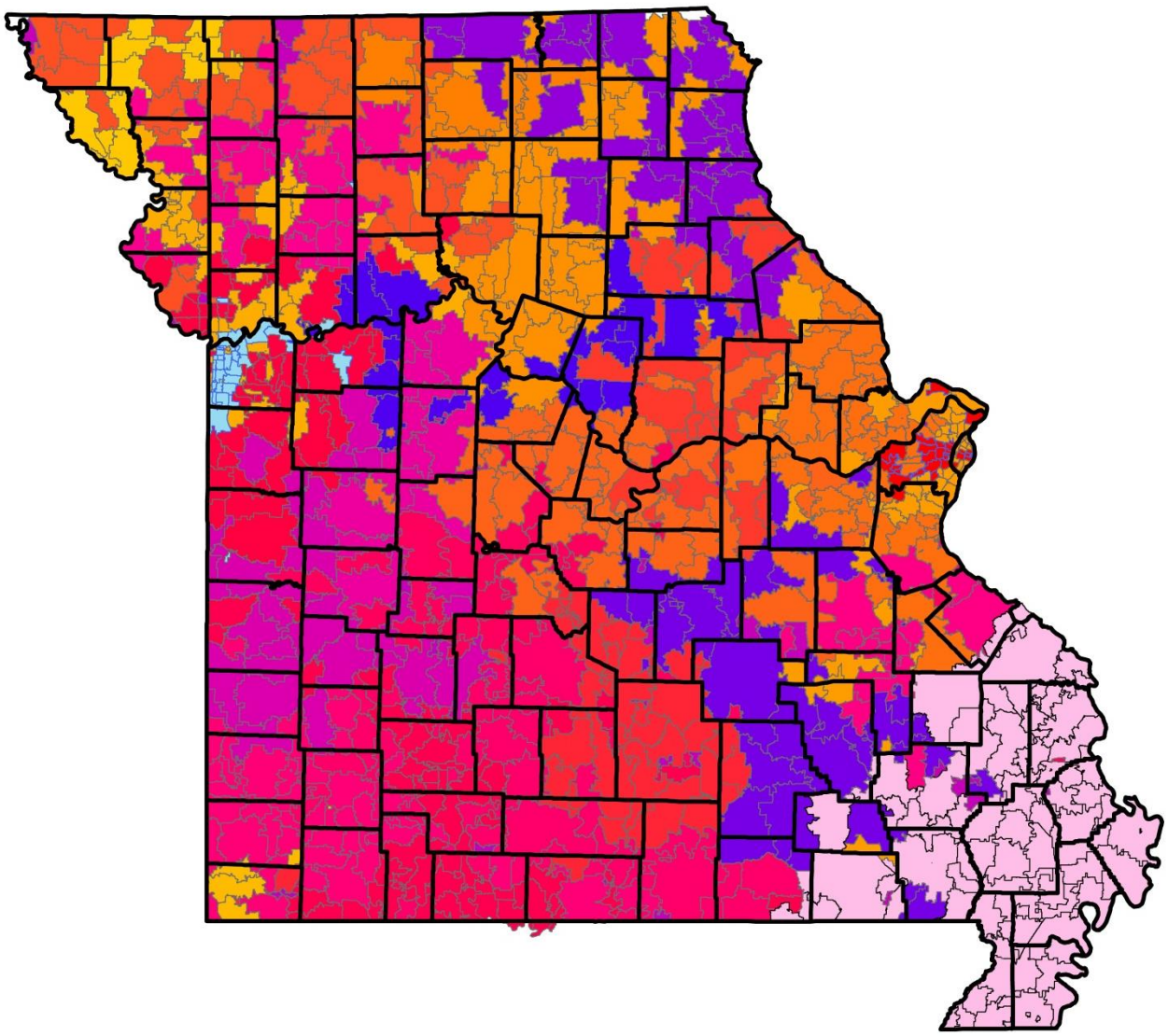
1. Aggregate characteristics of a population were modeled at the ZIP code level to predict losses based on geographic variations in individual-level characteristics. An OLS regression was employed to model liability loss frequency (number of claims per car year) as a function of such factors as age and gender composition, socioeconomic variables and the concentration of non-preferred risks ($R^2 = .45$).
2. The residuals (the deviation of actual losses from predicted values) of the model are interpreted as reflecting the geographic risk independent of individual-level characteristics[11]. For example, positive residuals indicate that a ZIP code was associated with higher risk than was predicted by the statistical model of individual-level characteristics.

