

Fiscal Federalism and its Potential Effects on  
Public Transportation in Mid-Sized Cities

by  
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## **Abstract**

The current fiscally conservative climate on Capitol Hill, as the next surface transportation bill is being negotiated, may possibly carry over to a greater dependence on fiscal federalism for funding public transportation. With local governments already straining their resources, an examination of how a greater reliance on local funds for public transit is a prudent topic.

This thesis focuses on expenditures (both total and operating) by public transit systems in four mid-sized US cities and their revenue sources between 2005 and 2010 in order to ascertain if systems that are more reliant on local revenues for their expenditures are more cost effective, more cost efficient, and more service effective than their peers. It also examines the local revenue sources and whether systems that are more heavily reliant on local funds use a more diverse set of revenue generation tools. This thesis uses a multiple case study approach in order to examine the trends in expenditures and revenue sources by four bus and demand response public transportation systems in Alabama, Oklahoma and Nebraska.

The findings of this thesis, while not generalizable to all transit systems in mid-sized cities, indicate that systems that are the most reliant on local revenues are not necessarily the most cost efficient, perhaps because the burden of financial responsibility is too large for the system to effectively handle. Trends also indicate that systems that have heavier reliance on local funds generate their revenues through a more diverse set of sources than their peers.

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# Table of Contents

Abstract	3
Acknowledgements	5
List of Figures	7
List of Tables	8
List of Acronyms	9
Foreword	10
Chapter One: Introduction	12
Research Motivation	12
Historical Context	14
Recent Federal Transportation Policy	14
Fiscal Federalism	18
Funding the Local Share	20
Research Questions	25
Research Hypothesis	26
Research Method	26
Thesis Format	26
Chapter Two: Methods	28
Chapter Three: Case Studies	37
Birmingham – Jefferson County Transit Authority (BJCTA)	37
Transit Authority of Omaha (TAO)	43
Central Oklahoma Parking and Transportation Authority (COPTA)	48
Metropolitan Tulsa Transit Authority	53
Chapter Four: Analysis	58
Operating Statistics	58
Total Expenditures	60
Operations Expenditures	62
Historical Funding Source Trends	70
Federal Funding Sources	71
Local Funding Sources	72
Chapter Five: Conclusions, Shortcomings, & Further Research	79
Conclusions	79
Shortcomings	85
Further Research	86
Data & Image Sources	88
Bibliography	89

## List of Figures

Figure 1: FTA Historical Expenditures, including ARRA in 2009 (2005-2009)	13
Figure 2: FTA Urban Area Formula Program: Funding Formula Flowchart	17
Figure 3: Fielding et al.'s framework for a transit performance model (1985)	35
Figure 4: Birmingham, Alabama	37
Figure 5: BJCTA System Map	39
Figure 6: BJCTA Service Statistics (2005-2010)	40
Figure 7: BJCTA Total Reported Revenues, FY 2005- FY 2010	41
Figure 8: BJCTA Bus Operating Expenditures per Unlinked Passenger Trip	41
Figure 9: BJCTA Paratransit Operating Expenditures per Unlinked Passenger Trip	42
Figure 10: Omaha, Nebraska	43
Figure 11: TAO System Map	45
Figure 12: TAO Operating Statistics	46
Figure 13: TAO Total Reported Revenues (2005-2010)	46
Figure 14: TAO Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)	47
Figure 15: TAO Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)	47
Figure 16: Oklahoma City and Tulsa, Oklahoma	48
Figure 17: Oklahoma City Metro System Map	50
Figure 18: COPTA Operating Statistics (2005-2010)	51
Figure 19: COPTA Total Expenditures (2005-2010)	51
Figure 20: COPTA Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)	52
Figure 21: COPTA Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)	53
Figure 22: MTA System Map	54
Figure 23: MTA Operating Statistics	56
Figure 24: MTA Total Expenditures (2005-2010)	57
Figure 25: MTA Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)	57
Figure 26: MTA Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)	58
Figure 27: Annual Bus Revenue Miles Operated	59
Figure 28: Annual Unlinked Passenger Trips	59
Figure 29: Unlinked Passenger Trips per Revenue Mile	60
Figure 30: Total Expenditures (2005-2010)	61
Figure 31: Share of Total Expenditures (2005-2010)	61
Figure 32: Operating Expenditures (2005-2010)	63
Figure 33: Operating Expenditure per Unlinked Passenger Trip (2005-2010)	64
Figure 34: Share of Operating Expenditures (2005-2010)	65
Figure 35: Bus Operating Expenditures per Passenger Boarding (2005-2010)	66
Figure 36: Demand Response Operating Expenditures per Passenger Boarding (2005-2010)	66
Figure 37: Operating Expenditures per Trip vs. Annual Bus Boardings (2005-2010)	68
Figure 38: Operating Expenditure per Trip vs. Annual Demand Response Boardings (2005-2010)	69
Figure 39: BJCTA Federal Funds used for Operations (2005-2010)	73
Figure 40: TAO Federal Funds used for Operations (2005-2010)	74
Figure 41: COPTA Federal Funds used for Operations (2005-2010)	75
Figure 42: MTA Federal Funds used for Operations (2005-2010)	76
Figure 43: Local and Directly Generated Funds	78
Figure 44: BJCTA Operating Expenditures (2005-2010)	84

## List of Tables

Table 1: TRCP 141 Likeness Factors	30
Table 2: BJCTA TCRP Peer Group Selection	31
Table 3: BJCTA Final Peer System Selection	32
Table 4: Contextual Characteristics (2000 Census Data)	33
Table 5: Case Study General Operating Statistics	33
Table 6: Total Expenditure by Funding Source per Unlinked Passenger Trip (2005-2010)	62
Table 7: Operating Expenditures by Funding Source per Unlinked Passenger Trip (2005-2010)	64
Table 8: Urban Area Formula Funds Expended	77

## List of Acronyms

Acronym	Definition
<b>APTA</b>	Association of Public Transit Agencies
<b>BJCTA</b>	Birmingham - Jefferson County Transit Authority (Birmingham, Alabama)
<b>COPTA</b>	Central Oklahoma Parking and Transportation Authority (Oklahoma City, Oklahoma)
<b>USDOT</b>	United States Department of Transportation
<b>FHWA</b>	Federal Highway Administration
<b>FTA</b>	Federal Transit Agency
<b>FTIS</b>	Florida Transit Information System
<b>INTDAS</b>	Integrated National Transit Database Analysis System
<b>ISTEA</b>	Intermodal Surface Transportation Efficiency Act of 1991
<b>LOTTs</b>	Local Option Transportation Taxes
<b>MAP-21</b>	Moving Ahead for Progress in the 21st Century
<b>MTA</b>	Metropolitan Tulsa Transit Authority
<b>NTD</b>	National Transit Database
<b>SAFETEA-LU</b>	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
<b>TAO</b>	Transit Authority of Omaha (Omaha, Nebraska)
<b>TCRP</b>	Transit Cooperative Research Program
<b>TEA-21</b>	Transportation Equity Act for the 21st Century
<b>UAFB</b>	Urban Area Formula Program
<b>UMTA</b>	Urban Mass Transit Agency

## Foreword

As of the writing of this thesis, the current surface transportation bill, “Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users”, better known as SAFETEA-LU, has now been extended for the ninth time since it expired in 2009. President Barack Obama and Secretary of Transportation Ray LaHood have demanded action by Congress to pass a new surface transportation bill in order to get projects built, putting construction workers to work and helping us all carry about our daily lives. “Moving Ahead for Progress in the 21st Century” (MAP-21) was passed in the Democrat-controlled Senate on March 14, 2012. This bill proposes reforms for the highway programs, while it largely continues the legacy of SAFETEA-LU for public transit. The American Energy and Infrastructure Jobs Financing Act of 2012 (H.R. 3864), proposed but never voted on in the Republican-controlled House of Representatives. That bill included significant cutbacks for public transportation, as well as bicycle and pedestrian project funding. The American Energy and Infrastructure Jobs Act of 2012 (H.R. 7) is the most recent version of a transportation bill seen in the House, but was not taken to a vote and instead an extension of SAFETEA-LU was authorized through the end of June 2012.

The reauthorization of the surface transportation bill became a contentious issue in recent years despite the fact that “the easiest bill to pass in Washington used to be getting roads and bridges built” (Obama, 2012). The House and Senate are planning to resolve the surface transportation legislation issue through Conference Committee (where hand-selected Representatives and Senators meet to write a bill

that both chambers will pass). The outcome of the Conference Committee session is uncertain and the future of funding for surface transportation has been uncertain since the expiration of SAFETEA-LU and the arrival of a more fiscally conservative climate in Washington.

The passage of any legislation, even something as bipartisan as transportation funding, is an inherently political process. The most technically sound solutions to problems never emerge from the legislative process unchanged (Wachs, 1995). However, it is not the political process that is being examined in this thesis, but rather what the future of public transit in the United States may hold in an environment of increased fiscal federalism. Will our public transit systems run more optimally if they have increased local responsibilities or will they be overburdened by the administrative and financial responsibilities?

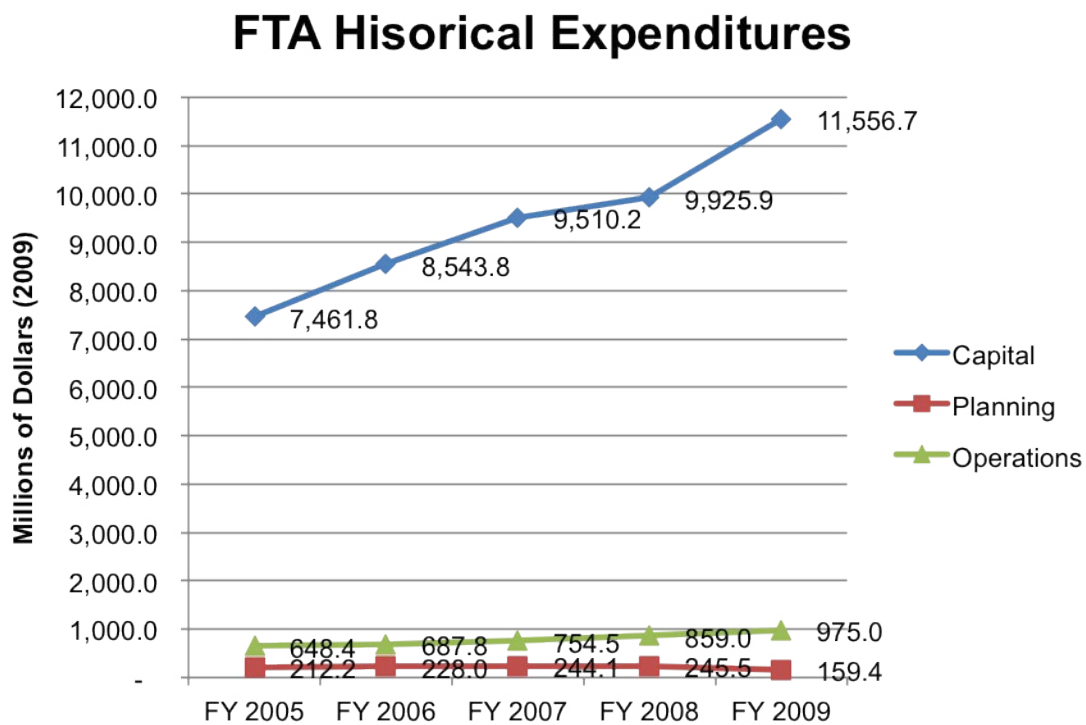
# Chapter One: Introduction

## Research Motivation

Frustrations and fascinations with projects being built for riders that never came and systems falling into states of serious disrepair lead me down the path to my ultimate thesis topic. In a 1992 study conducted by Don Pickrell, he compared forecasts to actual ridership and costs for both constructing and operating four heavy rail and four light rail systems. His research showed that the discrepancies in the forecasts and realities could not be explained solely by forecasting errors, but rather by perverse incentives created at the federal level and the subsidies provided by the Urban Mass Transit Agency (UMTA), which is now the Federal Transit Authority (FTA) (Pickrell, 1992). These cost overruns declined somewhat after changes to transit funding after 1991 when the “Intermodal Surface Transportation Efficiency Act of 1991” (ISTEA), ushered in the recent generation of surface transportation bills, although cost overruns are still prevalent (Dantana, 2006).

Jianling Li and Martin Wachs (2003) produced a case study of the Geary Corridor in San Francisco that examined the role of federal subsidy on the alternatives analysis decision-making process. They conclude that local financial constraints play a large role in the decision making process for capital projects and that federal policy to support capital projects more than operating subsidies in the recent years may have led to more capital intensive investments (Figure 1). Similarly to Pickrell and Li and Wachs, Bent Flyvbjerg and his colleagues prescribe greater financial responsibility placed on those actors proposing megaprojects (and those responsible for maintaining

and operating them), to avoid approving projects that had underestimated costs, overestimated ridership, and overly optimistic project completion timelines (Flyvbjerg et al., 2009). Assuming local responsibility for cost overruns incentivizes more realistic cost estimations at the early stages of the alternatives analysis, ideally resulting in appropriately scaled projects that meet the needs of the population.



**Figure 1: FTA Historical Expenditures, including ARRA in 2009 (2005-2009)**

In light of these studies, I was interested in looking at whether systems were operated, rather than built, more efficiently if they were more reliant on local revenues for funding sources, a perspective consistent with the principles of fiscal federalism. The House proposal that included major cuts to public transit altered the ultimate direction of this thesis. As a result, I decided to examine the impacts of reduced federal support for public transit systems in mid-sized US cities, which are already struggling in many cities.

## **Historical Context**

### **Recent Federal Transportation Policy**

At the federal level, policy change is an incremental and slow process. The politics involved in transportation bills were largely influenced by the need for Congressmen to “bring home the bacon” by earmarking special projects and creating funding formulas that benefited their states, rather than developing a truly comprehensive transportation vision for the United States like the one that was put forth by the National Interstate and Defense Highways Act of 1956 (Panagopoulos and Schank, 2007). After the completion of the Interstate Highway system in the 1990s, the direction of US transportation policy was guided by the “3 Teas”: ISTEA, TEA-21, and SAFETEA-LU.

President George H.W. Bush signed the Intermodal Surface Transportation Efficiency Act (ISTEA) into law on December 18, 1991. The legislation was landmark because it was the first to be passed after the completion of the Interstate Highway system. With the purpose of the previous transportation legislation fulfilled, it was possible for the states to use transportation funds more flexibly and for projects that were state and local priorities (Panagopoulos and Schank, 2007). ISTEA is the framework upon which the two successive transportation bills were based. Five major programs were created by ISTEA that are still in place today: the National Highway System (NHS); Interstate Maintenance (IM); the Surface Transportation Program (STP); Congestion Mitigation and Air Quality (CMAQ); and Bridge Replacement and Rehabilitation (BRR). Of these, only STP and CMAQ funds are available for transit use.

ISTEA expired on September 30, 1997 and was followed by the Transportation Equity Act for the 21st Century (TEA-21).

TEA-21 was signed into law on June 9, 1998 by President Bill Clinton. At the time, it was the largest public works bill in history and provided a 31 percent increase in transit authorizations over ISTEA levels. The bill also “guaranteed” minimum funding levels for highway, highway safety and transit programs. However, TEA-21 ended funding for federal operating subsidies in urbanized areas with populations larger than 200,000 people. This was a major departure from decades of federal operating subsidies (Brown, 2005). Lastly, the bill also guaranteed each state a minimum return on its contributions to the Highway Trust Fund based on the amount of gas taxes contributed. TEA-21 expired on September 30, 2003 and was succeeded by SAFETEA-LU (NYDOT, undated).

SAFETEA-LU was signed into law by President George W. Bush on August 10, 2005, after twelve extensions of TEA-21. Yet again, the new surface transportation bill provided record levels of funding for public transportation, guaranteeing over \$10 billion for transit funding in FY 2009. It also retained “annual funding guarantees to ensure long-term funding stability” and improved the delivery of programs (APTA, 2005). SAFETEA-LU included over 6,300 earmarks worth almost \$24 billion over the life of the bill, including 5,500 that were “special demonstration projects” (Panagopoulos and Schank, 2007). SAFETEA-LU expired at the end of FY 2009, but has been extended nine times, through the end of June 2012, in order to maintain funding while new

legislation is being created in a bipartisan Conference Committee.

Currently, a major component of the apportionment of federal funds to transit systems is through the Urbanized Area Formula Program (UAFP). Based on the size of the urban area, funds are allocated depending on operation mode, population, population density, and vehicle revenue miles. For this thesis, all four cases being evaluated receive funding based on the lower right corner of Figure 2: 50 percent bus vehicle revenue miles, 25 percent population and 25 percent population density. UAFP funds are only supposed to be used for “eligible activities.” The FTA describes eligible activities for these funds as:

Eligible activities include planning, engineering design and evaluation of transit projects and other technical transportation-related studies; capital investments in bus and bus-related activities such as replacement of buses, overhaul of buses, rebuilding of buses, crime prevention and security equipment and construction of maintenance and passenger facilities; and capital investments in new and existing fixed guideway systems including rolling stock, overhaul and rebuilding of vehicles, track, signals, communications, and computer hardware and software. All preventive maintenance and some Americans with Disabilities Act complementary paratransit service costs are considered capital costs (FTA, undated).

Funds used for operating assistance cannot exceed 50 percent of project operation costs (FTA, undated). Operating assistance is also only supposed to be available to urbanized areas with less than 200,000 people. However, rules about how these UAFP funds can be used for operations projects is not widely available despite the use of the funds for over 25 percent of total operating costs by the four case studies in this thesis (see Chapter Four for more analysis).

Section 5307  
Formula Process

STIC= Small Transit Intensive Cities  
 Population Density= Persons Per Square Mile (2000 Census)  
 Pop= Population (2000 Census)  
 FG PMT= Fixed Guideway Passenger Miles Traveled  
 OC= Operating Costs  
 FG VRM= Fixed Guideway Vehicle Revenue Miles  
 BPMT= Bus Passenger Miles Traveled  
 BVRM= Bus Vehicle Revenue Miles  
 FG DRM= Fixed Guideway Directional Route Miles

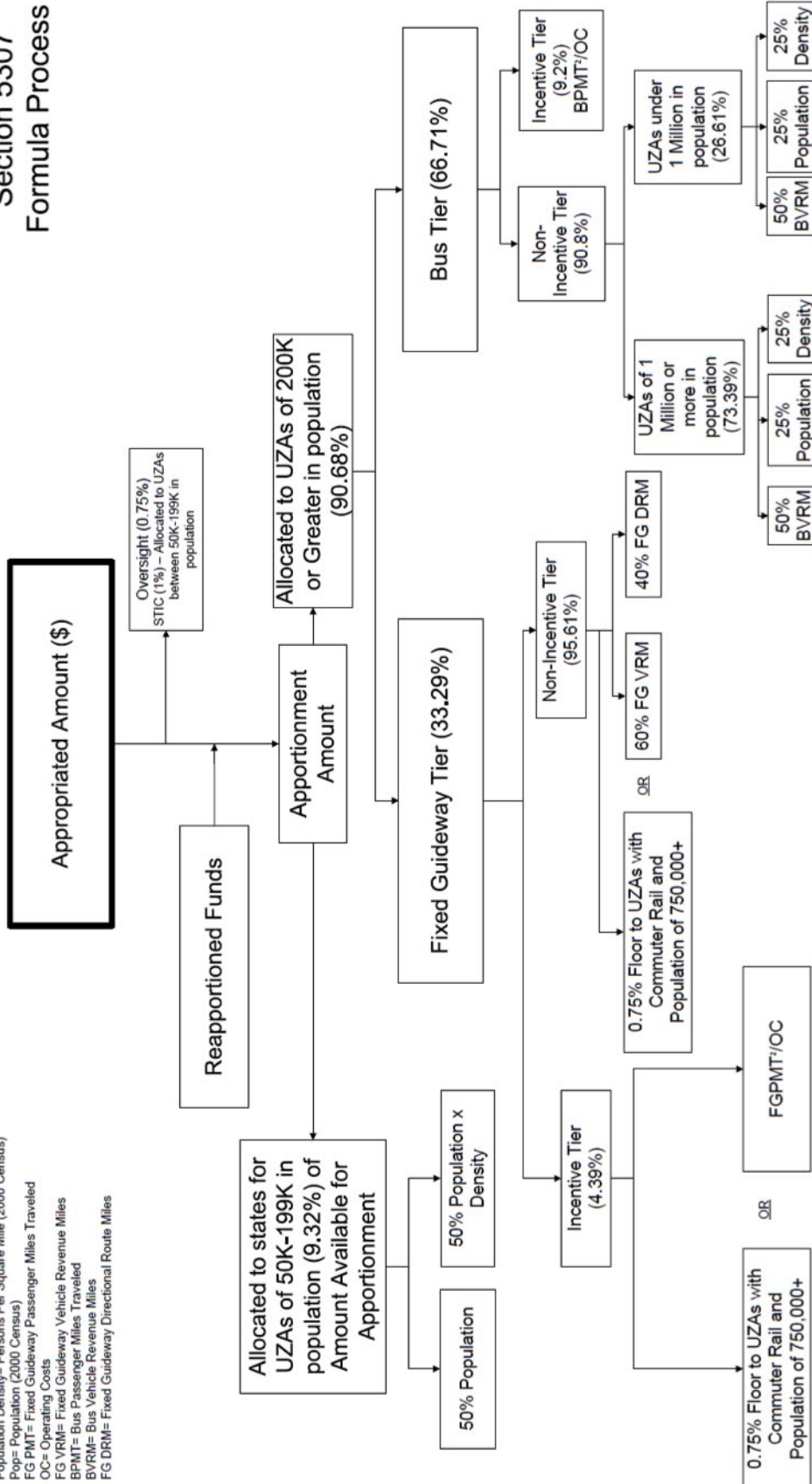


Figure 2: FTA Urban Area Formula Program: Funding Formula Flowchart

## **Fiscal Federalism**

Fiscal federalism refers to the way in which public finance responsibilities (revenue raising and expenditures) are assigned among various levels of a nation's government (e.g., national, state, local). Fiscal federalism represents a set of principles which can guide fiscal decentralization and reconfiguration, such as has been going on in Europe over the past few decades, due to the European Union influence (Favero, 2006). Some have argued that, due to the local nature of both the costs and the benefits of building and operating public transportation systems, fiscal federalism would suggest devolving administrative and financial responsibility for public transportation to metropolitan-level institutions (Zegras et al, 2012). Inherent in the devolution of financial responsibility, comes a greater authority to make management and administrative decisions relevant to service operations and investments.

