Methodology for Determining the Impact of Highway Bypasses in Oklahoma

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January, 2001

Cynthia L. Rogers, Ph.D.
Richard S. Marshment, Ph.D.

Research & Development Division
Oklahoma Department of Transportation
200 N.E. 21st Street, Room 2A2
Oklahoma City, Oklahoma 73105
(405) 521-2671
FAX (405) 521-6948

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16 . ABSTRACT
Project #2160 develops a methodology for determining the impact of highway bypasses on small town business districts in Oklahoma. The focus is predicting likely impacts of proposed bypasses on US 70.

Economic impacts are measured by comparing changes in the sales tax base in the bypassed cities with those of in similar non-bypassed cities. Quasi-experimental control group and difference-in-difference estimation techniques are employed.

The method is demonstrated by analyzing the 1993 bypass of Stonewall as well as bypasses of Rush Springs and Snyder in the early 1970s. The null hypothesis that the bypasses had no impact on city sales taxes cannot be rejected. The results are not conclusive due to a lack of bypass cases and usable data on traffic volumes and composition, residential property values, regional economic performance and business climate during the pre-bypass period.

The recommendations based on site visits and interviews are to include signs identifying business districts as well as follow-up safety studies of route intersections in bypass project plans. The results of the project were presented at the annual meetings of the TRB in January 2001, published in an academic journal, and summarized in a PowerPoint presentation developed for ODOT's use in planning and development.

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Cynthia L. Rogers, Ph.D.
Assistant Professor of Economics

Richard S. Marshment, Ph.D.
Professor of Regional and City Planning

University of Oklahoma

Research & Development Division
Oklahoma Department of Transportation
200 N.E. 21st Street, Room 2A2
Oklahoma City, OK 73105
Telephone (405) 521-2671
FAX (405) 521-6948

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CHAPTER 1. INTRODUCTION

PROBLEM DESCRIPTION

Highway bypasses can often improve levels of transportation service particularly in small towns where traffic is slowed by congestion, traffic control devices or poor geometry. Where a highway passes through the center of a small community feasible alignment options are limited due to existing social and cultural infrastructure (e.g., churches, schools, parks, and national historic sites) as well as environmental obstacles (e.g., underground or aboveground storage tanks, and industrial areas). A typical highway bypass reroutes through-traffic around a small town on a new alignment, retaining original roads as business routes.

While safety improvements and reduced travel times are readily observed, the indirect impacts of highway bypasses are less clear. The potential for adverse economic impacts on the local economy is of particular concern in very small communities. Even a seemingly minor negative impact could have severe consequences for a local economy based on just a few businesses. As a result, transportation planners are confronted with legitimate and conflicting concerns about potential impacts of proposed bypass projects.

In a recent case, a proposed bypass of downtown Cordell, Oklahoma (estimated 1998 population of 2,280) produced public outrage. Mayor Phil Kliewer, who feared that the bypass would be the "death knell" of his hometown, "proudly declared victory" when the state transportation department decided not to bypass his community (Jackson, 2000). Others in the community welcomed the bypass as a needed safety measure and doubted the "life-or-death" talk concerning the demise of the business district. The situation in Cordell typifies the mixed reaction found in small communities when a bypass is proposed.

Unfortunately, the existing body of research provides little guidance for transportation planners, business owners, and citizens of small towns concerned about potential economic impacts of proposed bypasses. Although location theory suggests that improved access conveys a competitive advantage than can lead to economic growth, the empirical literature is inconclusive. Furthermore, there are only a limited number of studies that investigate bypass impacts on very small towns, mostly due to the inadequacy of data available at the community level. The inability to rely on previous research when responding to concerns about proposed bypass projects impedes project development and draws public criticism.

The Oklahoma Department of Transportation (ODOT) commissioned a study at the University of Oklahoma to develop a defensible methodology based on reliable data that can be used in the highway bypass planning process. Predicting the likely economic impacts of proposed bypasses on US 70 is of particular concern. Accordingly, this project seeks to develop a methodology for investigating the economic impact of highway bypasses on small communities in Oklahoma. This report summarizes the methodology, data, and implications of the analysis conducted.

An article based on the research conducted for this project was published in a special transportation edition of the Review of Urban and Regional Development Studies (Rogers and Marshment, 2000). The project results were also presented at the annual meetings of the Transportation Research Board in January 2001. Finally, a PowerPoint presentation and script summarizing the analysis, results and conclusions of the project was developed.