[11] See, for example, Spatial analysis of gastric cancer in Costa Rica using SAS. So Young Park and Marcela Alfaro-Cordoba

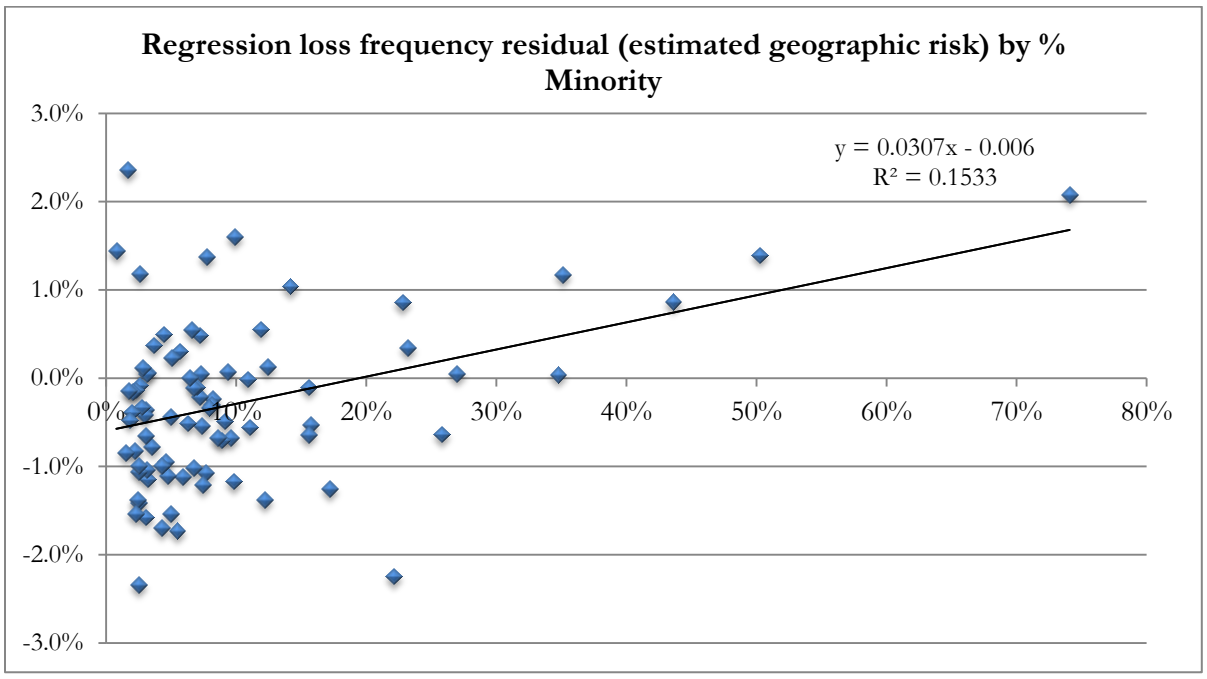
3. A non-parametric cluster procedure (SAS "Proc modeclus") was then employed to identify spatial clusters of residuals. Latitude and longitude were included to ensure a degree of spatial proximity of the resulting clusters of ZIP codes.

The resulting clusters can be meaningfully interpreted as akin to rating territories, or as an estimate of the risk associated with a geographic area independent of individuals residing in each area. The procedure produced 33 clusters, a number not atypical of the rating territories constructed by insurers. Clusters are depicted in the following map.