The act of fiscal devolution does not remove responsibility for the systems from the national government. In fact, the central government must remain a player in public transportation (and other areas of devolution) because it has "the basic responsibility for the macroeconomic stabilization function and for income redistribution," in order to assist the sub-national governments that are resource constrained in comparison to others at the same horizontal level (Oates, 1999). In the context of US transit policy, the Urban Area Formula and Other than Urbanized Area programs function in this manner, redistributing collected revenues from all fifty states in a manner that allows the poorest states to still provide transit services to the poor and elderly (at the very least). The

UAFP does not provide enough funding to make all jurisdictions “equitable,” but instead attempts to help jurisdictions (either counties or municipalities) reach a minimum level of service needed for that area. However, a stricter application of fiscal federalism to the transportation sector would provide states, counties and municipalities greater flexibility in making choices about the sources and levels of funding to provide for roads and transit.

A key element of fiscal federalism is the “hard budget constraint,” that is, spending limits, which help ensure local governments adequately consider costs and benefits in systems where some financial transfers come from higher levels of government. At the same time, fiscal federalism is guided by the idea of asymmetry between local and central knowledge of local needs, as local decisions theoretically create more efficient (Pareto optimal) solutions (Oates, 1999; Favero, 2006). The US Department of Transportation (USDOT) acknowledges the informational asymmetry between the local and federal governments about the local needs. As a result, the FTA’s rules for funding New Starts and Small Starts projects require them to accept whatever is chosen as the “locally preferred alternative” as the outcome of the alternatives analysis. However, as mentioned previously, scholars have questioned the heavy financial support provided by the federal government as a potential bias toward picking alternatives that would cost the local government less, but not necessarily provide the best service.

Hard budget constraints can be positive for localities because it requires them to

carefully consider expenditures to serve their constituents' needs. Alternatively, because of the constraint jurisdictions may wait for others to innovate and test ideas on their behalf. Ultimately, devolution to sub-national governments requires that they have the technical capacity for operations, decision-making, and revenue collection in order to adhere to the principals of fiscal federalism (Favero, 2006).

### **Funding the Local Share**

Municipalities and state governments do not have the same ability to spend that the federal government exercises when it enacts legislation. In 1999, thirty-seven states had balanced budget requirements that did not allow them to carry a deficit into the next fiscal year, unlike the federal government (NCSL, 1999). These state and local governments must turn to other ways to finance large infrastructure projects that would be nearly impossible to fund directly with existing revenues. They employ methods such as issuing bonds, getting federally backed loans, and charging additional taxes and fees to either the entire jurisdiction or specific areas in order to generate the funds necessary to build and operate projects.

A comprehensive report detailing funding mechanisms for the local and regional level by TCRP (2009) provides a menu of and a framework for determining the feasibility of various new funding generators including: “traditional taxes”, activity fees, user fees, and project value capture. Additionally the authors discuss the role of

financing mechanisms such as State Infrastructure Banks and bonds. Surprisingly the increasingly popular Transportation Infrastructure Finance and Innovation Act program (TIFIA) was left off out. The report provides a table detailing the advantages and disadvantages of many types of taxes and fees, as well as describing ways to “sell” the uses of the revenues to the voters that typically must approve them. This is an important resource that should be considered before the implementation of any new funding resources to meet new gaps in funding.

### ***User-fees***

Tolls and transit fares are the most prominent and direct types of revenue generation available. The users know and accept that they are being charged for the use of infrastructure provided for them. In both cases, these fees are typically not enough to cover the costs incurred by the use of the roads or transit systems (pollution, system maintenance or capital investment), although monetary returns on investment are higher for highways than transit systems, based on the private construction and operation of highways in some developing countries, such as Chile. In the United States, fares cover about 37 percent of transit operating costs, which means that other funding sources are needed in order to keep transit systems functioning (Brown, 2005).

### ***Municipal bonds***

The sale of bonds is the closest that municipalities and states can get to deficit spending. This process is frequently used for long-term, expensive infrastructure projects. It is not only used to fund the construction of transit facilities and infrastructure,

but also sewage and water projects, as well as school construction. The process is justified as a way to spread the costs over the life of the system, requiring all the users over the years to fund its existence, rather than requiring the users at the beginning of the system's lifetime to foot the bill for the entire project and allowing future users to function as free riders. In many states, municipalities or the state are required to put the bond up for referendum (Kim, 1987). Bond measures are used for funding capital projects, not for year-to-year operations expenditures, since the money is being borrowed and must be paid back to the bond holders eventually.

### ***Credit Assistance***

TIFIA has been a USDOT federal program since 1998 and provides support for both highway and transit projects. TIFIA is used for capital projects only. TIFIA provides local governments with three forms of federally backed credit assistance: secured (direct) loans, loan guarantees, and standby lines of credit (FHWA, undated). TIFIA attempts to provide direct loans only when the private market cannot provide the necessary investment needed to complete the project (FHWA, undated). The TIFIA program provides a way for local agencies to borrow money at lower rates than they likely could on their own because of the federal guarantees. The FTA has only documented four transit capital projects, including the Washington Metropolitan Area Transit Authority's Capital Improvements Program, Tren Urbano in Puerto Rico, and the Staten Island Ferries Project. Several additional multi-modal projects have also been backed that involved a large transit component, including the Transbay Transit Center in San Francisco, California and the Denver Union Station Project in Denver, Colorado

(FTA, undated).

(Unless otherwise noted, the following examples of local revenue generators were supported by information from TCRP Report 129.)

### ***Taxes and Fees***

Taxes and fees come in many forms at the state and local level. In many cases, their success is dependent on the state where they are enacted and the scale at which they are applied. Local option transportation taxes (LOTTs) arose as fuel tax revenues began to decline through the 1970s, and there was political resistance to raising the gas tax (Wachs, 2003). Wachs reported that local sales taxes are the most common form of LOTTs, but can also include vehicle registration fees, earmarked local income or payroll taxes, and taxes on new real estate developments. He also identifies ballot measures as positive because the voters are seeing what the taxes will be applied to, but cautions that it makes spending funds inflexible in case of changing needs.

### ***Sales Taxes***

In many states, the sales tax can be raised as the result of a referendum with specific increases going towards particular projects or the general transportation fund. This tax is also sometimes applied at a regional, county or municipal scale. Sales taxes for transit tend to range from 0.25 to one percent. One of the more important components of applying a non-statewide sales (or any other) tax to fund transportation projects and operations is that the geographic coverage of the tax should cover the

entire metropolitan area in order to not encourage further retail development away from the city core (Misiak, 2009).

### *Property Taxes*

In some states, the only way the municipalities can really raise additional funds aside from bond measures is to raise property taxes. This is largely seen as undesirable by constituents and leaves the feeling that not all users of the system (e.g. commuters) are paying their fair share of projects if they do not also live in the same area where the tax increase was applied.

### *Tax Increment Financing*

Tax increment financing (TIF) is typically used as an overlay district in areas that are being redeveloped in downtown areas. They attempt to capture benefits from value added to properties as they are redeveloped, which can include improved or new transit access to the area. Tax rates are not actually increased on the properties, but new revenues gained from development beyond the old revenues from properties taxed are applied to special projects instead of being general revenues.

### *Business Improvement Districts*

Business improvement districts are generally used to attract more commercial and retail business to downtown areas as a result of improving the infrastructure, aesthetics and service to the district. The costs for the improvements are funded by fees and typically assessed based on square footage on the businesses in the district.

These fees are justified based on the localized nature of the improvements. However, these fees are typically not enforceable and it is up to feelings of civic obligation, desire for good public appearance or belief that these improvements will also increase their bottom line that convince businesses to participate.

### *Other Fees and taxes*

Fees such as vehicle registration fees, parking fees and rental car taxes are all examples of justifying fees and taxes because of their mitigation potential. Because driving is harmful to the environment, many times use of money extracted from that harmful action can be applied to improving alternatives to driving, such as public transit. Parking fees are sometimes more visible to the drivers because they are forced to pay them on a daily basis and may be more likely to affect driver behavior. In some cases, payroll taxes have been applied to employers in order to capture the benefits commuters gain from infrastructure improvements.

## **Research Questions**

Are systems that are more heavily reliant on local funds for operations expenditures more cost efficient? Are they more cost effective? Are they more service effective?

How do the local governments and transit agencies analyzed in the cases generate revenue for funding the local share of operating expenditures? Do systems with larger proportions of local funds use more diversified sources to meet their obligations?

## **Research Hypothesis**

Under the premise of reduced or stagnant public transit funding levels from the federal government (as the hypothetical outcome of the next surface transportation bill), I hypothesize that most local jurisdictions would become more cost efficient as a result of heavier reliance on local funding sources. Using the Birmingham - Jefferson County Transit Authority (BJCTA) as a proxy for a system experiencing required larger local funding shares, due to the lack of state-level support, I will attempt to demonstrate that despite paying more at the local level to operate their transit systems, the system operates with a similar level of efficiency and is capable of paying the larger local shares mainly by diversifying their means of raising local funds.

## **Research Method**

This thesis utilizes an exploratory multiple case studies approach to examine what the future of public transit could look like if funding levels are reduced. While federal funding for transit could be reduced by the elimination of programs, it could also happen if the Urban Area Formula Program (UAFP) is adjusted and systems experience a reduction (or lack of an increase) in funding that they rely on for operations expenditures.

## **Thesis Format**

The remainder of this thesis follows the following structure. In Chapter Two, I present the method for selecting the case study transit systems. I also discuss the

metrics utilized in the analysis. Chapter Three introduces the context for the cases examined within this thesis. Chapter Four analyzes the cases and their comparison systems. Lastly, Chapter Five discusses my conclusions and ideas for future related research.

## Chapter Two: Methods

As stated in the introduction, this thesis aims to answer the questions:

Are systems that are more heavily reliant on local funds for operations expenditures more cost efficient? Are they more cost effective? Are they more service effective?

How do the local governments and transit agencies analyzed in the cases generate revenue for funding the local share of operating expenditures?

Do systems with larger proportions of local funds use more diversified sources to meet their obligations?

For this thesis, I used a case study research design. I opted to use multiple cases for multiple transit systems in order to evaluate similarly sized systems with variation in levels of local funding shares. Because most agencies receive similar levels of federal support for operations, it is the varying shares of state level funding that determine which transit systems must be more heavily reliant on local funding. The cases ultimately selected ranged from a system where the states provided no support to a system where the state covered over ten percent of the system's operating expenditures.

In the United States, there are three states that reported, as part of APTA's yearly "Survey of State Funding for Public Transit" between 2005 and 2010, no state level transit funding to any systems in their state: Alabama, Hawaii and Utah. Hawaii was eliminated as a place to select a case because of its lack of geographic proximity and

comparable climate to any other systems. Utah was removed because the data in the National Transit Database (NTD) reports state funding for the Utah Transit Agency, in direct conflict with the data from the APTA survey. This left Alabama systems to be used as proxies for the transit systems requiring heavier reliance on increased local funding.

Ultimately, the Birmingham - Jefferson County Transit Authority (BJCTA) was chosen to represent the case of increased shares of local funding. This system was chosen for its comparability to other systems in other mid-sized US cities, as opposed to the other smaller systems in Alabama's other cities. Studying small to medium sized systems that operate buses and demand response vehicles helps to reduce potentially confounding factors that would arise from comparing systems that operate different modes. Using these types of cases also controls for the effects of the presumed "attractiveness" of light rail over buses and removes the question of varying capital costs. I opted to examine medium sized systems because of their applicability across a large portion of US cities, rather than just largest metropolitan areas or rural systems.

Once the Alabama transit system was selected, I selected additional cases to represent BJCTA's peer systems based on the TCRP Report 141 criteria (see Table 1) (TCRP, 2010). These criteria attempt to approximate similarities between systems by comparing factors such as: modes operated, service area demographics, revenue miles operated, annual budget, etc. Likeness scores are given for every factor based on formulas provided in the TCRP report and summed to provide the final Total Likeness Score, which ranks systems based on their similarity to the original transit system, in

this case BJCTA, according to the data available. Likeness scores are calculated for each peer grouping factor, in most cases by a percentage change from the “base” system (in this case, BJCTA). The scores are then summed and divided by the number of factors used in the calculation. Total Likeness Scores can be as low as zero (perfect match) and in the case of BJCTA, got as high as 426.57 for the 644th closest (and last) peer system. For reference, the 20th closest peer system had a score of 0.7 and the 100th had a score of 1.86.

<b>Screening Factors</b>	<b>Peer-grouping Factors</b>
• Rail operator (yes/no)	• Urban area population
• Rail-only operator (yes/no)	• Total annual vehicle miles operated
• Heavy Rail operator (yes/no)	• Annual operating budget
	• Population density (pop/mi <sup>2</sup> )
	• Service area type
	• State capital (yes/no)
	• Percent college students
	• Population growth rate
	• Percent low-income population
	• Annual roadway delay (hours) per traveler
	• Freeway lane miles (in thousands) per capita
	• Percent service demand-responsive
	• Percent service purchased
	• Distance from selected agency

**Table 1: TRCP 141 Likeness Factors**

The Florida Transit Information System (FTIS) maintains a database that contains all the raw reported data to the NTD program from 1984 through 2010 that can be queried, called the Integrated National Transit Database Analysis System (INTDAS). This database uses the TCRP criteria to rank peer systems to a selected system based on the likeness score from the TRCP criteria. Table 2 shows the original peer groups selected by the TCRP criteria and the INTDAS system.

Agency Name	Location	State	Total Likeness Score	Rail	Urban Area Population	Total Vehicle Miles Operated	Total Operating Budget	Population Density
Birmingham-Jefferson County Transit Authority	Birmingham	AL	0	No	659,052	3,903,905	\$20,379,870	1,681.36
Transit Authority of Omaha	Omaha	NE	0.35	No	651,814	4,279,299	\$19,239,981	2,879.28
Central Oklahoma Transportation and Parking Authority	Oklahoma City	OK	0.41	No	777,891	3,656,363	\$17,086,741	2,412.81
Greater Dayton Regional Transit Authority	Dayton	OH	0.47	No	689,659	10,128,573	\$57,862,169	2,131.40
Regional Transit Service, Inc. and Lift Line, Inc.	Rochester	NY	0.48	No	685,128	7,147,468	\$54,025,077	2,321.59
Metropolitan Tulsa Transit Authority	Tulsa	OK	0.49	No	562,812	4,230,443	\$16,134,251	2,153.15

Agency Name	State Capital	Percent College Students	Population Growth Rate	Percent Low Income	Annual Delay (hours) per Traveler	Freeway Lane-Miles per Capita (000)	Percent Service Demand Response	Percent Service Purchased	Distance from BICTA (miles)
Birmingham-Jefferson County Transit Authority	No	6.57	-0.69	23.34	33	0.99	0.29	0.05	0
Transit Authority of Omaha	No	7.58	4.02	19.58	25	0.47	0.11	0	736.34
Central Oklahoma Transportation and Parking Authority	Yes	6.72	4.13	25.75	21	0.88	0.23	0.16	626.7
Greater Dayton Regional Transit Authority	No	8.36	-1.96	23.42	17	0.75	0.38	0	458.09
Regional Transit Service, Inc. and Lift Line, Inc.	No	9.8	-1.33	21.25	10	0.75	0.16	0	832.93
Metropolitan Tulsa Transit Authority	No	6.31	0.8	26.56	19	0.92	0.59	0.63	547.19

**Table 2: BJCTA TCRP Peer Group Selection**

Based on service characteristics such as annual boardings, service area population, and revenue miles, I reduced the cases within the peer group to be systems that were more similar in size. The final cases selected can be found in Table 3.

<b>Agency Name</b>	<b>Location</b>	<b>State</b>	<b>Total Likeness Score</b>	<b>Abbreviation</b>
<b>Birmingham-Jefferson County Transit Authority</b>	Birmingham	AL	0	BJCTA
<b>Transit Authority of Omaha</b>	Omaha	NE	0.35	TAO
<b>Central Oklahoma Transportation and Parking Authority</b>	Oklahoma City	OK	0.41	COPTA
<b>Metropolitan Tulsa Transit Authority</b>	Tulsa	OK	0.49	MTA

**Table 3: BJCTA Final Peer System Selection**

Prior to analyzing any operations data, I felt that the four urban areas needed more context, so I utilized US Census data for the cities' urbanized areas (because the transit systems operate beyond the city boundaries) for some baseline criteria. The criteria examined are as follows:

- Total population
- Median Household Income
- % unemployment
- % of journey to work trips made using public transit
- % population that is white

These data were analyzed with Census 2000 data because the urban area Census geography was not available with the most recent American Community Survey data at the time of analysis.

Agency	Total Population (2000)	Median Household Income (1999\$)	% of Journey-to-work trips taken by public transit	% unemployment	% population that is white
<b>BJCTA</b>	663,615	\$39,025	1.0%	3.8%	58.5%
<b>TAO</b>	626,623	\$44,012	1.3%	2.7%	83.4%
<b>COPTA</b>	747,003	\$36,476	0.7%	3.2%	72.3%
<b>MTA</b>	558,329	\$37,778	0.9%	3.3%	74.1%

**Table 4: Contextual Characteristics (2000 Census Data)**

Once I selected the final cases for analysis, the data for 2005 through 2010 were downloaded through INTDAS. These years were selected to coincide with the enactment of SAFETEA-LU, in order to ensure that funding formulas and other grant programs would be consistently applied to all of the transit systems examined in this thesis. Data from the NTD “Funds Expended and Funds Earned” form (F-10), which documents the sources and amounts of revenue generated and expended over the year, were extracted through INTDAS and imported into MS Excel for analysis, along with the NTD’s annual system profiles (sample of data in Table 5).

Agency	Total Revenue Miles (2010)	Unlinked Passenger Trips (2010)	Number of Routes Operated	Service Area (mi <sup>2</sup> )
<b>BJCTA</b>	3,405,257	2,562,785	32	186
<b>TAO</b>	4,699,455	4,281,971	31	178
<b>COPTA</b>	3,125,856	2,805,659	23	244
<b>MTA</b>	4,241,662	2,717,917	26	196

**Table 5: Case Study General Operating Statistics**

The data sets were then processed in order to develop several statistics for comparisons across the systems. All financial data were adjusted using the US Bureau

of Labor Statistics Consumer Price Index (CPI) to normalize the data to 2011 dollars. Many of the statistics used in this analysis were chosen in concert with the research conducted by Fielding et al. (1978, 1985) which was based on research conducted on behalf of UMTA (the FTA predecessor) for determining appropriate indicators for cost efficiency, service effectiveness, and cost effectiveness.

Three of the performance concepts being evaluated in the following analysis are:

1. cost per output – used as a metric to determine the amount per passenger boarding that the system expends per rider. This is an important factor to minimize when operating under a hard budget constraint due to the lack of additional funds available to cover losses;
2. utilization of service – used as a metric to determine the efficiency of the existing routes. Depending on the service goals of the system, this may not be optimized, but higher utilizations of service tend to indicate higher quality service provided; and
3. revenue generation per expense – used as a metric to determine which levels of government are funding the costs of each trip most heavily and the sources of those funds.

Fielding et al.'s research determined that: cost per output was best determined by examining operating expenditures per revenue vehicle hours or total vehicle miles; utilization of service was best approximated through total passenger trips per total revenue vehicle hours or total passenger trips per total vehicle revenue miles; and

revenue generation per expense was determined to be dollars of operating revenue per dollar of operating expenditure or also as dollars of revenue per dollar of operating subsidy.

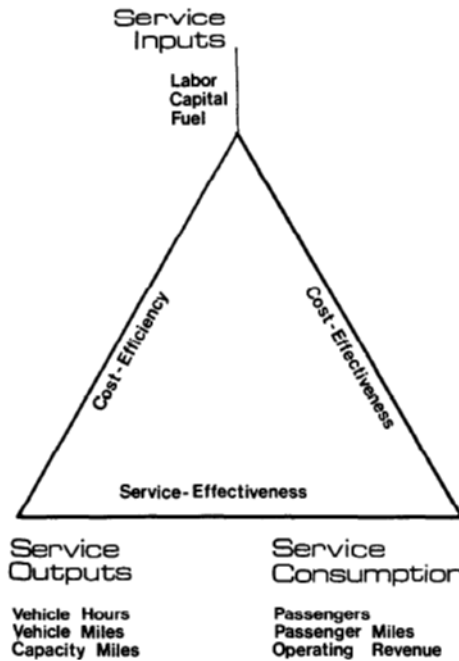


Figure 3: Fielding et al.'s framework for a transit performance model (1985)

This thesis utilizes metrics slightly different than Fielding et al.'s, based on data availability and research objectives. Costs per output are analyzed by dollars of operating expenditure per unlinked passenger trip, separated between fixed route and demand response services. Because of the way in which data are reported to the NTD, the operating expenditures are not explicitly separated by mode and I felt it was important that costs per output be mode-specific due to the nature of the case studies because of varying costs across transit systems and levels of demand-service usage. Service utilization is approximated as total unlinked passenger trips per revenue vehicle miles traveled. Revenue generation per expense is looked at by examining the source

of operating revenues, including revenues generated through fares.

In order to compare systems and derive the relevant performance measures, the following reported variables were collected from the NTD through both the annual system profiles as well as through INTDAS:

- Unlinked passenger trips
- Vehicle revenue miles
- Vehicle revenue hours
- Operating cost per unlinked passenger trip
- Local revenue by source
- State revenue by source
- Federal revenue by source
- Directly-generated revenue by source

These metrics are then used in the case study analysis to test my hypothesis regarding system efficiency and local revenue sources.

