Return on Investment for Rural Demand-Response Transit in Illinois

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Submitted to

Illinois Department of Transportation

July 2025

URBAN TRANSPORTATION CENTER

COLLEGE OF URBAN PLANNING AND PUBLIC AFFAIRS

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EXECUTIVE SUMMARY

Transit is frequently treated as a financial burden rather than a public investment, where the value is assessed primarily in terms of ridership or farebox recovery. This framing misses a wide range of external benefits, including workforce participation, healthcare access, and local economic activity. Additionally, public discourse and scholarly research around transit are often focused on urban systems, leading to policy and funding that inadequately reflect the needs of rural communities. Despite their importance, rural transit programs face underinvestment and are seldom evaluated in terms of their full economic return. In order to rectify this disparity, this report presents a state-level return-on-investment analysis of rural transit services, focusing on demand response transit systems in Illinois. Through a review of the existing literature, this report creates a conceptual framework for the benefits accrued by rural transit, formulates the conceptual model into an equation, applies the equation in various case studies, and discusses the results of the analysis.

Using a conservative cost-benefit framework that captures the fiscal impact of rural demand-response transit across multiple sectors (employment, healthcare, education, retail, and recreation), this analysis found that rural transit generates positive returns on investment in moderate and high transit dependency scenarios, and two out of three case studies found positive returns on investment even in the lowest transit dependency scenario. Thus, in nearly every modeled scenario, the benefits of rural transit exceeded the state's financial contribution, generating nearly $4 for every dollar spent in the best-case scenario.

The analysis implies important policy implications. Narrow performance metrics such as farebox recovery or raw ridership counts fail to capture downstream savings and revenue generated. It also affirms that rural transit gives back to the state of Illinois more than it receives in almost all scenarios. Given growing uncertainty about the future of federal transit funding, state governments may be asked to assume a larger share of the financial responsibility. They can do so with a clearer understanding of the returns that investing in rural transit offers.

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CHAPTER 1: INTRODUCTION

A central function of governments is the provision of services that promote public welfare [1]. The provision of public services such as education and public health, for example, are legitimized through their role in promoting economic efficiency and safeguarding the collective wellbeing. However, they are typically funded primarily through public expenditure, which subjects them to heightened scrutiny. The use of public funds is frequently evaluated through a narrow lens of direct, measurable outputs or short-term cost savings [2]. While this approach has its uses, it also obscures the broader societal impacts of service provisions, including indirect or long-term effects.

This limitation is particularly true for rural public transit, as many benefits that it generates are not felt directly within the transportation domain, but diffused into multiple sectors. The evaluation of urban, fixed-route public transportation services are relatively straightforward; they are attributed with large economic benefits from providing mobility, reducing externalities associated with automobile use, and generating direct economic growth in areas served [3, 4, 5]. Rural public transportation likewise provides real benefits for the communities that they serve, but the value of these services requires a more comprehensive framework that captures the downstream effects on public expenditures and individual livelihoods.

Cost-benefit analyses are widely utilized in the evaluation of public projects and policies [6, 7, 8]. Their utility is derived from their ability to analyze the impact of government investment on society [9]. The key insight of CBAs is the assignment of a dollar value for every benefit and cost [10], although this process can become quite complex. This is due to a variety of factors: it is difficult to assign a dollar value to certain benefits; there are various beneficiary groups; it can be difficult to quantify the opportunity cost of the proposed policy compared to other potential policies; positive and negative multiplier effects of both costs and benefits can be difficult to identify and quantify; etc. While acknowledging the limitations, this report utilizes a CBA to better understand the monetary benefits of rural transit because of its ability to synthesize cross-sectoral impacts into a single evaluative metric. This metric offers a more holistic value of rural transit, moving beyond simplistic performance metrics such as farebox recovery ratios or ridership counts that often dominate current evaluations [11].

Cost-benefit analyses require the specification of a perspective: the stakeholder or level of government for whom costs and benefits are measured. CBAs are often conducted from the national perspective; prior studies have attributed the gains of rural transit broadly to the nation [12, 13]. However, although the federal government does provide funding for rural transit, state governments also contribute substantial financial resources. Their funding decisions can have more direct and immediate impacts on their constituents, and, given the comparatively limited nature of state budgets, the need to allocate resources efficiently makes the evaluation of state-level returns particularly important. Thus, the analysis presented in this report is conducted at the state-level.

State governments play a central role in financing rural transit programs, and evaluating costs and benefits at this scale allows for the inclusion of state-specific expenditures (e.g., appropriations to transit agencies and contributions to social service programs) as well as revenues and savings that accrue specifically to the state through mechanisms such as state income and sales tax. While a more localized approach was considered (as transit agencies primarily serve counties or municipalities), this approach would be impractical in this context, as the benefits under consideration are primarily gained at the state level and are not easily disaggregated down to smaller jurisdictions. Additionally, with uncertainty surrounding the future of federal transit funding, state governments may be required to assume a greater share of operational costs. Considering these

challenges, a state-level framework provides a relevant and appropriate lens to evaluate the fiscal return on investment for rural transit.

Transit is frequently treated as a financial burden rather than a public investment, where the value is assessed primarily in terms of ridership or farebox recovery. This framing misses a wide range of external benefits, including workforce participation, healthcare access, and local economic activity. Additionally, public discourse and scholarly research around transit are often focused on urban systems, leading to policy and funding that inadequately reflect the needs of rural communities. Despite their importance, rural transit programs face underinvestment and are seldom evaluated in terms of their full economic return. In order to rectify this disparity, this report presents a state-level return-on-investment analysis of rural transit services, focusing on demand response transit systems in Illinois. This report builds on formulations of previous return on investment studies of rural transit by incorporating the vast majority of rural transit trips made into a monetary value. This multi-sectoral analysis will determine the benefits to the state holistically, specifically the state of Illinois, and compare it to what the state spends on rural transit.

CHAPTER 2: BACKGROUND

The type of public transportation analyzed in this report differs greatly from the fixed-route systems commonly found in cities. In urban areas, high residential and employment density and commuting distance to stations lead to high passenger volume [14]. In low density rural areas, this is not possible. Demand-responsive transportation was developed in the United Kingdom in the 1960s to provide public transportation in rural areas [15]. Originally designed to service only individuals with physical disabilities, this model has expanded to incorporate the general population, and it offers flexible, on-demand service that operates without fixed stops or routes. While ridership in rural areas remains lower than urban systems, demand response transit has made rural transit feasible by accommodating dispersed populations.