STUDY OBJECTIVES

The objectives of this study are threefold:

1. develop a methodology to assess the economic impacts of highway bypasses on small communities;
2. evaluate the impacts of past bypasses in Oklahoma; and
3. predict the economic impact of proposed bypasses along US 70 in Oklahoma.

The procedure for analyzing economic impacts will assist ODOT transportation planners in developing and implementing bypass projects. It will also be helpful for addressing concerns expressed by local officials, businesspersons and residents of towns scheduled for a highway bypass.

METHODOLOGY

The first step is to identify past bypasses in Oklahoma to serve as case studies for the analysis. The focus is on selecting bypass case studies that are similar to the proposed bypasses of small cities along US 70. For each case study, a group of cities with similar features, including population, proximity, and highway infrastructure, is selected to use as the baseline of comparison. The baseline provides a measure of how much the bypassed city would have grown without the bypass. A central part of the analysis involves constructing a database of the local tax base for all cities in Oklahoma that impose local sales taxes in their jurisdictions. The city sales tax data provide a general indicator of the vitality of the business community. These data provide a reliable, annual series of data at the city level. Economic impacts are measured by comparing changes in the sales tax base over time for bypassed cities and their comparison cities. Various techniques are used to estimate bypass impacts. The quasi-experimental control group analysis estimates bypass impacts using simple difference of group means tests in the post-bypass period. The difference-in-difference approach employs cross-section, time series data to estimate differences in the post-bypass period versus the pre-bypass period. Finally, the empirical analyses are supplemented with anecdotal methods, including site visits and personal interviews.

SCOPE OF THE REPORT

Chapter 2 presents a background review. It includes an overview of the proposed US 70 bypass projects, a review of relevant literature concerning bypass impacts, an explanation of the data limitations faced when analyzing bypass impacts for very small cities, a discussion of the importance of non-highway related factors that influence city growth, and a brief presentation of standard empirical methods used to estimate bypass impacts.

Chapter 3 documents the data used in the project. Sources, as well as information about the scope of relevant data, are discussed. The chapter then outlines the general methodological approach of using comparison groups to analyze bypass impacts. It also describes the matching procedure, estimation techniques, and anecdotal methods used in the study.

Chapters 4 and 5 provide demonstrations of the methodology we develop. Chapter 4 examines the Stonewall bypass of 1993. The details and results of the analysis are discussed. Chapter 5 analyzes the bypasses of Rush Springs and Snyder. The conclusions from this application, however, are limited by the lack of data for the pre-bypass period.

Finally, Chapter 6 presents the conclusions and recommendations drawn from the study.

CHAPTER 2. BACKGROUND REVIEW

A focus of this project is to predict economic impacts of the proposed US 70 bypasses of small communities in Oklahoma. With this in mind, this section provides an overview of the proposed US 70 bypasses and relevant literature concerning bypass impacts.

PROPOSED BYPASSES ON US 70

US 70 is part of the National Highway System. As a principal arterial road, US 70 is designed to convey large traffic volumes rapidly over long distances. The section in Oklahoma, extending from I-35 to the Arkansas State Line has been identified by the state as a Transportation Improvement Corridor (TIC). TICs are highways in need of improvement to adequately carry projected traffic loads by the Year 2020. ODOT conducted a Feasibility Study (ODOT, 1997) which outlined proposed infrastructure improvements including several bypasses along the US 70 corridor.

ODOT identified six US 70 proposed bypass projects in the request for research proposal for this project. These are listed in Table 2.1. The proposed US 70 bypass projects fall into three categories. Soper, Boswell and Valliant are very small communities with one main route; Kingston and Madill are a little larger (but still relatively small) with multiple routes; and Durant is considerably larger with several major routes.

Table 2.1 Proposed US 70 Bypasses in Oklahoma

Town	*County*	*Population 1990*	*Bypass Routes*
Soper	Choctaw	305	US 70
Boswell	Choctaw	643	US 70
Valliant	McCurtain	873	US 70
Kingston	Marshall	1,237	US 70, SH32
Madill	Marshall	3,069	US 70, SH199, SH99
Durant	Bryan	12,929	US 70, US-69/75, SH78

Bypass projects in small communities differ considerably from those in larger communities. In small, rural communities, bypass routes generally divert traffic from the main downtown of the city. The new alignments may lie completely outside of the city limits, as in the proposed plans for Soper and Kingston. In large communities, however, the bypasses divert traffic from high traffic volume areas, but still go through part of the town. In addition, when multiple routes intersect in larger communities, the bypass projects are built to connect main routes and eventually form loops around the central business district, as in the proposed Durant bypass.