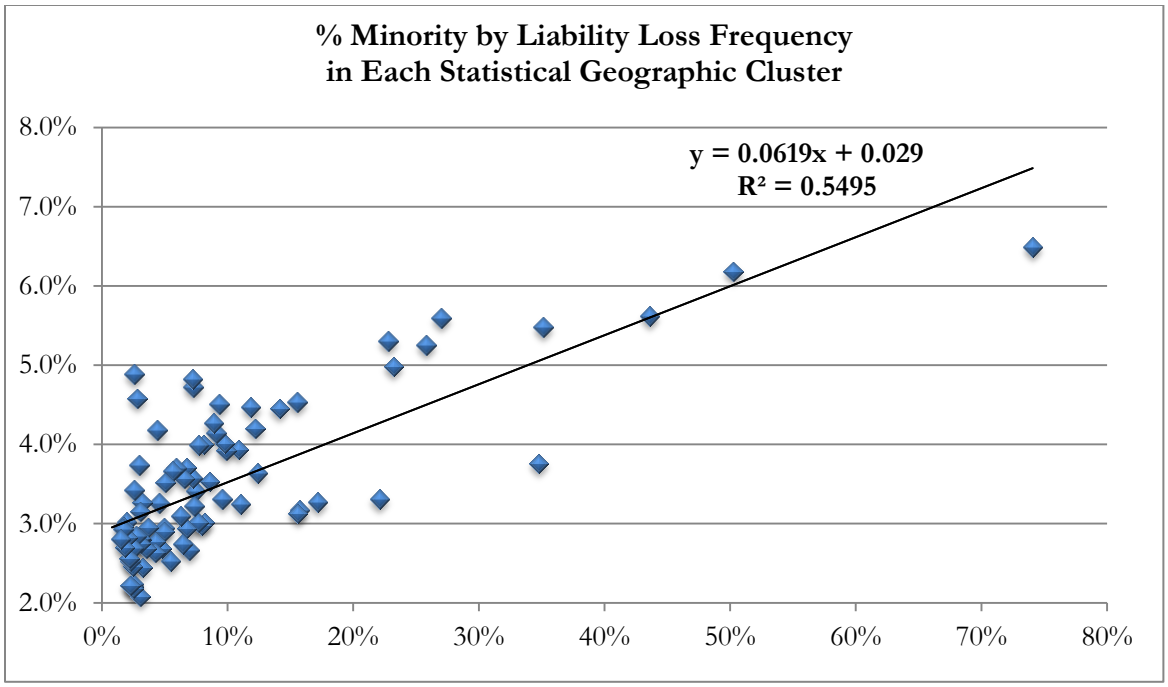
Clusters produced by regression on liability loss frequency, and cluster analysis on the regression residuals (and latitude and longitude)



As should be clear from the following graph, geographic risk as measured by the regression residuals of each statistical cluster (i.e. our estimates of geographic risk) is positively correlated with minority concentration. This is not terribly surprising, since minority concentrations are highest in core urban areas of relative higher crash risk associated with traffic density.