Demand-response transit typically operates through pre-scheduled, door-to-door service. Riders contact their local agency; oftentimes, agencies require at least one- or two-days advance booking. Agencies will then analyze all of the requested trips for that day and make a schedule that is as efficient as possible while getting all their requested rides to their destinations and back.

Rural public transportation systems are eligible for the Section 5311 Formula Grants for Rural Areas from the Federal Transit Administration, and this grant is often the most significant source of support [SOURCE]. This grant provides capital, planning and operational assistance to states to support public transportation in rural areas with populations of less than 50,000 [17]. The federal government covers up to 80% of capital expenses, 50% of operational costs, and 80% of costs for ADA-compliant non-fixed route paratransit services. These federal funds are awarded to state Department of Transportations, which are responsible for allocating the funds to their rural transit providers. The federal allocation formula is based on multiple weighted factors: non-urbanized land aera, non-urbanized population, non-urbanized vehicle revenue miles, and non-urbanized low-income individuals. Local capacity to provide match does not determine a state's share, although it can affect whether subrecipients can fully utilize allocated funds.

In Illinois, the matching funds for the 5311 grant are partially covered by the Downstate Operating Assistance Program (DOAP), which provide 65% of operating expenses. The remaining costs must be covered by local sources, such as county or municipal governments, fare revenues, agency contracts, etc. For example, in some areas, contracted agreements with healthcare providers, schools, or employment programs can help generate funds for the local match.

Beyond DOAP, Illinois provides additional state-level funding to support rural agencies through targeted grant programs or initiatives. The Rebuild Illinois capital program allocated $355.9 million towards the modernization of transportation infrastructure and vehicle fleets across downstate areas [SOURCE]. Through Medicaid, non-emergency medical transportation services can be reimbursed for transporting Medicaid beneficiaries to medical appointments. Funding from the Old Americans Act, administered by the Illinois Department of Aging, includes transportation services for seniors. These state-level funding sources, in conjunction with federal programs (and their state-level match) are the main methods through which transit agencies are funded, maintained, and improved.

CHAPTER 3: LITERATURE REVIEW

A growing body of research has attempted to monetize the social and economic value of rural and small urban transit; these studies consistently find that rural transit ridership generate positive returns on investment. Burkhardt (1999) analyzed 22 rural transit systems and found that rural transit creates a return of greater than 3.0 to 1.0 []. Southworth et al. (2005) estimated that rural transit generated $14.65 per trip in benefits for the state of Tennessee, although they did not go into the costs []. Penet (2011) estimated a 1.7 to 1.0 benefit to the state of South Dakota. Godavarthy et al. (2015) found that the benefit cost ratio of rural transit investment for the United States was 1.2 to 1.0, with an increase to more than 4.0 to 1.0 depending on the assumption of the percentage of foregone trips []. Mattson and Peterson (2021) found that the benefits ranged from 1.5 to 4.2 for every dollar spent in the state of Minnesota []. Together, these studies affirm that rural transit delivers positive return on investment for every dollar spent by saving costs or creating economic activity, primarily outside of the transportation sector. These benefits are more difficult to see in traditional transportation evaluation frameworks, and they must be accounted for to capture the full breadth of benefit that rural transit provides to the state.

MOBILITY BENEFITS

Rural public transit plays a vital role in accessing essential destinations, particularly those without reliable access to a personal vehicle. The primary value of rural transit derived from this increased mobility, many of which start as user benefits and can transition into government and/or societal benefits.

Rural transit is frequently used to access jobs and workplaces [12, 20, 21]. The absence of these services would cause individuals to be unable to make it to their job locations, which could result in wage reductions or unemployment. Employment is also a key social determinant of health; barriers to work access can negatively affect long-term health outcomes and well-being. From the employer's standpoint, job sites with transit access report higher employee reliability and satisfaction and reduced absenteeism. At the public sector viewpoint, facilitating commutes to work via transit reduces unemployment rates, lessening unemployment benefit and other social welfare expenditures, generating a potential return on investment for government agencies.

Access to healthcare is another core benefit of rural transit. One of the key components of the social determinants of health is having transportation options to healthcare facilities. Thus, access to healthcare through public transit is a crucial component of ensuring a healthy quality of life, especially for those that are unable to use a personal vehicle due to age, ability, or other factors [30, 31].

Missed care due to a foregone trip could lead to subsequent, costlier care through increased hospitalizations, emergency room visits, outpatient visits, physician and other office-based visits, and pharmacy costs [34]. Improving an individual's care leads to better health outcomes, such as an improved quality of life and longer life expectancy, and can lead to decreases in overall healthcare costs. Researchers have utilized the methodology and tools developed by the National Academies to estimate the benefits of non-emergency medical trips, which takes into account the cost-effectiveness of providing care to five preventative diseases (influenza, prenatal care, breast cancer, colorectal cancer, and dental care) and eight chronic diseases (asthma, heart disease, chronic obstructive pulmonary disease, hypertension, diabetes, depression/mental health, and end-stage renal disease) [34]. For the case asthma, for example, patients with mild to moderate asthma require two primary care visits annually, while severe cases may require three or more visits to both primary and specialist care. Missing these visits can lead to preventable hospitalizations, which are significantly more expensive than transit trips.

While the number of transit trips to educational and vocational training sites such as universities and colleges vary by rural community, some rural transit agencies do provide a substantial proportion of their trips to education sites [35, 13]. Users who attend/obtain a degree in higher education tend to have lower rates of unemployment than those who have not attended or do not hold a post-secondary degree [36]. Amongst 25–34-year-olds, the rate of unemployment was 12% for those who did not complete high school, 9% for those who graduated high school, 6% with some college, 5% with an associate's degree, 3% with a bachelor's degree, and 2% with a graduate degree. Additionally, workers with a higher level of education tend to earn more money. The median earnings of bachelor's degree holders working full time were $24,000 higher than those of high school graduates (or 67% higher) [37]. Thus, facilitating access to education and training through transit has long-term economic benefits for both individuals and communities.

