FOOD FOR THOUGHT: AN ANALYSIS OF METROPOLITAN FRAGMENTATION AND SCHOOL LUNCH DISPARITIES IN THE AUSTIN MSA

by

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DEDICATION

To the kids trying to find their way in a world that doesn’t always make it easy.

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
MSA	Metropolitan Statistical Area
PED	Percent Economically Disadvantaged
PSE	**Per Student Expenditures**
PSR	Per Student Revenue
ISD	Independent School District
CISD	Consolidated Independent School District
USDA	United States Department of Agriculture
SNAP	Supplemental Nutrition Assistance Program
ACS	American Community Survey

ABSTRACT

Metropolitan Fragmentation, racial and class polarization, and segregation have influenced each other and shaped the availability of resources in American cities, including the quality of school food service. In this project I use accessible, publicly available data to map how polarization, race, class, and school lunch relate to each other spatially in the Austin MSA. Through visual comparative analysis, I find that there is a strong relationship between the spatial patterns of uneven school food service characteristics, and the patterns of polarization of white, black, and Hispanic residents and students.

I. INTRODUCTION

Cities in the United States are increasingly characterized by metropolitan fragmentation, which is the non-uniform overlap of government jurisdictions, particularly tax districts, creating a variety of different zones of service within the same city or metropolitan area. A number of historical and contemporary forces contribute to metropolitan fragmentation, including 'white flight' from central cities to suburban enclaves, gentrification of inner-city areas as privileged groups "reclaim" urban space, patterns of capital investment in and disinvestment from the built environment and public services, bank lending practices ("redlining"), racial covenants, and other factors. In many North American cities, fragmentation also entails metropolitan polarization, characterized as a distinct spatial concentration and separation of different racial, ethnic, and class groups. Fragmented, polarized metropolitan areas typically feature disparities in educational funding and therefore educational opportunities, disparities which reflect the uneven development processes and racial, ethnic, and income segregation of polarized metropolitan space. School segregation is often worsened by the practices involved in providing school lunches, resulting in nutritional inequities within metropolitan areas. Nutritional inequities are also affected by poor funding and systemic racism, creating something of a vicious cycle between fragmentation, polarization, segregation, and disparities in education and nutrition.

In 2020, 6.1 million children in the U.S. were characterized as food insecure, 79 percent of which participate in the National School Lunch Program. 74 percent of school lunches and 85 percent of school breakfasts went to low-income students on free or

reduced lunch (Guthrie, 2021; Hales & Coleman-Jensen, 2022). For other students who may not be more food secure, school lunch can provide better food for a lower price, providing the energy and nutrition necessary for the rest of the day's learning. The program also provides a significant subsidization of the agricultural industry in providing a large and consistent market. Federal reimbursement for lunch is fairly low, between $3.31 and $3.54 per meal in the 2018-2019 school year for free lunch depending on the characteristics of the school (Federal Register, 2019). While schools with sufficient resources can add to that with other funding, poorer schools are sometimes only able to fund their meal programs primarily or solely with those federal funds. Programs such as Farm to School can bring high quality meals made from fresh raw ingredients from local producers, along with educational opportunities for the students; however, participation often costs a lot more, there are few if any stable funding sources to cover the added expense, and many districts rely on annual grants and donations to keep the program running.

The Austin MSA is an important case study for understanding the intersection of metropolitan polarization and school lunch, as the city has a significant history of segregation and is made up of diverse communities. From 1928 until the end of segregation, the City of Austin put in place a series of policies to push and keep black residents east of what is now I-35 (Busch, 2017). Similarly, Hispanic residents were encouraged to consolidate in Southeast Austin. In recent years, gentrification and other pressures have significantly changed the historical patterns of settlement for different minority groups in the city, commonly leaving the City of Austin in favor of cheaper

suburbs and rural communities. Even with this reorganization of the demographic patterns of the MSA, and long after the end of segregation, the east-west patterns of segregation can still be seen. Austin is also an important case study due to its rapid growth, going from a relatively small city to one of the largest in the state in about a decade, growth that is driving gentrification, displacement, and downward class mobility for the most vulnerable populations (Engsrtom & Robinson, 2021; Way, 2019). The Austin MSA is also not entirely unique in terms of all of these characteristics; most metropolitan areas in the United States have a history of spatial de jure segregation, the patterns of which can still be seen today, and many cities are experiencing similar patterns of growth and displacement. Austin was selected over other areas such as Houston or Dallas/Fort Worth (DFW) because it is a clearer illustration of the relationship between polarization and school lunch. The DFW MSA has two major cities along with several other large cities, and likely at least a hundred school districts, along with dozens of different concentrations of communities. Meanwhile, Houston's historical patterns of segregation are more complex than the east-west separation found in Austin. In the end, Austin is a large and rapidly growing city that shares current and historical characteristics with a large number of other cities across the country allowing the project to be adapted to fit other areas, but it is simple and constrained enough to better showcase the analysis and results.

This study experiments with existing and easily accessible data on school and public demographics as well as expenditure and preparation data for school food service in each district in the Austin MSA to explore a method for analyzing the spatial

relationships between characteristics of school lunch programs, demographics, and metropolitan polarization. Combining the data with shapefiles, I used Arc GIS pro to make a series of maps which I used in a visual comparative analysis in order to understand the patterns depicted in the data.

These maps illustrate patterns of race, ethnic, and class polarization in the Austin MSA, specifically a largely East-West separation with a dividing line often following I-35. These patterns of polarization related to those of school lunch characteristics in that patterns of school food service also largely aligns with this same east-west separation. Additionally, the strongest relationship between polarization and school food service was in regard to patterns of Hispanic settlement. Districts with higher percentages of Hispanic students tended to also be those with the highest expenditures and, where there was data, higher percentages of recipes made from scratch.

While this project shows strong relationships between polarization and unequal distribution of school food services, more in-depth research is needed to better understand how exactly these topics are related, with a campus/census block level analysis likely to better facilitate spatial statistical analysis as well as inclusion of qualitative data. This project takes an initial step towards mapping the relationship between polarization and school lunch can be done, and points towards potential future research expanding on the work.

In what follows, I put forth a set of questions relating to the patterns of school lunch and polarization that guided my research. I then explore the literature related to metropolitan fragmentation, segregation, and school lunch, and discuss how the racial

and class discrimination practices of segregation in American cities contributed to metropolitan fragmentation while also redistributing the resources of school lunch, and how these processes created feedback loops that fueled each other. I then lay out my methodology for assessing metropolitan fragmentation and nutritional inequities in Austin, explaining my analysis as well as the results as shown in the maps created for this project. From those results, I use that evidence to answer the overarching questions as well as build my argument for the need for future research on this subject.

Problem statement, study objective, and research questions

Following a thorough examination of relevant scholarly literatures, I am unaware of any studies that focus on examining the relationships between metropolitan fragmentation and polarization, residential and school segregation, and inequities in school lunch programs. Thus, while each of these phenomena is relatively well understood in its own right, there is a need for research that examines how they intersect and influence one another. This project presents a case study of the Austin MSA to test how existing datasets and GIS can be used to answer questions of spatial distribution of nutritional inequality, exploring spatial correlations between race, class, and ethnicity and funding for school lunches, the spatial distribution of different types of school lunch service, and the relationship between fragmentation, segregation, and nutritional inequality. The project is guided by the following research questions:

RQ1: What is the spatial distribution of per-student lunch funding in the Austin MSA?

RQ2 What is the spatial distribution of from-scratch school lunch in the Austin MSA?

RQ3: How does funding and from-scratch correlate with the spatial distribution of racial, ethnic, and class differences in the metro area?

II. LITERATURE REVIEW

Metropolitan fragmentation and polarization

Metropolitan fragmentation, a characteristic of most urban agglomerations in the United States, occurs when a variety of (often largely independent) government agencies share governance authority and responsibility for a metropolitan area. These agencies or governments may spatially overlap to varying degrees, as often occurs with municipal governments and school districts, or they may be spatially distinct, as in cases of the various municipal governments constituting a metropolitan region. As each government or agency has its own authorities, taxes, and tasks, fragmentation generally turns metropolitan areas into complex patchworks of jurisdictions. The fragmented nature of metropolitan areas also causes a division of authority and resources that limits the ability to address issues at the metropolitan scale such as inequality (Hutson et al., 2012; Squires & Jargowsky).

The underlying philosophies of this system are multifarious and historically and geographically contingent on a range of processes. As Weiher (1991, pg. xvi) explains, proponents of fragmentation tend to emphasize supposed democratic virtues of smaller, more localized governments: “the local government was to be the incubator of democracy, training citizens in their rights and responsibilities. Honesty, immediacy, and responsiveness were taken to be the virtues of government close to the people.” However, this Jeffersonian idea in the modern day can reproduce systems of oppression.

In post-war America, an intertwined series of policies, beliefs, and practices came together and drastically influenced the socio-spatial patterns of urban development. In this time the federal government heavily subsidized the acquisition of land by the white middle class, through creation of the interstate highway system and insuring housing loans. The guidelines from the Federal Housing administration created four categories of neighborhoods to use when deciding whether to insure these mortgages, and these maps were heavily influenced by racist and segregationist mindsets. The presence of one minority household was enough to place a neighborhood in the highest risk category, thus preventing people from getting mortgages in these areas in a practice known as 'redlining' (Squires & Powell, 2007; Busch, 2017). This style of discrimination influenced and was influenced by what Busch refers to, quoting George Lipsitz, as "a possessive investment in whiteness" in which socio-spatial economic conceptions and practices favor whiteness as an economic asset (Busch, 2017, pg. 17).

It can be argued this possessive investment in whiteness, alongside the mass subsidization of homeownership, largely influenced the 'white' view of the home as a primarily economic asset in which to grow wealth (Busch, 2017). This possessive investment in whiteness view combined with the view of the home as an economic asset to be protected, along with general racial segregation mentalities, led to the creation of racial covenants, in which the deed to the land contained a clause forbidding that land's possession by a racial or ethnic minority (Busch, 2017). Individual desire for segregation and large single-family homes, discriminatory lending practices, and the

advent of the interstate highway system encouraged white people in the cities to move to areas outside of the city and formed their own communities. Out of fear of being annexed by central cities or other jurisdictions such as school districts, combined with a desire to access city services without sharing access with minorities, these communities began creating their own cities, school districts, fire service districts and others. This exodus, referred to as white flight, and processes of suburbanization, created a feedback loop wherein more white residents of central cities took advantage of these new services found in the suburbs, therein reducing the central jurisdiction's tax base, and subsequently reducing the quality of services, further incentivizing white flight (Busch, 2017; Squires & Powell, 2007; Weiher 1991; Squires & Jargowsky, 2007).

With the expansion of the suburbs driven by white flight, and the patchwork of different jurisdictions that was created, those with means are able to make residential location decisions in a metropolitan area where the overlap of these governments met their specific criteria, one of the most common being schools (Hutson et al., 2012; Squires & Jargowsky, 2002; Zhang & Ruther, 2020; Weiher, 1991). School districts are generally funded by taxes generated in their jurisdiction; people choose where to live based on the quality of the school, forming a feedback loop that started with white flight and the creation of the suburbs, and has reproduced and even exacerbated urban decay and race/class segregation, a process further affected by enrollment in private schools (Squires & Jargowsky, 2002; Zhang & Ruther, 2020).

While these policies and practices led to the fragmentation and polarization of metropolitan areas, they also influenced the spatial distribution of social groups and

goods and services within cities. When creating the 1928 plan, the City of Austin, along with other cities across the country, created segregated patterns of public resource access. These policies, combined with discriminatory lending practices driven by the possessive investment in whiteness and city zoning ordinances, heavily 'encouraged' minority residents to move and concentrate on the east side of the city on the other side of East Avenue (Busch, 2017). This urban divide became even stronger with the construction of I-35, which was built on top of the East Avenue right of way, further separation the predominately black and Hispanic east side from the mostly white west side of the city. Even in the case of Hispanic residents, including those in integrated areas, de facto segregation maintained the institution (Busch, 166). These patterns were so deeply entrenched, that when Austin Independent School District (AISD) was ordered by a federal court to desegregate, after 20 years of failed and rejected proposals, including those intentionally created to circumvent the order such as integrating black students with legally white Hispanic students, the only way to integrate the schools that was found by the court was to bus children from different areas of the city to schools on the opposite side (Busch, 2017, pg. 166-168). The practice of busing allowed the district to integrate well enough that the federal case was closed in 1983, but three years later when the enforcement period was over, the district went back to the former boundary driven model and the schools quickly resegregated, peaking in the 1990's though not reaching the same levels of segregation as before busing (Busch, 2017; Cuban 2008).

It is important to note that there are logistical difficulties when researching metropolitan fragmentation. Weiher (1991 pg. 89-91) discusses this in depth, noting

that “Data on the relationships of local boundaries to each other are not always readily available.[…] When such information exists, it frequently requires the examination of a variety of publications, comparisons of a number of maps, and conversations with county officials, city clerks, and school superintendents to pull it all together.” Today we have access to new research tools and data sets that makes research in this area far easier than was available when those points were raised. But it can still be the case that data on multiple entities must be acquired from every one of those entities individually, even if websites provide an easier alternative to physical archives.

School segregation

Before the rulings in Brown v. Board I and II, effectively ending de jure segregation in public schools, there was much debate surrounding the issue of segregation, which had lasting influence on national policy. Public officials of different backgrounds supported the initiative to support farmers and feed children. Some, however, particularly southern Democrats, had reservations about the program as they worried it would be used as a mechanism to desegregate the school system (Levine, 2010). Gaddis (2020) discusses how in the late 1960’s the school lunch program was found to have significant gaps in use, highly along racial lines, with several black schools relying solely on funding from the 1965 Elementary and Secondary Education Act to fund the free lunch program.

Unequal access to education and other resources over generations has drastically impacted communities of color. These results of structuralized and

institutional racism often have the blame shifted elsewhere, as discussed by Meek and Tarlau (2015). Food deserts, for example, are often framed as simply a problem of access, rather than the result of systemic marginalization. Meek and Tarlau position such characterization within "[the] long history in the field of education blaming communities of color for their so-called underachievement in schools." Understanding how race is used as a scapegoat to deflect criticism from how systematic racism effects school performance adds to the discussions surrounding education as a means of addressing mass incarceration as outlined by Shange (2019, pg. 39-42). In both cases, individuals and their communities are set up to take the blame for systems of segregation and oppression.

In addition to racial segregation, the concept of economic segregation is also brought up in the literature. The school lunch program has within it three categories: free, reduced, and full price, differentiating children's participation based on economic status which creates stigma and social separation (Gaddis, 2020; Poppendieck, 2010). Some schools add to this segregation a spatial element, having separate lunch lines for those on free and reduced, and offering greater variety of more appealing options to those not receiving aid (Poppendieck, 2010). This system of school lunch segregation is also maintained through acts of social, sometimes even physical violence through what is known as "Lunch Shaming" in which a child without sufficient funds for lunch has their tray taken away, sometimes violently, and replaced with just a very simple sandwich, which is sometimes referred to as "the stigma sandwich" (Gaddis, 2020; Poppendieck, 2010). Some organizations and lunch workers have started initiatives to raise money to

pay off school lunch debt and end lunch shaming. One such initiative was started in honor of an elementary cafeteria manager who would pay out of his own pocket if kids did not have enough funds, and who was later killed by police in a traffic stop (Gaddis, 2020).

School lunch programs

The history of the American school lunch program is complex, as one might expect given that it is one of the largest food assistance programs in the country. One of the first large scale iterations of the program was created in 1946, and it was rooted in the idea of providing a means of disposing of agricultural surplus by providing it to schools. This program had several issues, but thanks in part to kitchens built from donations or Works Project Administration projects, schools were able to provide meals to some kids in need (Gaddis, 2020; Levine, 2010; Poppendieck, 2010). Over time the program went through many debates and had several major changes, resulting in the heat-and-serve system of today.