## Chapter Three: Case Studies

### Birmingham – Jefferson County Transit Authority (BJCTA)

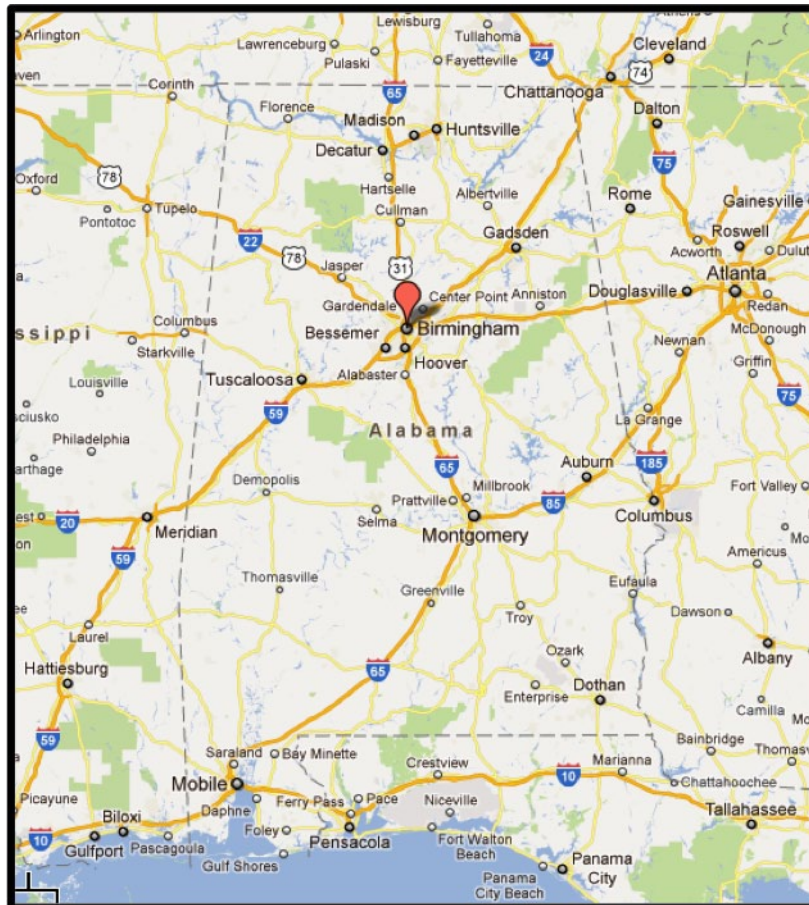
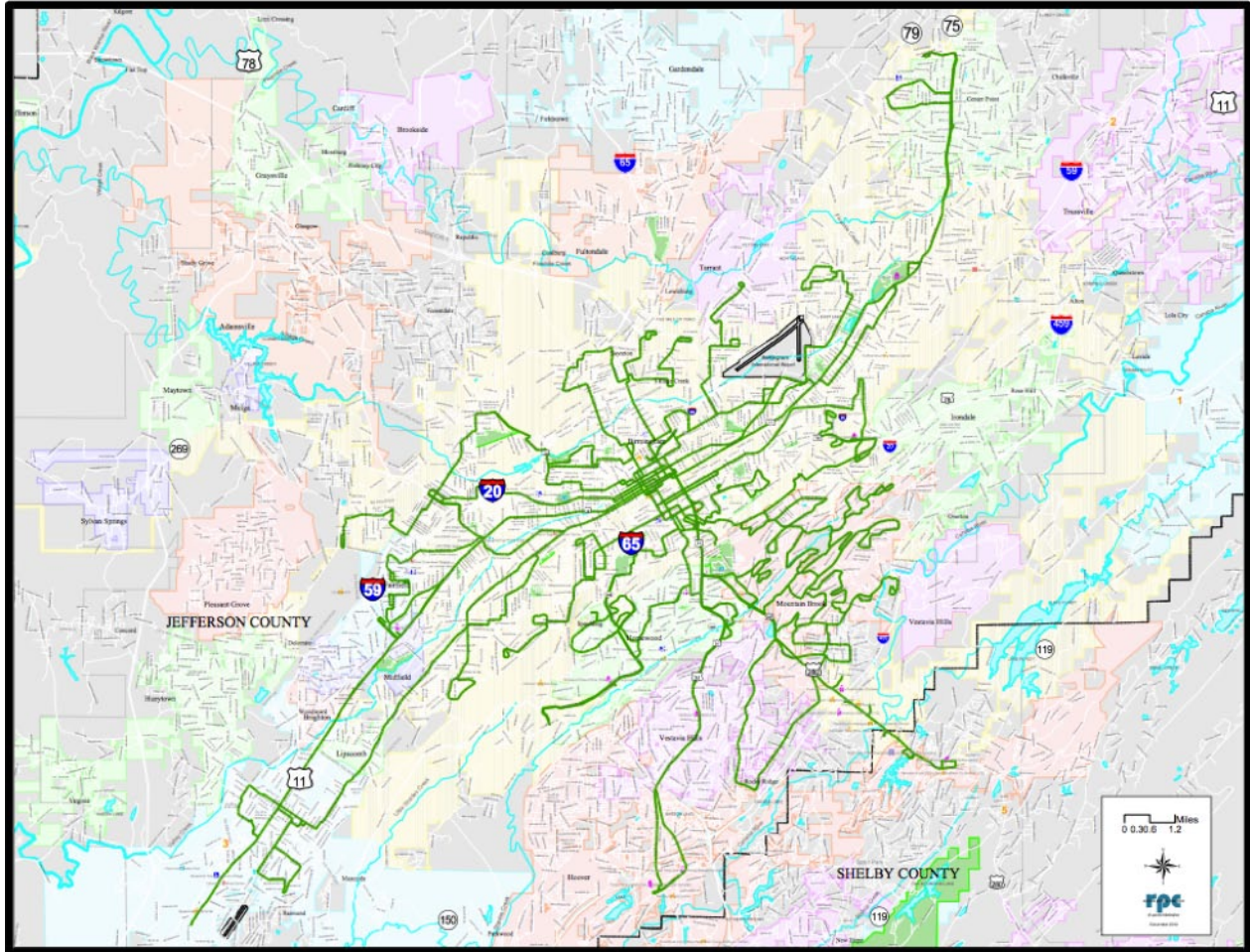


Figure 4: Birmingham, Alabama

Located in the center of Alabama, Birmingham sits at the intersection of I-65 and I-20, two major highways that run north-south and east-west, respectively, across Alabama, connecting the area to Atlanta, Georgia in the east, Nashville, Tennessee to the north, and Montgomery and Mobile, Alabama to the south (Figure 4). The city's regional connectivity through its highways as well as its low population density creates a heavy reliance on the automobile.

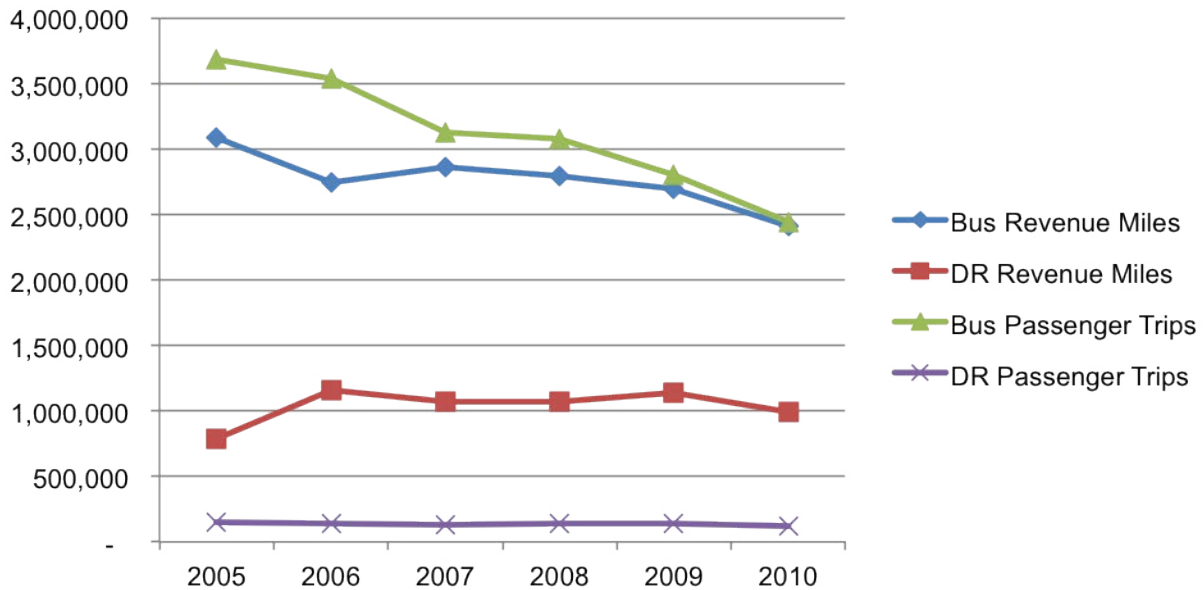
According to the 2000 Census, the Birmingham, Alabama Urbanized Area was home to over 660,000 people, with the BJCTA service area covering a population of approximately 450,000 residents, providing over 2.5 million unlinked passenger trips in 2010. The 2000 median household income (in 1999 dollars) was \$39,025, which was nearly \$5,000 higher than the median household income for all of Alabama. In 2000, Birmingham had a 3.8 percent unemployment rate, which was comparable to the 3.7 percent unemployment rate across the entire state. The City of Birmingham had a population that is 58.5 percent white, compared to a 71.1 percent white population statewide.

The BJCTA currently operates 32 bus routes in the City of Birmingham and throughout the surrounding region, including two shuttles. Additionally they operate a demand response paratransit service and a CNG powered “downtown trolley” circulator system (which was not included in this analysis due to the lack of reported data). The routes of the BJCTA system (Figure 5) are mostly radial from the downtown area and reach far into the surrounding suburbs. According to the 2000 Census, Birmingham’s urbanized area had 1.0 percent of the population commute to work by public transit, which was double the state figure. BJCTA also carried nearly a third of Alabama’s daily public transit trips to work.



**Figure 5: BJCTA System Map**

Between 2000 and 2010, the population of Birmingham has decreased by thirty thousand people. Accordingly, the BJCTA has seen declining ridership and threatened to reduce service in order to make ends meet during this recession (Whitman, 2011). Bus ridership dropped by 33.6% percent between 2005 and 2010, while paratransit service demand and revenue miles remained steady (Figure 6). This significant change in ridership greatly effected operating costs per capital over the six-year period studied here.

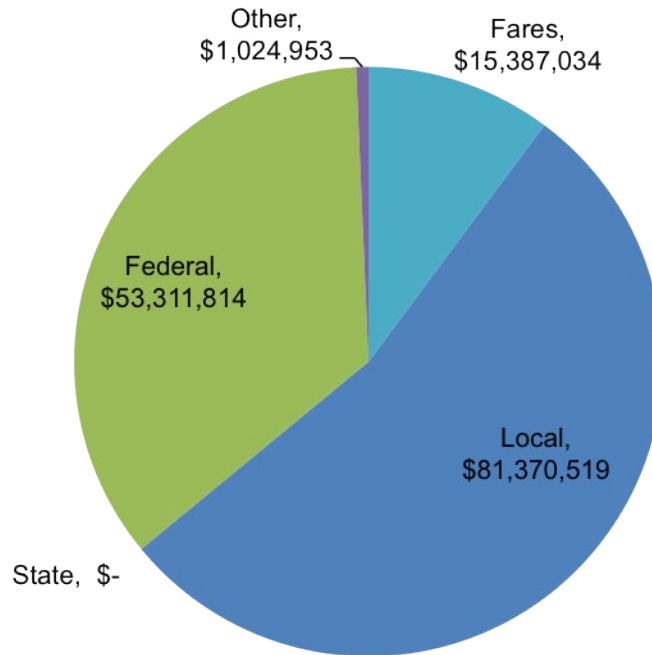


**Figure 6: BJCTA Service Statistics (2005-2010)**

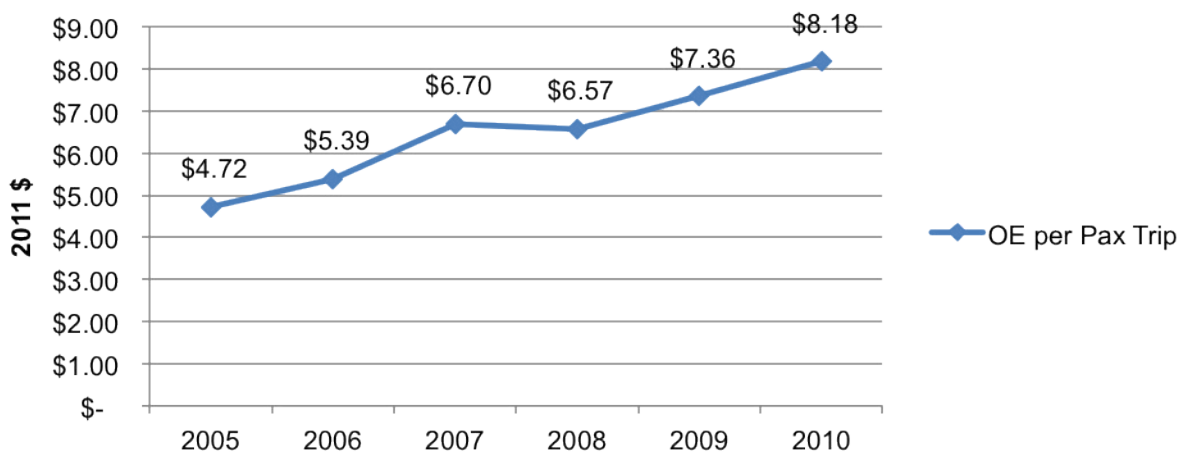
Over the past six years, BJCTA received \$53.3 million from the federal government through both capital and operating funds, while matching them with \$86.8 million in local money, coming from the city of Birmingham and Jackson County, as well as fares collected from riders (Figure 7). There have been some issues in the past few years with the city council trying to reduce funding to the transit authority, but agreements were reached in 2010 to keep funding at operational levels (Alabama’s 13 Staff, 2010). There was some talk reported by the city council in 2010 for pressuring the state to assist with funding, because Alabama is one of the few that does not provide any dedicated funding sources to transit (Golston, 2011).

Many of the current difficulties faced by BJCTA can be seen in the near doubling of operating expenditures per passenger trip for both bus and paratransit services over the past six years, even after being adjusted for inflation (Figures 8 and 9). This trend

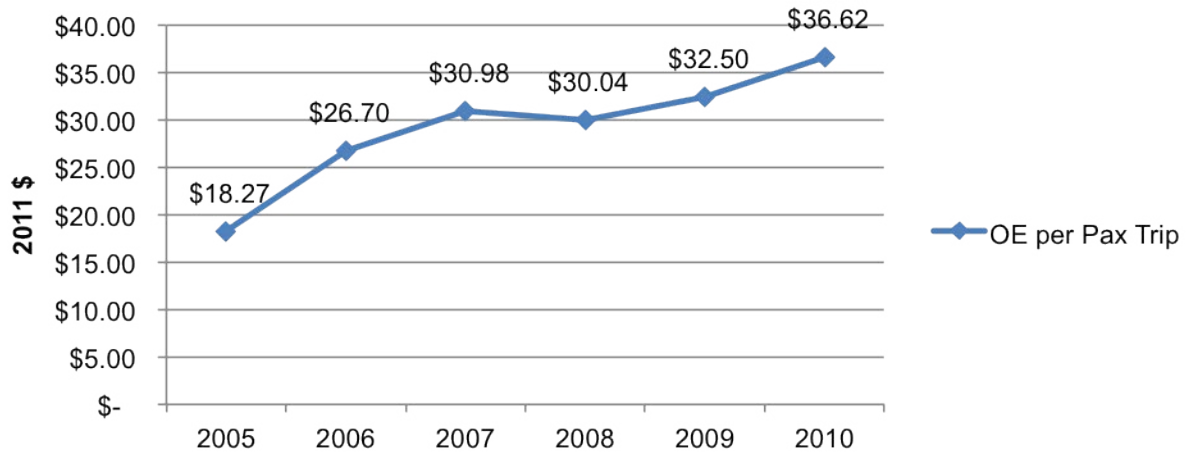
was not seen among most of BJCTA's peer systems analyzed and will be discussed in more detail in Chapter Four.



**Figure 7: BJCTA Total Reported Revenues, FY 2005- FY 2010**



**Figure 8: BJCTA Bus Operating Expenditures per Unlinked Passenger Trip**



**Figure 9: BJCTA Paratransit Operating Expenditures per Unlinked Passenger Trip**

## Transit Authority of Omaha (TAO)

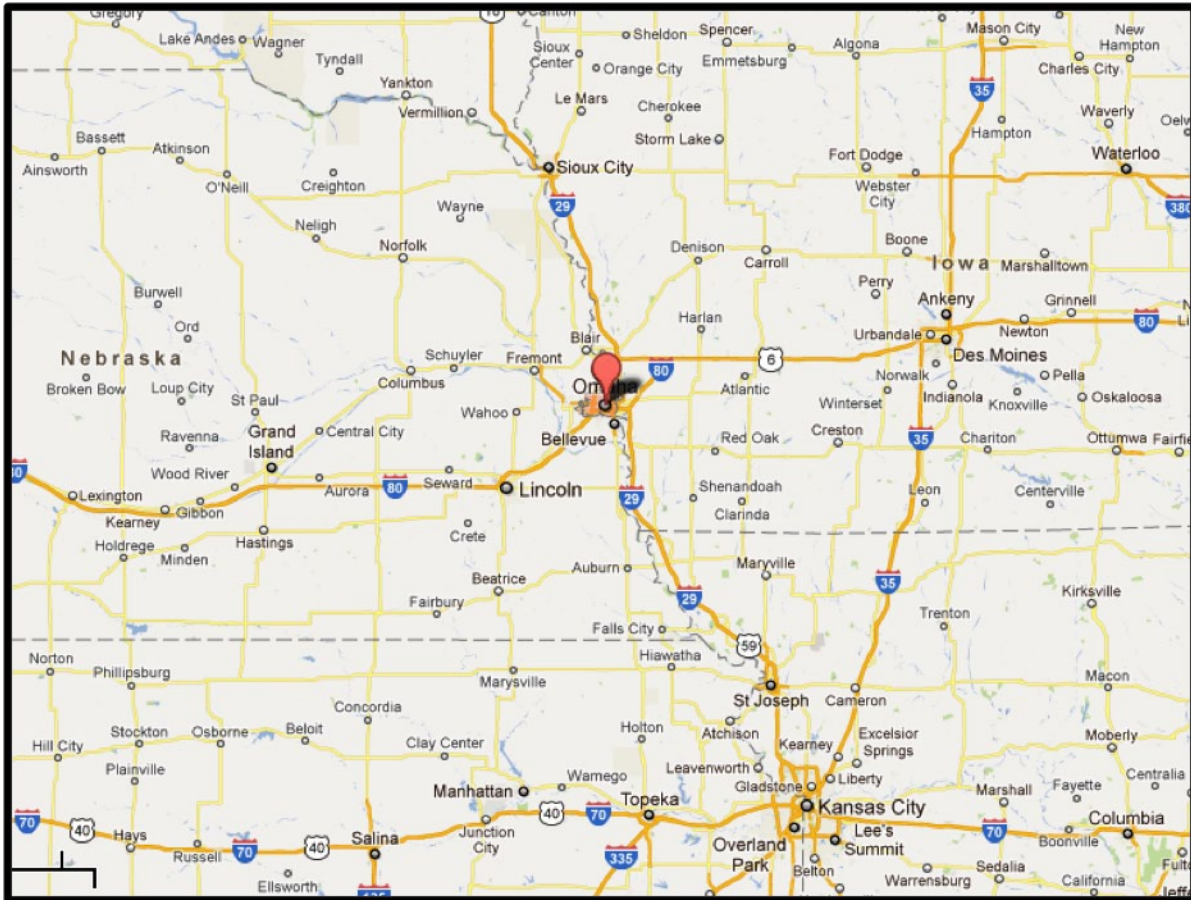


Figure 10: Omaha, Nebraska

Located on the eastern edge of Nebraska, Omaha sits at the intersection of I-29 and I-80, two major highways that run north-south and east-west, respectively, across the Midwest, connecting the area to Lincoln, Nebraska in the west, Kansas City to the south and Des Moines, Iowa to the east (Figure 10). Similar to Birmingham, the city's regional connectivity through its highways and sprawling development pattern create a heavy reliance on the automobile. While Omaha has greater population density than Birmingham, it is still low by comparison to the cities of the northeastern United States.

According to the 2000 Census, the Omaha, Nebraska Urbanized Area was home to almost 630,000 people, with the Transit Authority of Omaha (TAO) service area covering a population of approximately 580,000 residents, providing over 4.2 million unlinked passenger trips in 2010. The 2000 median household income (in 1999 dollars) was \$44,012. In 2000, Omaha had a 2.7 percent unemployment rate, which was the lowest among the four systems examined here. The City of Omaha had an 83.4 percent white population in 2000.

The TAO currently operates 31 bus routes in the Omaha metro area, including seven express buses. The routes are less radial than Birmingham, due to multiple employment centers within the city, but they still stretch across a large geographical area (Figure 11). In 2000, Omaha had 1.3 percent of the urban area population commute by public transit to work, the highest percentage of the four systems analyzed. TAO served 4.3 million trips in 2010, which was the second highest number of trips on the system during the period, off of a high of 4.7 million from 2005 (Figure 12).

Between 2005 and 2010, TAO expended almost \$168.6 million (2011 dollars), of which \$68.5 million was through federal programs, including \$25.9 million for capital expenditures. Comparatively, the city and Douglass County expended \$50.1 million of their own money, as well as the \$27.2 million received through fare collection. The additional \$22.8 million was covered through state-level support and other directly-generated funds (Figure 13).