Rural residents increasingly struggle to reach essential retail destinations like grocery stores and pharmacies [39, 40]. Public transit helps bridge this gap; at the same time, access to shopping destinations provides a positive benefit by improving residents' health outcomes and reducing the burden on the healthcare system. In addition, shopping trips via rural transit boosts sales at local businesses, supporting local economies, though this benefit may be somewhat diminished by the rise of online shopping [18].

Public transit enables riders to participate in social and recreational activities. These trips are often overlooked, but they are crucial for mental health and social inclusion; for many residents, especially older adults lacking the ability to drive, rural transit may be the only means of participating in social life outside the home [43]. Social isolation and loneliness are increasingly recognized as significant public health issues, as it is associated with heightened risk of depression, anxiety, cognitive decline, and premature death. This carries societal costs linked to increased healthcare utilizations and higher demand for long-term care services. Public transit that facilitates social and recreational engagement plays a preventative role, helping reduce these downstream healthcare burdens.

Some mobility benefits provided by rural transit are difficult or impossible to quantify in economic terms, yet they are deeply meaningful to individuals and communities. For people without access to a personal vehicle, transit offer increased independence and autonomy; this autonomy extends to their friends and family members, who might otherwise need to interrupt their own routines to provide rides. Public transit enables access to important civic and social destinations, such as voting booths, religious services, and community events. Although these benefits fall outside the scope of traditional analyses, they represent important contributions to personal well-being and community cohesion.

RURAL TRANSIT AS A MERIT GOOD

Despite the many monetary benefits, the benefits of rural transit cannot be provided by private markets alone. The concept of merit goods describes goods that are under-consumed when left to market forces, despite being considered socially desirable, because individuals may not fully recognize or act upon the long-term benefits. Classic examples include education and preventative healthcare are merit goods as they both benefit the individual and confer widespread societal gains through improved productivity and better public health.

Public transportation is similarly classified as a merit good []. Left solely to market forces, rural transit tends to be undersupplied due to lower population densities and higher per-rider costs. Even when demand for transit exists in these areas, it is difficult to support service provision at market prices []. Yet the externalities, such as reductions in healthcare costs and social isolation, yield returns beyond what can be recovered through the farebox. Governments are thus required to invest in rural transit in order to realize these benefits.

Even if the returns would not fully offset the costs, the paradigm of universal access frames mobility as a basic capability that is essential for participation in society. Mobility enables access to other fundamental goods and services, making transport a prerequisite for full social and economic engagement. In rural areas where market forces fail to provide adequate service, it becomes the responsibility of the government as a redistributor to ensure that all individuals and communities have access to mobility.

EVALUATION FRAMEWORKS

Cost benefit analyses are one of the most widely used tools for evaluating transportation investments. They compare the total expected costs of a project against the total expected benefits, quantified in monetary terms. For urban transit, CBAs take into account travel time savings, accident reductions, and environmental benefits; however, in rural settings, these benefits are not as pronounced (or negligible), thus requiring a separate methodology for studying rural transit.

Return on investment (ROI) is a simpler metric that measures the financial return generated relative to the costs, and it is commonly used in private sector evaluations. These evaluations often exclude broader social and economic benefits that do not directly translate into revenue for that company or agency. CBAs take a more holistic approach compared to ROI analyses by incorporating some of these social costs and benefits, which is particularly important in public sector decision-making, where economic efficiency is not the only goal of the government.

CBAs and ROI vary significantly depending on the level of analysis, At the agency level, evaluations tend to focus on operational efficiency. State and federal perspectives may incorporate wider goals, such as reducing healthcare costs or improving employment opportunities, which are beyond and outside of the scope of local transit operators. Transit agencies might only account for the impact of increased (or decreased) investment on riders, whereas state and federal agencies may be more interested in how transit affects local economies, for example. Additionally, there are non-user benefits of transit separate from users, agencies, and government, like employers who gain access to a larger workforce or families with reduced caregiving burdens. Recognizing these differences is critical as to not over-represent or double-count benefits.

Other methods outside of traditional CBAs or ROIs include willingness to pay analyses (WTP, which are used to capture user perceptions of value, especially for difficult-to-monetize benefits. However, WTP in the context of rural transit underestimates actual value, as individuals with lower or fixed incomes are limited in the amount of monetary value they can pay. Additionally, riders are unlikely to be able to value long-term or abstract benefits accurately (if at all), like work productivity increases or health improvements.

Economic input-output models, such as the Regional Input-Output Modeling System (RIMS-II), estimate how transit investments ripple through a local economy, capturing both direct and indirect effects. RIMS-II provides region-specific multipliers to estimate how spending in one sector is multiplied through other sectors. Investments in transit spending generate economic activity in construction, maintenance, and local service sectors. This can justify rural transit investments by highlighting job creation and increased economic output, even when ridership is low.

THE STATE OF RURAL TRANSIT FUNDING

The Section 5311 Rural Area Formula Grant Program is the primary source of funding for rural and tribal transit systems in the United States []. Federal law established formula grants for rural areas in 1978 for supporting both capital and operating costs for areas with populations under 50,000. Various reauthorizations of surface

transportation legislation, including ISTEA (1991), TEA-21 (1998), SAFETEA-LU (2005), MAP-21 (2012), and the FAST Act (2015), adjusted funding levels. The Infrastructure Investment and Jobs Act of 2021 significantly increased funding for 5311. The 5311 has required non-federal match funding since its inception, typically 80-20 (federal to non-federal) for capital expenses and 50-50 for operating expenses. While the ratios have remained at these levels, temporary federal relief programs such as CARES waived the match requirements during the COVID-19 pandemic.

State=level support for rural transit varies across the country. North Carolina and Minnesota, for example, have dedicated funding streams through the state's highway fund and a motor vehicle sales tax, respectively, that supplement federal dollars. Texas, on the other hand, funds rural transit through annual legislative appropriations from the general fund, which can be unpredictable []. In Illinois, the Downstate Public Transportation Act (referred to as the Downstate Operating Assistance Program) pays up to 65% of eligible expenses, and each participating agency receives an annual appropriation from the general assembly. Additionally, up to 20% of certain Federal Highway Administration program funds can be transferred for transit, up to the discretion of states, often used for capital needs [].

While 5311 funds are not based on performance measures, some states do tie funding to various metrics, like passengers per revenue hour, operating costs per passenger, operating cost per revenue hour, and customer satisfaction survey results. However, these metrics overlook key contexts. For example, many rural agencies are mandated to cover an entire county or counties, the size of which could vary wildly between even adjacent agencies, and differing geographic constraints might affect trip lengths. Especially compared to more urban or small-urban systems, larger service areas and deadhead mileage can cause certain indicators to become disproportionately high.