The literature highlights several philosophical debates from both the history of the program and modern discourse. One of these debates is about the purpose of the program. Some early local programs saw it as a means to socialize children, specifically of immigrants, into the cultural norms of Anglo-American society. Later the debate turned to using school lunch programs as a means to address agricultural surplus while simultaneously combatting malnutrition. The most recent historical political debate centers on combating obesity (Gaddis, 2020; Levine, 2010; Poppendieck, 2010). These

debates are not exclusive to the U.S., as discussed by Oostindjer et. al.(2016) who found a pattern of stages in the historical development of school lunch programs in several nations in the designed purposes of the program: first to combat malnutrition, then to improve the quality of the food frequently focusing on obesity, and finally creating a system focused on health and sustainability. Some argue that the United States is currently positioned in the 'health and sustainability' stage in this historical process (see also Gaddis, 2020).

Economics is another major theme of the literature, with school lunch programs situated within historic debates on the economics of welfare programs in general. Recent discourse on the argued harmful effects of a shrinking budget create an environment where schools feel forced to rely on intense industrial styles of food production – i.e. 'heat and serve'-- a system that devalues many different aspects and people of the supply chain (Gaddis, 2020; Gaddis, 2017; Levine, 2010). Critical research raises questions about the social implications of the program, both what it is and what it could be. As discussed above, economic and racial segregation are both aspects of the school lunch program. These patterns also exist along with gender in looking at the staff of these programs, who are mostly women of color, and that a significant portion receive food assistance benefits themselves. The intense devaluation of the work, both physical and emotional, that occurs in the heat and serve industrial model, helps to perpetuate these systems (Gaddis, 2020; Gaddis, 2017). The activity of providing school lunch, Gaddis argues, is a form of reproductive labour, labour that provides societal benefits that the system is not designed to value (Gaddis, 2020; Gaddis, 2017).

Critical food scholars provide a variety of ideas about how to address problems with the school lunch program, arguing that school lunch program reform has the potential "to provoke structural changes throughout the entirety of the food system," because "it is state-led...[which] gives it heightened reach, legitimacy and implementation capacity, [and] it is positioned specifically to reach populations particularly at risk of food insecurity in both its forms of hunger and obesity (Ashe & Sonnino, 2012, p. 1022). Thus, the program can serve as a catalyst to change in the wider food system, extending into societal relationships and reframing the value of care (Gaddis, 2020; Gaddis, 2017).

Much of the literature discussing these goals comes from research regarding the Farm to School (FTS) program, a movement of school food reforms centered around connecting schools and their students to local farms and farmers. Within the discourse surrounding FTS, some scholars promote its ability to provide these reforms and improve our food system overall, while others point out its potential to perpetuate inequalities (Kloppenburg & Hassanein, 2006; Bisceglia et. al. 2020; Gaddis & Coplen, 2017). While a major focus of the FTS movement is on education, the movement is often touted for its focus on bringing fresh, local foods into the cafeteria, and as the literature discusses, if this is done explicitly with systematic change in mind, this seemingly simple approach could produce necessary change. Across the literature, from the simplest improvements to the most radical systematic changes, scholars find that kitchen infrastructure able to prepare meals from raw ingredients is necessary.

However, in places that do not have the existing infrastructure, building it can be too resource intensive without outside help for some schools.

In the literature discussed above, some works illustrate the relationships between metropolitan fragmentation and segregation both economic and racial, and others discuss the relationship between segregation and school lunch. But none of the literature reviewed here adequately, or directly, relates the concept of metropolitan fragmentation to the discourse surrounding the school lunch program. Based on the literature, it can be inferred that such a relationship could exist, but it cannot be determined solely with the literature found. While Zhang and Ruther (2020) provide methods of analyzing segregation between school districts as a result of metropolitan fragmentation as well as listing several databases with relevant statistics, none of the literature here discusses a method for analyzing school lunch in relation to metropolitan fragmentation.

III. METHODOLOGY

For this project I exclusively used publicly available data. In addition to my research objective of understanding the relationships between metropolitan polarization, segregation, and school lunch programs, I also sought to develop a methodology that is generalizable and replicable for other cities and MSAs. I focused on data from the 2018-2019 school year, for several reasons. First, the USDA Farm to School Census existed only for that school year. More significantly, 2018-2019 was the last full school year before the Covid-19 Pandemic, which brought massive disruption to schools and school lunches, as well as other data sources used in this project such as U.S. Census counts. I note this as any future research in this vein will likely have to adapt the methodology to reflect the constantly changing nature of the school lunch program from 2020 onward.

The visual spatial comparative analysis I used in this project is adapted from a methodology I developed in previous work, itself adapted from a form of visual analysis used in genetics research. I first learned of a methodology in genetics research in which researchers analyze gene sequences by creating sets of what I later referred to as "punch cards", matrices of squares with columns representing each nucleotide and a different color or hole marked in each row corresponding to the nucleotide at that point in the sequence. The reason for this, I was told, is that due to the nature of these sequences, it is difficult for a computer to differentiate useful patterns from 'noise,' and thus this visual method allows human researchers to better compare sequences with a human's innate ability to detect patterns from noise. I later created similar matrix

"punch cards" in order to create a map visualizing the unequal pattern of effects of climate change in each state. After completing this project and finalizing the map itself, I realized that the punch cards themselves were unnecessary to that project as creating a symbology in GIS that was similarly easily distinguishable, someone could assess patterns just as easily from that. The utility of this type of visual analysis comes when looking for patterns in data that computers would have difficulty discerning, either due to large amounts of noise such as climate or genetic data, or in the case of this project, the data being compared is not in a form conducive to mathematical comparisons (Crane, Unpublished). With this project, especially given the low resolution of the data, and inability to acquire data conducive to statistical analysis, I felt this method of visual pattern analysis of simple maps would be the best method for my primary analysis. I created a series of maps, primarily using simple gradient color schemes, trying to stick to 5 groups at most for each characteristic, and using the same color schemes for the maps being compared the most so as to make potential patterns as easily discernable as possible. Additionally, this form of analysis may allow an easier method for analyzing the spatial patterns of qualitative data that would help further understanding the patterns and relationships discussed here.

In the literature discussing how to improve school lunch in all aspects -- taste, nutrition, equity, and environmental concerns -- a common factor necessary to implement those changes is the need for schools to prepare meals from scratch. It argues that a reliance on an industrialized food system -- in this case in the form of heat and serve meals- - contributes to increased health risks, environmental degradation,

and as Gaddis and Coplen (2017) argue "…erodes the public value of the NSLP." Additionally, this system contributes to the devaluation of not only the food, but those who prepare and serve it. Moreover, the focus on efficiency can inhibit workers' ability to provide care and build important bonds with the children they are charged with serving. This is why from-scratch meal preparation and the pay and working conditions of lunchroom staff were the most common characteristics considered in scholarly discussions on improving school lunch. Following this approach, I chose these data points as central measures of the quality of school lunch programs for this project. Acquiring necessary wage data for food staff for each district proved unfeasible for the scope of this project, and thus data on expenditures, both per student and percent of budget, were chosen as the best substitutes since, while they do not illustrate the valuation of the workers, they arguably illustrate the valuation and prioritization of the food program as a whole. As far as the percentage of meals prepared from scratch, the U.S. Department of Agriculture (USDA) Farm to School Census provided an easily and publicly accessible data set that included that data, even if it did not include every district in the research area, and no other comparable data set was found.

In order to understand the role class plays in the spatial patterns of school lunch, I chose to measure this in terms of percentage of students who qualify for the Free and Reduced lunch program as determined by the USDA, and for the general population, examining the percentage of households that receive food stamps/Supplemental Nutrition Assistance Program (SNAP). While focusing on these measures creates an oversimplified, binary notion of class difference -- those who qualify and those who do

not -- given that the project revolves around the demographics of children, the only accessible data for understanding class in the context of each district's student is the percent who are defined as Economically Disadvantaged, i.e., qualify for the free and reduced lunch program. Data on percentage of households receiving SNAP benefits was chosen as the closest comparable measure for the general population as both programs are administered by the USDA, and while exact qualification requirements may differ, both serve similar functions, and the qualifications use the same administrative definitions. While other characteristics were considered such as household income, they were decided against as there was no feasible way of acquiring comparable data about students for this project and attempting to compare household income data to Free and Reduced lunch participation was determined to be too much of a detraction from the goals and scope of the project.

For the analysis on the role of race and ethnicity, I focused on the largest three groups in the area, white, black/African American, and Hispanic/Latino. I chose to focus on these groups not only because they are the largest, but there are incongruous terms between the TEAs data and the U.S. Census data when it comes to other groups. Given the nature of this project, and the size of the three chosen groups compared to others, I decided focusing on just those three would not significantly impact my ability to understand how race and ethnicity factor into patterns of school lunch, even if it does not provide a perfect illustration of this relationship. In addition, I felt these three groups, given their size and historical relationships in terms of de jure and de facto segregation, would help show patterns of polarization and inequity.

In order to match with the data gathered on the school districts, data from the U.S. Census' American Community Survey (ACS) from 2019 was chosen for analysis on the general population. The highest resolution data available for the 2019 ACS was at the census tract level, and given the size of a census tract, many tracts crossed the boundaries of school districts, making any quantitative analysis comparing population data within districts difficult and likely inaccurate. In addition, the nature of the ACS and its methodology created larger margins of error than would be found in a full decennial Census. That said, while I considered using the 2020 decennial Census data at the census block level, given the rapidly changing nature of the Austin MSA, the higher likely error rate of the 2020 census compared to other decennial censuses, and that it simply did not match the other data sets, the 2019 ACS data was chosen as the better fit with the project, despite spatial incongruencies and considerations of error.

School data was used at the district level as while it is possible to gather some of the relevant data at the campus level, much of the other data was not available at that high of a resolution. For one, TIGER had no shapefiles with campus attendance zones, nor do many districts publish that data in a GIS accessible format. Also, due to the inability to access data on how many students live out of district and where they are from, and it was assumed a relatively sparse number of students did, so these situations were not considered. However, if this project were to be done at the campus level, the existence of magnet schools and other scenarios was considered to contribute to much higher rates of students from outside of the campus attendance zones but still from within the district, thus causing greater inaccuracy than would be found in a district

wide analysis. In addition, this project focused on 36 districts for analysis, and in these 36 districts there is a total of almost 500 campuses (479), and without centralized data sets covering all relevant data for all of those campuses, the work was determined to be outside of the scope of this project.

While no specific research was done into the individual bureaucracies and logistical frameworks for each district's food service program, it was also a concern that there is a potential for some or even most of the districts in this study to be set up for decisions on food such as meal planning and purchasing to be made at the district level instead of by the individual campuses, which if true would cause additional considerations in a campus level analysis outside of the scope of this project. Furthermore, given the use of district wide data over campus specific, since the data is averaged across the whole of the district, I felt the best means of comparison is to also use characteristics averaged to a percent or per student basis in order to account for differences in school size when comparing these characteristics.

I obtained the necessary shapefiles from the Census Bureau's TIGER archives, all 2019, including Texas School District Boundaries, Texas MSA Boundaries, and Census Tracts. I also used a Texas Cities Boundaries shapefile obtained from TXDoT. For school district data on community type, percentage of students classified as Economically Disadvantaged, the Per Student Revenue, and the racial and ethnic makeup of the student population, I used 2019 TEA Snapshot data. In addition, 2018-2019 TEA PEIMS District Financial Budget Reports provided financial data on total food expenditures, what percentage of the total budget went to food, and how much per student was

allocated. The percentage of recipes made from scratch was obtained from the FTS Census 2019 from the USDA.

Once downloaded (and, in the case of the PEIMS data, copied), I formatted, using Excel 365, data into usable sheets, pulling relevant data based on district and criteria into clean sheets, then copied the values of those tables onto three new sheets in the same Excel book. I then proceeded to reformat the district names to be consistent in terms of case and abbreviation, i.e. turning “Independent School District” or “Cons ISD” to be “ISD” and “CISD” respectively in order to match the format of the district names in the TIGER shapefile.

The last steps of data processing were done using ArcGIS Pro 2.3.0. Within the Project I created a master “data” map in which to create the layers needed from the raw data. All data was added to the project, then starting with the Texas MSA Boundaries file I selected the Austin MSA and created a layer from selection. Using that layer with the Intersect and Layer from Selection tools I created the other layers from the other shape files, the relevant school districts, cities, and Census Tracts . With the “Districts” layer made from the selection of those school districts that significantly intersected the MSA, I used the Join feature to join the shape layer with all three tables imported from Excel, using the respective district name columns as the join feature. From there I created a new Map in the Project, and copied the relevant layers onto it, and used Symbology to illustrate the spatial distribution of the different characteristics. For Figure 6. Districts: Revenue per Student, Figure 2. Districts: Per Student Expenditures, Figure 4. Districts: Percent of Students that are Economically Disadvantaged, and Figure 5.

Districts: Percent of Budget Allocated Towards Food Service I used a gradient color scheme using Equal Interval with five classed, with the exception of Figure 4 in which I used a manual interval, setting it in five blocks of 20 percent from 0 percent-100 percent as that made more logical sense than 2.6 percent-93.8 percent with an odd interval. For Figure 3. Districts: Percent of Recipes From Scratch and Figure 1. Districts: Community Type, I used Unique Values Symbology, and manually created a gradient color scheme. For the Census Tract layer, I used the intersect tool as before, selecting all tracts that intersected the Districts layer, then once again used the layer from selection tool to create the layer. Additionally, to aide in the reading of the created maps, I used the clip tool in order to only include the parts of the Census tracts within the Districts layer. I then Joined this layer with the imported table containing the relevant demographic information.

For the maps depicting the patterns of Race and Class in relation to the other characteristics of the districts (Figures 7-9,13-18), I created three sets of bivariant maps. Each set shows one of the three racial/ethnic groups that are focused on in this project as discussed previously and contain a map comparing the percentage of each group with the Economically Disadvantaged, Per Student Expenditures, and Percent of budget. In these maps I set the symbology to show the percent of each group along the pink axis, and the school characteristic along the blue axis. For the maps showing the general population patterns using the Census tracts and data (Figures 10-12), I set up a similar symbology with bivariant maps showing each group along the pink axis, and the percent of households receiving Food Stamps/SNAP along the blue. Finally, I created a Layout

with the Map Frame of the illustrative Map, added, and formatted a legend, then toggled through each layer, exporting each to a JPEG to be used for visual analysis.

IV. RESULTS

In order to understand the spatial patterns of school food characteristics, I first used Figure 1. Districts: Community Type to see if and how the different community types could explain the patterns. In Figure 1, it shows the community types of each district as defined by the TEA (definitions attached below), with the eight types being Major Urban, Major Suburban , Other Central City , Other Central City Suburban , Non-Metropolitan: Fast Growing, Non-Metropolitan: Stable, Independent Town, and Rural. Based on the population and spatial aspects to the definitions, there is no surprising pattern to the distribution of community types in this map, with Austin ISD being the Major Urban, and Georgetown ISD and San Marcos CISD as the Other Central Cities, and rings of suburbs around those nodes. The smallest districts by these definitions are mostly clustered to the East of the central cluster, with more rural being in the Eastern part of Williamson County. With acknowledgement of these patterns, this map is compared with the various aspects of school food in order to check against the possibility of district size being the sole explanation of the differences found.