The complexity of the analyzing bypass impacts derives from the interplay of the various socio-economic forces, including the orientation of business, community size, and external forces. Consequently, separate analysis for each category of bypasses is warranted. Of particular interest is analyzing bypass impacts on very small communities where the literature is sparse.

LITERATURE REVIEW

This section provides a brief synthesis of the literature relating to bypass impacts. It focuses on the most recent contributions that pertain to estimating bypass impacts on business districts in small communities.

Developmental Aspects of Highway Infrastructure Projects

Bypasses are generally tied to larger transportation projects. As such they have important developmental aspects that contribute to economic growth. Kuehn and West (1971), for example, suggest that highway bypasses might stimulate local growth by improving access to external markets and generating highway construction employment and spending. Their empirical analysis of counties in the Ozark Mountain Region of Arkansas, Oklahoma and Missouri from 1954 through 1963 does not support this view. Nor does the Eagle and Stephanedes (1987) analysis of Minnesota counties for the period from 1957 through 1982. More recent studies looking at impacts in rural areas find mixed results (Broder et al., 1992; Clay et al., 1992). For example, Isserman et al. (1989) conclude that "depending on the circumstances, highway improvements will lead to development, no change, or accelerated decline of economically faltering regions" (page 8).

Notably, the research on developmental aspects of highway development relies mostly on county level of analysis. This can obscure real economic losses at the municipal level. Studies focused on larger cities can ignore this effect since larger municipalities dominate county economies.

Bypass Impacts

Many researchers have probed the relationship between highway bypasses and economic performance. A review of early studies by Mohring and Harwitz (1962) and a later research summary published by the Federal Highway Administration (FHA, 1976) confirm that the research "has so far failed to reveal any direct or consistent relationship between business activity and traffic changes in bypassed areas" (FHA, 1976). This finding held regardless of the population of the bypass community.

Conclusions drawn from research focusing on small and rural communities in particular are also ambiguous. For example, Sanders (1973) performs a qualitative analysis of the bypass effect of I-35 on small and medium size towns in North Central Oklahoma. His findings of negative impacts on business activity contrast with those of Skorpa et al. (1974) which fail to find a conclusive connection between local business activity and bypass construction around small Texas communities. While these studies use different methodologies and focus on different types of bypasses (i.e., interstate versus highways), the comparison illustrates the inconsistencies prevalent in the literature.

Perhaps the most relevant recent research on highway bypass impacts is that by Andersen et al. (1993; 1992) and Helaakoski (1992). This series of papers analyzes the impact of highway bypasses on small towns in Texas using multiple approaches. Employing an econometric model, Andersen et al. (1993) find small but statistically significant decreases in business volumes in bypassed towns. With cluster analysis, they show the economic base of the city to be an important factor in predicting bypass impacts. Based on case-study analysis, they conclude that the negative impacts of bypasses are sometimes counteracted by reorientation of local merchants. The results from this series of studies supports previous findings and the general conclusion that bypass impacts on small communities are "neither conclusive nor uniform across locations" (Andersen et al., 1993).

Data Limitations

Common measures of economic activity in bypass studies include employment, retail sales and personal income (Helaakoski et al., 1992). These data are not easily obtained for very small places. The U.S. Census Bureau does not aggregate data for places of fewer than 2,500 people. While it is possible to aggregate at the tract level, the resulting data would only be available for Census years. Zip code level data are of limited use since rural zip codes areas can include one or more small towns plus surrounding non-incorporated land areas. Accordingly, studies of very small towns generally rely on site visits and surveys to assess bypass impacts. Survey data are costly to obtain and subject to bias. Furthermore, it is difficult, and sometimes impossible, to get data for the pre-bypass period after the fact. People move and businesses close, change owners, or don't keep adequate records. The unavailability of reliable, quantitative data poses a major obstacle for analyzing bypass impacts on small communities. Consequently, studies of bypass impacts on small town business districts are limited in number and scope.