Many rural agencies are struggling to maintain or increase their current levels of service []. Rising labor costs and increased maintenance expenses have placed strain on often stagnant funding levels. Without sustained increases in operating assistance (and especially so when funding decreases), rural systems may be forced to reduce service or defer critical maintenance. Smaller agencies face difficulty replacing aging vehicles, as capital grants tend to be competitive, leaving operators with limited staff at a disadvantage.

Existing funding mechanisms fail to reflect the broader social and economic benefits that rural transit provides. While urban transit systems can point to measurable outcomes that departments of transportation can appreciate, like congestion relief or emissions reductions, rural transit benefits are diffused through sectors outside of transportation, like in healthcare or social services. This results in rural transit systems being undervalued and overlooked despite their benefits.

CHAPTER 4: CONCEPTUAL MODEL

The estimation of the value of rural transit services requires a structured understanding of how transit access translates into social, economic, and ultimately fiscal outcomes. A conceptual model serves as the foundation for this process, clarifying the causal links between service provision and benefits as found through the literature review process. This section proposes two conceptual models: the first model outlines a basic, conservative view that captures the measurable effects commonly found in previous studies; the second expands upon this by incorporating broader, interrelated outcomes that, while impractical to quantify, better reflect the deeper value of providing access via rural transit.

CORE CONCEPTUAL MODEL

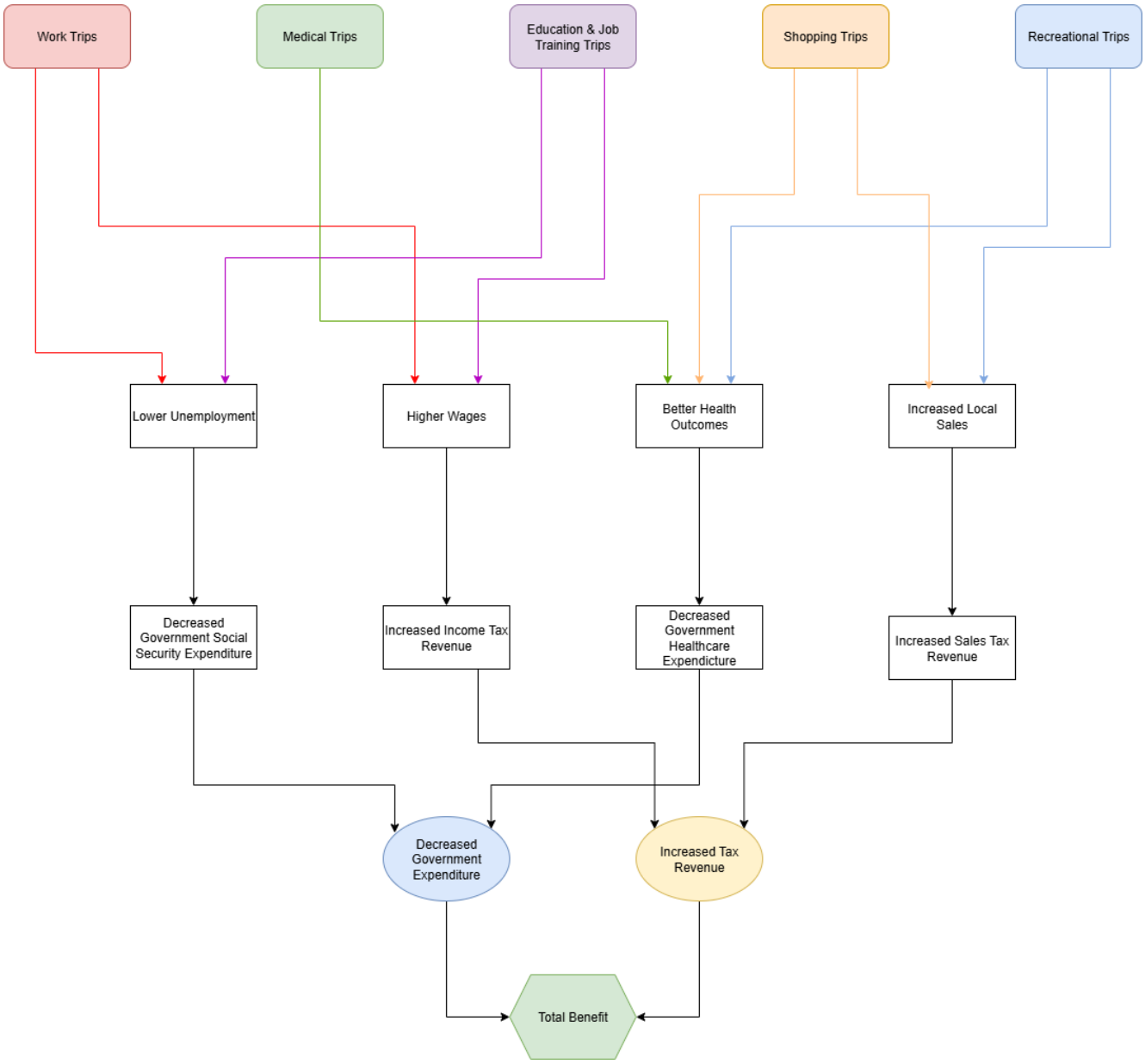

Figure 1: Core Conceptual Model

The core conceptual model provides a representation of the most measurable and cited fiscal impacts of rural transit services. It is designed to isolate benefits that are attributable to access to public transit, can be estimated using available data, and are conservative in scope to avoid highly oblique or double-counted effects. This model is used as the basis for the cost-benefit calculations presented in subsequent sections.

The main conceit of the core conceptual model is that rural public transit enables individuals to complete trips that would otherwise be foregone. These trips, in turn, facilitate participation in the economy and in society through employment, education and job training, medical care, shopping, and recreation. The provision of trips to each of these locations generates quantifiable monetary outcomes for the state government, by either increasing tax revenues or decreasing government expenditures. The effects of each trip are directly traceable. For example, transit access to employment opportunities results in higher individual productivity and sustained labor force participation. These outcomes translate into increased personal income, yielding higher income tax revenue for the state, and a reduced need for unemployment or other social assistance programs.