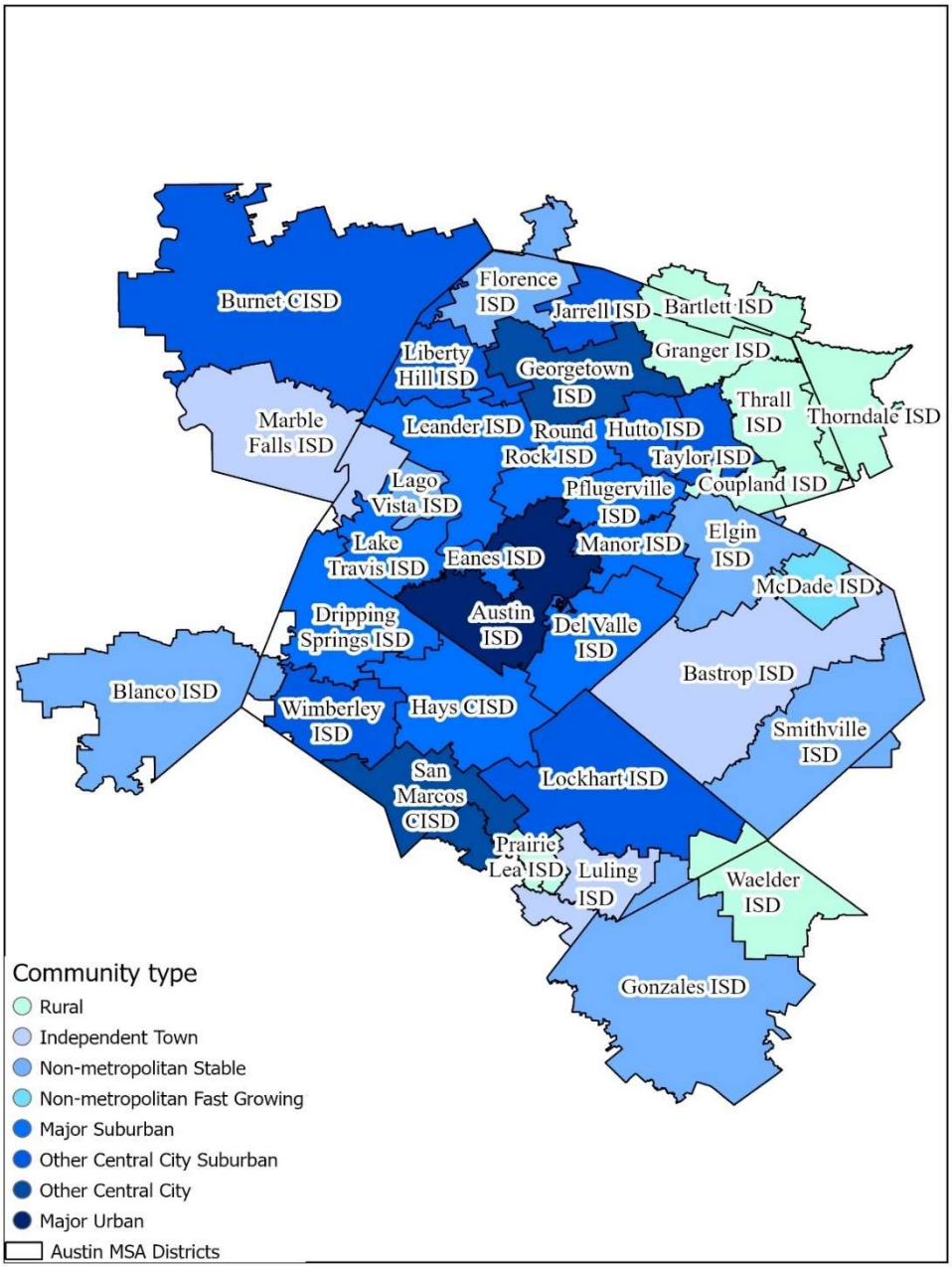

Figure 1. Districts: Community Type

Figure 2. Districts: Per Student Expenditures is a map of the Per Student Expenditures towards Food, as defined below, for each district. Bartlett ISD, Del Valle ISD, and Prairie Lea ISD are shown as having the highest rate of per student expenditures, with several other relatively high-rate districts also located in the eastern portion of the MSA. There is also a cluster of districts between Austin ISD and Georgetown ISD with the lowest rates. When compared to the Community Type map (Figure 1), the three districts with the highest expenditures, two were rural while Del Valle ISD is listed as Major Suburban, and in different relative locations within the MSA. No Community Type had mostly consistent rates of expenditures, and those districts with higher rates spanned several community types, though did tend towards the smaller district types, therefore Community Type does not explain these patterns well by itself.

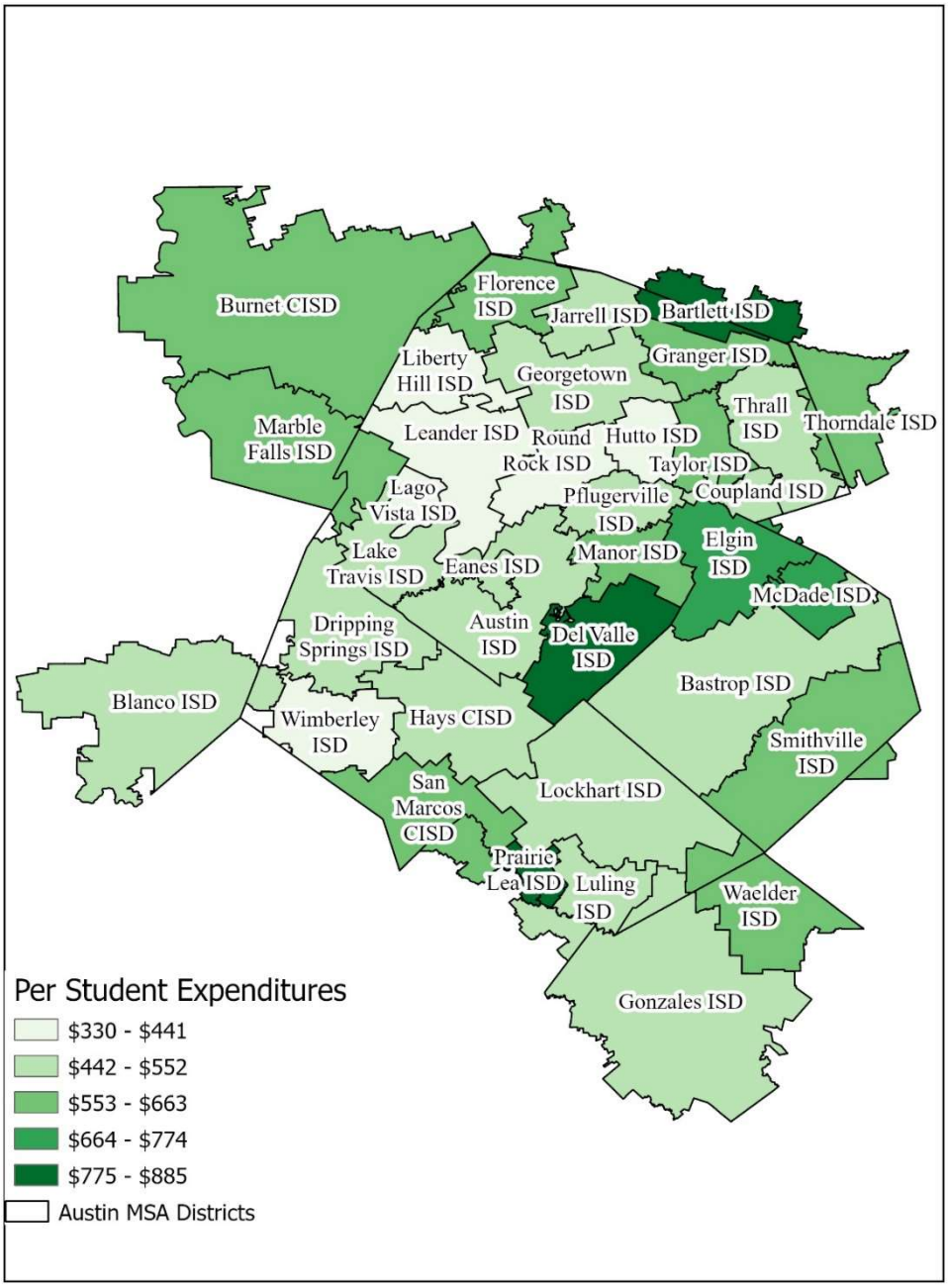

Figure 2. Districts: Per Student Expenditures

Figure 3. Districts: Percent of Recipes From Scratch shows a map of the percent of meals made from scratch by each district which responded to the survey. The number of districts for which there is no data makes spatial comparisons difficult for this characteristic. That said, Taylor ISD is the only district shown in the highest rate tier, and Del Valle and Georgetown are the only other districts that make over half of their recipes from scratch. The varying Type of districts within each rate tier in this map shows that for the data available, Community Type is also not a good explanation for this pattern either. That said, while Taylor and Georgetown ISDs were not in the lowest expenditure rate groups, they were still relatively low, meanwhile Del Valle was among the highest per student expenditures and one of the top three for percent of recipes from scratch. Other tier to tier comparisons between Figure 3 and Figure 2 do not match up.

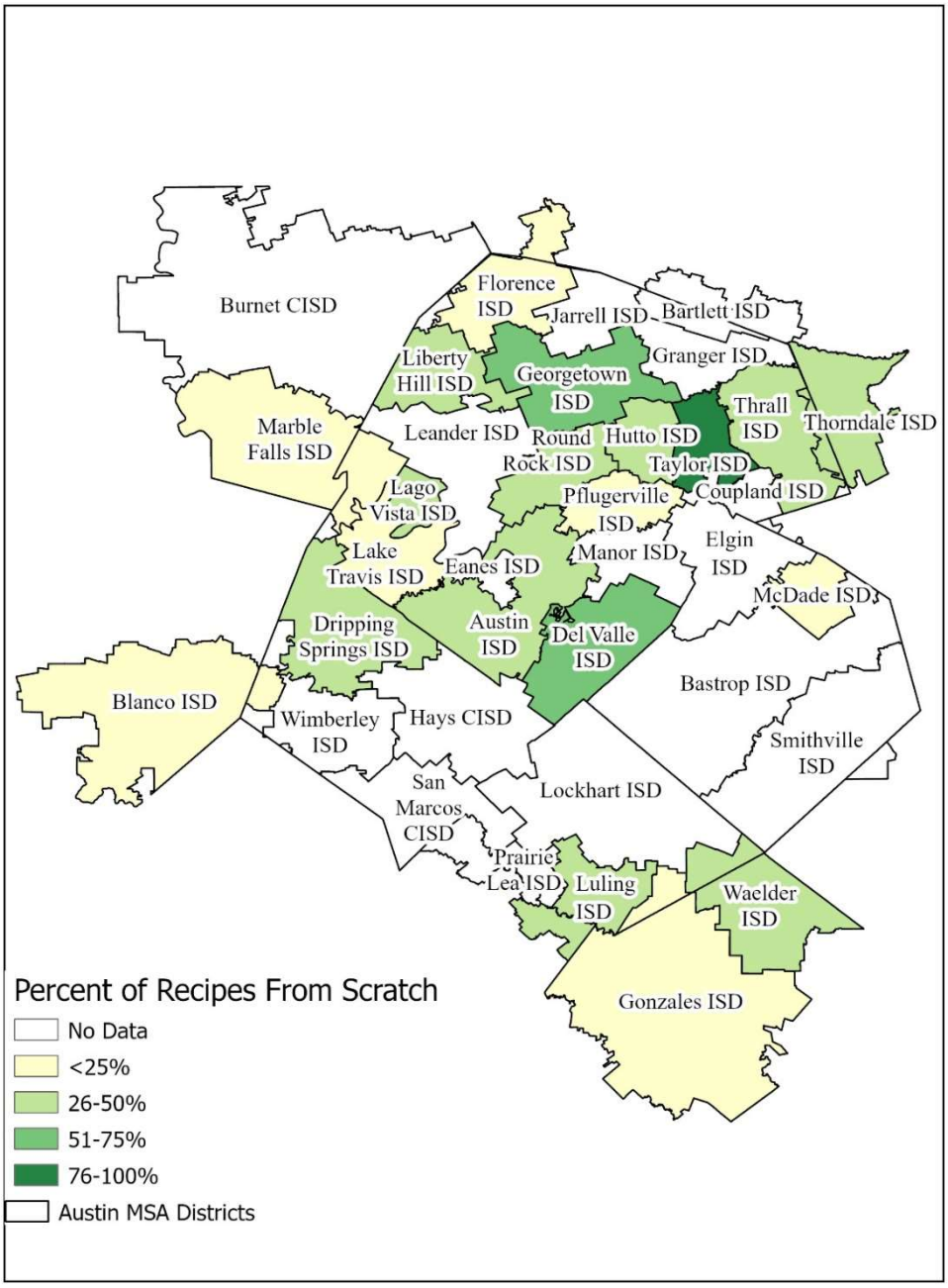

Figure 3. Districts: Percent of Recipes From Scratch

Figure 4. Districts: Percent of Students that are Economically Disadvantaged shows the percentage of students classified as Economically Disadvantaged (defined below) in each district. There is a strong spatial pattern in this map, with most of the highest percentages being concentrated in the Eastern, particularly Southeastern part of the MSA. Once again, Bartlett ISD and Del Valle ISD are in the top three along with Waelder ISD. Four of the districts along the western edge of Austin ISD; Leander ISD, Eanes ISD, Lake Travis ISD, and Dripping Springs ISD, were the only districts below 20 percent, and all are concentrated in the Western Center of the MSA. While there are several outliers each way, the map shows a strong east-west polarization in terms of Economically Disadvantaged students.

In terms of Community Types as shown in Figure 1, there is variation in the levels of disadvantages students within the suburb and city types, however, all three independent towns, the only Non-Metropolitan Fast growing, and most of the Rural districts were all above 61 percent, and the Non-Metropolitan Stable were all the same or higher than their neighbors. When comparing with per student expenditures, those with the highest expenditures were among the highest percent disadvantaged; however, the inverse is not the case, in fact several of the most disadvantaged had relatively low expenditure rates. Taylor ISD and Del Valle ISD were some of the highest in both Economically Disadvantaged and Meals from Scratch Figure 3. However, there is not a strong comparison between the two otherwise with only the districts with data in Figure 3.