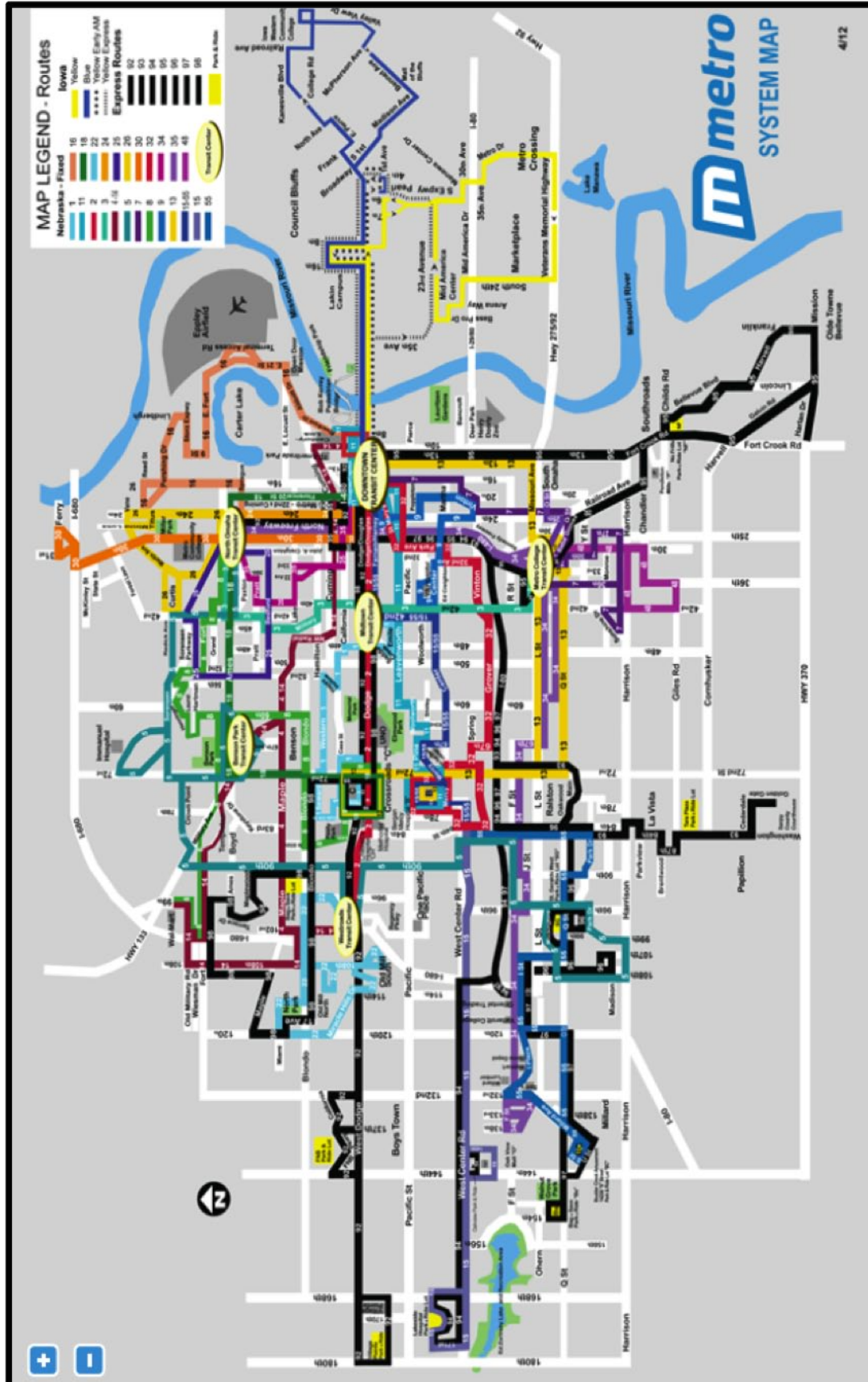
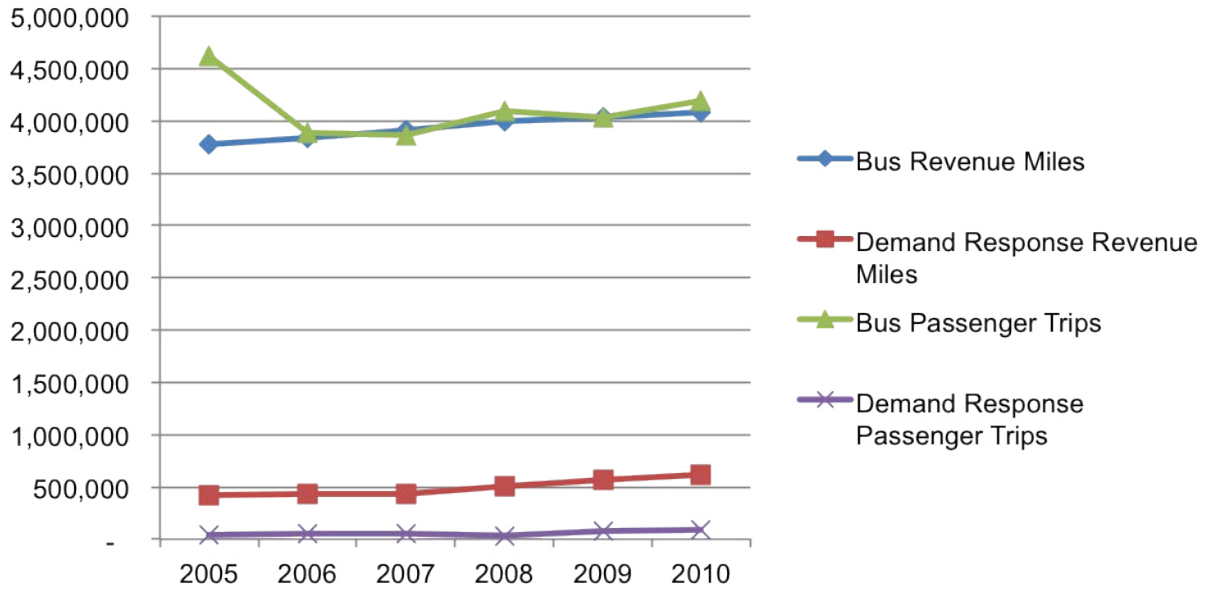
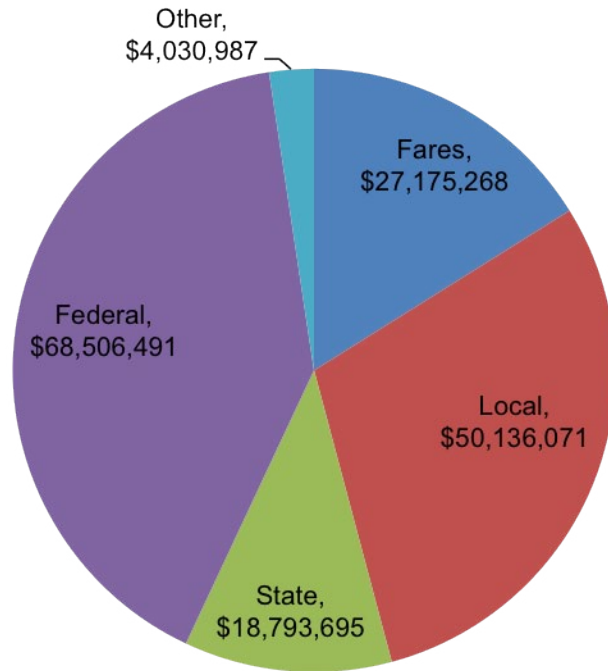


Figure 11: TAO System Map

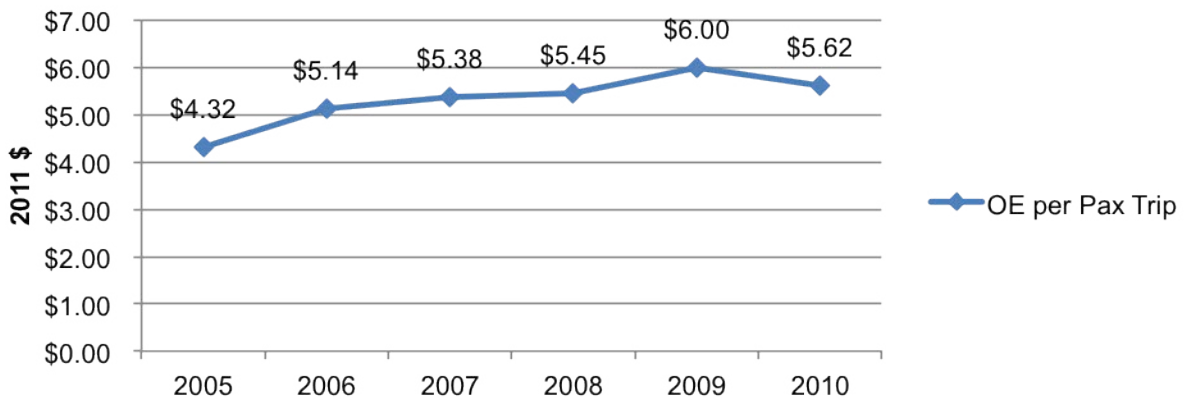


**Figure 12: TAO Operating Statistics**

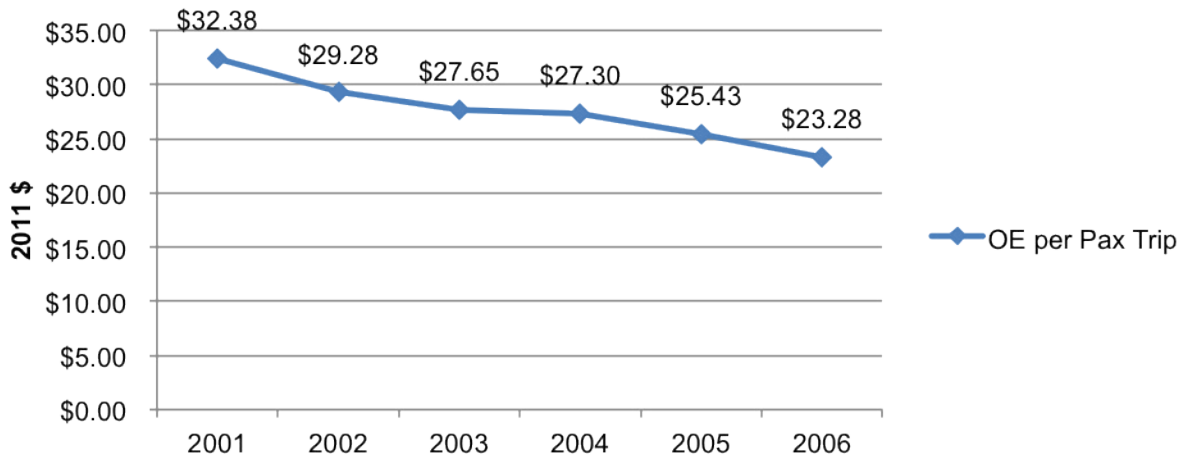


**Figure 13: TAO Total Reported Revenues (2005-2010)**

Operating expenditures per unlinked passenger trip for bus services increased \$1.30 when adjusted for inflation between 2005 and 2010 (Figure 14). Conversely, the operating expenditures per unlinked passenger trip of the demand response service decreased over \$9 during the same period (Figure 15). These trends will be discussed in greater detail in Chapter Four.



**Figure 14: TAO Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)**



**Figure 15: TAO Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)**

## Central Oklahoma Parking and Transportation Authority (COPTA)

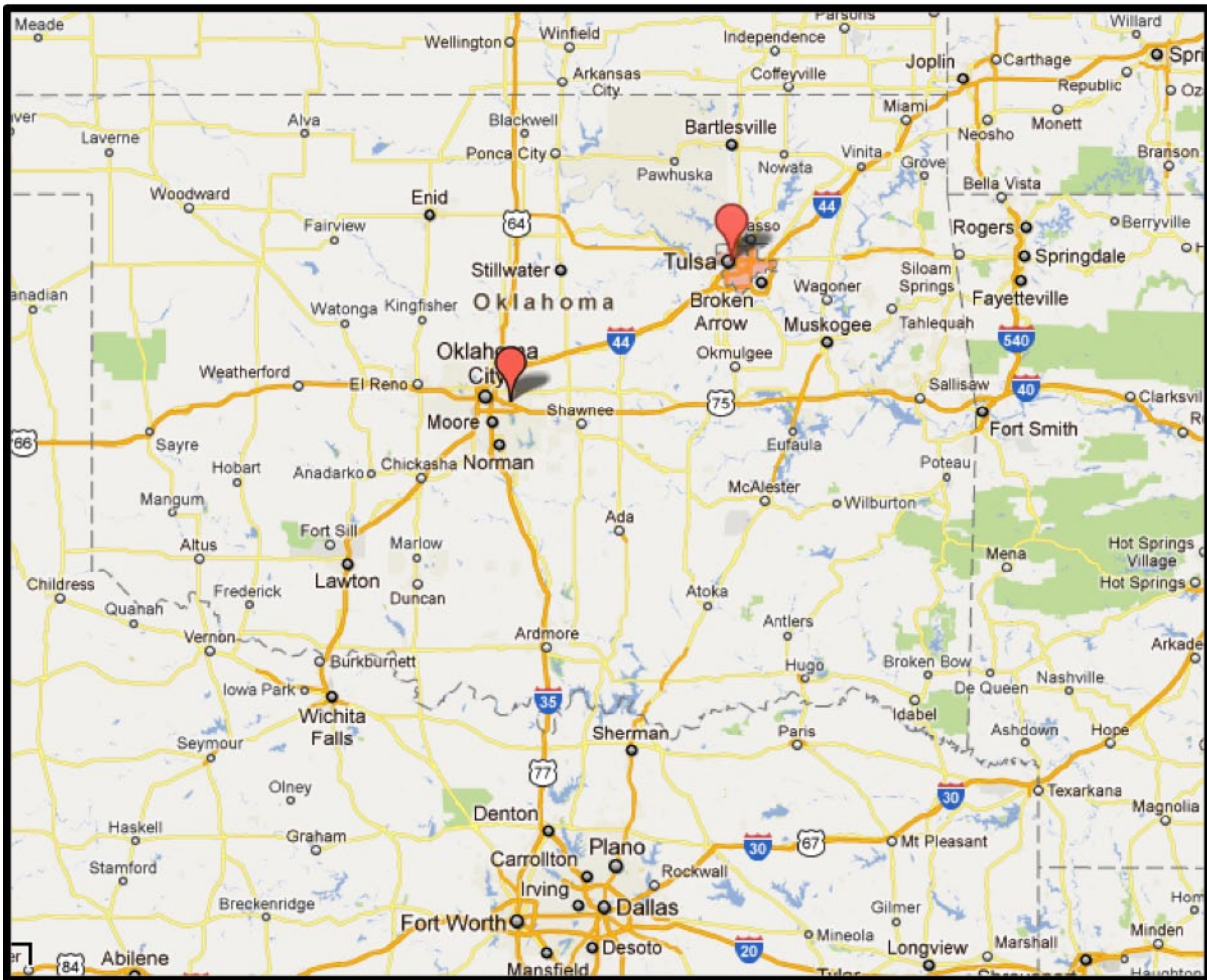


Figure 16: Oklahoma City and Tulsa, Oklahoma

Oklahoma City, Oklahoma is located at the intersection of 3 major highways: I-35, which connects to Dallas-Fort Worth to the south and Wichita to the north; I-44, which connects to Tulsa to the northeast; and I-40, which connects the city to Amarillo to the west and Fort Smith (and eventually Little Rock, Arkansas) to the east (Figure 16). Oklahoma City is located about 100 miles from Tulsa. Oklahoma City is very heavily

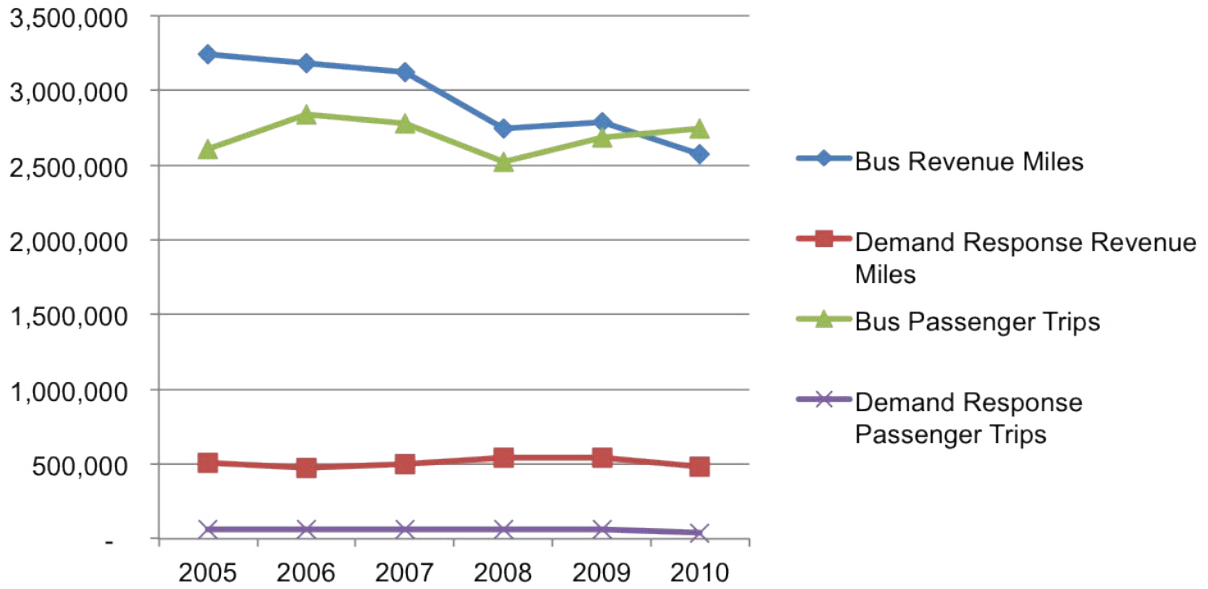
auto-dependent, just like the two previously discussed cases.

According to the 2000 Census, Oklahoma City's urban area had a population of nearly 750,000, the largest of the four cities studied here, and the Central Oklahoma Parking and Transportation Authority (COPTA) serves a population of 650,000. With a median household income in 2000 of \$36,476 (in 1999 dollars), Oklahoma City was the poorest of the four cases analyzed in this thesis. Its population was 72.3 percent white and had an unemployment rate of 3.2 percent.

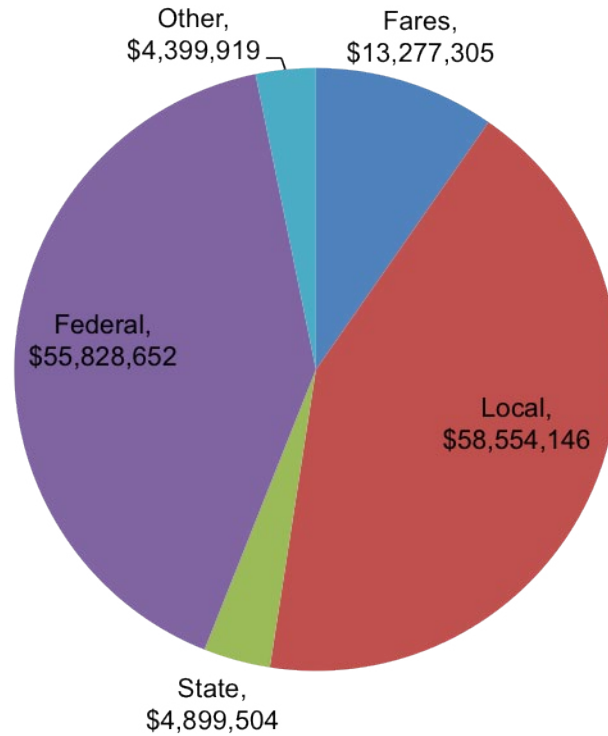
COPTA operates 23 bus routes that served 2.8 million passenger trips in 2010. The system functions in a radial pattern to bring people into the downtown transit center next to the Oklahoma Statehouse (Figure 17). They also operate a free downtown circulator trolley that was not included in this analysis, due to the lack of reported data. Ridership remained fairly steady between 2005 and 2010, although revenue miles have decreased over the same period (Figure 18).

COPTA expended \$137 million between 2005 and 2010, \$13 million of which was used for capital expenditures. Comparatively, the local jurisdictions expended \$58.6 million of their own money, as well as the \$13.3 million received through fare collection. The additional \$9.3 million was covered through state-level support and other directly-generated funds (Figure 19).



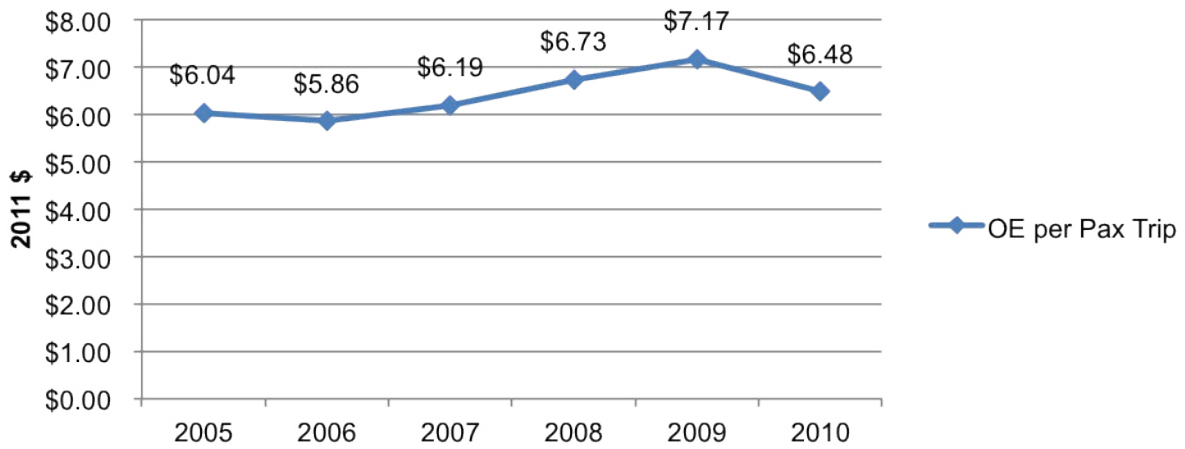


**Figure 18: COPTA Operating Statistics (2005-2010)**

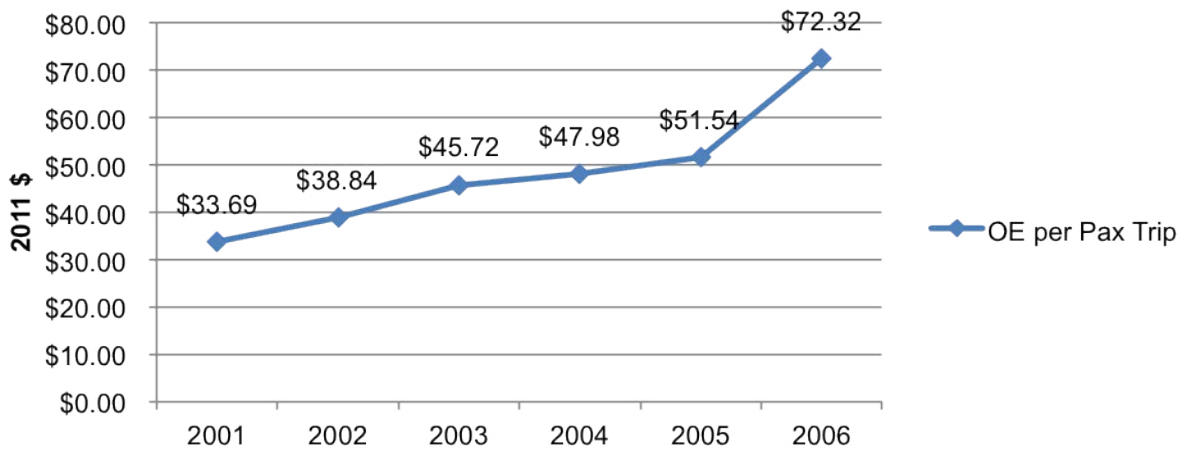


**Figure 19: COPTA Total Expenditures (2005-2010)**

Operating expenditures per unlinked passenger trip for COPTA's bus system has remained nearly constant between 2005 and 2010 (Figure 20). However, during the same period, the demand response service saw operating expenditures per trip increase by 115% (Figure 21). The increase in operating expenditures per unlinked trip for the demand response service is an extreme outlier in comparison to the other three cases analyzed in this thesis. These statistics will be discussed in more depth in Chapter Four.