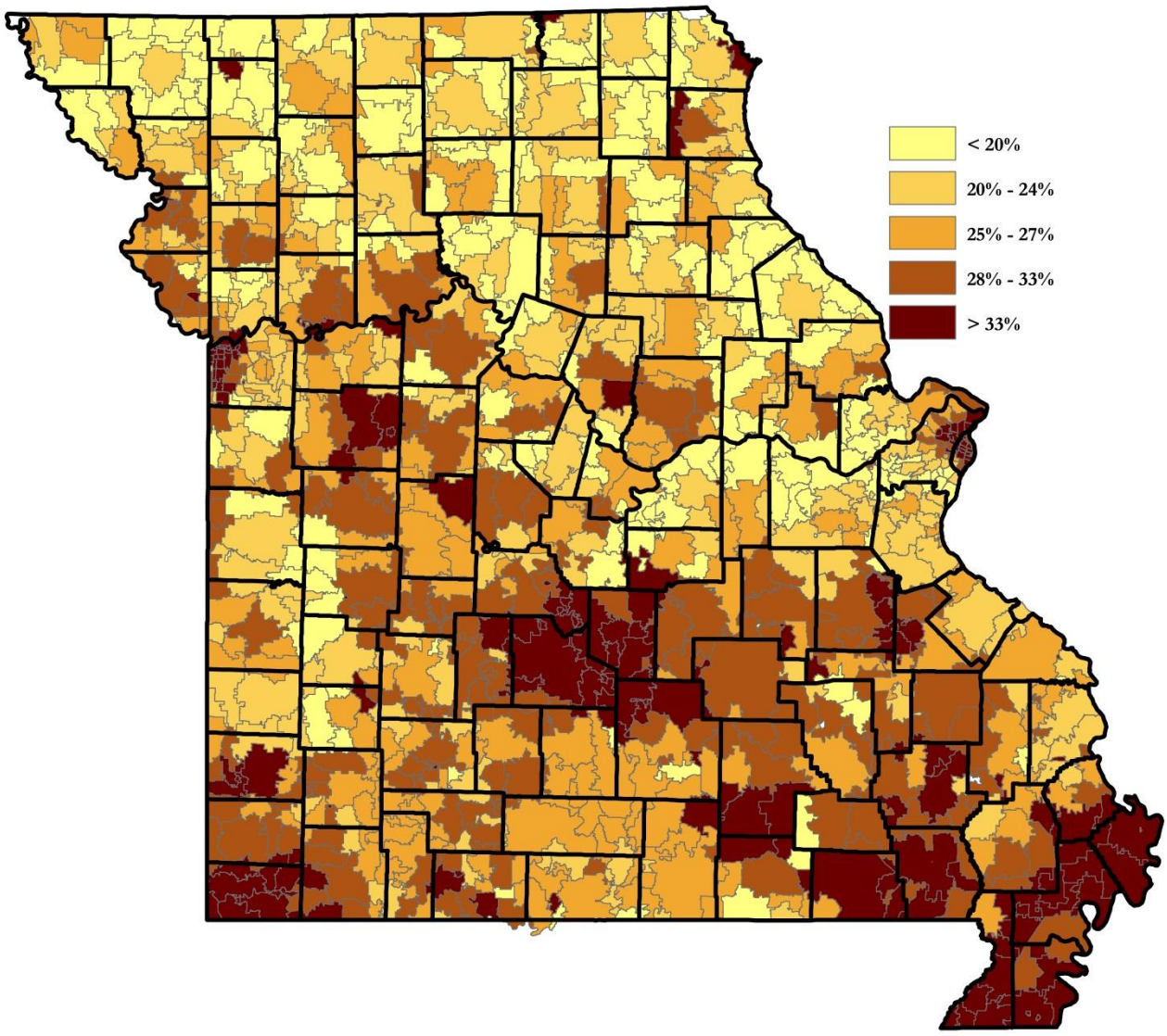


The loss frequency over the period 2011-2016 in each statistical cluster largely replicates the industry rating territories in terms of surcharing areas with higher concentrations of minorities.


% Minority by Liability Loss Frequency
in Each Statistical Geographic Cluster
y = 0.0619x + 0.029
R² = 0.5495
8.0%
7.0%
6.0%
5.0%
4.0%
3.0%
2.0%
0%
10%
20%
30%
40%
50%
60%
70%
80%

% Non-Preferred Risks

While there is no standard definition of "preferred risks," in general non-preferred risks are surcharged for prior claims experience, driving infractions as well as other criteria that might be used by insurers. Non-standard risks are concentrated in core of Kansas City and St. Louis, and well as the Lake of Ozark area and the New Madrid area.



The percent of non-preferred risks is higher in high minority areas and in areas falling in the lowest household income quartile.

% Minority	Exposures	Non-preferred Exposures	% Non-Preferred
< 20%	3,590,725	897,567	25.0%
20%-50%	364,883	116,191	31.8%
51% - 80%	157,720	54,376	34.5%
>80%	291,892	110,421	37.8%

Income Quartile	Exposures	Non-preferred Exposures	% Non-Preferred
1 (lowest)	635,583	206,005	32.4%
2	856,276	254,921	29.8%
3	1,012,405	277,294	27.4%
4	1,894,686	438,566	23.1%

Non-preferred risks are charged about 30% more for liability coverage. Loss ratios indicate that they are not charged more relative to risk than are preferred risks.

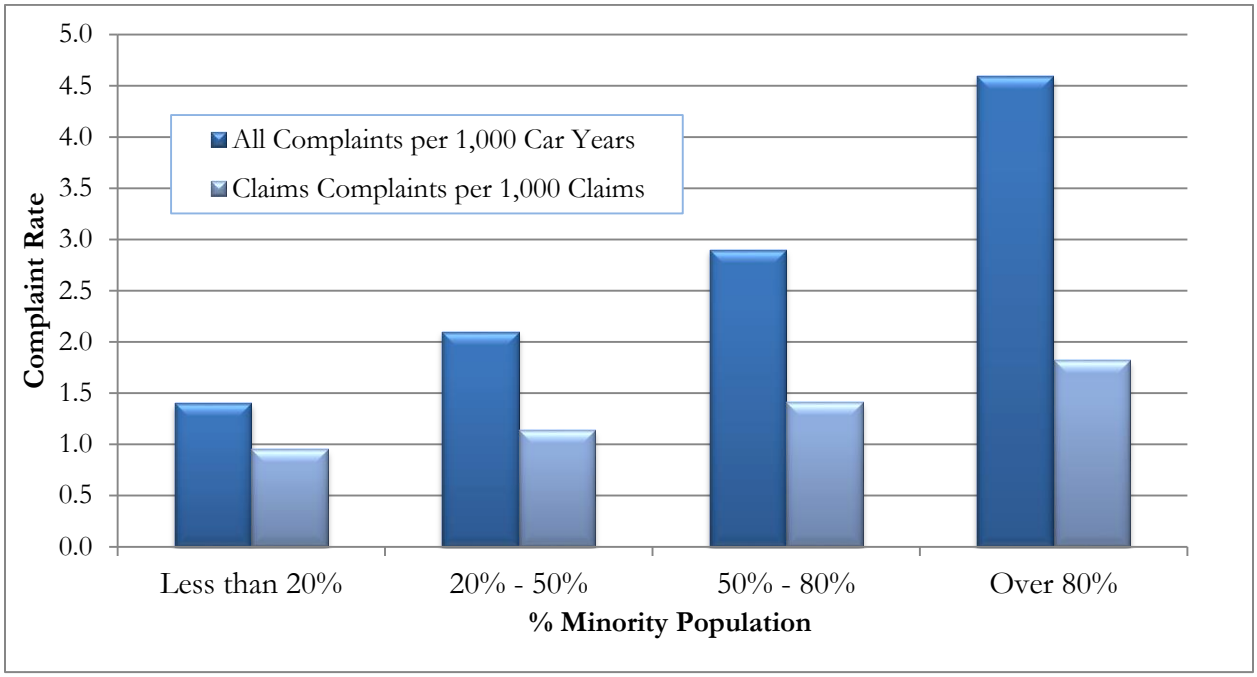
Average Premium & Loss Ratio by Risk Class		
Risk Class	**Avg. Annual Premium**	**Loss Ratio (2011-2016 Pooled Data)**
Preferred	$303	62.3%
Non-preferred	$392	64.6%