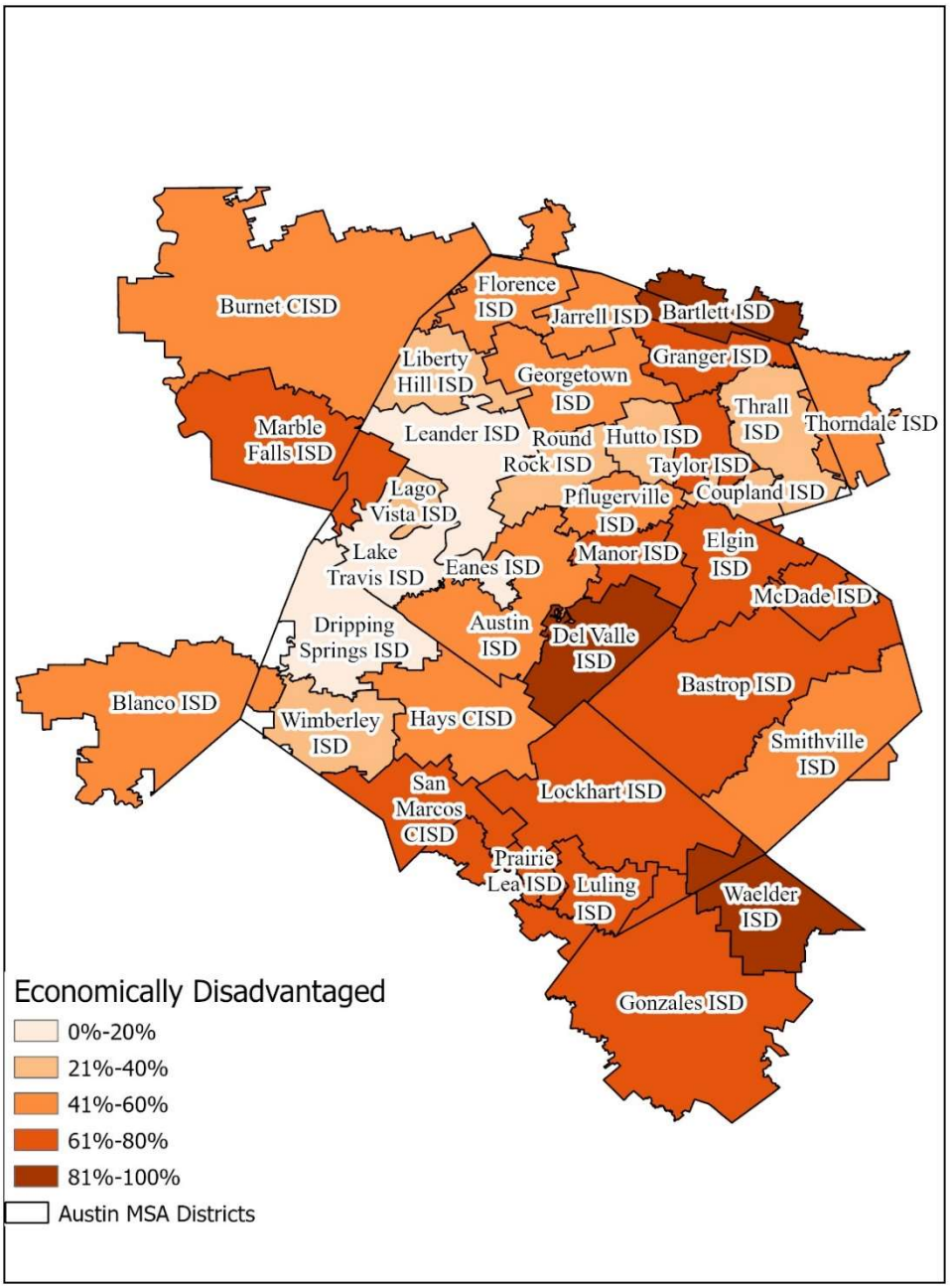

Figure 4. Districts: Percent of Students that are Economically Disadvantaged

Figure 5. Districts: Percent of Budget Allocated Towards Food Service shows the Percent of budget that goes towards Food for each district. While weaker than other maps, this map shows an East- West polarization between those districts that allocate more towards Food in the East, and less towards the West. However, there are several outliers in the Northwest and Southeast. Bartlett ISD, Del Valle ISD, and Prairie Lea ISD are all once again in the top tier, along with Elgin ISD. Three of the four lowest percent allocations are clustered Northwest of Austin, with Wimberly ISD as the outlier in its category. There is not a strong comparison between the community type and percent allocated. However, those with the highest allocation percentages were nonmetropolitan (not any of the city or suburb types) with the exception of Del Valle ISD. It does however align closely with the map of Per Student Expenditures Figure 2. It is difficult to compare Figure 5 with Figure 3 as many of the districts with the highest allocations were ones with no data on meals from scratch, and the districts with data in Figure 3 show no consistent pattern when compared to Figure 5. There are several similarities between the Percent of Budget and Economically Disadvantaged, particularly in the line of districts from Bartlett ISD to Del Valle ISD relative to the surrounding districts. The concentration of lower percentages west of Austin is also shared between the two maps, but with a slight difference with Lago Vista ISD and Lake Travis ISD between the two maps.

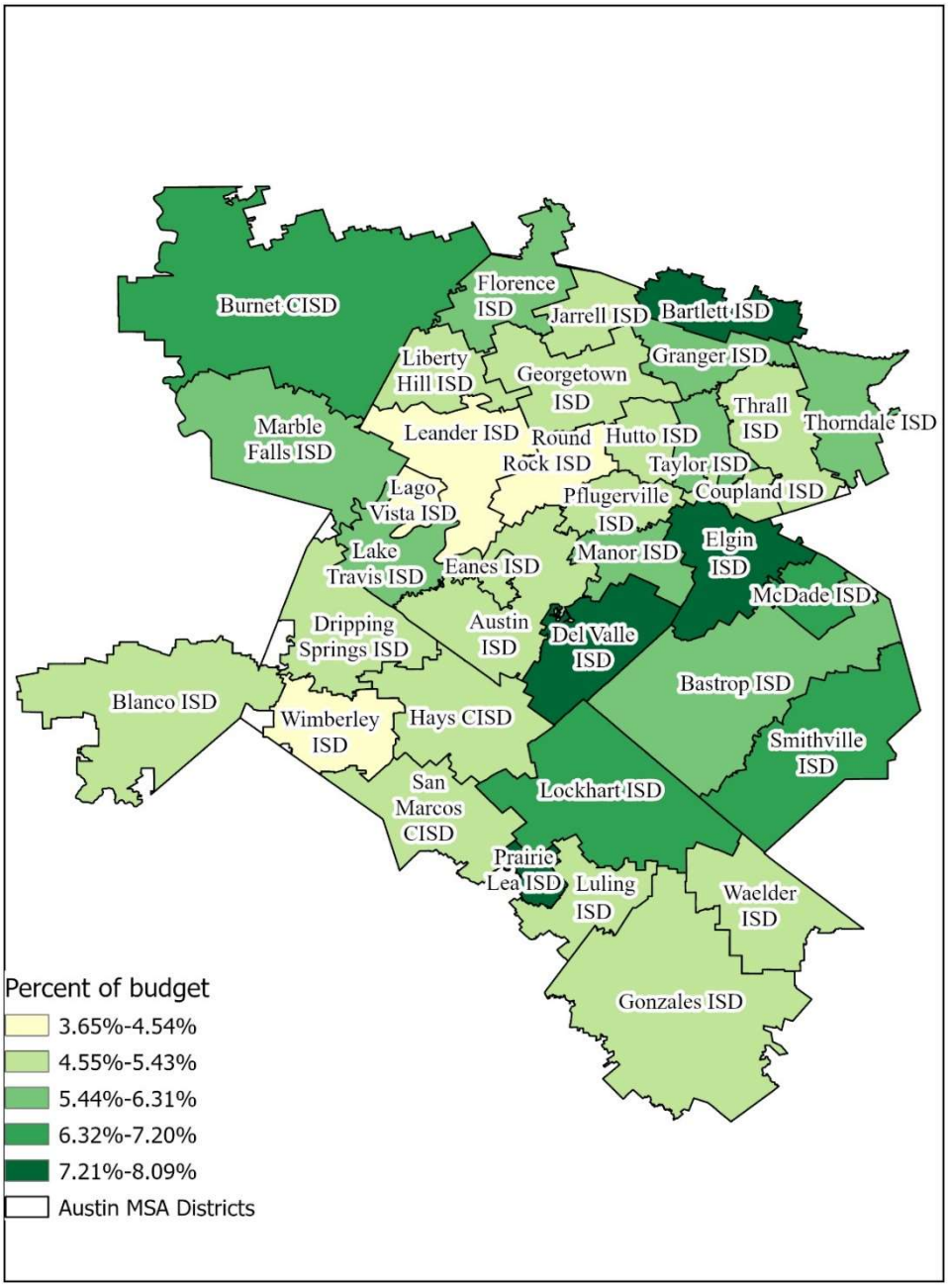

Figure 5. Districts: Percent of Budget Allocated Towards Food Service

In Figure 6. Districts: Revenue per Student, showing total revenue for each district per student, there is a strong concentration of the highest rates within the districts covering parts of Travis and Williamson Counties, with the exception of Round Rock ISD which is low relative to its surrounding districts, and Blanco ISD in the Southwest, which is one of the highest, alongside Bartlett ISD, once again in the top, and Manor ISD. This map does not perfectly relate to any of the others discussed previously, though it does show a north-south polarization in revenue rates.

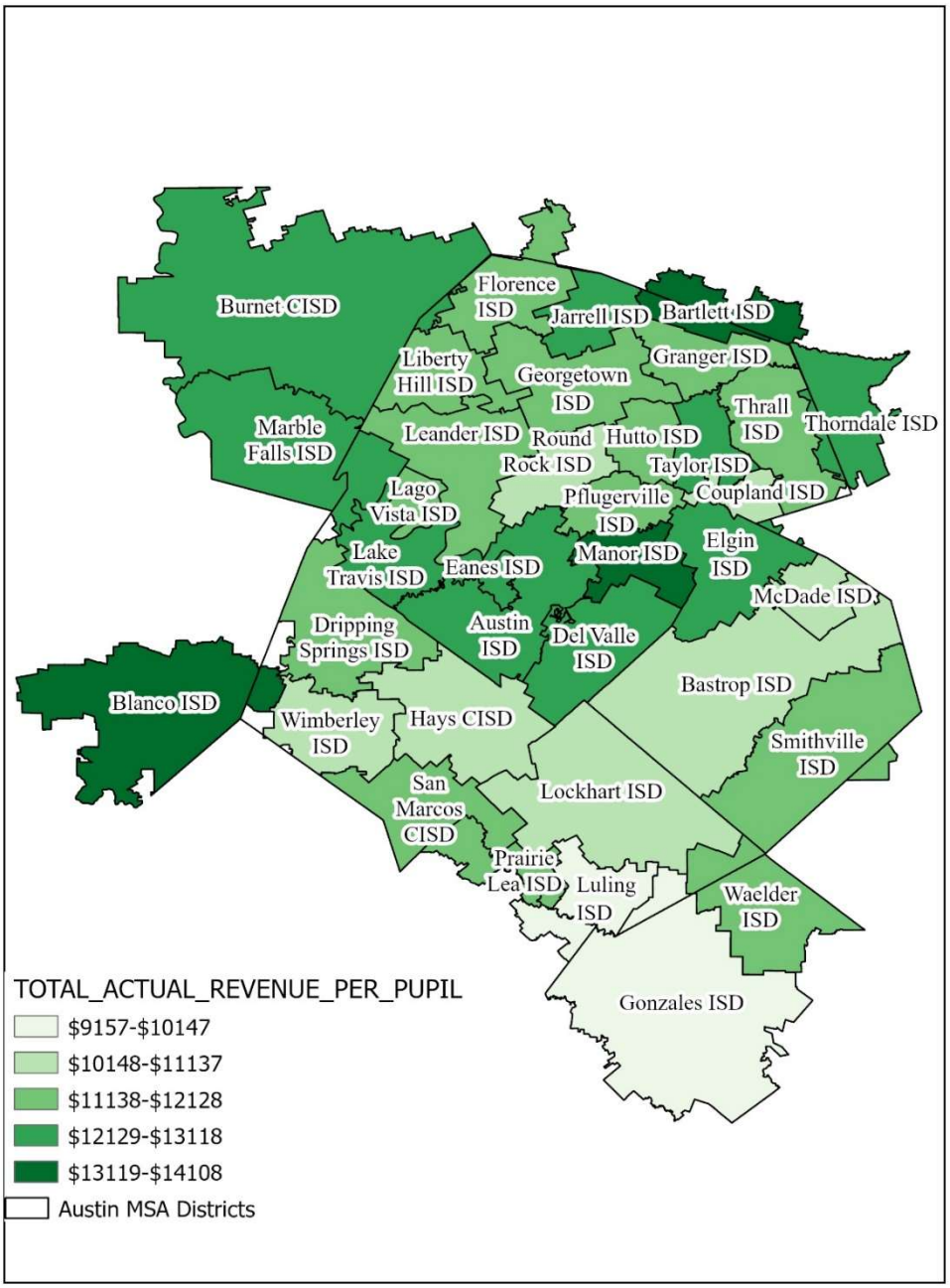

Figure 6. Districts: Revenue per Student

Figure 7. Districts: African American vs Economically Disadvantaged is a Bivariant map depicting the percentage of students reported as African American along the pink axis, and the percent economically disadvantaged along the blue. Focusing first on the pink axis, the districts with the highest percentage of students that are African American are clustered Northeast of Austin (the max percentage is 20 percent): Manor ISD, Pflugerville ISD, and Hutto ISD. Most other districts are shown to be relatively low percentages. Manor ISD is the only district shown to have a High percentage of students who are African American as well as a High percent Economically disadvantaged. Meanwhile, the other districts with a higher percentage of African American students are shown with lower percentage economically disadvantaged. Bartlett, Elgin, and Waelder ISDs are shown to have a high percent disadvantaged, and a somewhat high percent African American. The districts in the west constitute a cluster of Low Low districts. The number of districts shown to be Low High, and the number that are High Low, with few along the midline between the two, with the exception of Manor ISD, indicates a weak relationship between percent African American and PED.

Figure 8. Districts: African American vs Per Student Expenditures is a Bivariant map depicting the percentage of students reported as African American along the pink axis, and the Expenditures Per Student on the blue. Unlike Figure 7, this map shows a slightly stronger relationship between the characteristics, specifically looking at Bartlett ISD, Waelder ISD, and the cluster of districts centered on Pflugerville ISD Northeast of Austin. This map also show a large number of Low Low districts, showing a relatively stronger relationship than Figure 7.