COMPREHENSIVE CONCEPTUAL MODEL

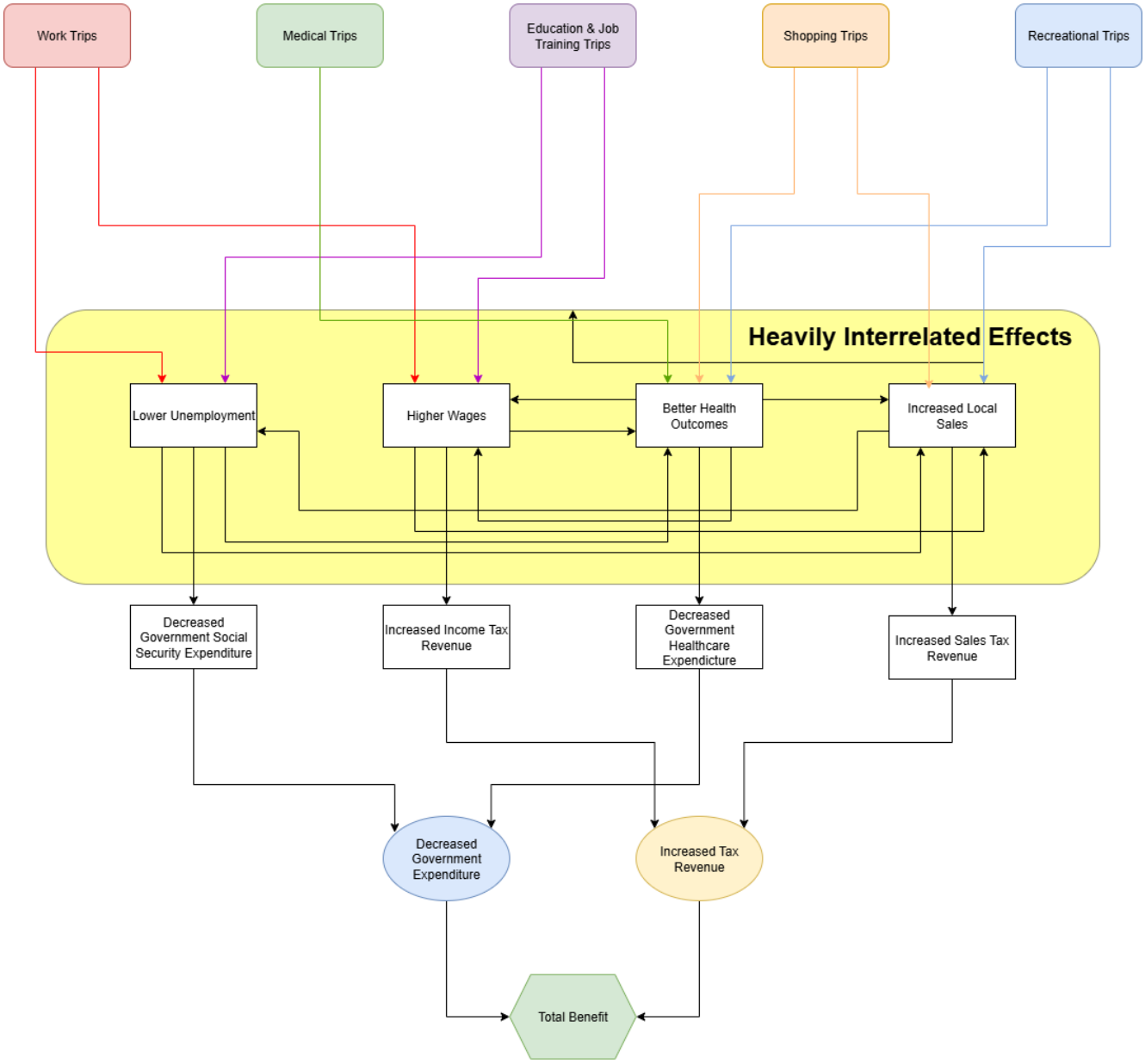

Figure 2: Complex Conceptual Model

While the core conceptual model captures some of the fiscal impacts of rural transit, it does not encompass the full range of value generated. The comprehensive conceptual model attempts to expand the boundaries of the analysis to reflect the incidental, cascading, and interrelated effects that emerge when individuals have access to transportation. Reliable transportation to employment, education, healthcare, etc. sets off a chain of positive effects across the lives of individuals, which ripples outwards to the broader population. For example, stable employment contributes to greater financial security, improved mental and physical health, and intergenerational gains such as higher educational attainment for children [48, 49, 50]. An individual who has better health outcomes because they are able to access healthcare sites will have better employment opportunities, productivity, and are able to spend more in the local economy [51].

These interactions produce feedback loops. Improved health leads to better educational outcomes, leading to better employment prospects, leading to increased spending; each step in this process affects the finances of the government. Due to the complexities of these calculations and limitations of data, the comprehensive conceptual model cannot be used for the numeric cost-benefit calculations in this report. However, it reinforces the idea that the value of rural transit extends beyond direct metrics and into the broader realms of economic inclusion, public health, and social resilience. The comprehensive model also highlights areas for future research where more intensive metrics may be developed to capture all potential returns on transit investment.

CHAPTER 5: METHODOLOGY

A series of benefit calculations were developed based on the primary purposes of transit trips. These include trips for employment, education and job training, medical care, shopping, and recreation. Each of these trip types produces distinct monetary impacts through one of two avenues: increasing government tax revenue or decreasing government expenditures. All monetary benefits are calculated on an annual basis and at the state level.

WORK TRIP BENEFITS CALCULATION

One measurable benefit of rural transit is derived from its role in enabling access to employment and reducing reliance on state-funded social welfare programs [28, 13]. In the absence of transit service, a portion of workers would be able to get to occupational sites via alternative means, such as rides from family members. However, others are forced to forego the trip entirely, particularly those who are transportation-disadvantaged. Riders that are forced to forego their trip would be unable to reach their workplace if transit services were non-existent, leading to job insecurity and increased dependence on social welfare programs.

The number of transit trips to work is provided by the agencies. It is then multiplied by the percentage of trips that would be foregone in the absence of transit. This results in the number of trips where transit was required in order to access the workplace. Given a standard work calendar of 260 workdays per year, an employed individual would require 520 transit trips annually (260 outbound and 260 return trips). Dividing the number of trips where transit was required by 520 results in the number of individuals who relied on rural transit in order to be employed.