Complaint Rates - Complaint rates are significantly higher in high minority areas. This finding is consistent with prior findings by DIFP. Complaints are interpreted as an expression of dissatisfaction with the quality of service.

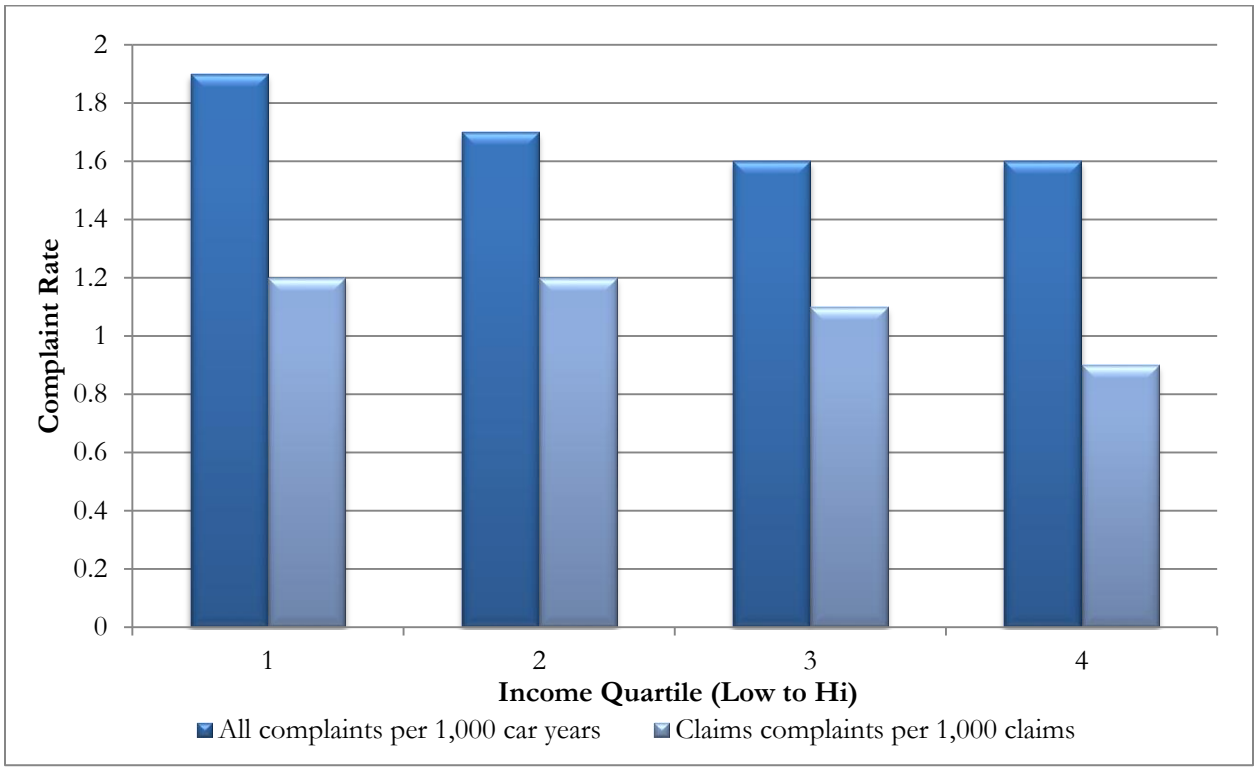
Complaints are also slightly elevated in poorer areas of the state.