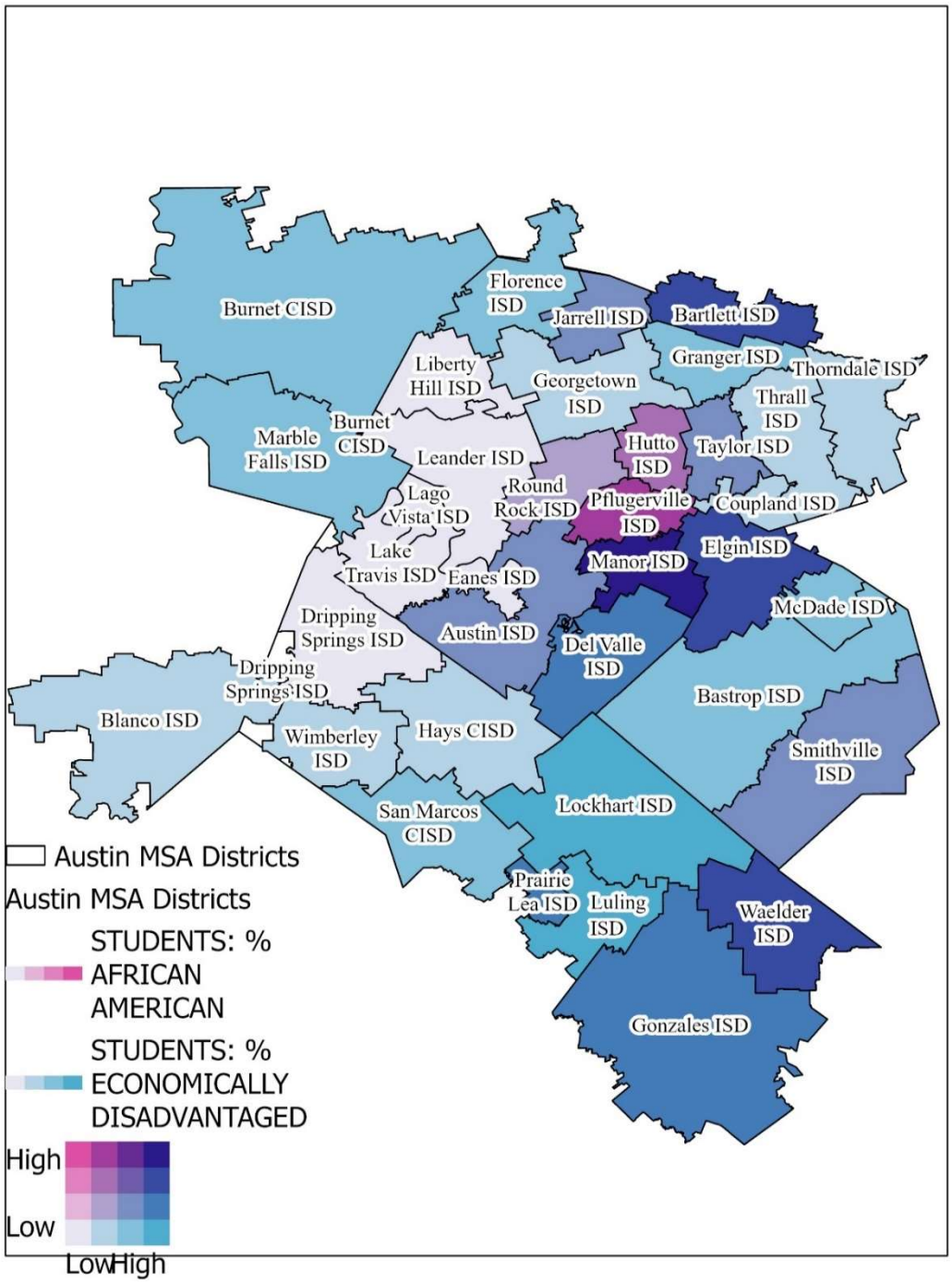

Figure 7. Districts: African American vs Economically Disadvantaged

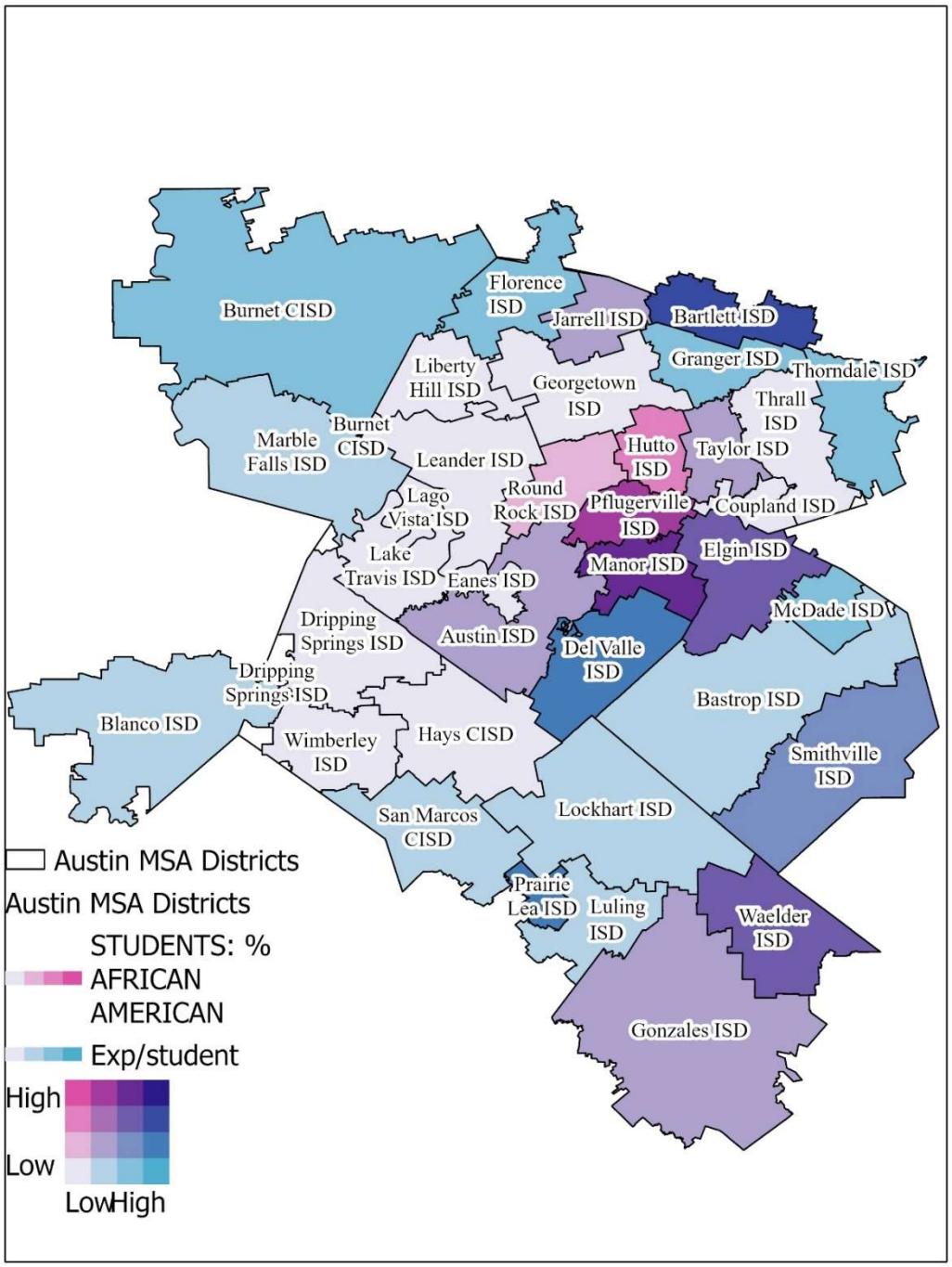

Figure 8. Districts: African American vs Per Student Expenditures

Figure 9. Census Tracts: Percent Black vs SNAP is a bivariant map created using census tracts and data depicting the general populations relationship between the percent of the population that is Black/African American on the pink axis, and the Percent receiving Food stamps, SNAP or other government food assistance. It reveals High High tracts as being concentrated immediately north-northeast of Austin and including the edges of the city and Austin ISD. This concentration is centered at the meeting point of Austin ISD, Manor ISD, and Del Valle ISD. Additionally, tracts shown as higher in both axes, but not High High, are also concentrated north of the High High area, including Pflugerville ISD, and parts of Manor, Round Rock, Hutto, and Elgin ISDs. Additionally, Low Low tracts are concentrated to the west-southwest of Austin, including the western half of Austin ISD, Eanes ISD, Leander, Lake Travis, and Dripping springs ISDs. This map closely relates to the district maps focusing on the African American student population (Figure 7 , Figure 8) and shows the same pattern of polarization.

Unlike the districts however, the higher resolution of this map allows us to see a much more defined line of separation between these polarized areas, running north-south down the middle of every district between Jarrell ISD and San Marcos CISD. Given the location of this line and the historical patterns of segregation, it safe to say this line follows I-35 very closely. A point of interest on this map is the Tract that is located almost entirely in Granger ISD and partially in Bartlett ISD, shown to have a High percentage black population and a somewhat high percentage receiving federal food assistance. However when compared to the district map (Figure 7), Granger ISD is

shown to be a low percentage African American, while Bartlett ISD is somewhat high on that axis. Furthermore, Taylor ISD has areas with High black populations, and others with Low populations, while the district is shown to be somewhat low somewhat high. These examples help Illustrate the difficulty of analyzing the correlations between school and general demographics using data of this resolution.

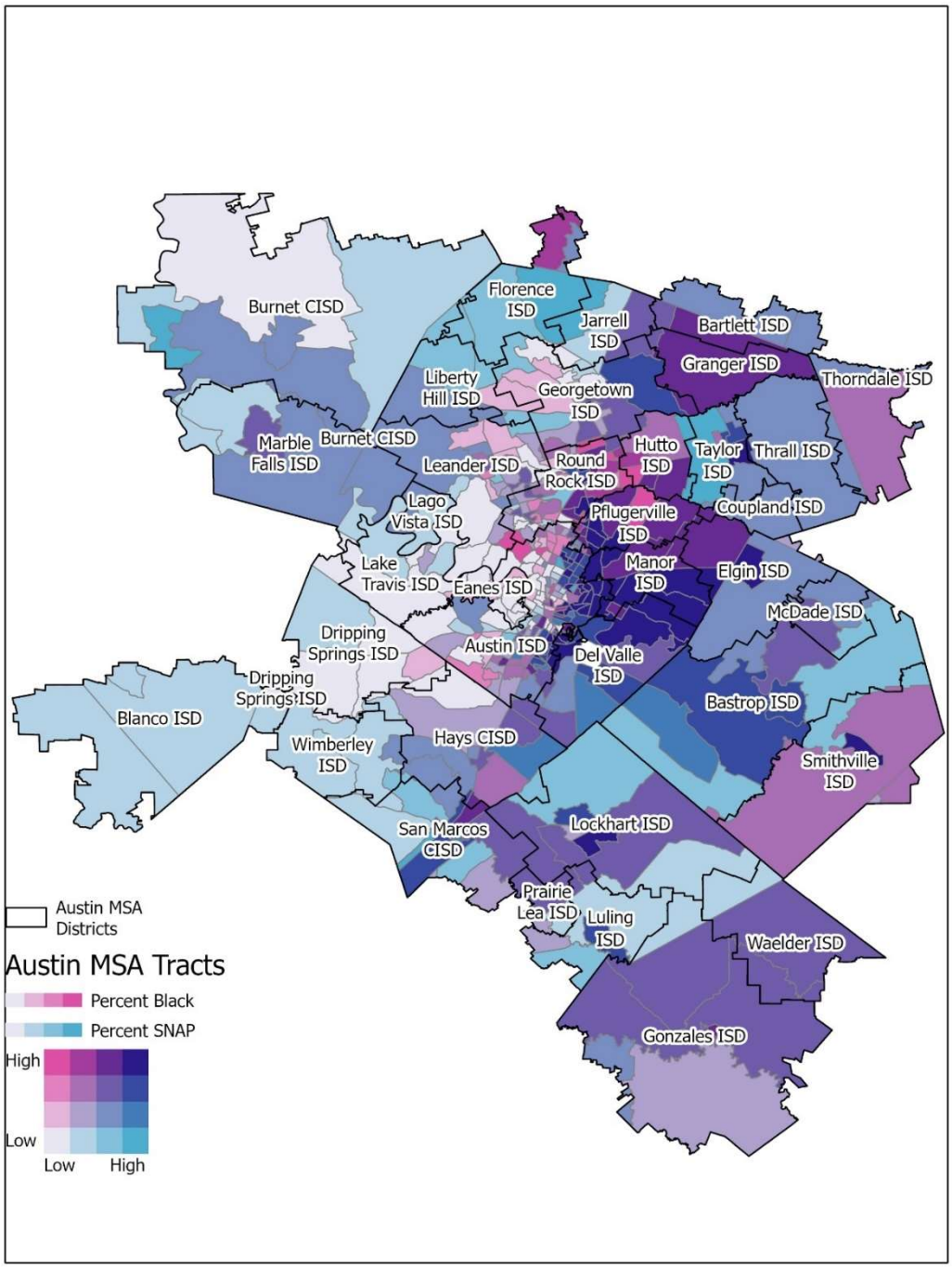

Figure 9. Census Tracts: Percent Black vs SNAP

Figure 10. Districts: Hispanic vs Economically Disadvantaged shows the percentage of Hispanic Students along the pink axis, and PED along the blue. The important takeaway from this map is that it shows a strong relationship between percent Hispanic and PED, and a concentration of High High districts in the southeastern part of the MSA. The same cluster of Low Low districts from Figure 7, the districts between Liberty Hill ISD and Dripping Springs ISD, exist in this map as well.

Looking at districts that are relatively high in both categories and compared to those relatively low in both categories, there is an obvious polarization between the west and the southeast. This pattern of polarization is also seen when PED is replaced by Per Student Expenditures Figure 11, though the relationship between PSE and percent Hispanic is not as strong as that seen in Figure 10. The districts shown in Figure 11 to be in the top right edge of the gradient key are Del Valle ISD, high high, Elgin and Waelder ISD, high somewhat high, and Bartlett and Prairie Lea ISD, somewhat high and high.