**Figure 20: COPTA Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)**



**Figure 21: COPTA Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)**

## **Metropolitan Tulsa Transit Authority (MTA)**

Tulsa, Oklahoma is located 100 miles northeast of Oklahoma City, along I-44, which is one of its major highways. Additionally, SR 64 and SR412 are other major roadways around the city (Figure 16). Similar to the other three cases, Tulsa is heavily auto dependent due to the low density and expansive coverage of the city.

According to the 2000 Census, Tulsa's urban area had a population of almost 560,000 people and MTA serves a population of 400,000. MTA has the smallest service population of all of the cases analyzed in this thesis. With a median household income in 2000 of \$37,778 (in 1999 dollars), it was the second lowest of the study, slightly higher than Oklahoma City. Its population was 74.1 percent white with an unemployment rate of 3.3 percent.

MTA operates 26 bus routes, including 3 express routes, which served 2.7 million trips in 2010 (Figure 22). This system is very similar to Oklahoma City because the routes focus on a main downtown center, with routes that extend into the suburbs and have large headways. Ridership trends for the MTA follow the trends of revenue miles operated per year (Figure 23). MTA carries 0.9 percent of journey-to-work trips for the urbanized area.

# Tulsa Transit System Map

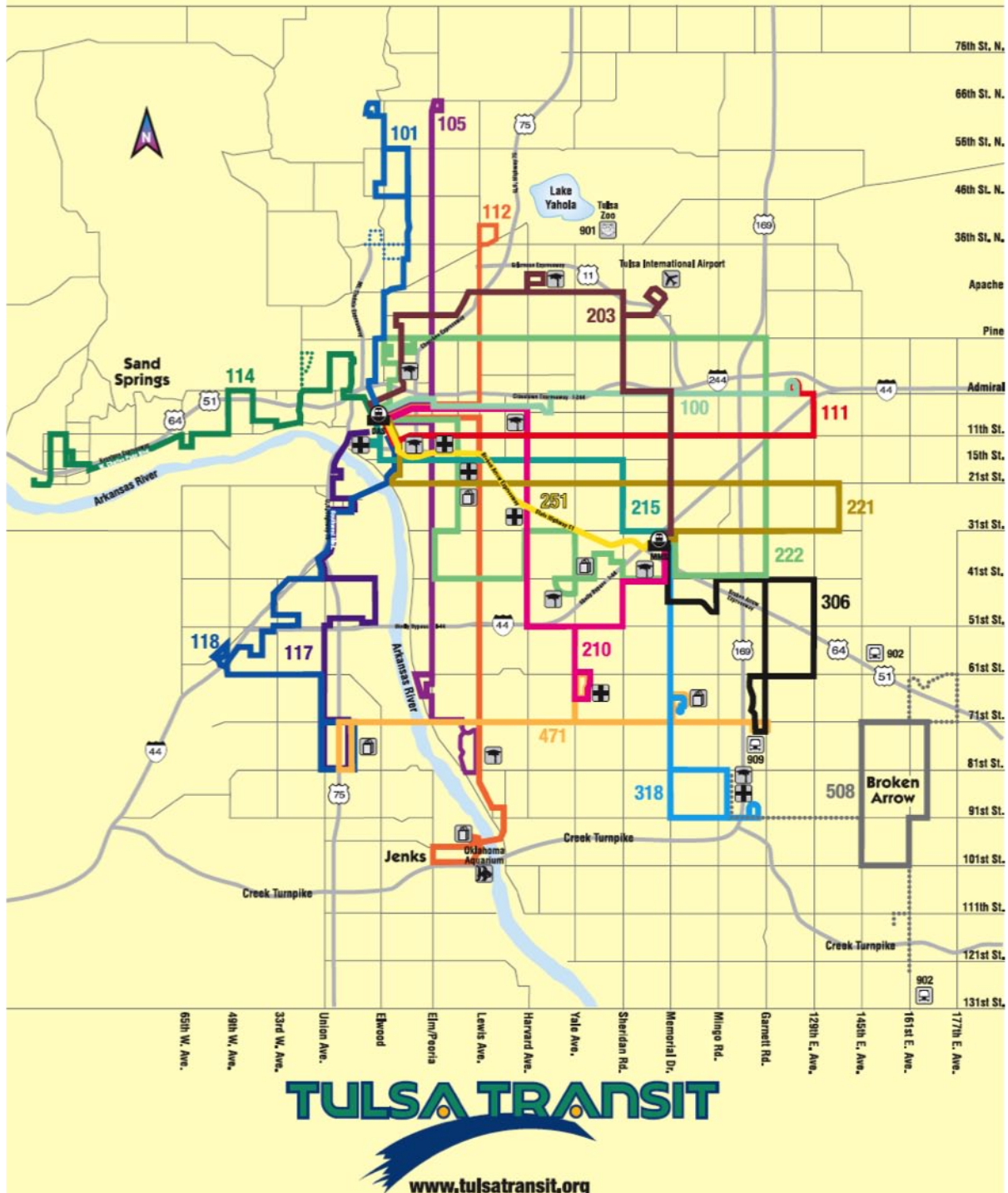
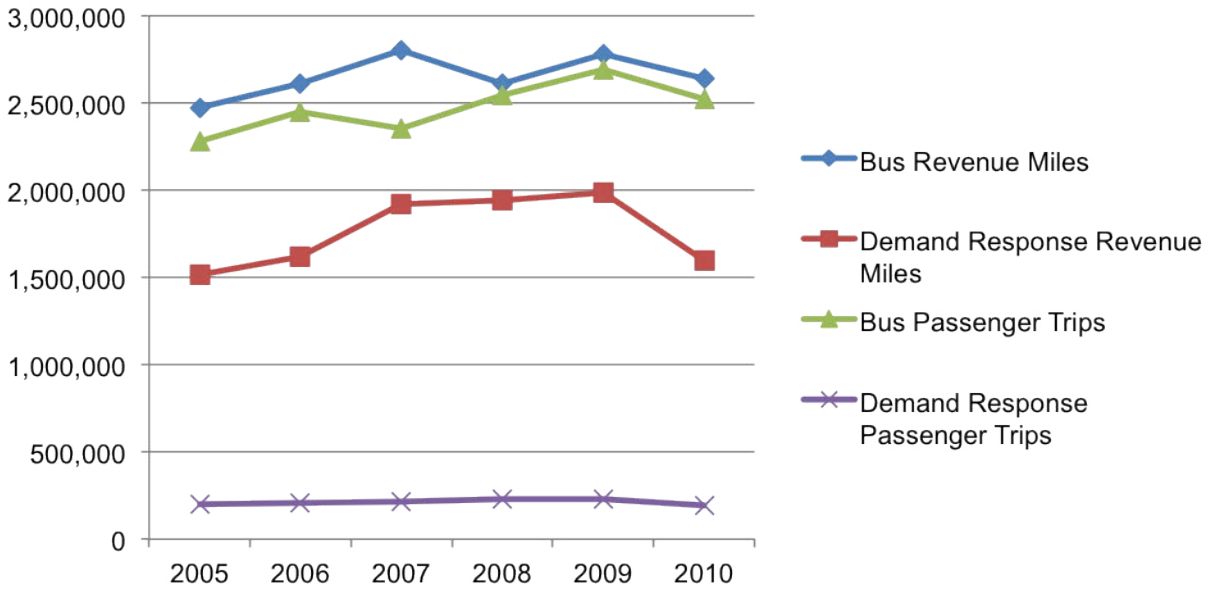


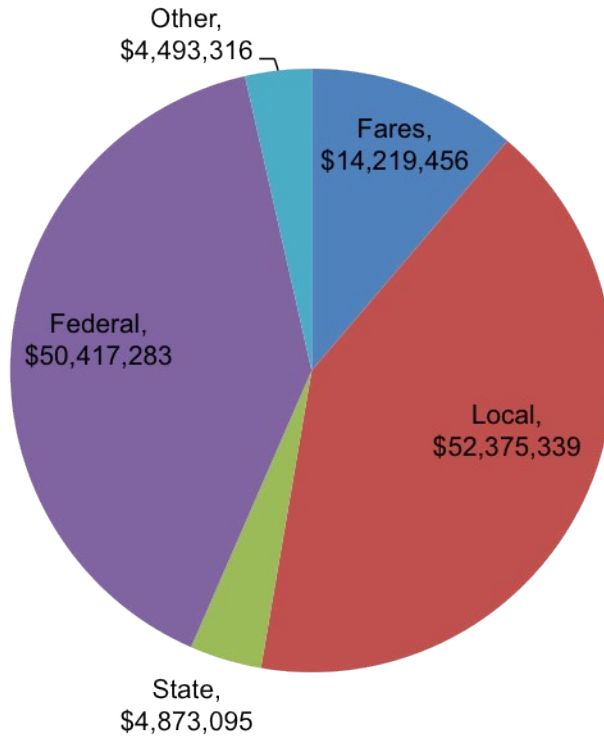
Figure 22: MTA System Map



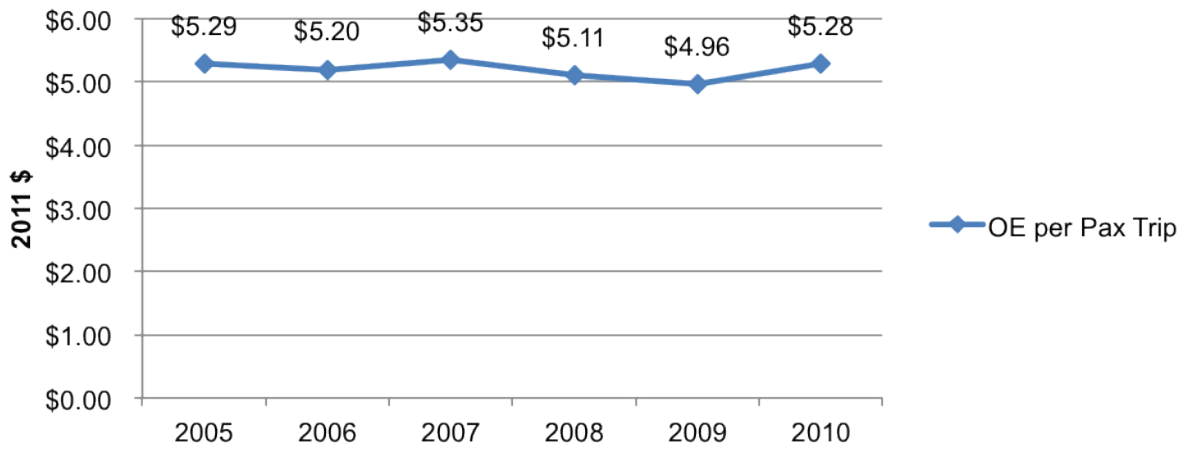
**Figure 23: MTA Operating Statistics**

MTA had expenditures totaling \$126.4 million between 2005 and 2010. These expenditures included \$19.1 million expended on capital projects (Figure 24). Expenditures linked to federal funds accounted for \$50.4 million during this period. The expenditures attributed to local sources were \$52.4 million, plus an additional \$14.2 million in collected fares. The remaining \$9.4 million were covered through state-level support and other directly-generated funds.

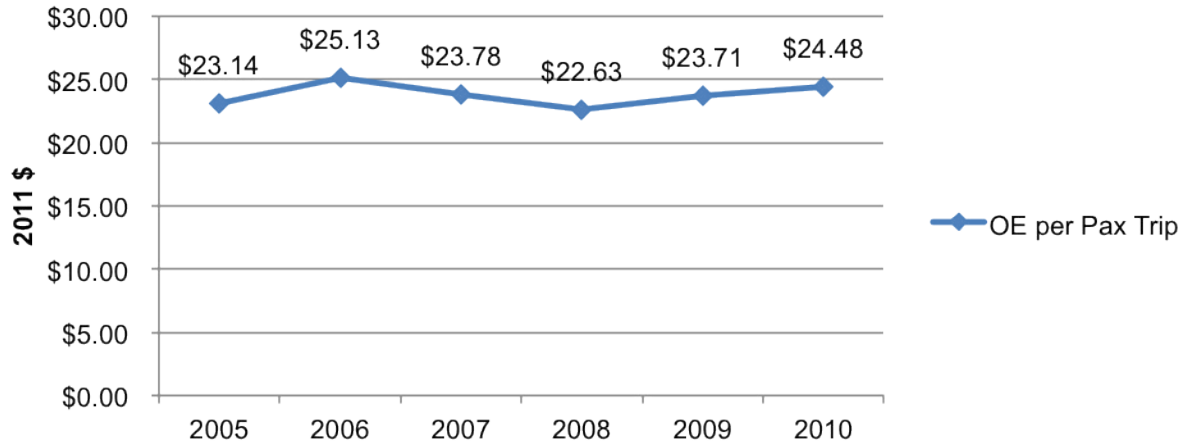
The MTA experienced a more stable level of operating expenditures for both bus and demand response services between 2005 and 2010 than any of the other three cases examined here (Figures 25 & 26). MTA had the lowest bus operating expenditures per trip in 2010 and was just slightly more than TAO for demand response operating expenditures per trip in 2010.



**Figure 24: MTA Total Expenditures (2005-2010)**



**Figure 25: MTA Bus Operating Expenditures per Unlinked Passenger Trip (2005-2010)**



**Figure 26: MTA Demand Response Operating Expenditures per Unlinked Passenger Trip (2005-2010)**

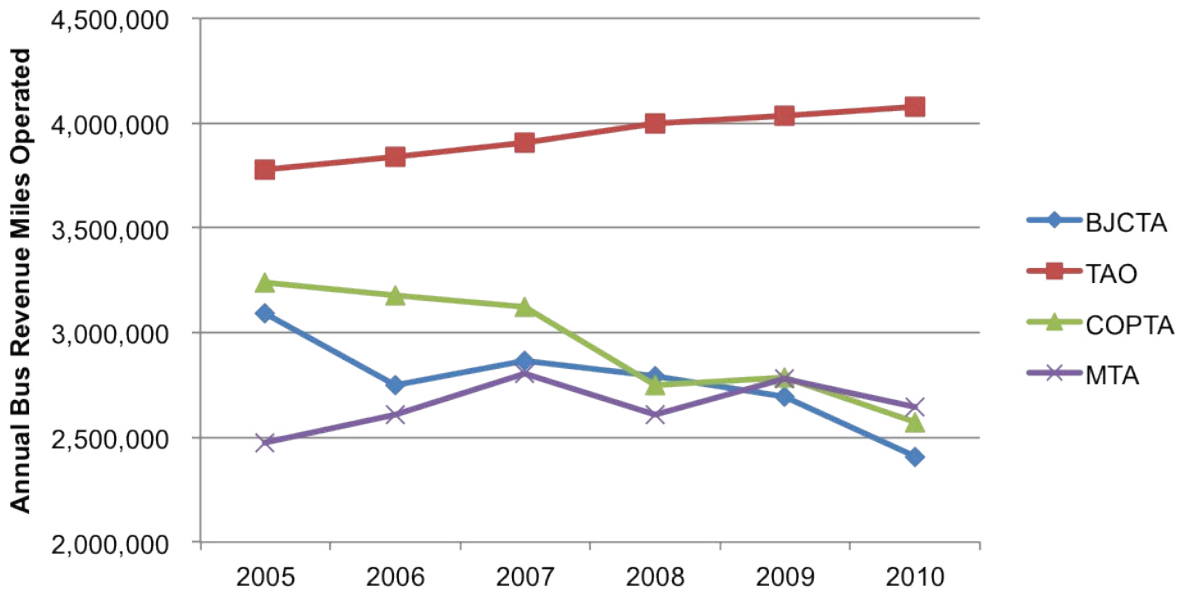
## **Chapter Four: Analysis**

In this chapter, I demonstrate that the BJCTA is providing a similar level of service as the three other systems, but it does not do it at reduced costs as I postulated in my research hypothesis. Despite the higher local revenue share, which intuitively leads one to think that they would be the most heavily scrutinized and therefore most cost-effective, it had the second largest total expenditure per unlinked trip from 2005 to 2010 out of the four systems (Table 6).

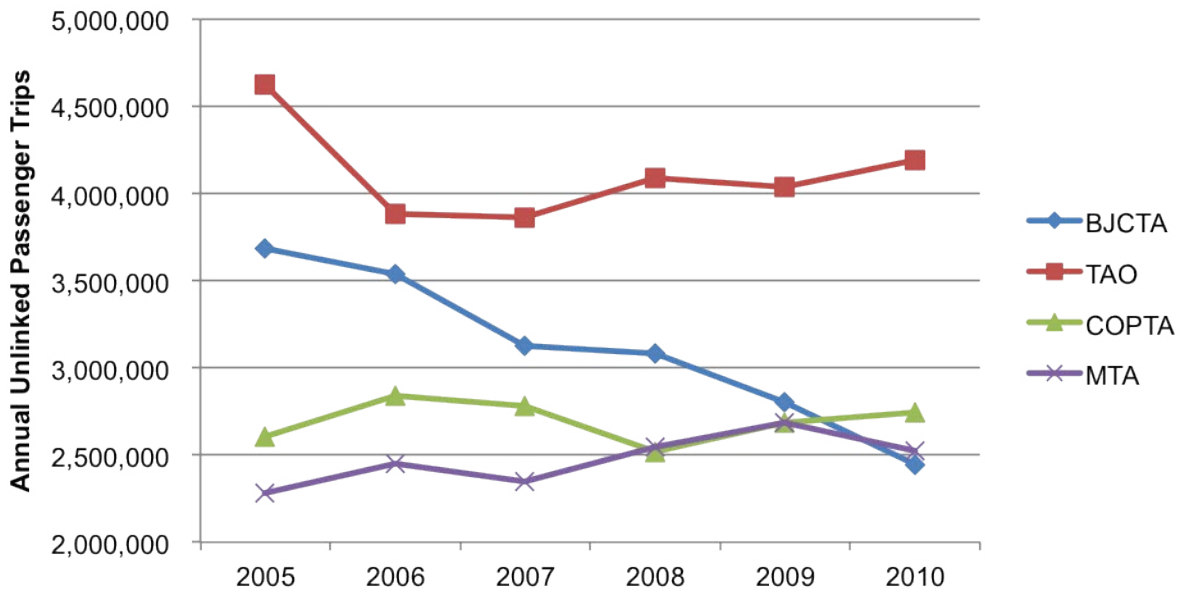
### **Operating Statistics**

Birmingham and Oklahoma City saw 22 and 20 percent reductions in bus revenue miles traveled over the study period, respectively, while Omaha and Tulsa saw eight and seven percent increases, respectively (Figure 27). When looking at annual boardings (Figure 28), Birmingham had a decrease of nearly 34 percent and Omaha had a nine percent reduction. Oklahoma City saw a five percent increase in boardings and Tulsa saw an 11 percent increase. However, when the number of boardings per vehicle revenue mile is examined (Figure 29), all four systems operated at a level of approximately one boarding per revenue mile in 2010. Therefore, all four systems operated at a similar level of service utilization in 2010.

While the systems are of slightly different sizes, they are comparable based on the TCRP likeness score discussed in Chapter Two, as well as the basic operating statistics. I will now move on to an examination of the expenditures and funding sources

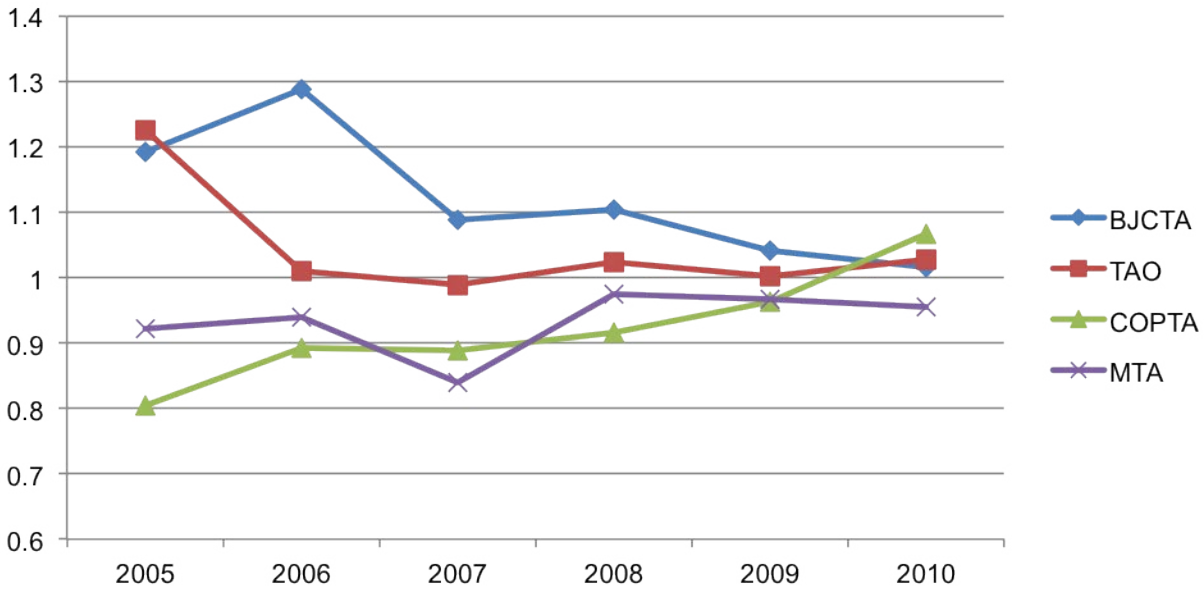


**Figure 27: Annual Bus Revenue Miles Operated**



**Figure 28: Annual Unlinked Passenger Trips**

of the systems based on data from the NTD annual system profiles and the financial data gathered through the FTIS INTDAS database.



**Figure 29: Unlinked Passenger Trips per Revenue Mile**

## Total Expenditures

The total expenditures for the four systems followed closely the number of passenger boardings experienced by the systems over the study period (Figure 30). TAO spent almost \$15 million more than BJCTA, but also had 5 million more boardings than BJCTA did. Both BJCTA and TAO spent nearly identical amounts of non-federal funds, but the TAO spent almost \$15 million more federal money than BJCTA did (Figure 30). The other systems spent \$15-30 million less local money during the six-year period than Birmingham did over the same period.