Complaints rates are measured as the ratio of private automobile insurance complaints per 1,000 car years, and as the ratio of claims-related complaints per 1,000 claims.

Complaint Rates by Minority Concentration in ZIP Code



Complaint Rates by Median Household Income Quartile in ZIP Code



Ratio – Low to Hi
All complaints – 1.13
Claims-related complaints – 1.27

Multivariate analysis indicates that minority population density is associated with higher complaint rates, even controlling for a host of other socioeconomic variables, loss frequency, and percent non-preferred drivers. An appropriate interpretation of these results is not intuitive, but the situation may merit additional scrutiny or assessment. Loss frequency is still the most significant correlate with complaint rates.

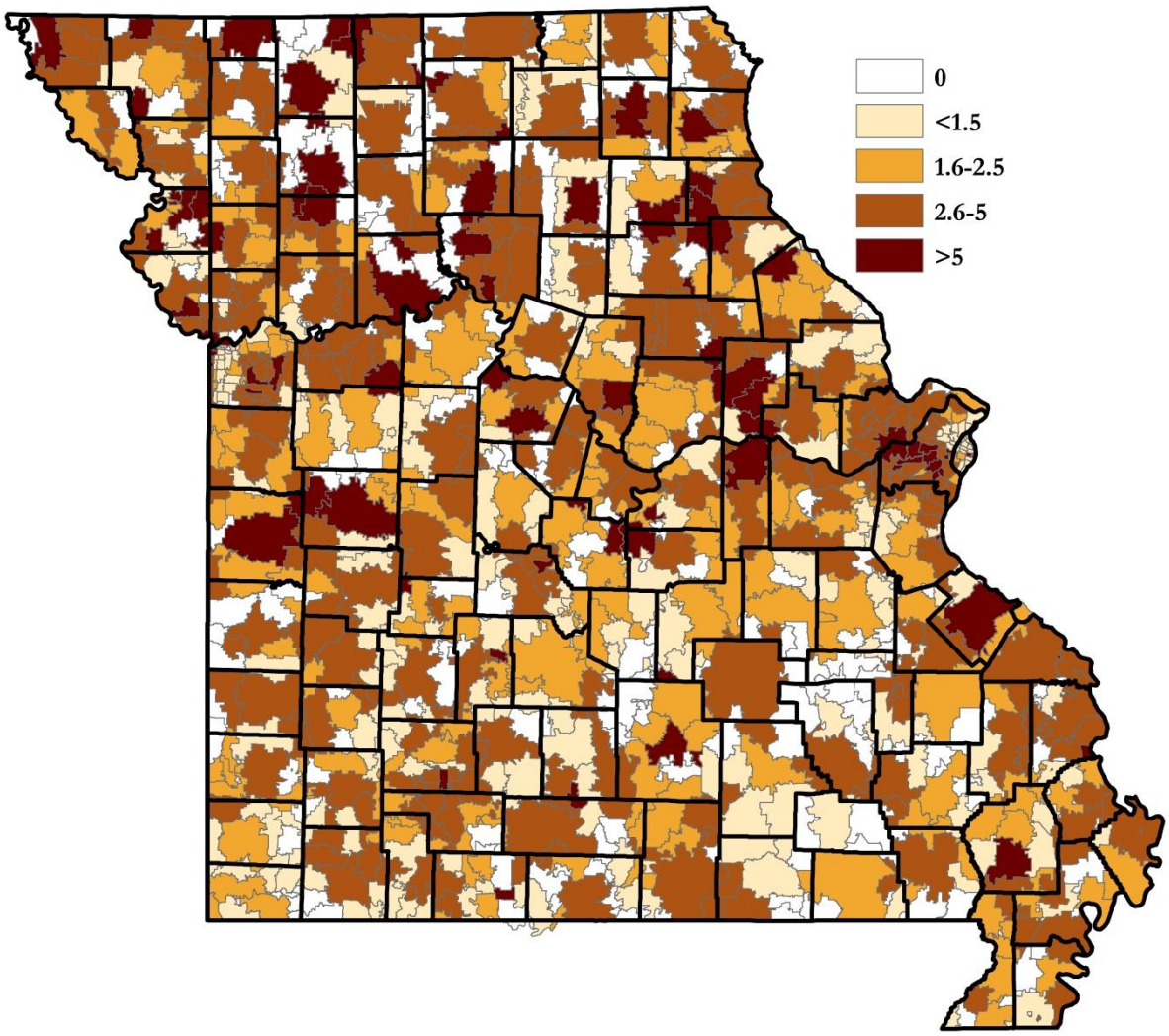
Results of Multivariate Regression on Complaint Rate		
Variable	**Parameter Estimate**	**Pr > |t|**
Intercept	-0.86195	0.0714
% non-preferred	-0.31243	0.6065
% minority*	1.52910	<.0001
Median Household Income (in $000s)	-0.02055	0.5379
% without college degree*	0.78066	0.0393
% renters*	0.96894	0.0142
Unemployment rate	0.69074	0.5209
% families below poverty	-0.00010832	0.2109
% without health insurance	0.04645	0.9363
Loss frequency*	39.75828	<.0001