Multiplying the number of individuals relying on transportation for employment by the cost of social benefits per recipient results in the cost the state would spend on social benefits for these riders, if transit had not existed. Thus, the benefit of rural transit is quantified as the avoidance of paying for various social welfare benefits via the following formula:

$$S_w = \frac{T_w * f_w}{N_w} * C_{sa}$$

Where:

- S_w = Government spending savings from providing work trips
- T_w = Annual number of trips to work locations
- F_w = Foregone trip rate for work trips
- N_w = Number of trips required to work per year
- C_{sa} = Cost of providing social benefits per individual

In addition to the avoided costs of social assistance, rural transit generates economic value by improving job reliability for transportation-insecure individuals. Lack of reliable transportation options can result in absenteeism, tardiness, or the inability to retain stable employment. Rural transit agencies mitigate this issue by providing consistent access to employment, enhancing annual worker productivity.

For example, one study found the average increase in earnings associated with improved job reliability enabled through transit service is valued at $3542.86 per year per worker [29]. Of this increase in productivity, the state of Illinois recoups 4.95% of it through income tax revenues. Unlike the calculation of avoided social assistance costs, which only applies to riders who would be unable to work without transit access, the

productivity gain from increased employment reliability is attributed to all riders using rural demand response transit for work purposes. Given that this population is assumed to be transportation-disadvantaged, it can also be assumed that all riders of this category would experience a measurable productivity benefit from consistent, dependable access to employment.

To quantify this benefit, the number of work-related transit trips is divided by 520, the number of annual roundtrips associated with full-time employment. This yields the number of workers using transit to access work locations. That number is multiplied by the average annual productivity gain per worker and by the effective state income tax rate (4.95%) to estimate the total increase in state tax revenue from improved worker productivity. This calculation is expressed as:

$$I_w = \frac{T_w}{N_w} * (P_w * t_{inc})$$

Where:

- I_w = Tax income increase from providing work trips
- P = Productivity increase from providing work trips to transit disadvantaged populations
- t_{inc} = State income tax

It is important to recognize that stable employment also generates a range of secondary benefits that are harder to quantify within the scope of the current analysis. For example, employed individuals are more likely to spend locally, increasing state sales tax income [52]. They also experience better physical and mental health outcomes, requiring fewer public health and social services [48]. These outcomes can generate further revenues and cost savings for state governments; however, because these effects are more indirect, they are excluded from the calculations.

MEDICAL TRIP BENEFITS CALCULATION

Rural transit services deliver significant benefits by increasing access to healthcare facilities. These non-emergency medical trips (NEMT) consist of both preventative care (e.g., vaccinations or cancer screenings) and treatment for chronic conditions (e.g., diabetes or end-stage renal disease treatments). For transportation-disadvantaged individuals, missed or delayed medical appointments can result in worsened conditions, increased emergency room use, and higher long-term healthcare costs [34]. By providing reliable transit access to healthcare, these outcomes are mitigated, thus saving money in the form of reduced healthcare costs.

The National Academies' NEMT cost-benefit model considers five common preventive care conditions and seven chronic care conditions, and it calculates the cost difference between well-managed and poorly-managed care for each condition; it also considers the monetary value of quality-of-life improvements and deducts the costs of additional medical treatments occurred. Based on this tool, the net benefit per NEMT is estimated at $1,187.73 saved in healthcare costs per round trip ($713 in 2005 USD). State governments account for 25% of total health spending [53]; thus, the total amount the state saves in healthcare expenditures via rural transit is:

$$S_m = T_m * H_{nemt} * p_{health}$$

Where:

- S_m = Government spending savings from providing medical trips
- T_m = Annual number of trips to medical locations

- H_{nemt} = Health benefit per NEMT
- R_{state} = Proportion of total health are spending accounted for by state and local governments

EDUCATION AND JOB TRAINING TRIP BENEFITS CALCULATION

The primary benefits associated with educational trips are, like employment trips, the avoidance of social assistance spending due to higher levels of education correlating with lower unemployment, and an expected increase in wages bringing in additional state income tax revenue [38]. For transportation-disadvantaged students, consistent access to education can be a significant barrier; without reliable transportation options, students may be forced to delay or abandon postsecondary education, limiting their future earning and employment potential.

The most common destinations for education-related transit trips are community colleges and vocational training centers, which typically lead to the attainment of an associate's degree. On average, individuals with an associate's degree earn $7,700 higher annually than those whose highest level of education is a high school diploma [54]. Based on this earnings differential, the state captures 4.95% in income tax revenue from the additional income earned.

The number of annual educational trips is divided by estimated number of trips a student makes per year to attend educational institutions. This yields the approximate total number of students utilizing rural transit to get to class. This figure is then multiplied by the rate at which these trips would have been foregone to get the number of individuals for whom transit was essential in order to attain their degree. To estimate the fiscal benefit to the state, this number is multiplied by the average annual earnings differential associated with higher educational attainment and the applicable state income tax rate, yielding the expected increase in tax revenue attributable to rural transit service provision:

$$I_e = \frac{T_e * f_e}{N_e} * (P_{edu} * r_{tax})$$

Where:

- I_e = Tax income increase from providing education trips
- T_e = Annual number of trips to education locations
- f_e = Foregone trip rate for education trips
- P_{edu} = Productivity increase from individuals with an associates degree compared to those whose highest level of education is a high school diploma
- N_e = Number of trips required to educational facilities per year

Individuals with no post-secondary education face higher unemployment rates and are more likely to rely on public assistance programs [54]. In contrast, those who attain an associate's degree are less likely to need these supports. This differential represents a direct cost savings for the state when transit access enables students to complete their postsecondary education.

To quantify this benefit, the number of students for whom transit was essential in attaining their degree is multiplied by the unemployment rate of those whose highest education level is a high school diploma. This provides an estimate of individuals who would likely be unemployed in the absence of public transit. This

figure is multiplied by the average annual unemployment benefit cost per individual, yielding the total amount of public assistance expenditures avoided by enabling degree completion through rural transit services:

$$S_e = \frac{T_e * f_e}{N_e} * r_{hs} * C_{sa}$$

Where:

- S_m = Government spending savings from providing medical trips
- r_{hs} = Rate of unemployment for those with a high school diploma

SHOPPING TRIP BENEFITS CALCULATION

Trips to retail and shopping destinations can make up a moderate proportion of total rural transit trips. These trips enable the participation in the local economy through retail spending and by increasing access to essential goods (e.g., healthy foods) for rural populations.