Figure 31 suggests that nearly two-thirds of total BJCTA expenditures were covered by local funds and fares, while approximately half of MTA and COPTA expenditures were covered by their respective localities and fares. Omaha local governments only covered 36 percent of TAO's expenditures during this period, but

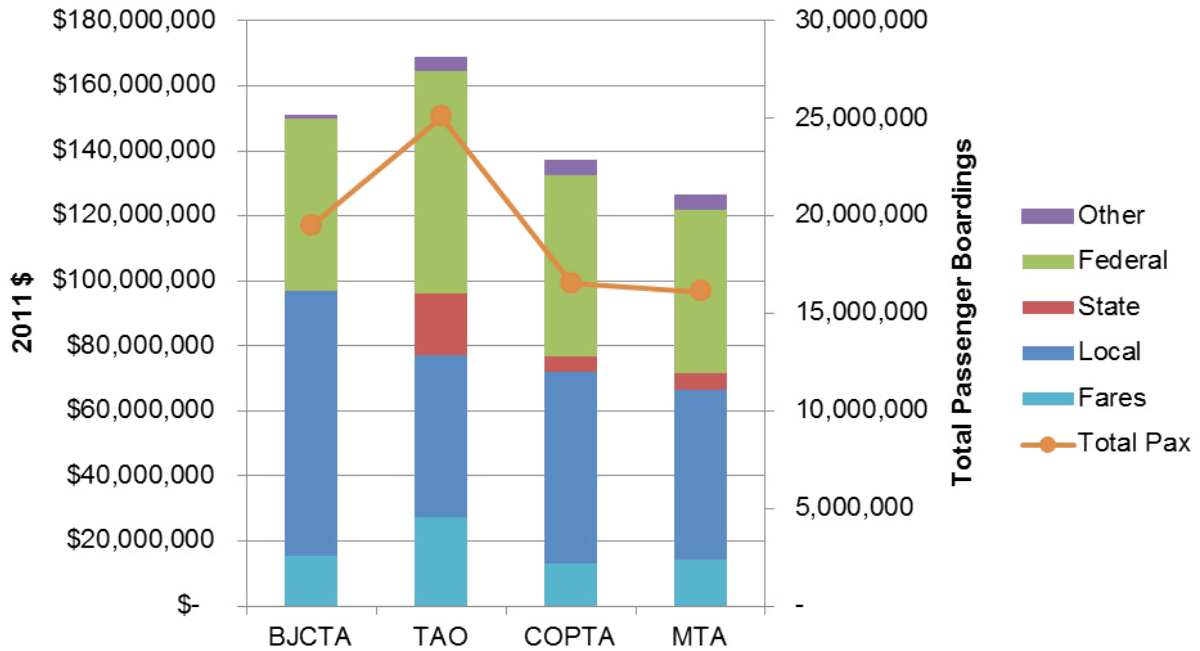


Figure 30: Total Expenditures (2005-2010)

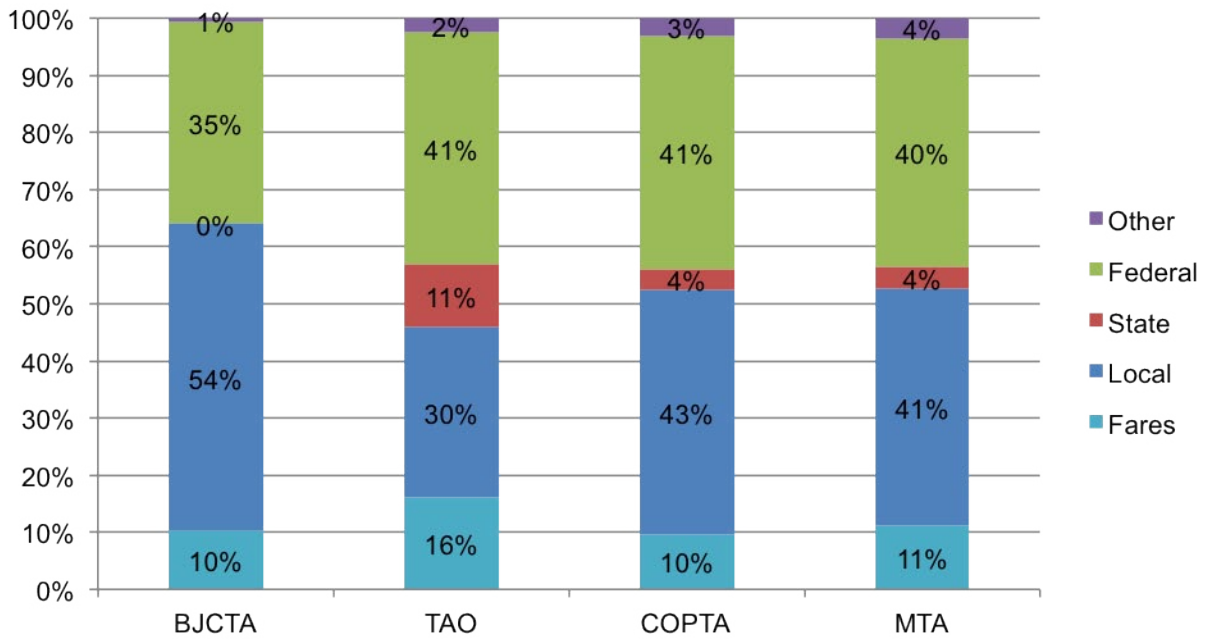


Figure 31: Share of Total Expenditures (2005-2010)

their system also had the most capital investment (all federal) during this period, which influences their overall shares. Due to higher ridership than the other systems, Omaha also collected the most fare revenue. When this is separated from the local share, TAO only paid for 30 percent of the total expenditures of the transit system with local funds, while Tulsa and Oklahoma City paid for 41 and 43 percent of expenditures excluding fare revenues and Birmingham covered 54 percent excluding fare revenues. Table 6 shows the total expenditure by source for every unlinked passenger trip.

Agency	Total Revenue Miles (2010)	Unlinked Passenger Trips (2010)	Number of Routes Operated	Service Area (mi <sup>2</sup> )
BJCTA	3,405,257	2,562,785	32	186
TAO	4,699,455	4,281,971	31	178
COPTA	3,125,856	2,805,659	23	244
MTA	4,241,662	2,717,917	26	196

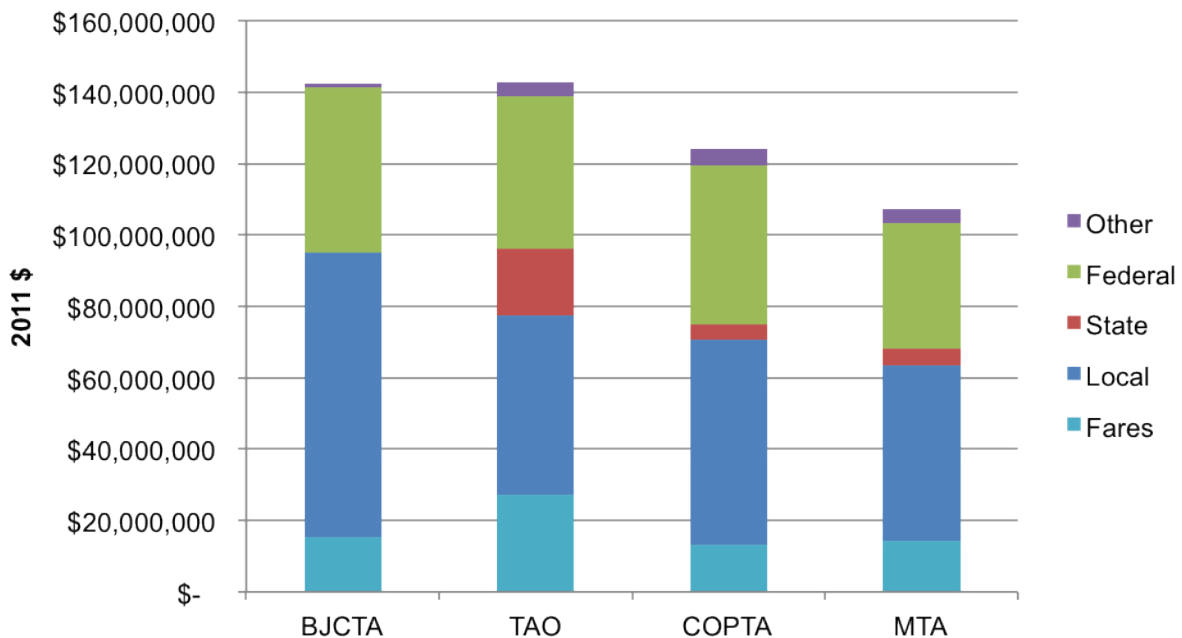
**Table 6: Total Expenditure by Funding Source per Unlinked Passenger Trip (2005-2010)**

## Operations Expenditures

Because of differences in capital expenditures and their cycle lives being longer than this study period, operating expenditures are examined here in order to attempt to remove those potentially confounding factors from the data. Analyzing operating expenditures will also answer the research question of whether having larger local revenue shares results in more cost efficient service.

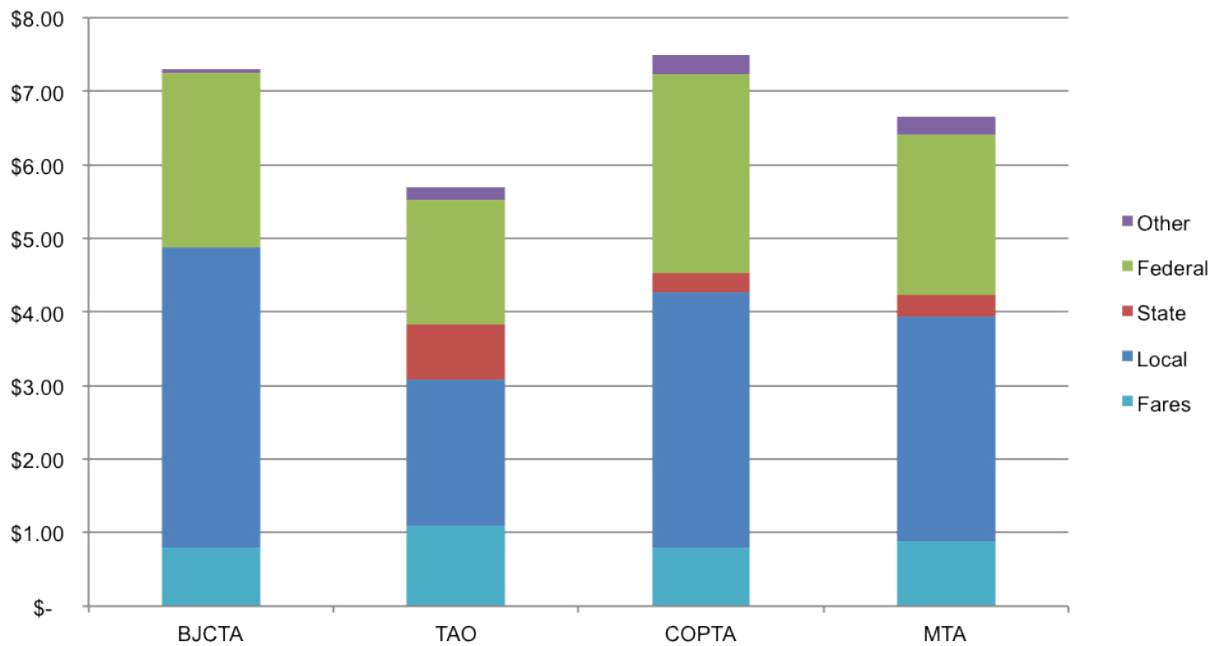
Over six years, BJCTA and TAO spent similar amounts on operations, but TAO was providing more vehicle revenue miles of service, as well as more passenger

boardings. They both spent \$20 million more than COPTA and \$35 million more than MTA (Figure 32). Before even examining the per trip expenditures, it is clear that the City of Birmingham paid much larger amounts to operate their system (after fares) for these six years than its peer systems (\$81.3 million vs. approximately \$50 million for the other three).



**Figure 32: Operating Expenditures (2005-2010)**

When examining the data at the passenger boarding level (with paratransit trips included), BJCTA operates the second most expensive system per trip in the study, being slightly cheaper than the COPTA system (Figure 33, Table 7). The inclusion of paratransit trips makes COPTA more expensive because of their extremely high cost per paratransit trip, which in 2010 was double the amount that the next most expensive system cost at over \$72 per trip (Figure 36). Based on these six years of service



**Figure 33: Operating Expenditure per Unlinked Passenger Trip (2005-2010)**

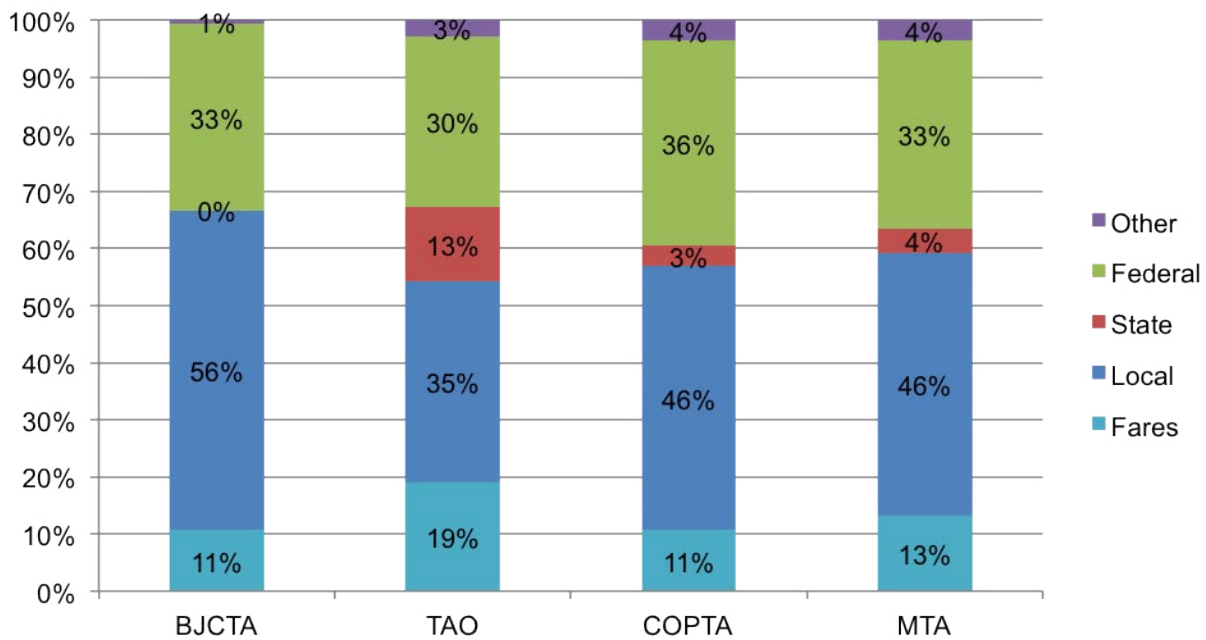
	Fares	Local	State	Federal	Other	Total
<b>BJCTA</b>	\$0.79	\$4.08	\$0.00	\$2.38	\$0.05	<b>\$7.30</b>
<b>TAO</b>	\$1.08	\$2.00	\$0.75	\$1.70	\$0.16	<b>\$5.69</b>
<b>COPTA</b>	\$0.80	\$3.47	\$0.26	\$2.70	\$0.26	<b>\$7.49</b>
<b>MTA</b>	\$0.88	\$3.06	\$0.29	\$2.19	\$0.24	<b>\$6.65</b>

**Table 7: Operating Expenditures by Funding Source per Unlinked Passenger Trip (2005-2010)**

data, BJCTA operates a slightly less efficient system than the MTA. It was expected that TAO would have a lower operating cost per passenger boarding because of the higher ridership presumably resulting in more cost-efficient routes. Birmingham’s local governments cover over \$2.00 more of the cost per unlinked passenger trip than Omaha’s do and between \$0.50 and \$1.00 more than the Oklahoma cities do.

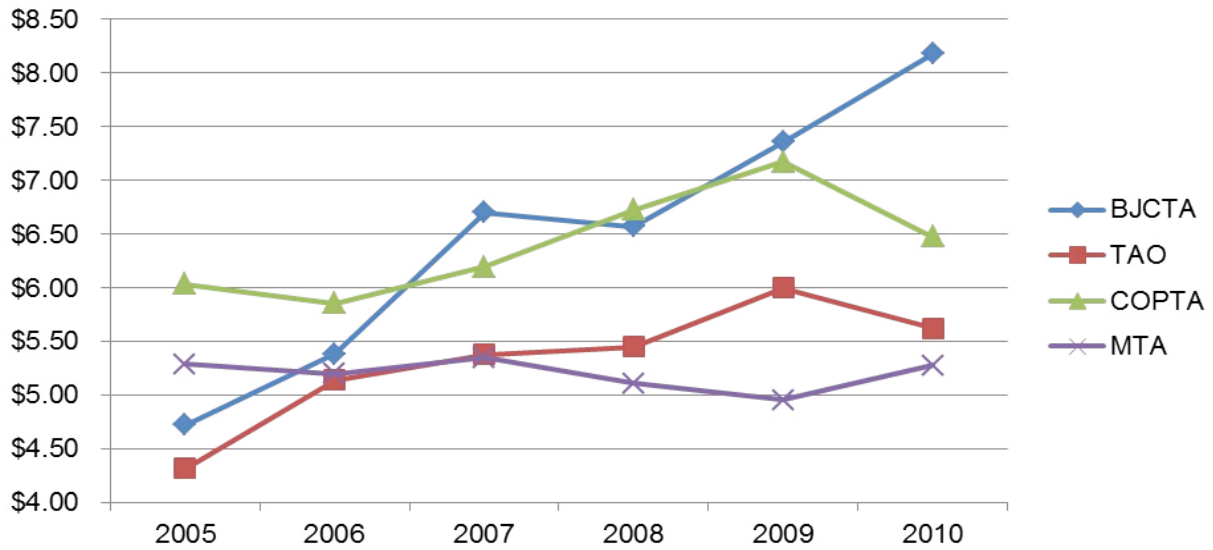
With the fares separated from local contributions, Birmingham covers 56 percent of BJCTA’s operating costs (Figure 34). MTA and COPTA have the second highest local

share with 46 percent, and TAO has a 35 percent local share. Omaha has a farebox recovery rate that is almost double that of the other three agencies and uses this to partially balance its lower local contributions. All four systems have 64 to 70 percent non-federal shares for operating expenditures.

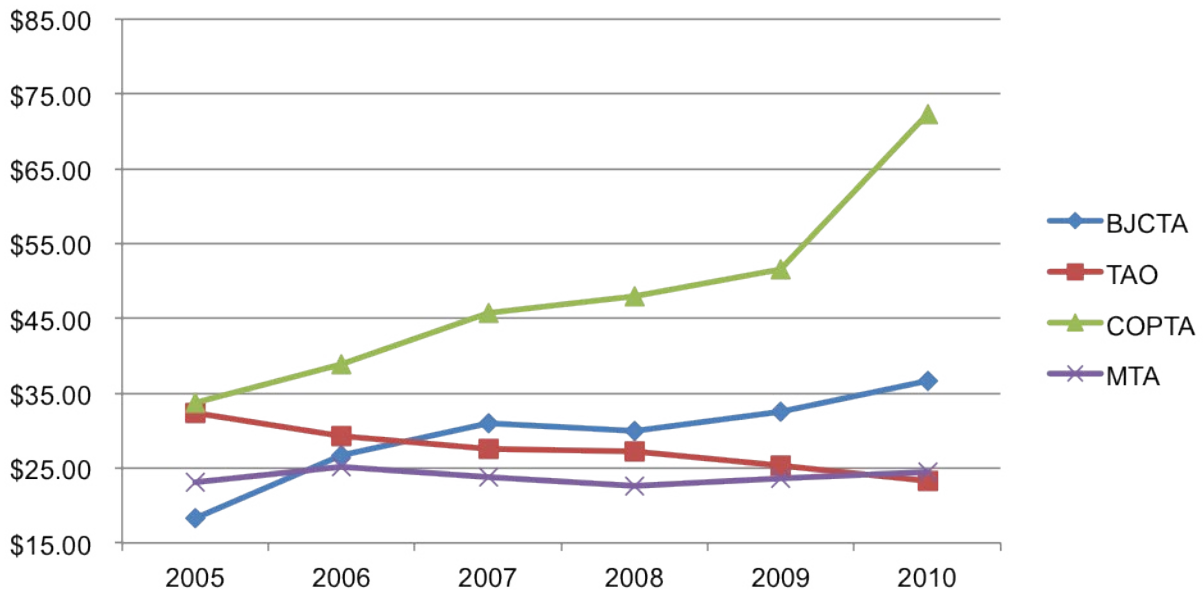


**Figure 34: Share of Operating Expenditures (2005-2010)**

As mentioned in the previous chapter, BJCTA saw a near doubling in the operating expenditures per passenger boarding for both its bus and demand response services (Figures 35 and 36). The only other system that saw similar increases in operating expenditures was COPTA's demand response service, which more than doubled and cost almost \$75 per trip in 2010. The cost of \$72 per trip was more than twice as much as the second most expensive demand response system. The MTA, which provided nearly identical amounts of passenger trips and revenue miles as



**Figure 35: Bus Operating Expenditures per Passenger Boarding (2005-2010)**



**Figure 36: Demand Response Operating Expenditures per Passenger Boarding (2005-2010)**

BJCTA in 2009 and 2010, had almost constant (when adjusted for inflation) costs per trip for both their bus and paratransit systems. This implies that BJCTA is not operating as efficiently as its peers.

COPTA's incredibly large change in paratransit costs per passenger boarding was due to a large jump between 2009 and 2010 costs. If 2010 is excluded, the rise in COPTA's paratransit costs was similar to BJCTA's rising costs for paratransit trips. Interestingly, COPTA and TAO had nearly identical paratransit costs in 2005, but were almost \$30 different in 2009 and nearly \$50 different per trip in 2010. The large gap between the costs of these two agencies is attributable to both the increases seen by COPTA, but also by TAO's ability to reduce cost per paratransit trip, which none of the other agencies analyzed was able to do.

BJCTA and TAO had similar costs per bus passenger boarding in 2005 and 2006, but as BJCTA ridership fell and TAO ridership increased, their costs trends diverged and BJCTA trips now cost the agency nearly \$2.50 more per trip than TAO trips. Meanwhile, COPTA followed very similar trends to TAO (except in 2005), but was \$0.75 higher in 2006 and remained essentially \$0.75 higher through the remainder of the period of analysis.