*statistically significant to the .05 level.

R^2 = .43

Agents per capita – Agent location data has been used in prior DIFP reports as one indicator of the availability of coverage. The physical presence of agents in an area may be less impactful of market options today with the emergence of alternative delivery mechanisms (i.e. internet based sales etc). Data are presented here with the appropriate caveats.

Automobile Insurance Agents per 1,000 Residents, by ZIP Code



Agents by Percent Minority

% Minority	Agents	Population	Agent per 1,000 Residents
< 20%	16,634	4,595,771	3.6
20%-50%	1,663	541,857	3.1
51%-80%	455	271,392	1.7
>80%	1,016	650,837	1.5

Agents by Income Quartile

Income Quartile	Agents	Population	Agent per 1,000 Residents
1	2,287	1,080,018	2.1
2	3,151	1,229,248	2.6
3	4,560	1,365,049	3.3
4	9,763	2,378,400	4.1

Market Concentration

Standard measures of market concentration do not indicate a lack of competition by any demographic population segment. Markets are generally highly competitive across the state.

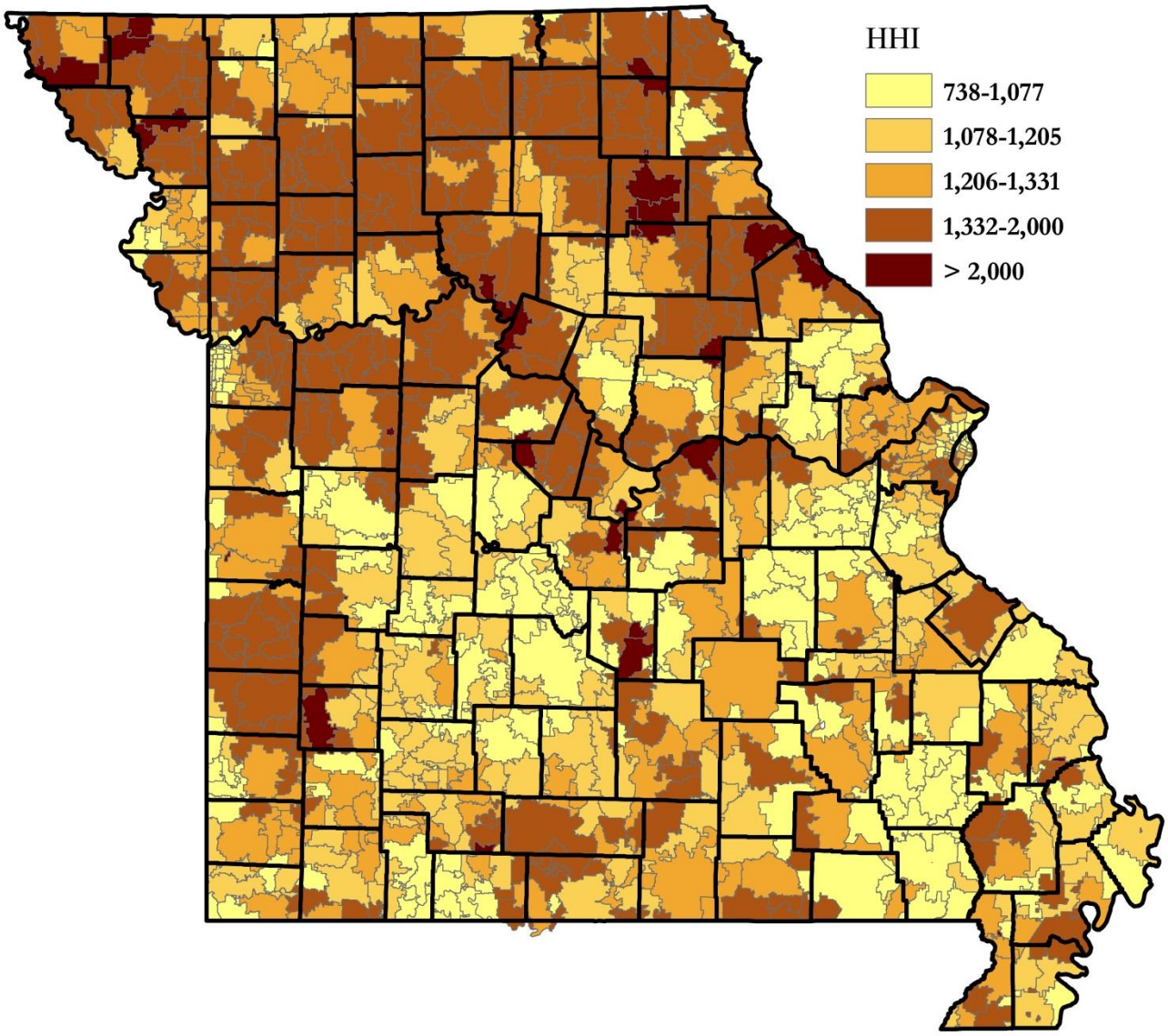
% Minority	Mkt. Share, Top 4	Mkt. Share, Top 8	HHI*
<20%	54.2%	74.5%	1,130
20%-50%	53.8%	75.6%	1,082
50% - 80%	50.8%	76.2%	995
> 80%	46.9%	74.0%	891
Statewide	46.8%	69.6%	1,102