The local option sales tax data offer a reliable, annual source of sales tax data for bypassed and non-bypassed communities of all sizes. Few other bypass studies have exploited this data. A notable exception is the study of the impact of I-35 on towns in North Central Oklahoma (Sanders, 1973). The ability to exploit the local sales tax data is a central part of our approach to analyzing bypass impacts on small town business districts.

THE IMPORTANCE OF NON-HIGHWAY RELATED FACTORS

A common theme in literature focusing on small, rural communities is the importance of ongoing economic and social change that has changed the face of rural America. (Freshwater, 1999; Fuguitt et al., 1989). Notably, the diminishing role of small town business districts may be related to improved transportation via lower transportation costs in general rather than the realignment of routes (bypasses) in particular. One important consideration is the impact of large discount chain stores and franchise restaurants in contributing to the demise of traditional downtown shopping districts. The lesson from the rural development research is that the impact of a bypass must be taken as just one of the many forces influencing economic performance in small communities.

The economic growth in a small rural community may deviate significantly from that of nearby urban areas. With lower profit margins and smaller volumes, rural business may be more susceptible to government regulations and industry reorganizations than their more urban counterparts. Of particular concern are environmental regulations and fundamental market changes affecting gasoline retailers. As discussed below, such changes have had profound impacts on small gasoline retailers starting in the mid 1980's.

Environmental Regulations

Underground storage tank systems (USTs), such as those used by convenience stores and gas service stations, are regulated by the Environmental Protection Agency (EPA). Prior to the mid-1980's most USTs were made of bare steel making them prone to leakage. The greatest threats from leaks are ground water contamination and potential for fires or explosions. In 1984, Congress required the EPA to develop and implement requirements for USTs and banned the installation of unprotected steel tanks and piping beginning in 1985. The timeline for the implementation of the EPA UST regulations is shown in Table 2.2. Details of the regulations regarding USTs can be found in "Musts for USTs: A Summary of Federal Regulations for Underground Storage Tank Systems," United States Environmental Protection Agency, EPA 510-K-95-002, July 1995.

In 1986, Congress directed the EPA to also develop financial responsibility regulations for owners and operators of USTs. Numerous options are available for meeting financial responsibility regulations, including insurance, guarantees, surety bonds, letters of credit, third-party trust funds or participation in state financial assurance funds. As shown in Table 2.3, these regulations became effective for biggest operations first and the smallest ones last.

Table 2.2 UST Regulations

Compliance Date	*UST Requirements*
December 1988	All new USTs must meet the new federal regulations regarding spill, overfill and corrosion protection;
December 1993	All USTs must have leak detection;
December 1998	All tanks must be compliant with new federal regulations. Non-compliant tanks must be upgraded, removed, or closed in place. The regulations allow for the temporary closure of noncompliant USTs meeting certain requirements for a period of 12 months.

Table 2.3 UST Financial Compliance Deadlines

Compliance Deadline	**Group Designation by number of tanks**
January 1989	1,000 or more tanks
October 1989	100-999 tanks
April 1991	13-99 tanks
December 1993	1-12 tanks

Generally, most of the compliance costs come from meeting the technical requirements. While estimates can vary significantly depending on site-specific factors, a modest rough estimate for upgrading a 3-tank facility would be about $12,700. Removing existing USTs and replacing them with new tanks might run between $80,000 and $100,000 and involve a few weeks of downtime. The EPA estimates that permanently closing the facility could cost upwards of $5,000 (EPA, 1999). The cost of meeting the financial responsibility requirements could range from about $1,000 to $1,500 a year for a facility with three to five compliant tanks. Those participating in a state financial fund might pay tank fees from $100 to $250 per tank annually (EPA, 1998).

The expected impact of the UST regulations is the closure of some retail motor gas outlets, particularly the smaller, low-volume units. Expected impacts are likely to correspond to the timing of compliance deadlines. The first compliance deadlines for small retailers were in 1993 and the most stringent ones in 1998. According to the National Petroleum News (NPN) annual station count survey, there was a sharper drop-off in the number of stations from 1997 to 1998 compared with previous years. Furthermore, the UST regulations are expected to contribute to closing of many low-volume units past the 1998 deadline due to continued enforcement and the resulting inspections (NPN, 2000).

The influence of the UST regulations was observed in Oklahoma as well. According to the Oklahoma Corporation Commission (OCC), there was a 28 percent reduction in the number of in-use regulated tanks in the state from July 1998 to February 1, 1999 as a result of owners' decision to close rather than upgrade tanks. The number of retail motor fuel outlets declined by 8.5 percent over the year as well. The records do not indicate how many of these closures were related to the new regulations (OCC, 1999).