Changes in operating costs per passenger trip have a nearly inverse relationship with changes in ridership for both modes. As can be seen in Figures 37 and 38, as ridership (dotted lines) rises, the operating expenditures per trip (solid lines) decline and vice versa. The majority of the changes in operating expenditures can be explained by the changes in ridership, although there are certainly some external factors such as wages and fuel prices that can add to operating costs.

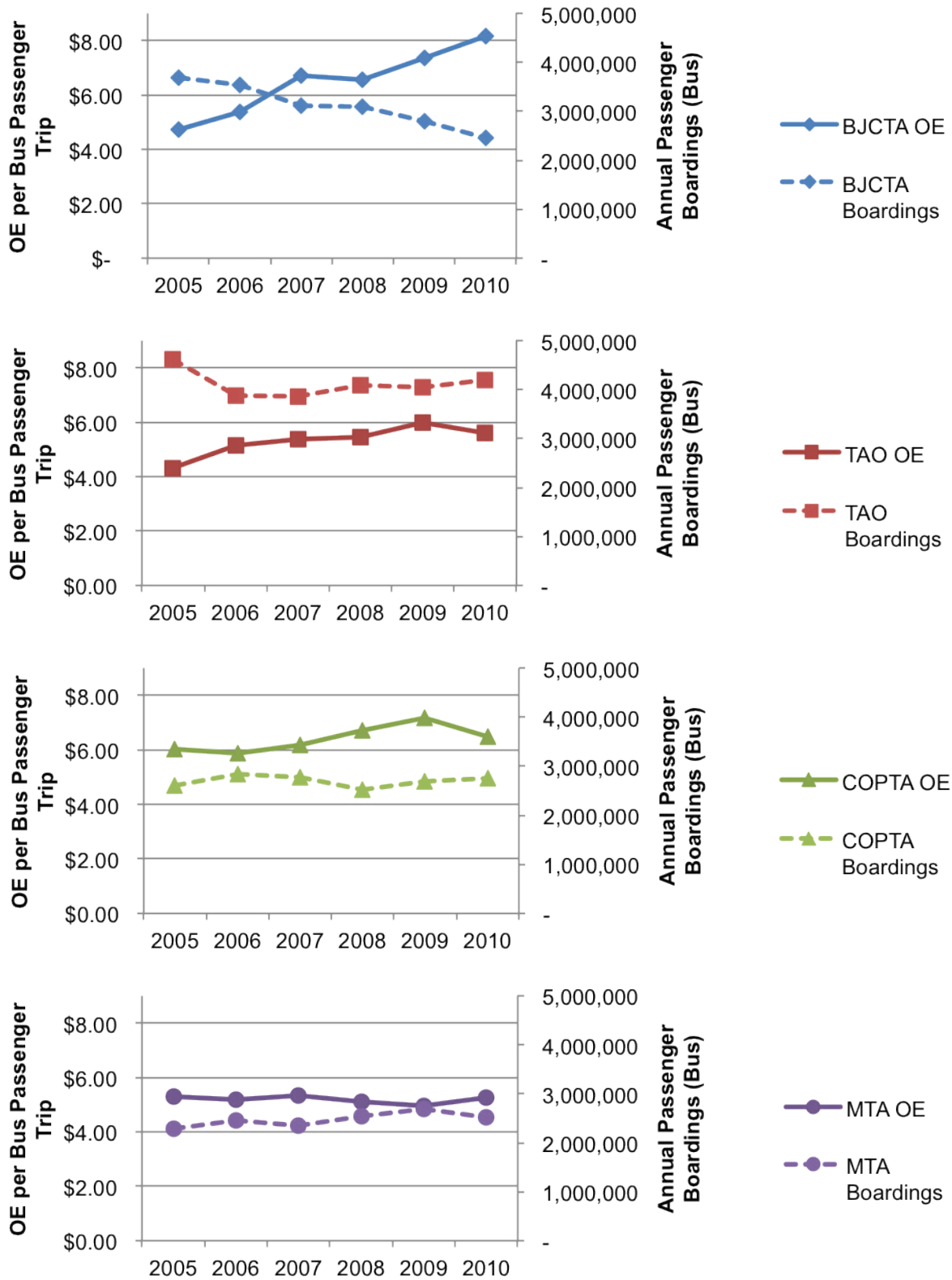


Figure 37: Operating Expenditures per Trip vs. Annual Bus Boardings (2005-2010)

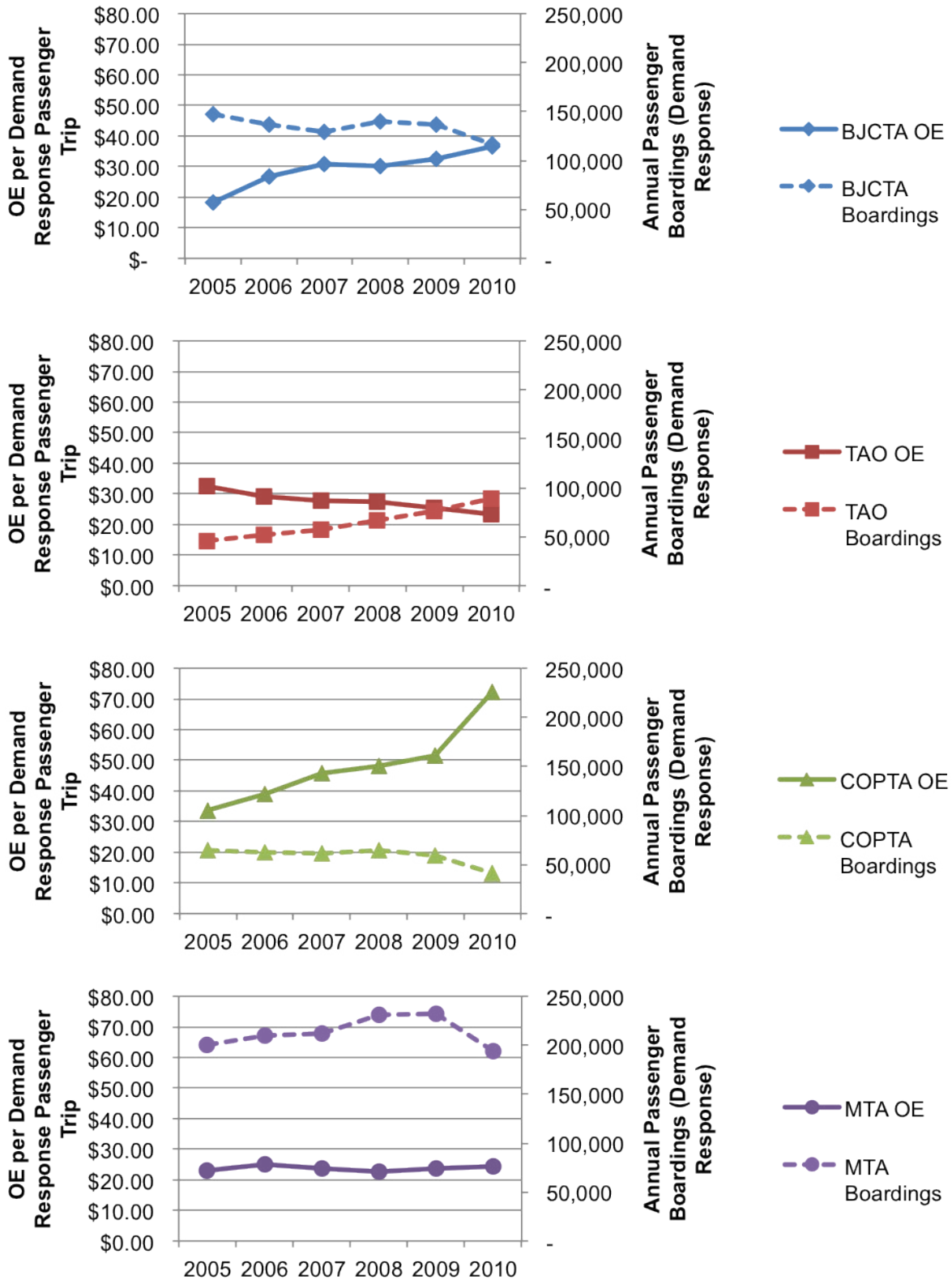


Figure 38: Operating Expenditure per Trip vs. Annual Demand Response Boardings (2005-2010)

## Historical Trends in Funding Sources

Jeffery Brown conducted a study in 2005 that examined the trends in reliance on varying levels of funding (federal, state and local) as well as some of the funding sources at the state and local levels (Brown, 2005). In this study he examined NTD data at four time points (1984, 1991, 1998, and 2001) for transit systems by Census region and size of urbanized area. His aim was to examine the changes in funding sources after the end of federal operating subsidies with the enactment of TEA-21 in 1998. Because his funding figures are unadjusted for inflation, I only used the ratio of funding source to total operating costs for comparison to the case systems. In all funding ratios, the ratio is calculated by “the ratio total [source level] funds to total operating expenses” (Brown, 2005). This measure is somewhat skewed by any capital investments that occurred during 2001, but it will at least provide a benchmark for comparison to the case studies. All following percentages are for systems that serve urbanized areas with populations between 500,000 and 1 million people. TAO is considered to be in the Midwest region and the other three systems are located in the South region.

In 2001, transit systems in urbanized areas with between 500,000 and 1 million people, the federal share of operating expenses averaged 24.1% in the Midwest and 18.1% in the South. Based on these metrics, all four system examined here were above average for the amount of funding received from federal sources. The state-level funds averaged a 15.6% share in the Midwest and 13.0% in the South. All four systems fell below the average share of state funds. The Midwest had an average of 4.0% local share of operating expenses, while the South had a 71.2% local share. In this share,

the three Southern cases fell well below the average, while TAO well above the regional average.

The farebox recovery ratio (fares/operating expenses) is a directly comparable statistic from the Brown (2005) study. In 2001, the Midwest Region systems averaged a 16.6% farebox recovery ratio, while the South Region had a ratio of 19.6%. Only TAO had a higher farebox recovery ratio than the regional average, while the three Southern cases were at least six percent below the regional average.

Because the comparison statistics are from 2001 and the case study values are an average of 2005-2010, differences between the study and the cases were expected because of the enactment of a new surface transportation bill in 2005 that again changed the way transit was funded. However, the difference between the regional averages and the case study average funding shares are important when considering the broader applicability of the findings of this analysis.

## **Federal Funding Sources**

Figures 39-42 display the federal programs that provided the funds for the four case study systems. Across the board, the Urban Area Formula Program (UAFP) accounts for between 62% and 85% of all federal funds granted between 2005 and 2010 to each of the four agencies examined. BJCTA actually has the highest proportion of federal funding coming from that program due to the minimal amount of capital funds utilized during this period. This UAFP funding makes up nearly thirty percent of all

funding received by the BJCTA with just over \$45 million dollars during the six years. Table 8 shows the importance of UAFP funding to each system.

Figures 39-42 shows the heavy reliance on UAFP funds to cover the federal portion of operating expenditures. In the most recent years, there have been additional programs created that provide minor amounts of funds that cover operating expenditures. Table 8 shows that all four agencies used UAFP funds to cover between 27 and 32 percent of their operational expenditures over the study period. As a result, they will all be similarly impacted by changes to the UAFP funds formulas if they are revised in the new legislation.

## **Local Funding Sources**

The one of the research questions focuses on the type and diversity of local funding sources used to cover expenditures. The local cost burdens have already been analyzed earlier in this chapter, so now the ways in which they pay those local shares will be examined. Using data from the F10 form of the NTD Annual Report, the sources of both local and directly-generated funds (raised directly by the agency through fares, advertising and property leases, etc.) were examined over the study period. It is important to note that nearly all taxes collected at the local level are property taxes, so in many cases, allocated funds, which are budgeted on a year-by-year basis at the jurisdictional level, are the byproducts of property taxes or taxes on businesses.

Federal funds are those that are appropriated by Congress and distributed

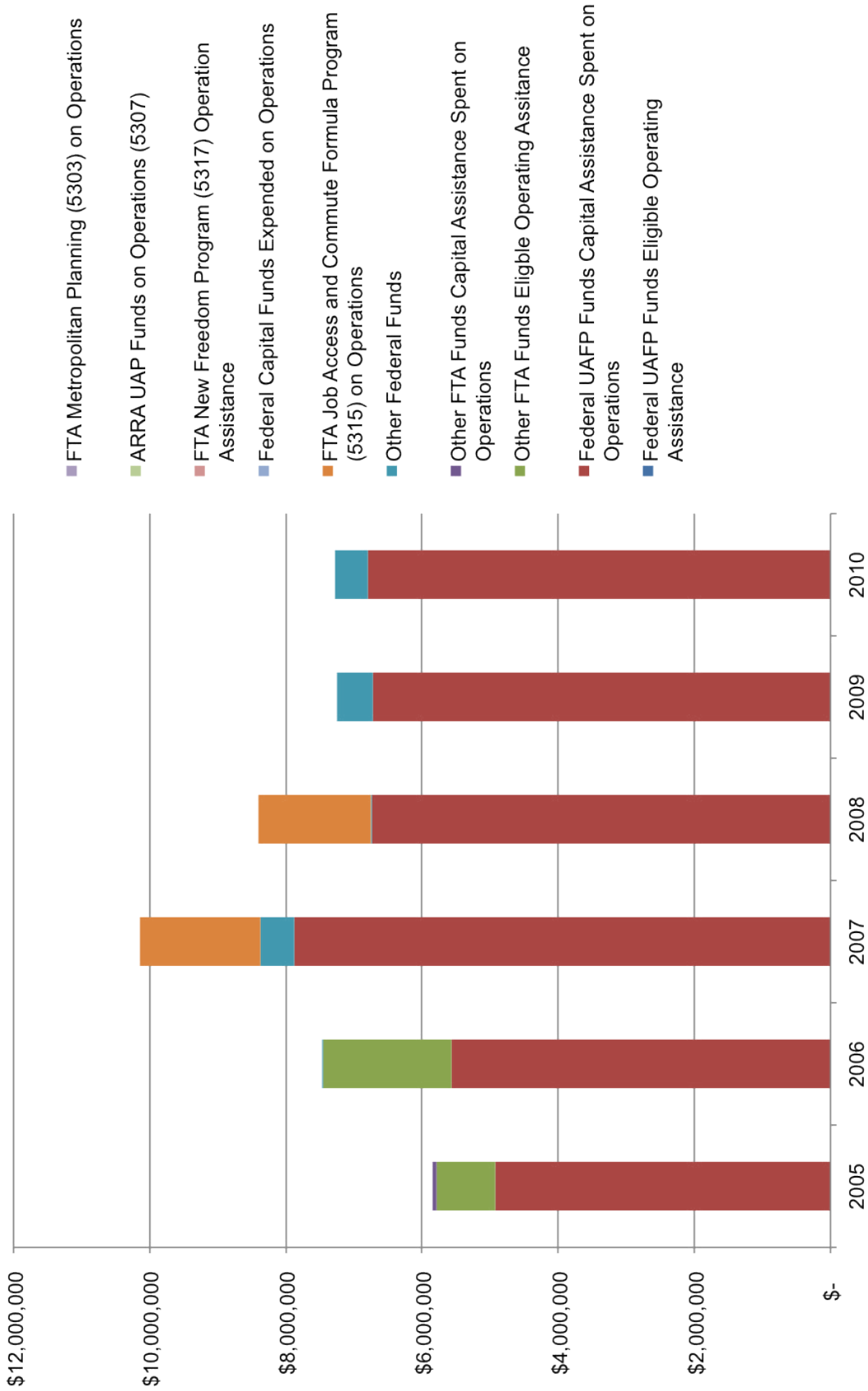


Figure 39: BJCTA Federal Funds used for Operations (2005-2010)

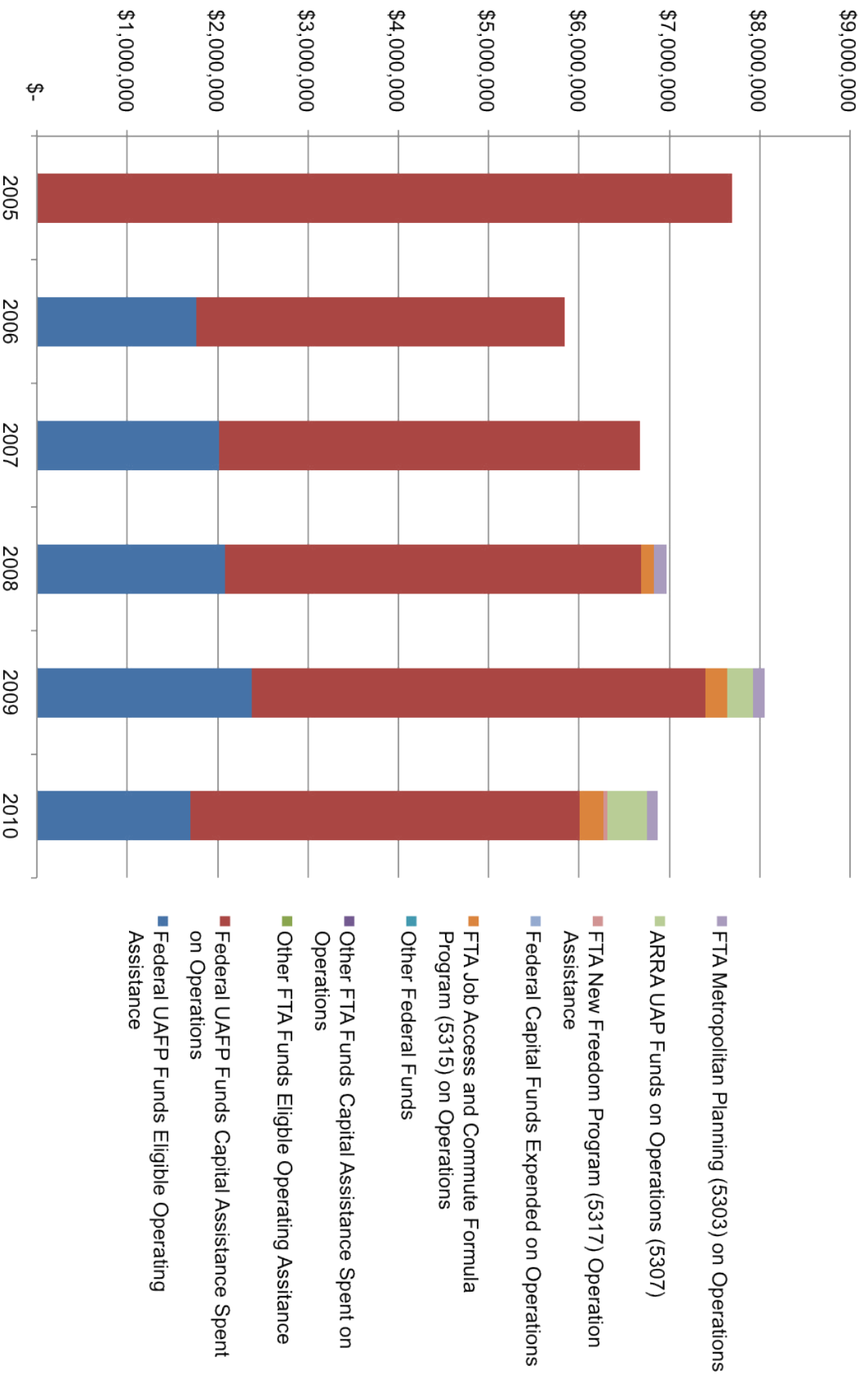


Figure 40: TAO Federal Funds used for Operations (2005-2010)

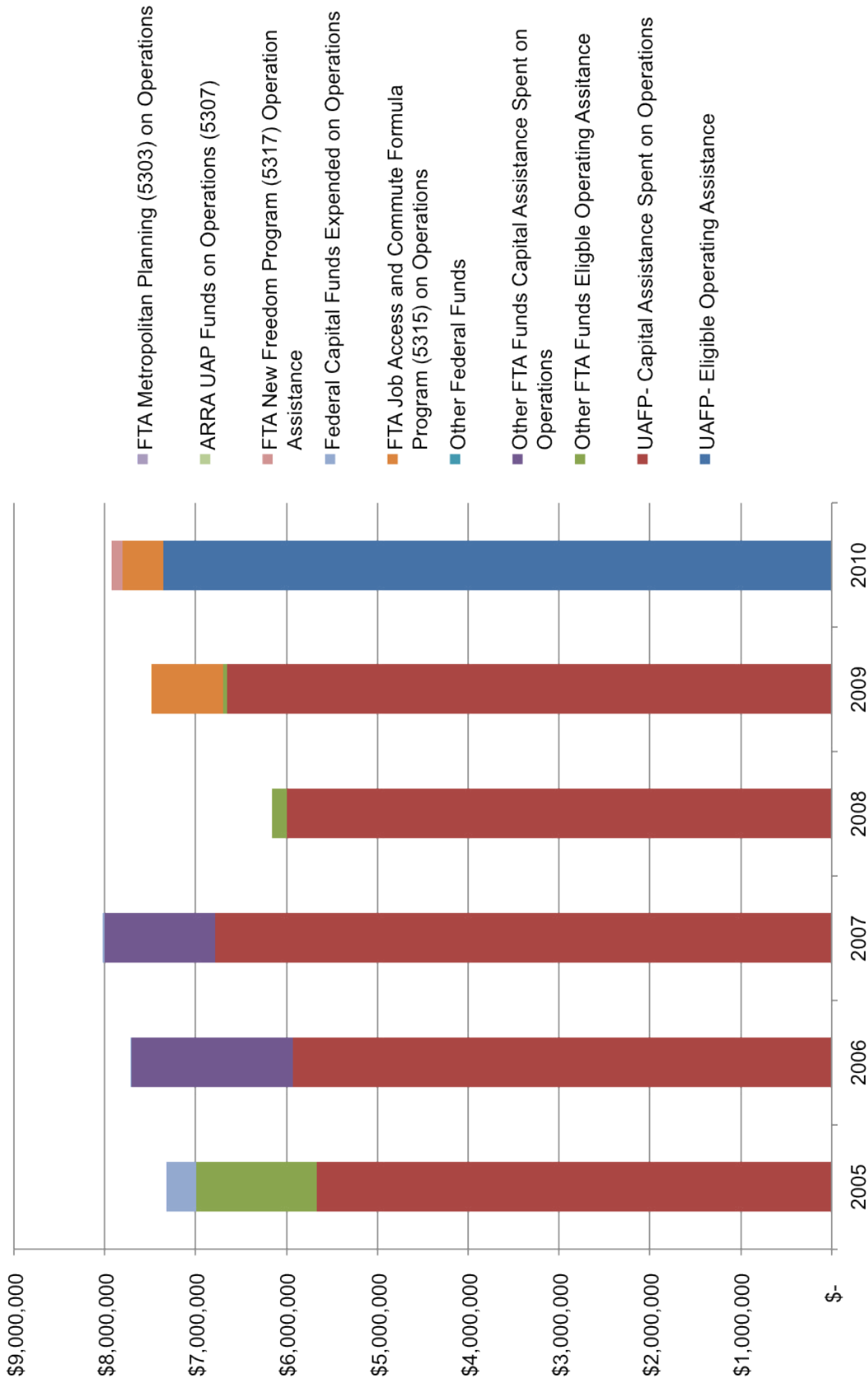


Figure 41: COPTA Federal Funds used for Operations (2005-2010)