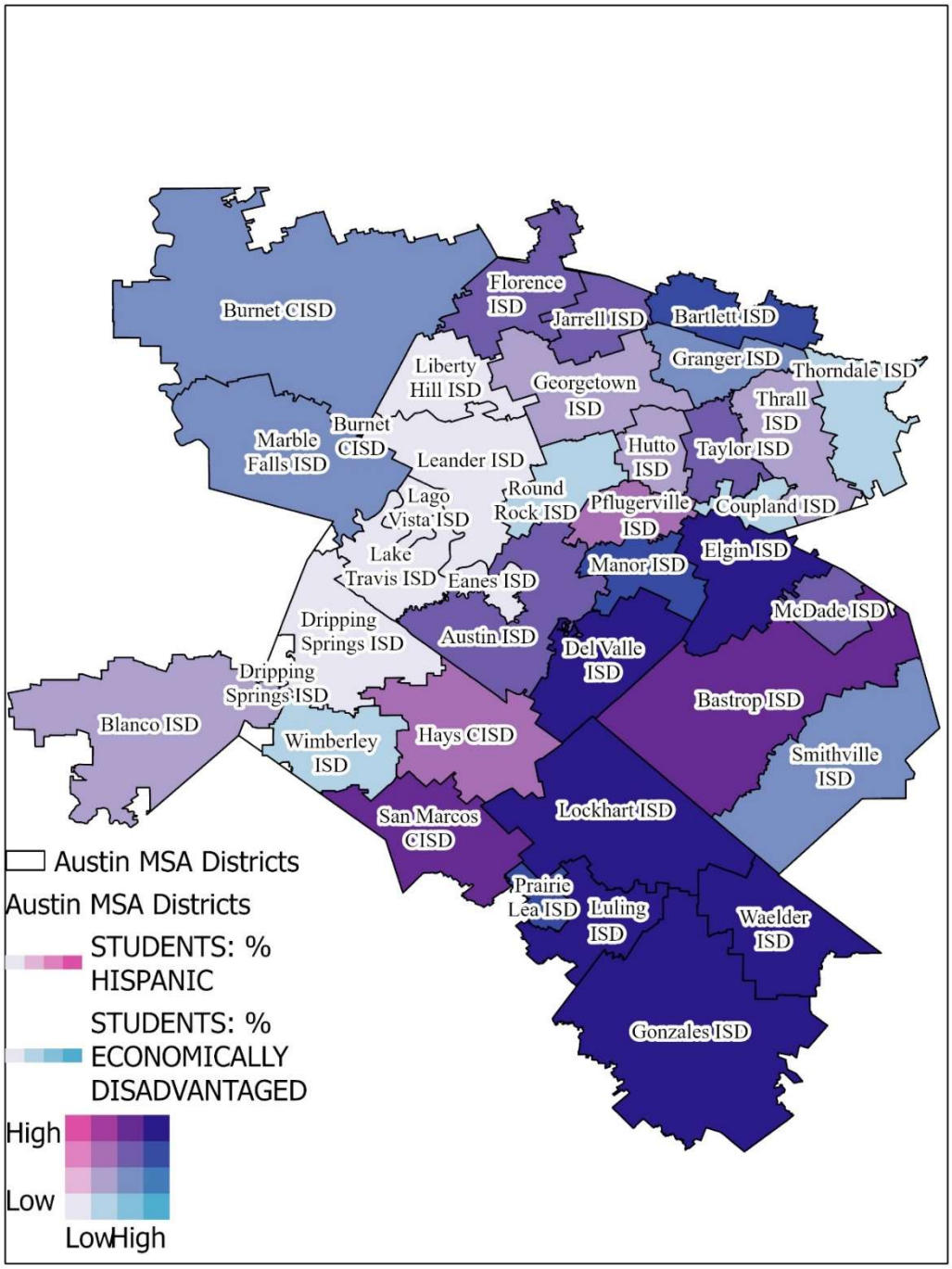

Figure 10. Districts: Hispanic vs Economically Disadvantaged

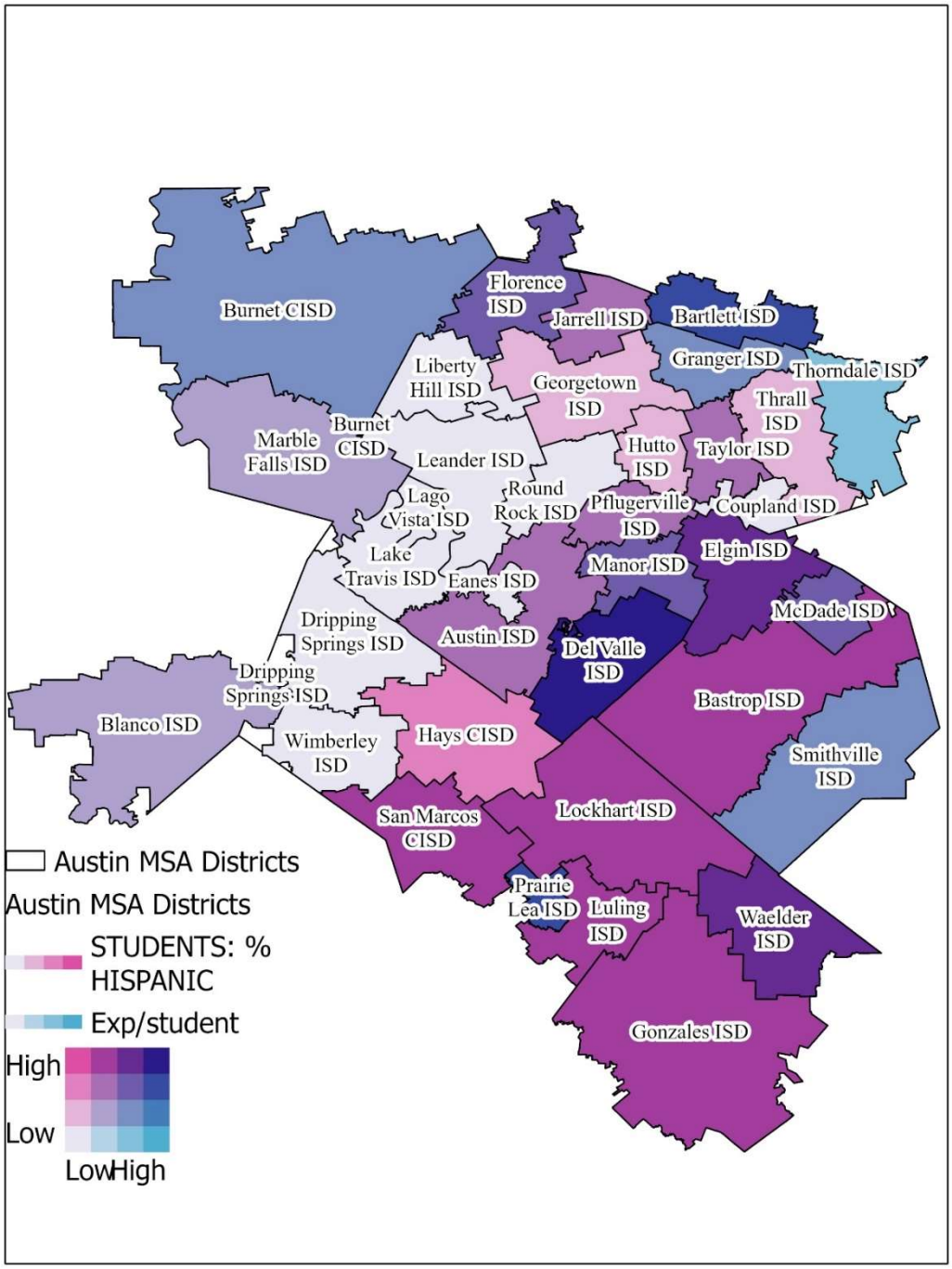

Figure 11. Districts: Hispanic vs Per Student Expenditures

Figure 12. Census Tracts: Percent Hispanic vs SNAP is a Bivariant map similar to Figure 9, showing the percent of the general population that is Hispanic vs percent of households receiving federal food assistance. Tracts shown as High High are not as consolidated in this map as in Figure 9, but there is still a pattern of concentration at the eastern edge and east of Austin ISD, mostly in Del Valle ISD and Manor ISD. The map also shows other High High spots corresponding to the cities of Taylor, Elgin, Lockhart, Luling, and San Marcos. Similarly to Figure 9, there is also a noticeable line of polarization between the east and west along I-35, though in this case it is not as defined and there are more outliers on both sides of the line than are present in the other map. When compared to Figure 10, there are similar patterns of High vs Low on both axis, however, in the southeast with Lockhart, Waelder, Luling, and Gonzales ISDs, the maps show a higher percentage of economically disadvantaged students than households that receive SNAP in the general population. The more varied pattern of distribution in this map compared to others also illustrates the difficulty of working at this resolution, as in the western half of the MSA there exists several tracts shown to be high on one axis or the other, but are located in districts shown as Low Low.

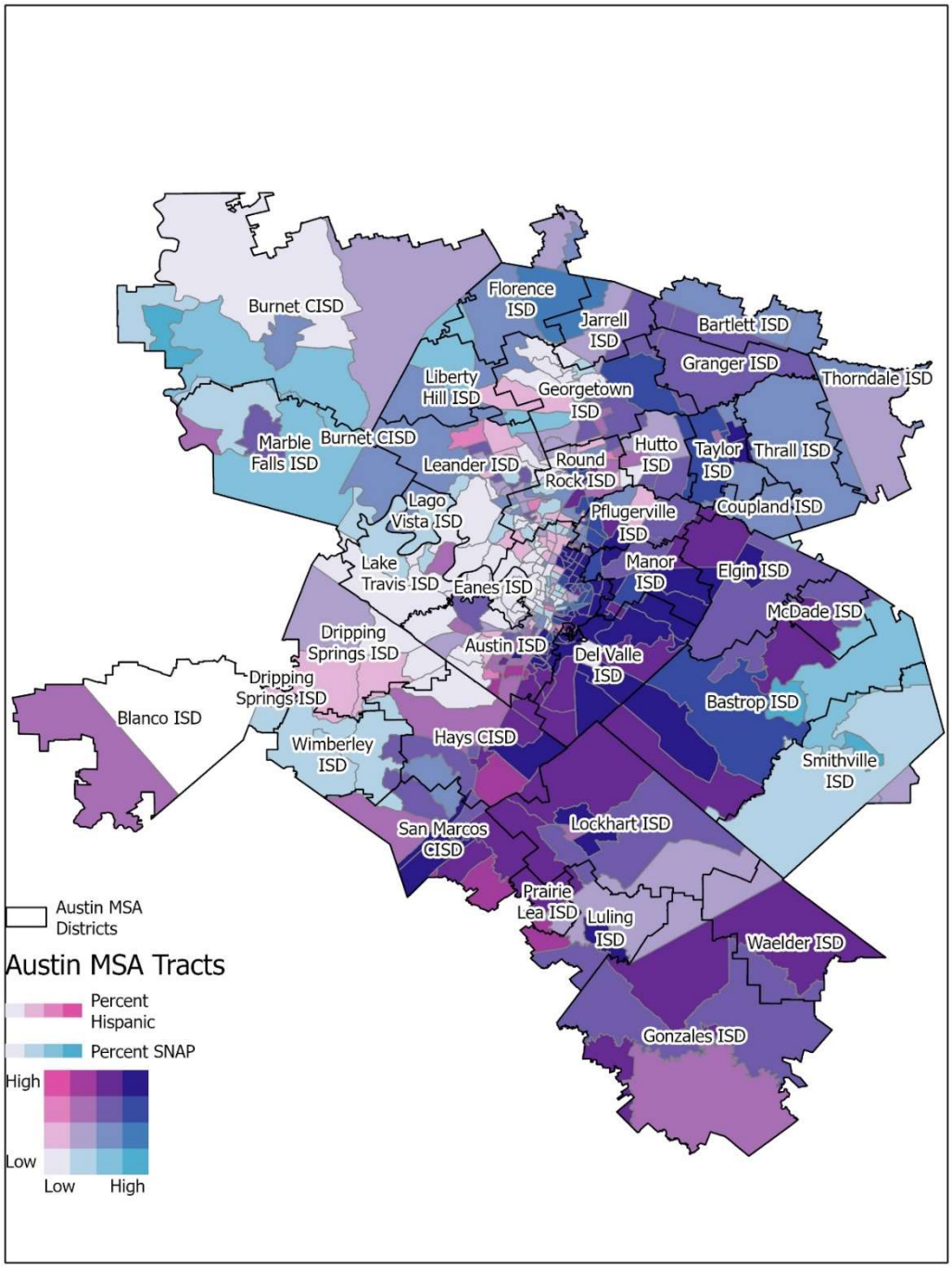

Figure 12. Census Tracts: Percent Hispanic vs SNAP

Figure 13, Figure 14, and Figure 15 are bivariant maps showing the percent of students of each racial/ethnic group, Hispanic, African American, and white respectively, on the pink axis, and the percent of the district budget allocated towards Food on the blue axis. The pattern shown in these three maps is not significantly different than that of their respective per student expenditure maps (Figure 11, Figure 8, and Figure 17), with the exception of Figure 13. While the general pattern of the relationship between higher percentage Hispanic students and percent of budget is similar to that in Figure 11, Figure 13 shows a much stronger relationship between the criteria depicted than those shown in Figure 11.