Reorganization in Gas & Oil Industry

Gas station dealers are being "swept up in an oil-industry sea change which, while rooted in technology and economics, is leaving its mark on the social fabric of Main Street America by further minimizing the role Mom-and-Pop service stations play in their communities." (Boston Globe, 2000). Increased competition in the retail gas market has come from convenience-store gas stations operated by independent distributors and from supermarkets and discount stores selling gas from their parking lots. Faced with increased competition for retail gas sales and a resulting flat growth in gas sales, oil companies are restructuring their marketing strategies.

Gas is no longer seen as a profit center, but as a means to attract customers to sell other retail items. Shell Oil Company, for example, has been the most aggressive in its restructuring attempts. Dealers who lease stations from oil companies are being hit with substantial increases in rents caused by the reduction and elimination of rebates from the leasing companies and in some cases recalculation of rents based on new property appraisals. While the company argues that it is only responding to competitive pressure, the result of the changes is that many dealers are forced to turn over the keys to the company. In response, dealers are claiming unfair business practices and in many cases are suing the company and its marketing affiliates.

Evidence of changes in the gas service station business is shown in Table 2.4. While the total number of employees and payroll increased from 1990 to 1997, payroll increases outpaced employment increases. In contrast, the total number of establishments fell over the period. The tendency toward larger gas retail outlets is demonstrated by the increase in establishments in the 20-99 category by 43.2 percent and a corresponding decrease in the smallest size establishments by 4 percent. The pattern for Oklahoma is similar to that seen in the United States as a whole.

The net impact of the reorganization in the industry is a tendency for larger gas stations to replace small independent operations. Smaller operators are squeezed out not only from competition from larger operators, but also from oil-industry-turned-convenience-store operators. These factors are extremely significant for small town retailers who compete with the new type of gas station/convenience store outlets.

Table 2.4 Gasoline Service Station (SIC 5540) Summary for Oklahoma, 1990-1997

				Establishments by Employment Size Category					
	Total	Payroll	Total	Number			Percentage		
Year	Emp.	($1000s)	Estabs.	1-19	20-99	100-499	1-19	20-99	100-499
1990	8,156	79,599	1,521	1,482	37	2	97.44	2.43	0.13
1991	8,032	84,195	1,486	1,453	32	1	97.78	2.15	0.07
1992	7,941	83,407	1,438	1,411	26	1	98.12	1.81	0.07
1993	8,756	93,991	1,528	1,500	26	2	98.17	1.70	0.13
1994	8,861	100,394	1,489	1,458	29	2	97.92	1.95	0.13
1995	8,905	102,719	1,441	1,405	34	2	97.50	2.36	0.14
1996	8,773	109,057	1,424	1,383	38	3	97.12	2.67	0.21
1997	10,081	120,323	1,478	1,422	53	3	96.21	3.59	0.20
Change 1990-1997	23.6%	51.2%	-2.8%	-4.0%	43.2%	50.0%			

Source: U.S. Census, County Business Patterns

METHODS OF ANALYSIS IN BYPASS STUDIES

Measuring the overall economic impact of a bypass project requires a comparison of a community's observed growth after the fact with the unobserved counterfactual--how much the community would have grown without the bypass. The standard methods for representing the counterfactual growth include quasi-experimental techniques and econometric analysis. Most studies of bypass impacts on small communities rely on quasi-experimental methods. Studies of larger communities also employ time-series, cross sectional regression techniques. Some studies conduct hybrid analysis using matching and econometric analysis.

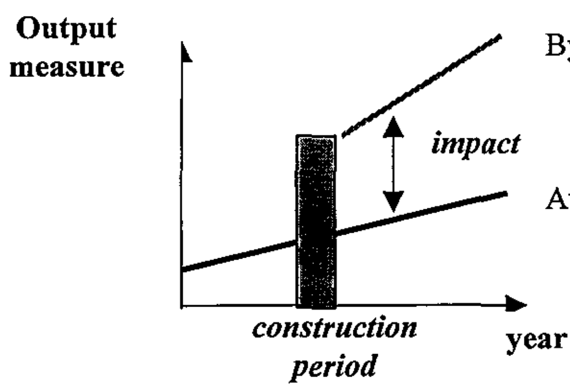
Quasi-Experimental Control Group Methods

Quasi-experimental control group (QECG) methods are often used to measure the impact of highways and other public investments. For example, Rephann and Isserman (1994) analyze new interstate highways in rural areas; Broder et al. (1992) measure the impacts of developmental highways in rural Georgia; Henry et al. (1991) investigate four lane highway investments in rural South Carolina; and Andersen et al. (1992) use QECG methods as well as other approaches to analyze the impact of bypasses in particular. QECG methods are intuitively appealing, have low data requirements, and are easy to apply.