Riders taking transit to retail establishments directly contribute to the state budget through purchases that generate sales tax revenue. The number of shopping trips is multiplied by the average per-trip expenditure and the state sales tax rate. This figure is also adjusted using a shopping-specific foregone trip rate, which differs from other trips types due to the flexibility of shopping trips and the existence of viable alternatives, like online shopping and grocery delivery [18]. The adjusted result represents the state sales tax revenue attributable to the existence of rural transit:

$$I_s = T_s * f_s * (s * t_{sales})$$

Where:

- I_s = Tax income increase from providing shopping trips
- T_s = Annual number of trips to shopping locations
- f_s = Foregone trip rate for shopping trips
- s = average per-trip expenditure
- t_{sales} = state sales tax

Rural transit improves access to healthy food options. Individuals living in rural areas, especially those without reliable access to personal transportation, often face barriers in reaching full-service grocery stores [55], a critical component of the social determinants of health [41]. They may be forced to rely on convenience stores or fast-food outlets, resulting in poorer dietary outcomes, leading to increases in chronic diseases such as diabetes and obesity, which costs public health care systems long-term. Inversely, individuals with better healthy food access impose lower per capita healthcare expenditures [56].

To calculate the state-level healthcare cost savings, the total number of shopping trips is multiplied by the foregone trip rate, then divided by the typical number of annual shopping trips to estimate the number of shoppers dependent on rural transit for healthy food access. This number is multiplied by an estimate of annual per-person healthcare cost savings due to improved nutrition and by the state's share of healthcare spending to get the government cost savings from shopping trips:

$$S_s = \frac{T_s * f_s}{N_s} * B_{healthy} * p_{health}$$

Where:

- S_s = Government spending savings from providing shopping trips
- N_e = Average annual number of shopping trip per person
- $B_{healthy}$ = Annual per-person healthcare cost benefits due to improved nutrition

RECREATIONAL TRIP BENEFITS CALCULATION

Recreational trips involve visits to sites such as movie theaters, restaurants, and local events, where discretionary spending directly generates state sales tax revenue. Transit trips to recreational sites enable participation in the local economy that might not have occurred otherwise. The number of recreational transit trips is multiplied by the average amount spent per trip on entertainment and leisure. This total is then multiplied by the state sales tax rate and adjusted by a foregone trip rate:

$$I_r = T_r * f_r * (s * t_{sales})$$

Where:

- I_s = Tax income increase from providing recreational trips
- T_s = Annual number of trips to recreational locations
- f_s = Foregone trip rate for recreational trips
- s = average per-trip expenditure

Recreational trips also provide critical mental and social health benefits, particularly for older adults and those experiencing isolation in rural settings [57]. Social isolation is a significant determinant of poor health outcomes. Transit accessibility supports social connectedness and can reduce healthcare costs by reducing incidences of depression and anxiety and decrease hospitalizations associated with loneliness and chronic stress.

The number of recreational trips is multiplied by the foregone trip rate and divided by the average annual number of trips per person, resulting in the number of unique riders who rely on transit for recreation. This is multiplied by an estimate of healthcare cost savings associated with reduced isolation and the state share of healthcare costs, resulting in the government savings attributable to recreational trips:

$$S_r = \frac{T_r * f_r}{N_r} * H_{social} * p_{health}$$

Where:

- S_s = Government spending savings from providing recreational trips
- N_e = Average annual number of recreational trips per person
- H_{social} = Annual per-person healthcare cost benefits due to reduced social isolation

COSTS CALCULATION

While the benefits of rural transit are numerous and multivariate, the costs associated with operating rural transit services are relatively straightforward to quantify. Data from the National Transit Database provides information on the annual budgets of transit agencies, including operating and capital expenses, and the share of funding provided by the federal government and by the state government. For a state-level return on investment analysis, the state contribution to a rural transit system is the primary cost. The state's annual spending on rural transit is compared to the benefits quantified in previous sections to estimate a benefit-cost ratio.

FINAL COST BENEFIT ESTIMATION

The total annual economic value generated by rural demand response transit is the summation of the benefits received by providing employment, education and job training, medical, shopping, and recreational trips. These benefits arise through the avoidance of social assistance and healthcare spending and the increase in tax revenue. The total benefit is then divided by the state's annual contribution to rural transit funding, as reported via the NTD. The resulting cost-benefit ratio reflects the fiscal return to the state for every dollar invested in rural transit services:

$$Cost\ Benefit\ Ratio\ for\ Rural\ Demand\ Response\ Transit =$$

$$\frac{\begin{bmatrix} \frac{T_w}{N_w}(C_{sa} * f_w + P_w * t_{inc}) + T_m * H_{nemt} * h + \frac{T_e f_e}{N_e}(P_e * t_{inc} + C_{sa} * r_{hs}) + \\ T_s * f_s\left(S * t_{sales} + H_{healthy} * h\right) + T_r * f_r\left(S * t_{sales} + \frac{H_{social} * h}{N_r}\right) \end{bmatrix}}{C_{transit}}$$

CHAPTER 6: CASE STUDIES

Three case studies of transit agencies in Illinois illustrate how the cost-benefit analysis varies across service contexts. Three agencies volunteered their internal data, with the caveat that the confidentiality of sensitive, agency-provided data be preserved. Thus, the ridership numbers and operational costs have been modestly skewed or rounded to preserve the integrity of the analysis while also ensuring that no individual agency can be easily identified.

Each case study applies the cost-benefit formula using three scenarios correlating with access dependency. In particular, a Low (20%), Moderate (40%), and High (60%) foregone trip rate are used to reflect the percentage of riders that would be unable to complete trips in the absence of rural transit. For example, in the Low Dependency scenario, 20% of riders are unable to access their destination without transit; in other words, 80% of riders would be able to find alternate means of transportation to their destination, should transit not exist. Similarly, in the high dependency scenario, 60% of riders would not be able to reach their destination without transit, while a minority (40%) could find alternatives.