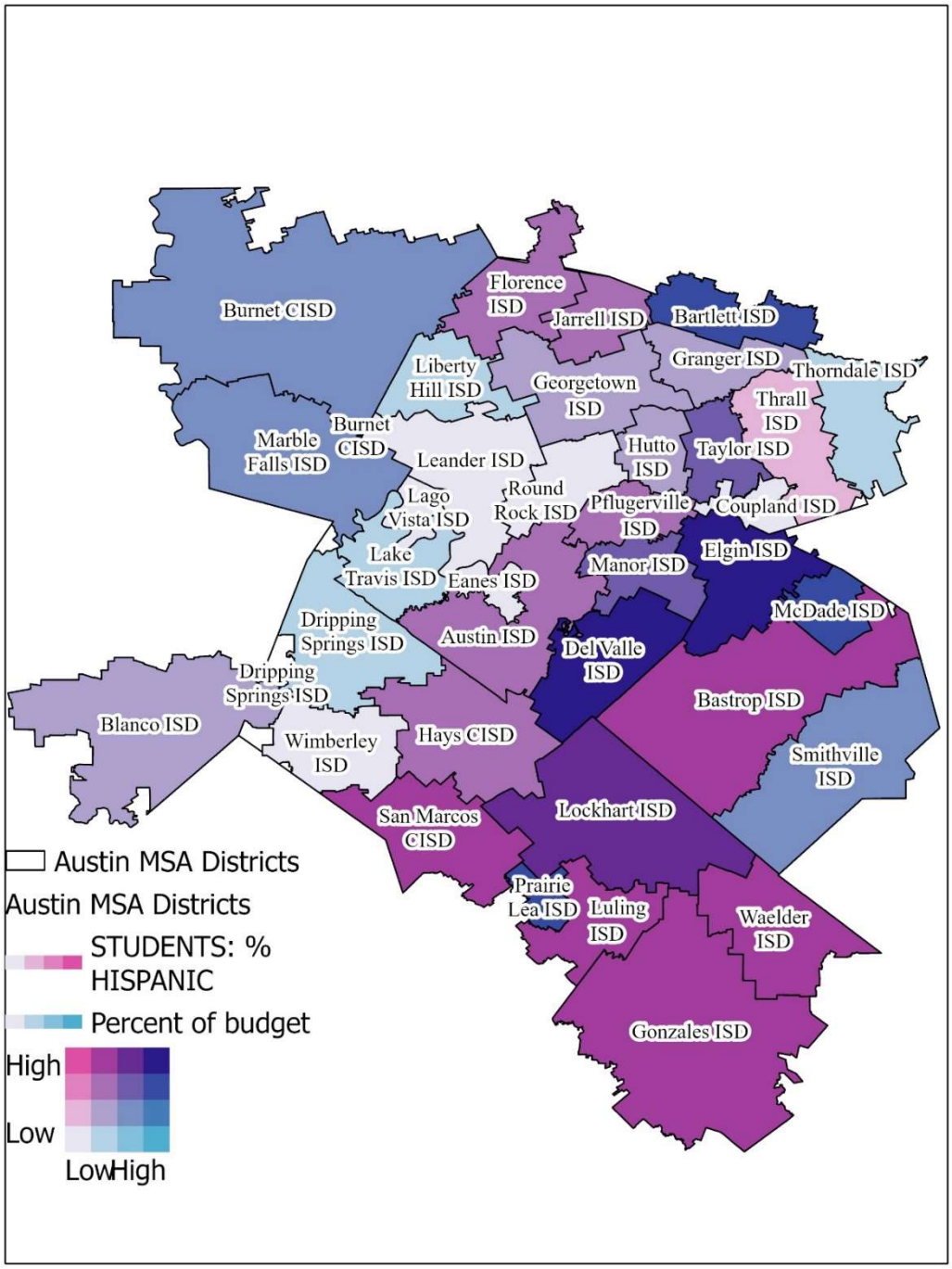

Figure 13. Districts: Hispanic vs Percent of Budget

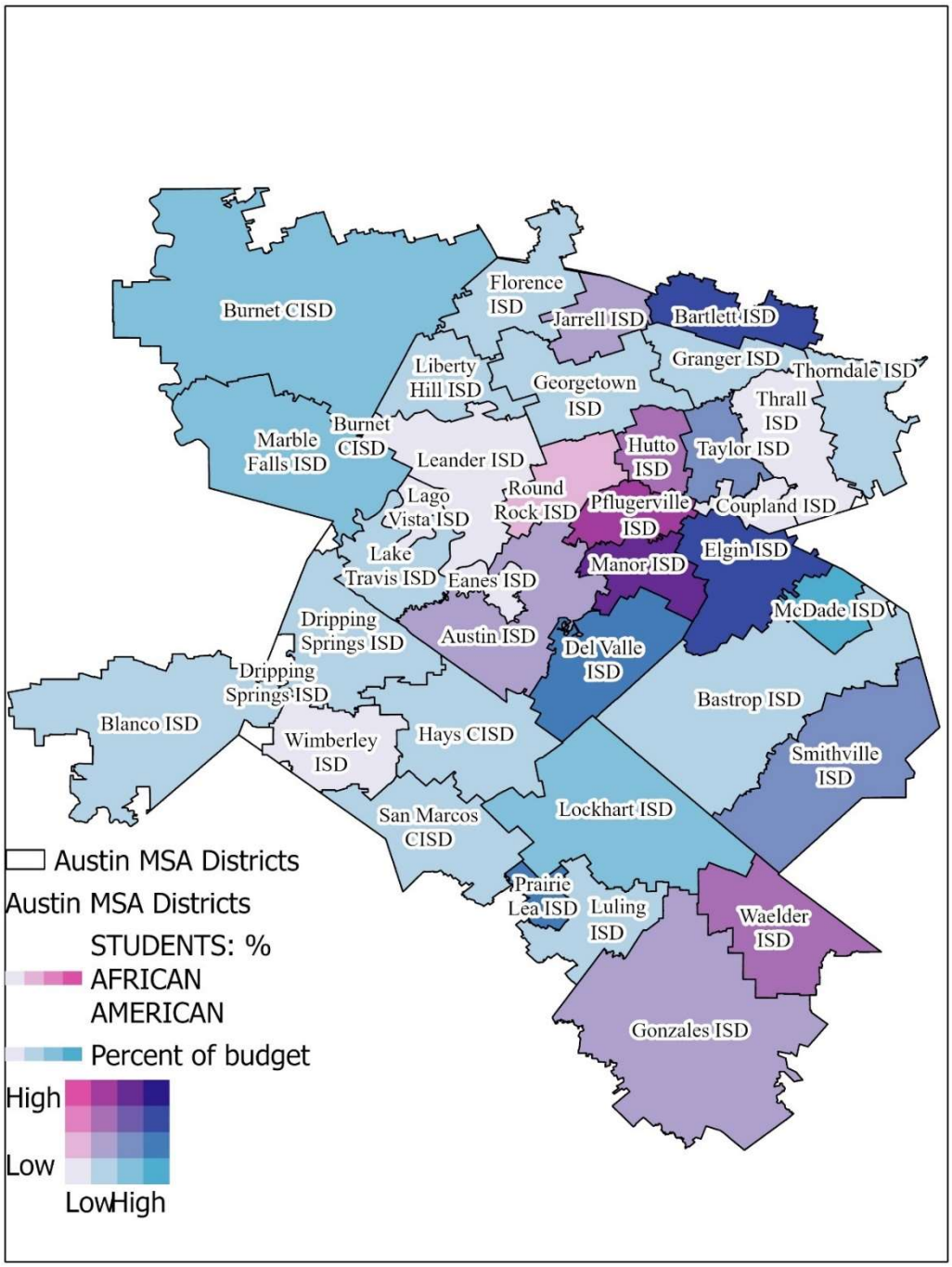

Figure 14. Districts: African American vs Percent of Budget

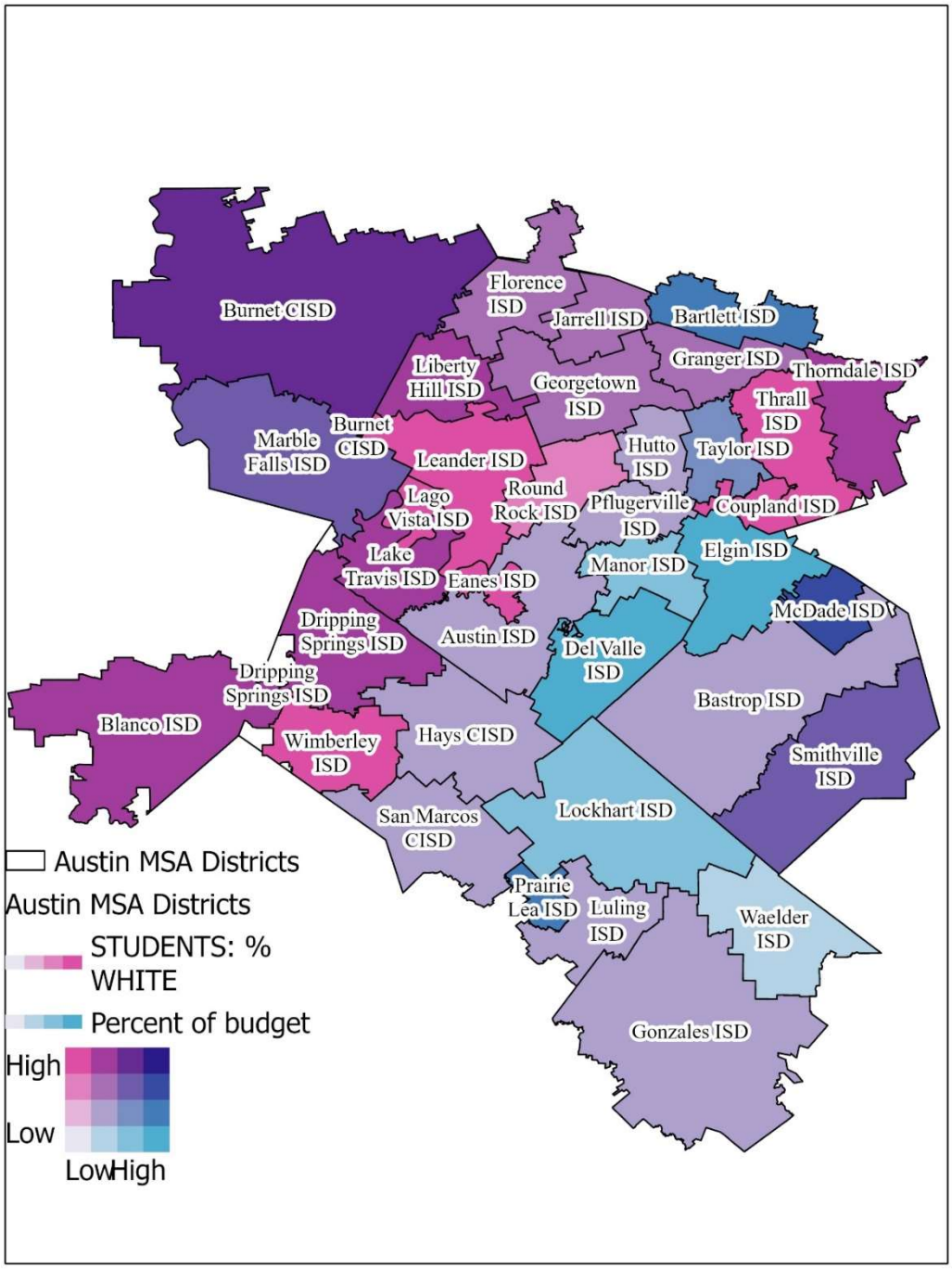

Figure 15. Districts: White vs Percent of Budget

Figure 16 and Figure 17 are bivariant maps with the percent of students reported as white on the pink axis, and the blue axes showing percent of students economically disadvantaged and per student expenditures respectively. The relationship between the characteristics shown in these two maps is not as strong as that found in the same maps regarding African American and Hispanic students, however there are still patterns of concentration and polarization. In Figure 16, the line of districts West of Austin from Liberty Hill ISD to Dripping Springs ISD are all shown to be High Low, and in contrast the map shows the Low High Districts as east of Austin from Elgin to Del Valle to Waelder ISDs. Outside of those clusters however, the relationship between the characteristics is more varied, as is the spatial distribution. Figure 17 shows similar patterns to Figure 16, specifically the High Low districts west of Austin, and it shows Del Valle ISD as the only Low High district. Figure 17 does not show a strong relationship between the percentage of students that are white and the expenditures per student.

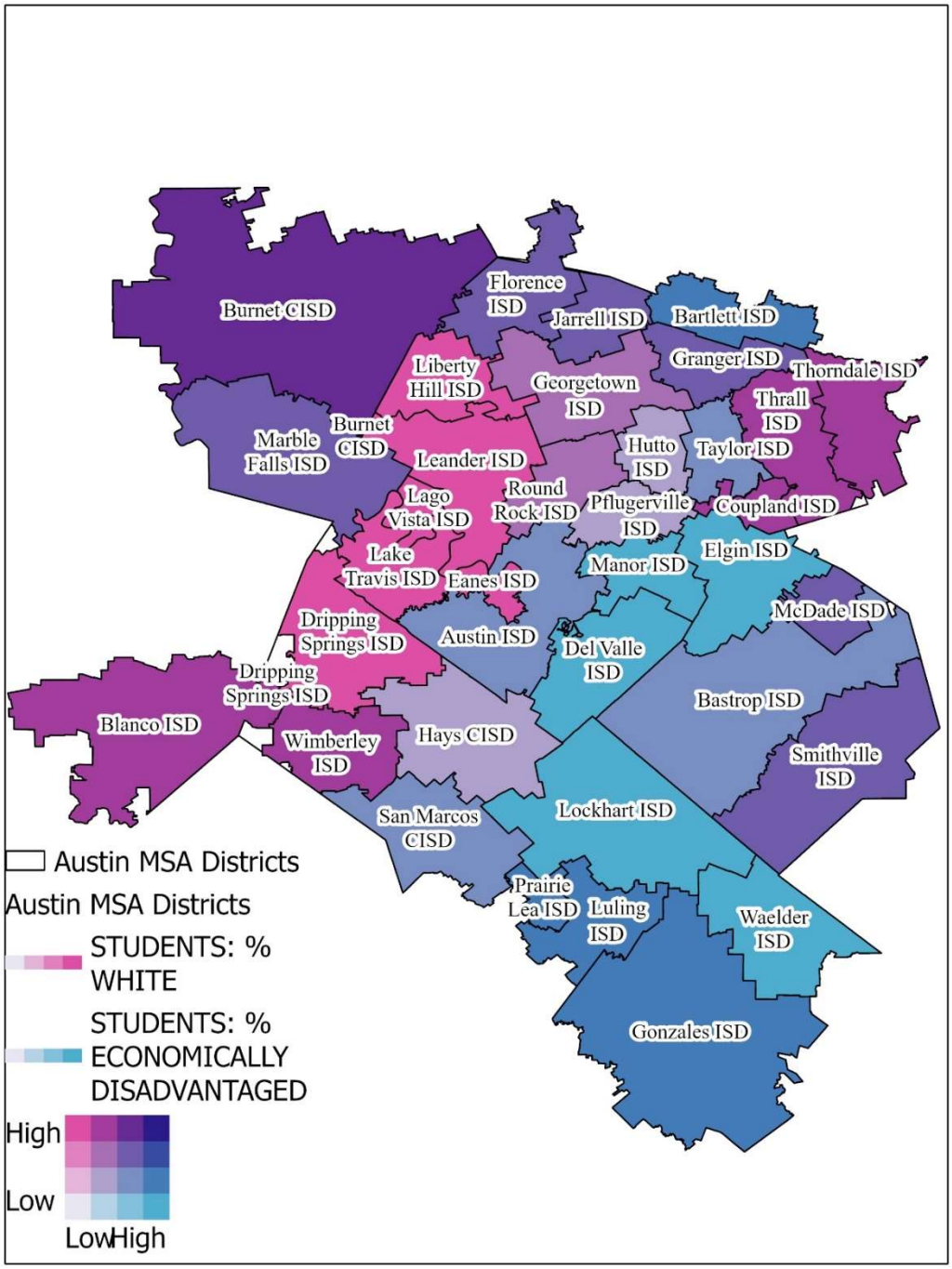

Figure 16. Districts: White vs Economically Disadvantaged

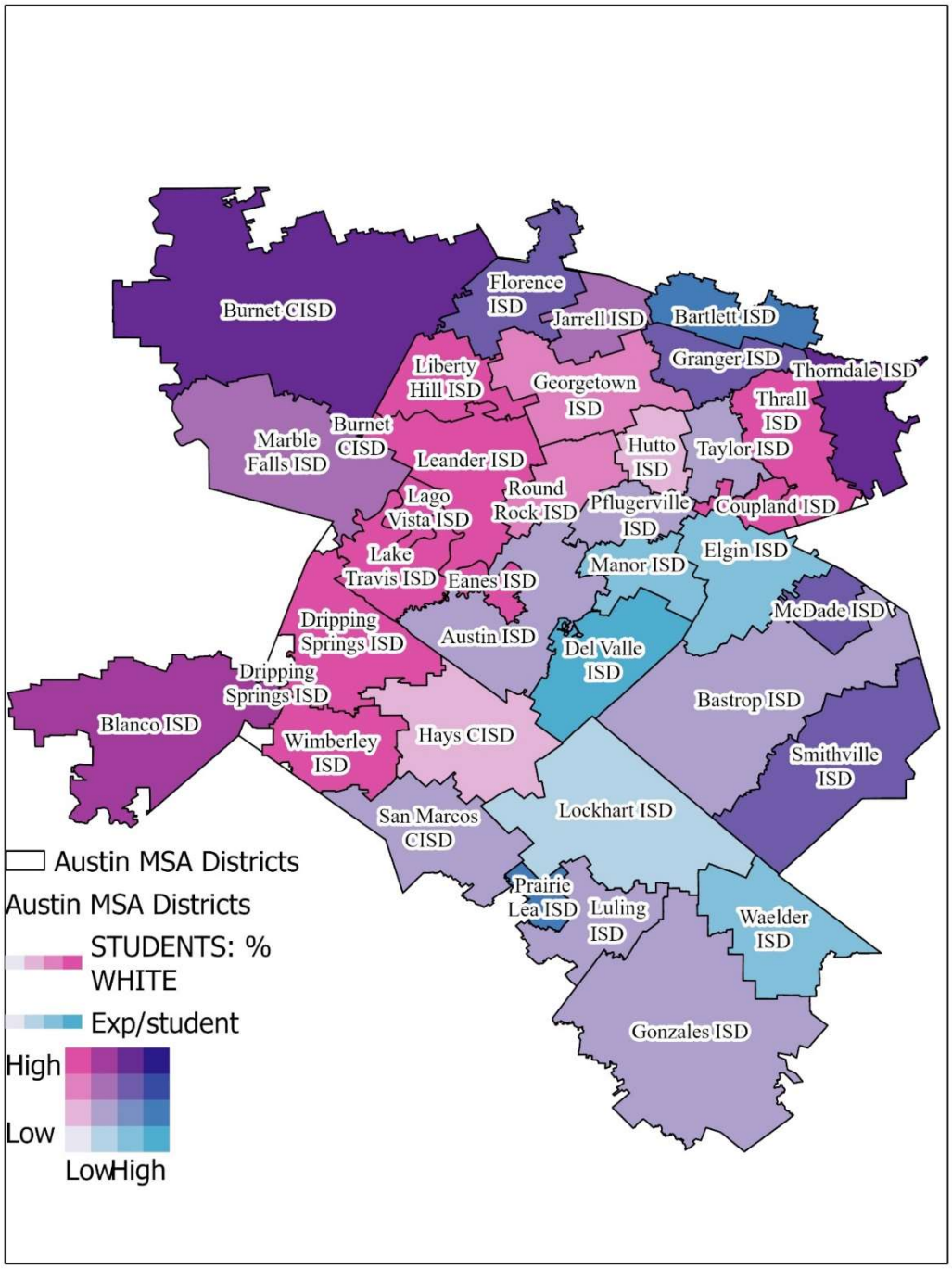

Figure 17. Districts: White vs Per Student Expenditures

Figure 18 shows the relationship between the percentage of the population that is white on the pink axis and percent on federal food assistance on the blue. While the maps show an east-west polarization similar to Figure 9 and Figure 12, the divide is not as definite and does not follow I-35 as closely as those seen in the other two maps. The contrasting extremes, High Low and Low High, are also concentrated towards the center of the MSA, particularly within Travis County, and elsewhere the tracts are shown to have more overlap between the two characteristics, particularly in Williamson County. There is a lot of variability between census tracts within most districts, and when considering the data is averaged for the districts, it shows a similar pattern to Figure 16, but the comparison between them is not as definitive as the similar comparisons for the other demographic groups due to this variability within districts.

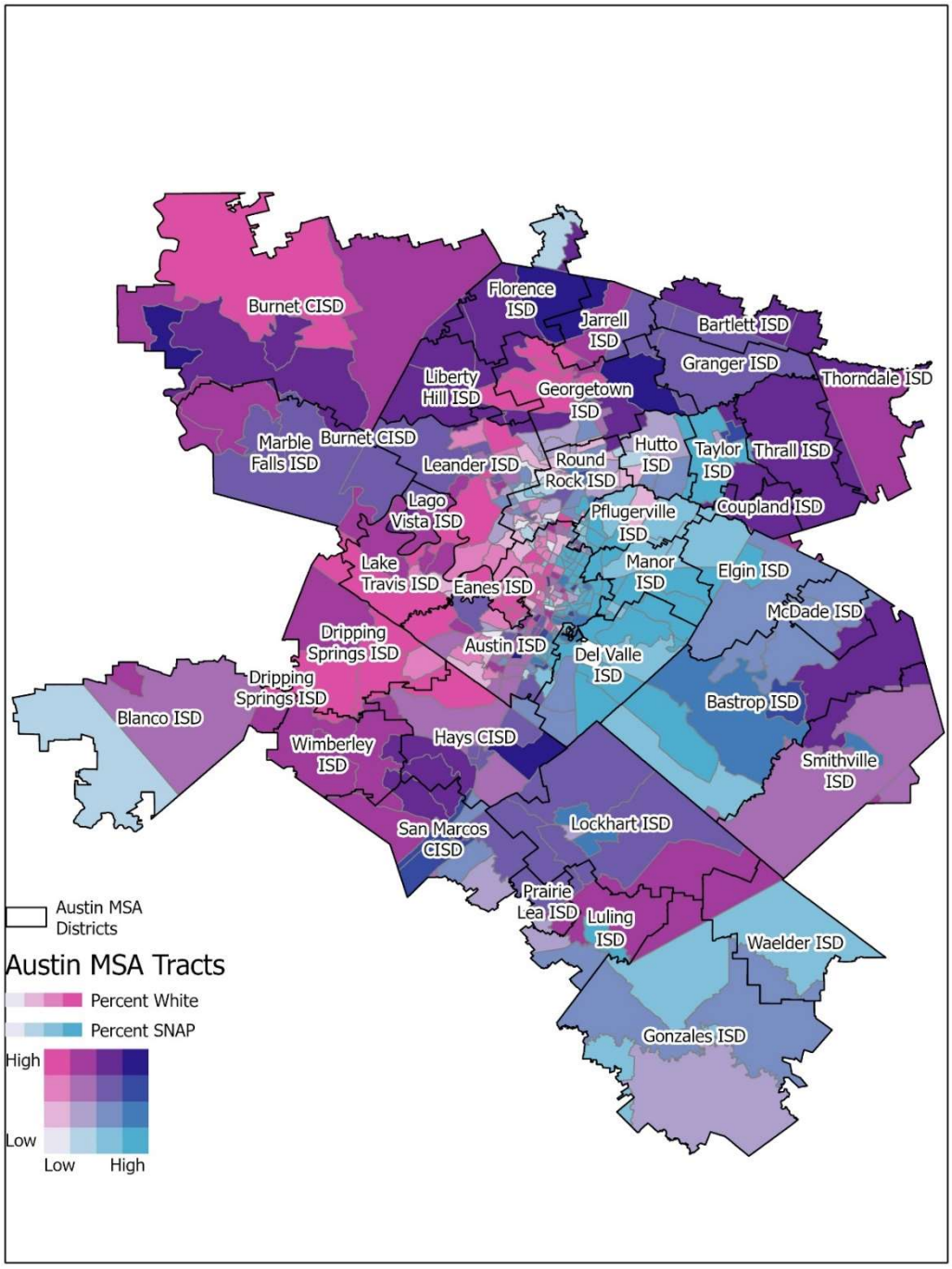

Figure 18. Census Tracts: Percent White vs SNAP

There was a strong relationship between areas with a high percentage of Hispanic residents and students, percentage of economically disadvantaged students, and higher school lunch expenditures. In addition, the districts with higher rates of from scratch meal prep, often had relatively high percentage of Hispanic students and/or black students. The maps did not show a strong relationship between census tracts with a relatively high percentage of households that receive Federal food assistance/SNAP and any of the patterns of race, class, ethnicity, or the school lunch criteria. Almost all of the highest percentages of assistance reception were located in east Austin at the junction of Austin ISD, Del Valle ISD, and Manor ISD, and given the district level resolution of the school data, any effects that concentration would have on individual school data would likely be averaged out across the district data. That said, there appeared a strong pattern that the schools that spent the most on food, both in per student and percent of budget, often tended to be high in Hispanic students and located in relatively high Hispanic areas, as well as often having lower per student revenue and higher rates of economically disadvantaged students. Within the data acquired, there also appeared a correlation between higher percentage Hispanic students and a higher percentage of meals made from scratch. There was strong relationship between per student revenue and areas/school demographics with higher percentage white populations, but these same areas had an overall negative correlation with food expenditures and meals from scratch.