The QECG method simulates a laboratory experiment *ex post*. Each bypass community (the treatment) is matched to a place or places that are very similar with respect to important factors (the control group). The control group serves as the baseline forecast for the place that was bypassed. As demonstrated in Figure 2.1, the impact of the treatment is estimated as the divergence in the outcome measure in the post-treatment period. The impact can be measured as the difference between the treatment and comparison group at a post-treatment point or as the divergence in the trends post-treatment period.

QECG approaches can take many forms. Some studies match one control for each treatment. This is sometimes called the *twins-studies* or *matched pairs* approach. It is useful when there are many treatments and many controls that can be pooled for analysis. Another approach is the case study method where multiple controls are selected for a particular treatment. This is appropriate when the goal is to analyze the impacts of a particular policy treatment (say the impacts of a particular bypass project). It is also possible to combine the approaches by using multiple treatments, each matched to multiple controls, in a pooled analysis (the many-to-many approach). This approach is useful when there are many treatments and potential controls to match. Reed and Rogers (2000) discuss the implications of allowing the controls to be duplicated for multiple treatments.

Figure 2.1 Quasi-Experimental Approach



In general, QECG results must be interpreted cautiously. While normality assumptions can be addressed by employing nonparametric methods, a small sample size is still problematic. Concerns about how well the control group forecasts the counterfactual for the bypassed community persist as well. In particular, a similar growth pattern in the pre-treatment period does not necessarily imply that the control and treatment towns would continue to experience the same growth in the post-treatment period in the absence of the treatment (Wojan and Bailey, 1998). Another criticism is that once close matches are selected, the QECG analysis does not control for the closeness of the matches or other factors that may be important determinants of growth. There are, however, ways to adjust for the closeness of the match and include influences of explanatory variables in the QECG approach (Reed and Rogers, 2000).

Difference-In-Difference Approach

The difference-in-difference (DD) approach is often used to test the treatment impacts of policy changes. Andersen et al. (1993) used this approach among others to investigate highway bypass impacts in Texas. The basic approach involves a cross-section, time series specification with a dummy variable indicating the post-treatment impact on the treated community. The regression estimates bypass impacts by examining both highway-related factors and non-highway-related factors.

Pooling the data to generate an observation for each place for each year in the observation period yields more data points from which to draw inferences and makes it possible to control for factors that may be important determinants of growth. Furthermore, since important factors can be included in the model, the reliability of the impact estimates are not as dependent on the closeness of matches compared with QECG models where only the differences in means are analyzed.

The DD approach is often used with a matched-sample design. In this case, matching techniques are used to generate the sample. Generally, a non-treatment observation is found for each treatment observation. The general goal is to construct a sample in which the means and distributions of the explanatory variables are very similar for the control and treatment groups. However, unlike the QECG approach, the information about the match selection is not incorporated into the regression estimation. The main difference in the methods lies in the computation of the standard errors used to test treatment impacts. See Angrist and Krueger (1999) for a full discussion.

As discussed in Reed and Rogers (2000), a problem with typical regression analysis is misspecification bias. In particular, if the form of the regression equation predicting the outcome variable is incorrectly specified (e.g., it is specified as linear when the true form is non-linear) the estimates of treatment impact will be biased. Given that we have poor knowledge about economic growth process, misspecification is potentially a big concern when estimating bypass impacts.

The ability to apply cross-section, time series methods when analyzing very small communities is limited by the unavailability of time-series data for potentially important explanatory variables. Annual data for small communities are sparse. While it is possible to include lagged values of some variables in the model, doing so precludes the use of the city dummy variables. Some of the data limitations can be overcome, however, by using a series of dummy variables to capture city-specific fixed effects. This fixed effect is useful for capturing unobserved factors that remain relatively constant over the sample period.