AGENCY A

Agency A serves primarily medical and daily-needs-oriented trips (Table 1), providing 12,300 trips annually, with the trips it serves heavily weighted toward medical (38%) and shopping (33%) trips. Recreational trips account for another 16% of trips, while work and education/job training trips comprise smaller shares at 8% and 5%, respectively. With $215,000 in state funding, the cost per ride is approximately $17.48. The agency yields a positive ROI across all modeled scenarios: 1.04 in the low dependency scenario, 2.07 in the moderate dependency scenario, and 3.11 in the high dependency scenario. These results reflect the outsized fiscal benefits of enabling non-emergency medical trips and food access, which contribute to reduced healthcare costs and improved public health outcomes.

Table 1: Agency A Cost Benefit Analysis

Agency A	
Work Trips	8%
Medical Trips	38%
Education and Job Training Trips	5%
Shopping Trips	33%
Recreational Trips	16%
Total Rides	12,300
State Funding	$215,000
Return on Investment – Low Dependency Scenario	**1.04**

Return on Investment – Moderate Dependency Scenario	**2.07**
Return on Investment – High Dependency Scenario	**3.11**

AGENCY B

Agency B presents a markedly different profile from Agency A, with a much stronger emphasis on employment mobility (Table 2). Of its 14,280 trips, 63% are work-related; in contrast, medical (18%), shopping (8%), and recreational (8%) trips comprise a much smaller share, with education/job training trips at just 4%. However, Agency B receives more than double the state funding of Agency A, yet does not provide double the volume of trips, resulting in a significantly higher state cost per ride of approximately $34.32 (compared to $17.48 for Agency A). The reasons for this efficiency disparity are unclear without further investigation.

Due to its high per-passenger cost, Agency B does not generate positive returns in the low dependency scenario, with an ROI of 0.66 (the state receives only $0.66 in benefit per dollar spent). However, the ROI increases to 1.33 in the moderate dependency scenario and 1.99 in the high dependency scenario. While Agency A provides positive returns in all scenarios by meeting essential health and daily needs, Agency B's impact is more contingent on the severity of transportation disadvantage among its riders.

Table 2: Agency B Cost Benefit Analysis

Agency B	
Work Trips	63%
Medical Trips	18%
Education and Job Training Trips	4%
Shopping Trips	8%
Recreational Trips	8%
Total Rides	14,280
State Funding	$490,000
Return on Investment – Low Dependency Scenario	**.66**
Return on Investment – Moderate Dependency Scenario	**1.33**
Return on Investment – High Dependency Scenario	**1.99**

AGENCY C

Agency C operates on a larger scale than both Agencies A and B, delivering 82,540 annual rides with a state operating subsidy of $1.45 million (Table 3). Its per-ride state cost is approximately $17.57, nearly identical to that of Agency A and less than half the cost per ride of Agency B. The agency provides a majority of its trip to medical or employment sites, with 39% of its trips for medical purposes and 30% for employment. In addition, a non-insignificant proportion of trips (15%) was used for shopping, alongside smaller shares for recreation (12%) and education/job training (4%). This profile suggests that Agency C caters to diverse needs and supports essential health access, economic mobility, and basic needs fulfillment within the communities it serves.

Agency C demonstrates strong fiscal performance across all scenarios, with an ROI of 1.31 in the low dependency scenario, 2.62 in the medium dependency scenario, and 3.92 in the high dependency scenario. Like Agency A, it delivers positive returns under all assumptions, but its combination of cost efficiency and service diversification enables it to outperform the others in overall value. While Agency B focuses heavily on employment and shows greater sensitivity to rider dependency assumptions, Agency C captures benefits across healthcare, employment, consumer access, and social inclusion. Agency C shows the value of rural transit systems that serve diverse interests.

Table 3: Agency C Cost Benefit Analysis

Agency C	
Work Trips	30%
Medical Trips	39%
Education and Job Training Trips	4%
Shopping Trips	15%
Recreational Trips	12%
Total Rides	82,540
State Funding	$1,450,000
Return on Investment – Low Dependency Scenario	**1.31**
Return on Investment – Moderate Dependency Scenario	**2.62**
Return on Investment – High Dependency Scenario	**3.92**

CHAPTER 7: DISCUSSION AND CONCLUSION

Using a conservative cost-benefit framework that captures the fiscal impact of rural demand-response transit across multiple sectors (employment, healthcare, education, retail, and recreation), this analysis found that rural transit generates positive returns on investment in moderate and high transit dependency scenarios, and two out of three case studies found positive returns on investment even in the lowest transit dependency scenario. Thus, in nearly every modeled scenario, the benefits of rural transit exceeded the state's financial contribution, generating nearly $4 for every dollar spent in the best-case scenario.

The case studies of three transit agencies revealed variations in trip distributions and outcomes. Agencies with high percentages of medical trips (Agencies A and C) consistently delivered strong returns by reducing public healthcare costs. The highly employment-oriented Agency B showed a less-than-one ROI in the lowest dependency scenario, but it was still solvent in the moderate and high dependency scenario. That is not to say that employment trips are inefficient, as Agency C also provided a substantial number of work trips and had the largest ROI.

The analysis implies important policy implications. Narrow performance metrics such as farebox recovery or raw ridership counts fail to capture downstream savings and revenue generated. It also affirms that rural transit gives back to the state of Illinois more than it receives in almost all scenarios. Given growing uncertainty about the future of federal transit funding, state governments may be asked to assume a larger share of the financial responsibility. They can do so with a clearer understanding of the returns that investing in rural transit offers.

At the same time, the analysis is subject to several limitations. This analysis assumed three scenarios of foregone trip rates uniformly attributed to all trip types. However, the foregone trip rate can vary by trip purpose, by geography, and by demographics. This could be an interesting avenue for future research, as getting the foregone trip rate by trip type and by service area could provide a uniquely tailored ROI calculation for each agency. Additionally, the current calculations did not consider the incidental, cascading, and interrelated benefits presented in the comprehensive conceptual model. More studies are required to truly capture the full realm of potential returns on transit investment.

Rural transit is a lifeline for rural communities and for individuals who cannot or choose not to drive. It is not only a public good that provides innumerable, immeasurable benefits, it also generates real fiscal returns that ripple across departments and policy domains. Investments in rural transit support healthier, more economically engaged, and socially connected communities. Transportation policy should reflect the true value of rural transit—not as a subsidy, but as a fiscally sound investment.

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