The maps discussed here show an east-west polarization in all categories and for both Districts and Census Tracts. While there was some relationship between

concentrations of black residents and students and economically disadvantaged, higher per student expenditures, and other criteria, those areas also had a higher percentage of Hispanic residents, who across the entire MSA correlated stronger with the criteria than the black population, so it is hard to definitively state a relationship in this circumstance.

V. DISCUSSION

The results of my study present several surprising findings and open up a diversity of new questions for additional research in this area. While I find that easily accessible public data can be used to map and analyze the relationship between polarization, inequity, and uneven school lunch service, I also find the need for far more in-depth research in order to gain a better understanding of these patterns and what causes them. The limitations faced due to the nature of this project can be addressed through additional research focusing on those aspects that were unable to be analyzed here.

Findings

Based on my initial anecdotal understanding of school budgeting, in conjunction with the literature's focus on the cost cutting mentality of industrialized school lunch due to decreasing funding for the program, I approached the project with the expectation that schools with less funding and more disadvantaged students would utilize cost cutting measures at a higher rate, and that services that included Farm to School participation or from scratch cooking would be primarily practiced by districts with more funding and fewer disadvantaged students. A major narrative of the Farm to School program, and one that partially influences the area of focus for this project, is that the Farm to School program and similar initiatives are necessary to improve the quality of nutrition for socio-economically disadvantaged kids whose primary source of consistent food is industrialized school lunches.

However, what my maps reveal instead is that in the context of this case study, districts with higher percentages of socio-economically disadvantaged students tend to have higher per student expenditures and in a few cases more recipes made from scratch. In addition, the inverse of this is also true. There are several factors that could influence these patterns. It is possible that in those districts that spend more on school food service and prepare more meals from scratch, there simply exists a greater community will for the district to provide such services compared to other districts. It could be that districts with higher enrollment produce food with greater economies of scale, thus reducing the per student cost. Another potential explanation is that districts in wealthier student populations, a higher percentage of them bring in outside lunch, and while their lack of participation lowers the total expenditures towards food since less food is purchased and prepared, their presence in the school dilutes the per student expenditure data, causing it to also be much lower. The spatially averaged data by district may also discount the experiences and characteristics of students at different campuses within the same district, affecting the ability to truly see the relationship between race/ethnicity, class, and school lunch.

The maps created in this project also show the spatial polarization of the Austin MSA. Figure 9, Figure 12, and Figure 18 all show the east-west polarization of the general population of the area on the basis of both race/ethnicity and class. They show a high concentration of households receiving federal food assistance in the eastern part of the area, and simultaneously higher concentrations of black and Hispanic populations in this same area, while the west is shown to have lower percentages of minority

households or those that receive benefits. This divide also closely follows the path of I-35, and as discussed previously, within the City of Austin the interstate was explicitly used as the border between segregated areas during segregation. The fact that this pattern persists today, as well as having proliferated throughout the rest of the MSA, shows not only the lasting influence of these discriminatory decisions, but also how entrenched de facto segregation is in the area today.

Furthermore, these same patterns of polarization are seen in the patterns of school demographics and food service. The districts with the highest percentages of minority students, as well as those with the highest PED, also follow this east-west polarization, being largely concentrated in the East. It is also these districts in the east that tend to have the largest per student expenditures and tend to make the most recipes from scratch. There are clear patterns of unequal service in school food, and those districts in the west tend to be characterized by metrics deemed favorable for the purposes of this project. While these metrics are seen as favorable, more research needs to be done to better understand how these characteristics actually relate to the quality of food service, and how they correlate with spatial polarization broadly and social segregation within the cafeteria.

Study limitations and future research

One of the biggest limitations of this project is the availability and type of data on this subject. While the USDA Farm to School Census provides useful information on school food service, some of which was included in this analysis, the nature and

methodology of the Census made the data difficult or impossible to fully utilize for this project. For one, the Census was only sent to districts with a record of participation or stated interest in Farm to School, and large sections of the questionnaire were only shown to respondents based on the SFAs participation status, including two questions that would have greatly added to this project. I would suggest a similar but more general School Food census be conducted in the future, gathering more basic and general information on SFAs, and being sent to all authorities that participate in the National School Lunch Program. I would especially recommend such a census include information on meals from scratch, procurement procedures, whether the district handles the service themselves or contracts it out, what model of kitchen do they use (central kitchen, per campus kitchen, vendor, etc.), general staff hours and wage information, and other similar information.

As discussed earlier in the paper, the U.S. Census data also caused issue in regard to lack of availability of high-resolution data outside of the decennial census limited the ability to do GIS-based spatial analysis to find correlations with district data. Additionally, aggregated district data limited the ability of this project to fully find and illustrate polarization and the spatial relationship between the studied characteristics in the most accurate way. The comparisons between Figure 9 and Figure 18 illustrate this point well, with the disconnect between census tracts and district populations at the extreme ends, with tracts that were shown to be high on one axis or the other located in districts shown as Low Low, and High High districts having relatively low percentages on both characteristics in some of the tracts they cover. While there could be other

explanations, I believe averaging of data across the district to be a very likely cause of these inconsistencies.

This project raises many questions that need to be answered in future research. Some of these include investigating the possible explanations discussed previously. Additionally, what is the breakdown of how many students bring outside lunch? What is the demographic makeup of those that participate in the program, especially in those districts with lower percentages of socio-economically disadvantaged students? While this project showed a level of metropolitan polarization, could such inequities exist and be better analyzed at the campus level?

While these patterns of relationships can be shown using existing data as shown in this project, new data would vastly improve the knowledge contribution to this topic. A focus on more detailed data regarding the quality of school lunch, looking into how many meals from scratch are made for every district in the focus area, gathering demographic and expenditure data at the campus level, using campus attendance zones and census blocks for higher resolution spatial analysis, gathering information on how many students bring lunch vs purchase it, and the demographics of each group, detailed information on the source of the food itself, the wage and working conditions of the food service staff, qualitative data on the perceived quality and culinary diversity of the menu, and many more. How does Austin compare to other MSAs with this same methodology, within Austin, why does Del Valle stand out as much as it does in all regards.

This project and the results discussed above contribute to scholarly discussions in several respects. While there is much research into each of the topics of Metropolitan Fragmentation and Polarization, Segregation, and School Lunch, and some work that relates two of those topics with each other, I am unaware of any research that examines the relationships between these three phenomena in an empirical case study. The exploratory nature of this project is intended to illustrate the need for and use of research in this area, and provide an early example of what this type of research can look like. It shows a significant gap in current understanding of how these areas of thought interact with each other, and how these interactions can manifest in the school food landscape.

The results of this case study, and further research into this area, may speak against some of the notions discussed in the literature reviewed. One of those topics is that districts in poorer areas with less resources may not have the resources to serve from-scratch meals, or spend more than their federal allotment. However, some of the findings of this study show districts with those characteristics tended to put more into school food per student and had, in some instances, more from-scratch recipes. As discussed previously, due to the nature of the data used in this project, further research is needed to definitively say if the case of the Austin MSA contradicts or confirms these ideas, and to examine if and how these patterns manifest in other metropolitan areas. If further research shows that Austin is indeed a unique example of an area that goes against the prevailing understandings or what is seen in other areas, then it could provide an important case to study for exploring the reasons why. If the Austin MSA is

shown to exemplify the understandings put forth in the wider literature, then this case study serves as an illustration of the need for better data related to this topic so that other studies may provide more accurate and explanatory results.

The benefits of having a case study such as this one is to test theory and to map it onto the landscape, in order to see if broader understandings of these systems are applicable and observable at the local scale. More importantly, findings from research such as this can be used to refine and reevaluate theory. And with respect to school food, if a case study such as Austin is shown to be a welcome contradiction to a theory discussing a problematic program of school lunch, then it can provide answers on ways to address the shortcomings found in other metropolitan areas. Additionally, the results found in this project, as well as those of future research, can not only contribute to theory, but may also provide a better understanding of the realities of the school food landscape, which will aid the efforts of others such as stakeholders and policymakers to improve the system. Without understanding current inequities and the forces that influence them, meaningful methods of addressing these issues and creating a more equitable, sustainable, and just school food programs, and reforming the wider food system as a whole, cannot be done effectively.

VI. CONCLUSION

This project shows that it is possible to observe and analyze the relationships between school lunch expenditures, student demographics, and metropolitan polarization using existing, easily accessible data sets as well as visual spatial comparison analysis. It builds off the existing literature in the areas of Metropolitan Fragmentation and Polarization, Segregation, and the School Lunch program, combining aspects of all three areas of research into an empirical case study that illustrates a need for further research in this area. In the case of the Austin MSA, this analysis shows a negative relationship between higher economically disadvantaged students and school lunch expenditures, as well as a relationship between percentage Hispanic students and the percentage of recipes made from scratch for the districts focused on. As discussed previously, while these data sets and simple methodology can be used to illustrate these patterns, there is a breadth of future research that can be built on this project, using more in-depth focus, that can provide better understanding of the relationship between polarization, race class and ethnicity, and school lunch. This research adds to the wider discourse in this area, showing that this type of research is necessary to bridge the gaps in the literature, and propose new questions that can lead future research. Future research that builds on or is otherwise inspired by this project can help those advocating for a better school food program in which all students have equitable access to high quality and sustainable meals, as well as contributing to improvements in creating a wider food system that shares the ideals of equitability, sustainability, and justice.

APPENDIX SECTION:

I. TEA Financial Categories Definitions:

With the exception of the first three, these definitions were copied from the Texas Education Agency 2018–2019 PEIMS Budgeted Financial Data Reports (Texas Education Agency, 2020).

Per Student Revenue: This is the same as TEA's Total Revenue Per Student.

Per Student Expenditures: The amount allocated towards Food (as defined below) Per Student in 2018-2019 school year.

Percent of budget: The percentage of the district's total budget allocated towards Food (as defined below).

Food: Food service operation expenditures/expenses are those used to pay for food service operation (function 35).

Total Revenue: Total revenue is the district's or charter school's total revenue and includes local tax revenue, other local and intermediate revenue, state revenue, and federal revenue. Equity transfers reported under function code 91 have been excluded from the total revenue figures.

Students % Economically Disadvantaged: Percentage of total students reported as economically disadvantaged. Economically disadvantaged students are those who are reported as eligible for free or reduced-price meals under the National School Lunch and Child Nutrition Program, or other public assistance. Students reported with any one of these status codes may or may not be enrolled in a special program such as compensatory or special education.

NOTE: About the "Per Student" Column Figures

These numbers are based on the number of students “in membership." The number of students in membership is the total number of public school students in the district who were reported in membership as of October 26, 2015, at any grade, from early childhood education through grade 12. Membership is a slightly different number from enrollment, because the count of students in membership does not include those students who are served in the district for less than two hours per day. For example, the count of total students in membership excludes students who attend a nonpublic school but receive some services from their local public school district, such as speech therapy, for less than two hours per day.

TEA Community Type Definitions:

Copied from the Texas Education Agency 2018-2019 District Type Glossary of Terms (Texas Education Agency, 2020)

Major Urban (11 districts). A district is classified as major urban if: (a) it is located in a county with a population of at least 1,020,000; (b) its enrollment is the largest in the county or at least 70 percent of the largest district enrollment in the county; and (c) at least 35 percent of enrolled students are economically disadvantaged. A student is reported as economically disadvantaged if he or she is eligible for free or reduced-price meals under the National School Lunch and Child Nutrition Program.

Major Suburban (79 districts). A district is classified as major suburban if: (a) it does not meet the criteria for classification as major urban; (b) it is contiguous to a major urban

district; and (c) its enrollment is at least 3 percent that of the largest contiguous major urban district or at least 4,500 students. A district also is classified as major suburban if: (a) it does not meet the criteria for classification as major urban; (b) it is not contiguous to a major urban district; (c) it is located in the same county as a major urban district; and (d) its enrollment is at least 15 percent that of the largest major urban district in the county or at least 4,500 students.

Other Central City (38 districts). A district is classified as other central city if: (a) it does not meet the criteria for classification in either of the previous subcategories; (b) it is not contiguous to a major urban district; (c) it is located in a county with a population of between 100,000 and 1,019,999; and (d) its enrollment is the largest in the county or at least 75 percent of the largest district enrollment in the county.

Other Central City Suburban (164 districts). A district is classified as other central city suburban if: (a) it does not meet the criteria for classification in any of the previous subcategories; (b) it is located in a county with a population of between 100,000 and 1,019,999; and (c) its enrollment is at least 15 percent of the largest district enrollment in the county. A district also is other central city suburban if: (a) it does not meet the criteria for classification in any of the previous subcategories; (b) it is contiguous to an other central city district; (c) its enrollment is at least 3 percent that of the largest contiguous other central city district; and (d) its enrollment is equal to or greater than the median district enrollment for the state of 897 students.

Independent Town (67 districts). A district is classified as independent town if: (a) it does not meet the criteria for classification in any of the previous subcategories; (b) it is

located in a county with a population of 25,000 to 99,999; and (c) its enrollment is the largest in the county or is at least 75 percent of the largest district enrollment in the county.

Non-Metropolitan: Fast Growing (31 districts). A district is classified as non-metropolitan: fast growing if: (a) it does not meet the criteria for classification in any of the previous subcategories; (b) it has an enrollment of at least 300 students; and (c) its enrollment has increased by at least 20 percent over the past five years.

Non-Metropolitan: Stable (166 districts). A district is classified as non-metropolitan: stable if: (a) it does not meet the criteria for classification in any of the previous subcategories; and (b) its enrollment is equal to or greater than the median district enrollment for the state.

Rural (466 districts). A district is classified as rural if it does not meet the criteria for classification in any of the previous subcategories. A rural district has either: (a) an enrollment of between 300 and the median district enrollment for the state and an enrollment growth rate over the past five years of less than 20 percent; or (b) an enrollment of less than 300 students.

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