Income Quartile	Mkt. Share, Top 4	Mkt. Share, Top 8	HHI
1	50.4%	72.1%	927
2	54.4%	74.1%	1,057
3	54.3%	74.7%	1,103
4	55.6%	75.9%	1,211
Statewide	**46.8%**	**69.6%**	**1,102**

* The Herfindahl-Hirschman Index (HHI) is a traditional measure of market concentration, and is defined as the sum of the squared market shares. Values of the HHI can range from 0 in a very highly competitive and fragmented market, to 10,000 in a pure monopoly. The anti-Trust Division of the Department of Justice provides one commonly used guideline:

A. Below 1,000: Unconcentrated or competitive
B. 1,000 to 1,800: Moderately concentrated
C. Over 1,800: Highly concentrated

Markets tend to be more concentrated in more rural northern areas of the state. The DIFP has no explanation for this trend.



The Price-Risk Connection

In the nearly 30 years that the DIFP has monitored prices, no evidence has been found that high minority areas are systematically overcharged relative to risk compared to low minority areas. The simplest and strongest evidence against this hypothesis is the lack of any systematic differences in loss ratios. The loss ratio is simply the ratio of losses to premiums. Drivers charged more per unit of risk will have a *lower* loss ratio than drivers charged less per unit of risk. That is, low loss ratios indicate that a group/region is overcharged and that the company retains more of each premium dollar paid by insureds. The following tables display loss ratios by percent minority and median household incomes divided into quartiles (four groups with equal numbers of ZIPs). No evidence indicates that high minority areas are charged more relative to risk, nor is there an association between loss ratios and area income. These results replicate prior DIFP analysis of earlier periods.

Loss ratio, liability coverage, 2011 – 2017 pooled data

% Minority	Liability Loss Ratio
< 20%	62.5%
20%-50%	63.5%
51% to 80%	67.8%
> 80%	70.1%

Median Household Income

Quartile	Liability Loss Ratio
1	63.1%
2	61.0%
3	62.1%
4	64.4%

Nor do more sophisticated analysis reveal any statistical pattern of lower loss ratios in high minority areas. While there is a statistically significant relationship between percent minority and *higher* loss ratios *in the opposite direction than expected if such areas are surcharged*, the very low R^2 value indicates that the correlation is very close to zero.

Results of Weighted OLS Regression of Minority on Liability Loss Ratio

Variable	Parameter Estimate	Pr > |t|
Intercept	0.55567	<.0001
% Minority	0.16488	0.0006

$R^2 = .0115$

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