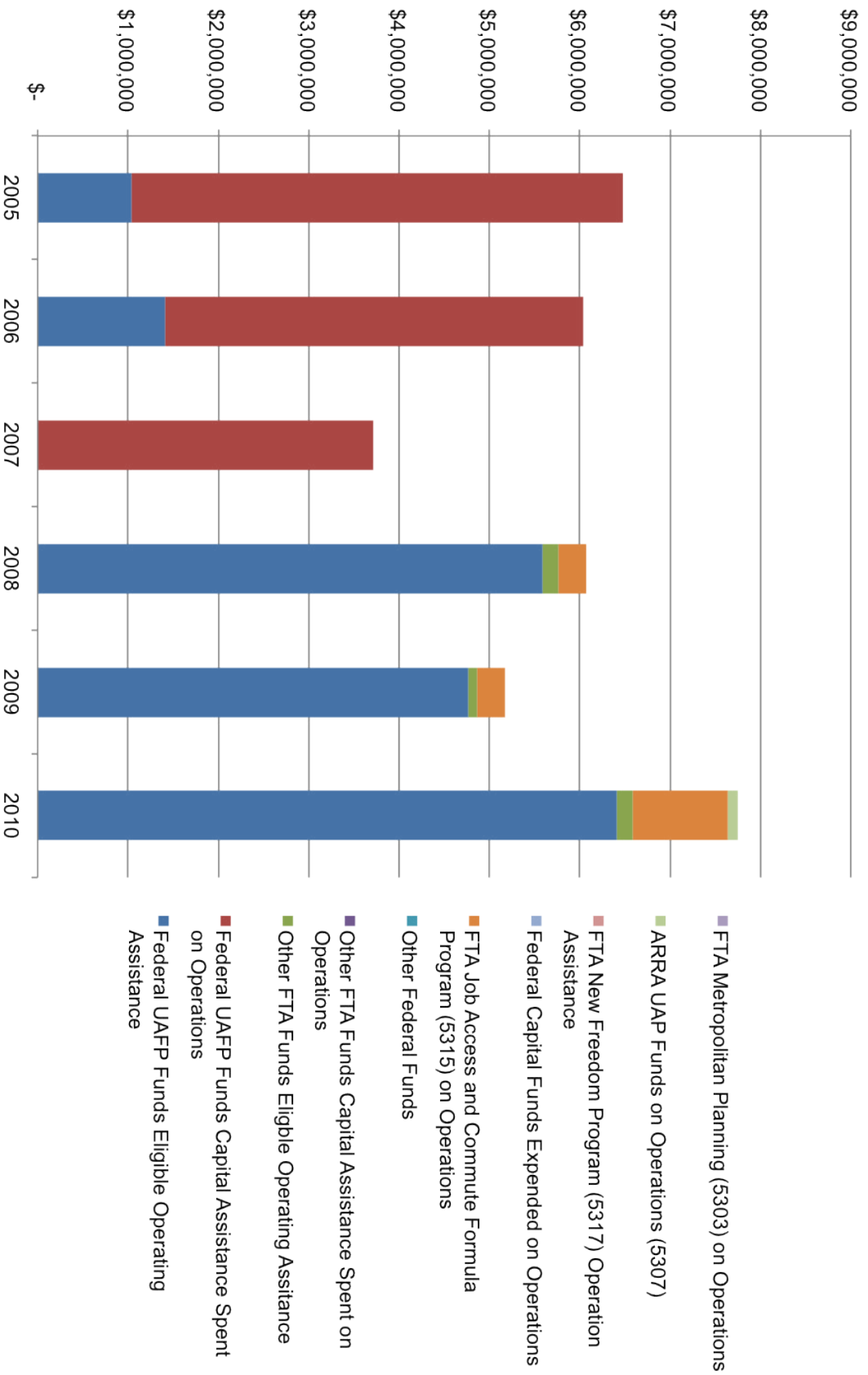


Figure 42: MTA Federal Funds used for Operations (2005-2010)

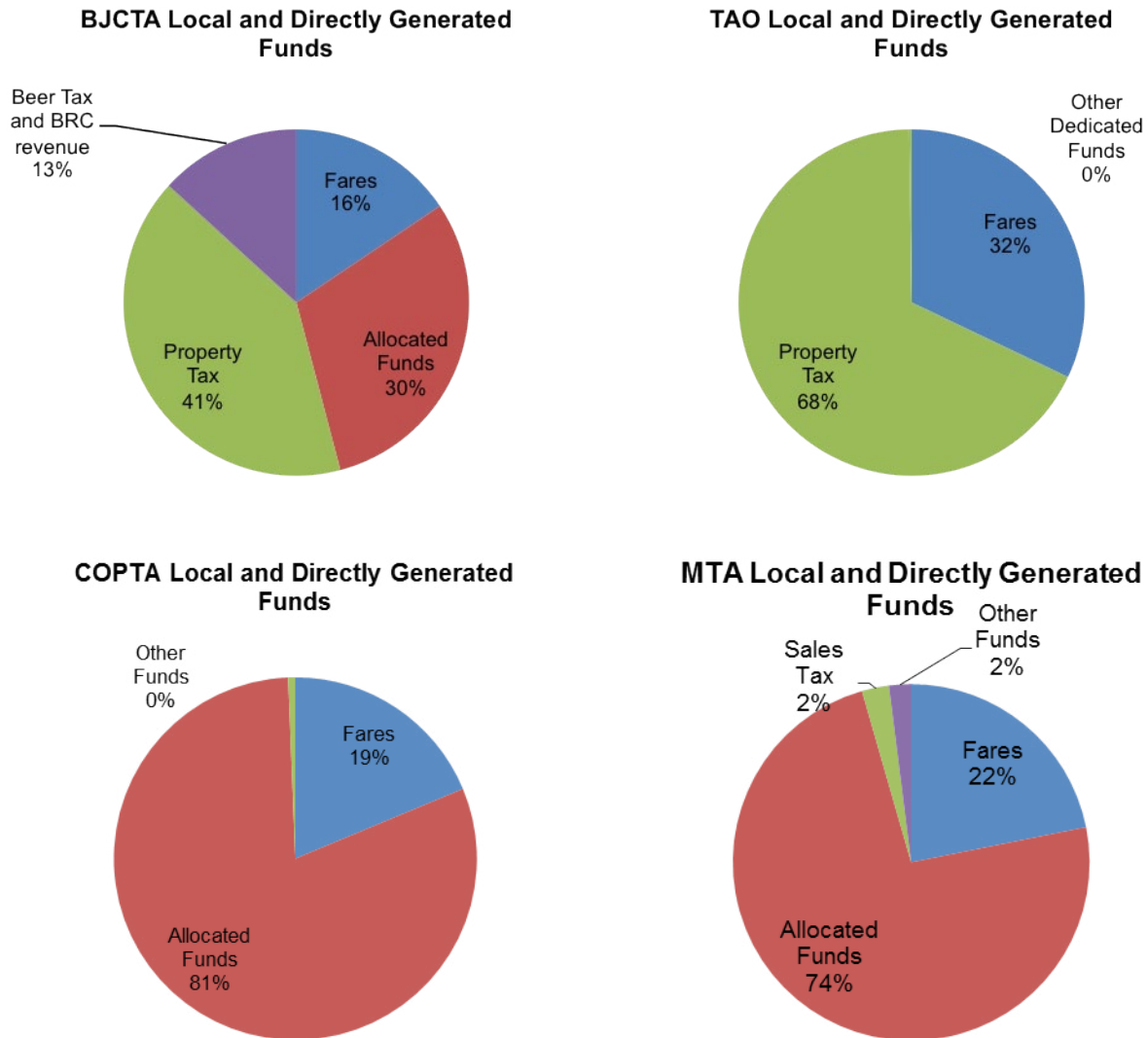
Agency	Percent of Federal funds that are UAFP funds	Percent of Operational Expenditures that are UAFP funds	Total UAFP Funds Expended
<b>BJCTA</b>	84.6%	27.1%	\$45,101,795
<b>TAO</b>	62.6%	28.2%	\$42,880,600
<b>COPTA</b>	76.4%	31.6%	\$42,677,911
<b>MTA</b>	71.4%	30.8%	\$35,981,128

**Table 8: Urban Area Formula Funds Expended**

through the FTA and DOT. State funds are those that are provided through either dedicated or allocated funding sources at the state level. Examples of these include dedicated portions of the state gas tax or sales tax. Local funds are defined as those that are generated at a sub-state level, whether it comes from the region, county or individual municipalities. Again, these can be allocated funds or come from dedicated sources similar to the state-level funding. Allocated funds are not necessarily guaranteed to the transit operators beyond a horizon of annual or biannual budgeting process.

Of the local and directly generated funds (Figure 43), fares accounted for 16 to 32 percent of this share. The Oklahoma agencies acquire their revenue almost exclusively through locally allocated funds, although Tulsa generates a small portion of their revenue through a sales tax where 1.167% of the 8.517% sales tax within the city limits goes towards capital and street improvement projects (City of Tulsa, undated). Omaha funds its local share almost completely through property taxes (levy of 0.047% at the county level) (Douglass County Treasurer, undated).

Conversely, Birmingham not only generates revenues through property taxes and



**Figure 43: Local and Directly Generated Funds**

allocated local funds, but also receives a minimum \$2 million contribution per year from the county beer tax, as well as one percent of the annual net profit of the Birmingham Racing Commission (Wachs, 2001). The lack of a state level funding mechanism for transit may allow Jefferson County and the City of Birmingham greater authority to levy taxes on their residents that might not have been able to happen in other states where the state government already provides transit support. Counties in Alabama also have the option to adopt 0.25% sales tax to fund public transit (Wachs, 2001).

## Chapter Five: Conclusions, Shortcomings, & Further Research

Because of the exploratory nature of the cases studied, rather than a broader empirical analysis, these results are not generalizable to all public transit systems of the size and type studied here. However, I believe some conclusions can be safely reached based on the analysis conducted in the previous chapter.

### Conclusions

*Are systems that are more heavily reliant on local funds for operations expenditures more cost efficient?*

**Larger local revenue shares do not guarantee the most efficient use of resources.** BJCTA had a higher operating expenditure per trip than MTA, even though they experienced similar levels of ridership and vehicle revenue miles operated in 2009 and 2010. TAO had the lowest cost per passenger trip, despite the fact that the local jurisdictions provided the smallest contribution to the operating expenditures, relative to the total operating expenditures.

Additionally, BJCTA failed to keep operating expenditures under control for their bus or paratransit services, both of which saw their per trip operating expenditures nearly double as ridership fell. Overall, bus operating expenditures increased by 15 percent, while passenger trips decreased by 34 percent over the six-year analysis period. Over the same period, demand response service operating expenditures

increased by 58 percent, while ridership decreased 21 percent.

*Are systems that are more heavily reliant on local funds for operations expenditures more service effective?*

**Systems are not more service effective when they are reliant on larger local revenue shares.** The four cases studied in this thesis had ratios of unlinked passenger trips to revenue vehicle mile range between 0.8 at the lowest and 1.3 at the highest (see Figure 29). However, between 2005 and 2010, the four agencies ratios all began to approach 1.0 as systems that had growing ridership (like TAO) also expanded service, and systems that had declining ridership (like BJCTA) reduced the number of revenue miles they operated.

*Are systems that are more heavily reliant on local funds for operations expenditures more cost effective?*

This question could not be appropriately evaluated given the data available. As a result, two supplemental questions were asked instead.

*How do the local level revenue generating mechanisms differ based on the transit system and reliance on the funding? Do systems with larger local revenue shares use more diversified sources to meet their obligations?*

BJCTA in Alabama, with the largest local revenue share, was reliant on four major sources of funding, while the other systems relied heavily on two funding sources. BJCTA utilizes revenues from property taxes (41%), allocated funds (30%), fares (16%)

and “Beer Tax” revenues (13%). Because the beer tax is guaranteed and property taxes are unlikely to fluctuate heavily from year to year, it only leaves the 30% of allocated funds at risk for being cut by the local governments, but in a future year when there is a local government budget surplus, it will allow BJCTA to potentially receive more funds. Diversifying the sources of local revenues is similar to the way one would diversify their stock investments in order to minimize risk (Antos, 2007).

Alternatively, TAO in Omaha is funded by fares (32%) and property taxes (68%). The reliance on property taxes is unlikely to fluctuate widely from year to year and offers budget stability, but does not allow for TAO to gain a larger amount of funding when there is a local budget surplus. The property tax is also not a very visible tax, so those that are funding the system (all property owners) are not necessarily conscious that they are supporting the system.

The Oklahoma agencies, COPTA and MTA, are funded almost entirely by fares (19% and 22%, respectively) and allocated funds (81% and 74%, respectively). Tulsa (MTA) also receives about 2% of its revenues through a portion of the sales tax that can be used for capital projects. The allocated funds can be somewhat unstable, particularly in a recession when local governments have decreased revenues and may be cutting funds to all services. COPTA and the MTA would be better served by trying to diversify their funding sources.

## **Additional Observations and Conclusions**

Fiscal federalism implies that if the federal government reduces the amount of funding that they distribute through their funding programs, that the states would still be the recipients of funds that approximate the amount paid into the highway trust funds through the gas tax. In this way, the state governments could help the local jurisdiction cover larger shares of operating expenditures by using their Flexible Funds on transit, rather than highways programs. However, it remains to be seen if Alabama would then begin to support public transit from the state-level in the face of fiscal devolution.

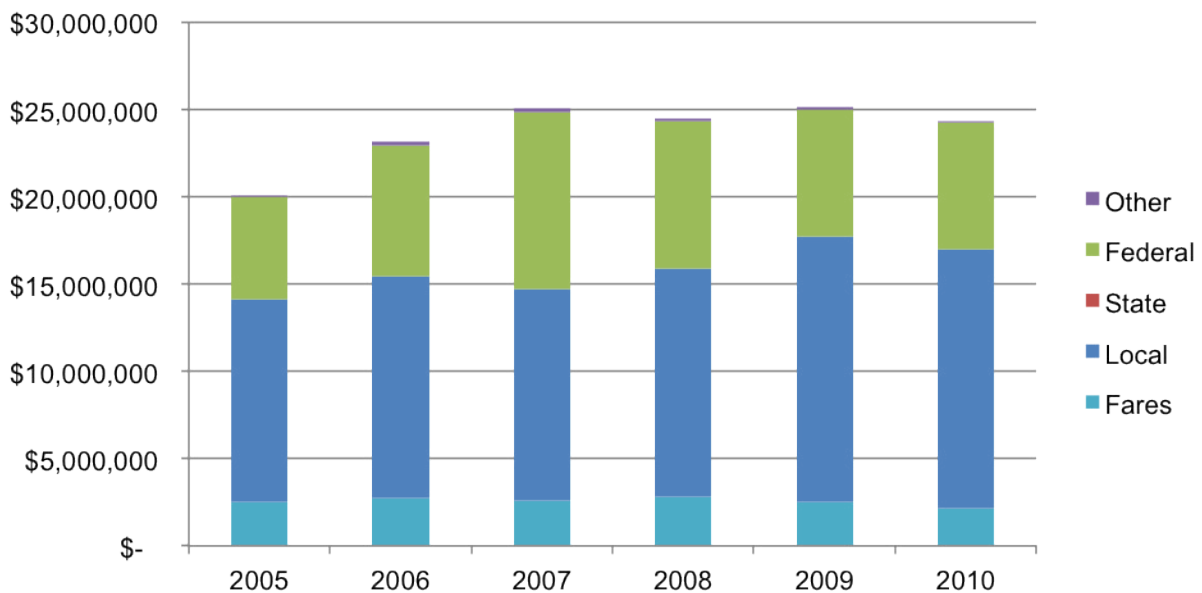
I believe that TAO, COPTA and MTA would be capable of raising additional funds if necessary because of their similarities to BJCTA and its context. The BJCTA operates in a state that is not transit friendly, with low household incomes compared to most of the United States. Their ability to consistently have funding available through a diverse set of local taxes can serve as an example for ways that other local jurisdictions could raise funds to cover future increases in costs. This peer comparison indicates that service levels need not drop (at least not in the long term) when a larger burden is placed on the state and local jurisdictions.

These four cases systems all operate in cities that are non-ideal for transit, with large service areas and relatively low population densities. Because they operate at similar scales with relatively similar expenditure levels, Oklahoma City and Tulsa could likely find another form of funding besides relying heavily on allocated funds and Omaha could rely on something other than just property taxes, which are somewhat variable based on housing values. A “beer tax” is not being suggested as the ideal mechanism

for new funds, but a similar tax or fee (such as parking fees, as discussed in Chapter One) with a guaranteed minimum level of funding can provide agencies security in the short term.

This thesis took on the approach of looking at transit systems in mid-sized cities in order to examine systems that are typically ignored. When many people think about public transit systems, they are likely to think about cities with rail systems like New York, Boston, Chicago, and maybe even Portland and Atlanta, but they are not likely to think of the cities with less than a million residents who rely on bus systems to move those who physically cannot drive or those who cannot afford to drive. Something that I believe should be considered in the next surface transportation bill is a revision to the Urban Area Formula Program, in order to not just distinguish urbanized areas as those above or below 200,000 people, but have a separate group for the mid-sized cities, those between 200,000 and one million people, who may be in need of more federal operating support. In the four cases studied in this thesis, they each spent several million dollars each year of UAFP Capital Assistance on operating funds, although some eventually were given UAFP Eligible Operating Assistance in the last few years of the study. I propose that Congress change the rules for the UAFP in order to provide more appropriate levels of funding in the areas that agencies need it the most by not only separating the smallest urbanized areas from the rest of the country, but also by separating the largest urbanized areas, since there is no comparison between Boston and Birmingham.

As for reasons why the intuitive hypothesis of “if you make someone spend more of their own money, they will spend it more wisely” did not stand in the case of Birmingham, it is most likely a combination of reasons. First, operating expenditures remained fairly level between 2007 and 2010 (Figure 44), but due to the continually decreasing ridership, the operating expenditures per passenger trip continued to climb from year to year. Secondly, the population density in Birmingham is lower than in the other three cities, so the urban form may have had an influence on making the other systems operate more efficiently than BJCTA. Third, fifty years ago, Birmingham and its buses played a part in the Civil Rights movement. This association between race and riding the bus may influence non-blacks to avoid riding the buses, decreasing the pool of potential riders.



**Figure 44: BJCTA Operating Expenditures (2005-2010)**

There is another factor which may influence the decline of some systems. When

the journey-to-work mode share is as low as one percent, it is unlikely that the transit riders have much political power. This would be particularly true if most transit riders are minorities. With the effort it takes to acquire every dollar from the FTA significantly higher than the effort it takes to acquire a dollar from the FHWA and a low amount of political will due to the size of the ridership and their social standing, these transit systems are unlikely to see a lot of work towards upgrading and improving their systems for the one percent, when the other 99 percent can see improvements to their roads. It is possible that having a greater financial burden left the BJCTA system without the resources to operate with a high administrative capacity.

## **Shortcomings**

The multiple case study approach was chosen in attempts to be sure that I was comparing “apples to apples”. I would have liked to conduct a second round of peer analysis with another system, preferably in another state that does not fund public transit, but the discrepancies between the APTA State Summaries and the NTD system profiles made this option unrealistic and nearly all other transit agencies in Alabama are primarily concerned with demand-response services for rural areas.

The lack of data for the service area (as opposed to the urbanized area) was unfortunate. The geographical boundaries of the service areas were not available, so I was unable to aggregate data for them based on some smaller Census geography, such as Census Tracts or Block Groups. More refined data about the service area would have been a valuable tool for understanding the demographics of the case

systems' potential riders. By using urbanized area data, the statistics include hundreds of thousands of people who do not have access to the transit system, which can cause bias.

I also acknowledge the fact that these are not high performing transit systems. Many of these routes operate at 30-minute headways for the majority of the day, making trips by transit far more inconvenient than automobile travel. The inconvenience of using transit to get around these cities shows in the low ridership and low journey-to-work mode shares.

## **Further Research**

Paratransit costs per trip are high across the US, and in some systems, continuing to rise. With BJCTA and COPTA seeing costs double over the six years examined in this analysis and COPTA's per trip costs rising to nearly \$75, it seems prudent to investigate ways in which savings can be achieved, possibly by helping those that are the least disabled take fixed route service, to operating more taxi-like vehicles to transport those who do not need special handicapped equipment. This is particularly important as the baby boomers begin to approach an age where they will begin utilizing those services.

Because this study was conducted with systems that only operated bus and demand response service, an analysis that examines the costs of operating light rail systems and attempts to tease out potential effects on ridership or service levels would

be useful to the field. Additionally, at a later point when an ex-post analysis can be conducted, it will be interesting to see if the lack of earmarks and potential cuts (or lack of significant increases) in transit funding in the next surface transportation authorization bill creates a pattern break from the types of capital projects being funded, such as whether there will be a larger focus on multi-modal transit centers or will capital projects only happen as extensions of existing systems.

Another interesting analysis might include whether there is a threshold of local revenue shares where it makes transit systems operate efficiently (because they are not just being handed money) and if there is a maximum threshold where the financial burden becomes too great and systems operate inefficiently, perhaps hoping for a bailout. Research like this could be used to help set formulas for funding programs or allow programs that are based on competition to favor these overburdened agencies.

## **Data & Image Sources**

Birmingham –Jackson County Transit Authority website: Figure 5

Federal Transit Administration: Figures 1 and 2

Fielding et al. (1985): Figure 3

Google Maps: Figures 4, 10 and 16

Integrated National Transit Database Analysis System: Tables 2 and 3

National Transit Database (accessed through INTDAS): Figures 6-9, 12-15, 18-21, 23-44, Tables 5-8

Oklahoma City Metro Transit website: Figure 17

Omaha Metro Website: Figure 11

TCRP Report 141: Table 1

Tulsa Transit Website: Figure 22

US Census Bureau: Table 4

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