Anecdotal Methods

Bypass projects may impact the distribution as well as overall growth of a traditional business district. The bypass route may completely divert traffic from the traditional business districts. New routes do not necessarily fall within the local government jurisdiction. In some cases, communities reacted to bypasses by annexing areas surrounding the new routes. Consequently, the distribution of activity change *within* a local jurisdiction while the overall level of sales remains the same. Such impacts will not be apparent using aggregate municipal level data (and even less so using county-level data).

Qualitative methods are useful for supplementing quantitative analysis when there is concern about city-scale effects. Methods typically employed include on-site interviews, photographs (archival as well as new shots), and historical records. These methods are particularly useful for determining the impact of a bypass on vacancies, types of businesses, numbers of businesses, changes of business types, and the overall appearance of areas in the downtown areas and along the bypass route.

SUMMARY

Highway bypasses can affect communities in a variety of ways. The impacts differ according to community features, including size, location, and industry base. While identifying important factors, the literature is inconclusive about the expected overall impact of bypass construction, particular for very small communities.

Quantifying bypass impacts on local economies is complex given the interplay of various socio-economic forces. A variety of methods have been used to analyze bypass impacts including quasi-experimental control group (QECG) and econometric cross-section, time series (DD) methods. Despite the obvious shortcomings there are few empirical alternatives to standard quasi-experimental approaches when cross-sectional, time series data are not available. The limited availability of sub-county level data hinders attempts to measure bypass impacts on small town business districts using standard econometric approaches.

The background review identifies factors and methods relevant for this study--analyzing bypass impacts of proposed US 70 bypasses in Oklahoma. The proposed projects involve communities with fewer than 15,000 people. Most involve very small communities of fewer than 1,500. The literature reveals appropriate methodologies and factors to employ when analyzing bypass impacts on very small communities.

CHAPTER 3. DATA AND METHODOLOGY

The target of our study is the impact of highway bypasses on small town business districts. Aggregate data are used to determine whether a bypass highway stimulated or inhibited economic growth in a city. The main outcome variable is the sales tax base, which provides a measure of overall economic activity at the community level. Unlike other relevant outcome measures, these data are available yearly for all communities that impose local sales taxes in Oklahoma, even very small communities. It allows for application of standard quasi-experimental control group (QECG) and econometric analysis (DD) of bypass impacts.

Our general approach is to employ QECG methods by finding comparison groups for each treatment. The process for conducting a typical QECG analysis involves four steps: (1) select the treatment for the study (i.e., bypass impacts); (2) identify treatment places (i.e., past bypass projects); (3) match treatments with one or more control places; and (4) perform post-treatment comparison between the treatment and the control groups.

We develop criteria relevant to our project focus for selecting past bypasses to analyze. Next we develop matching criteria to find control towns to use in the analysis. Finally we analyze the impacts using a standard QECG analysis as well as a DD approach. The DD approach analysis differs from QECG only in the final step. That is, we will estimate the econometric model using the treatment and control cities selected in the QECG analysis.

A second focus of our study is the impact of bypasses on the distribution of economic activity within communities. Anecdotal methods employed include interviews, photographs (archival as well as new shots), and historical records to determine the impact of bypasses on vacancies, types of businesses, numbers of businesses, changes of business types, and overall appearance of areas in downtown areas and along bypass routes. The anecdotal methodology is documented so that future bypasses can be evaluated in a similar fashion.

DATA COLLECTION AND SOURCES

This section documents the data sources used in the project. The sources as well as details about the scope of relevant data are discussed. Notably, some data were investigated, but not used in the direct analysis due to availability or reliability concerns. The project CD-ROM includes all data files created for the project in a directory labeled "DATA". The names of the files containing each set of data are documented below.

Local Option Sales Tax Data

Local option tax data provide a very practical way of overcoming data limitations when analyzing economies of small communities. As discussed in Mackey (1997) state legislatures authorize local option taxes at the county, municipal or special district level. A local option sales tax allows a municipality to tax qualified sales (sales subject to sales tax) occurring its jurisdiction. In Oklahoma, sales taxes (state and local) are levied as a percentage of gross receipts from the sale or rental of tangible personal property and from the furnishing of services. While this generally includes retail sales, some business purchases of non-retail items are included in the tax base. There are also exemptions for motor vehicle sales, agricultural sales,

sales subject to the Federal Food Stamp exemption, sales to exempt organizations, and non-taxable services (labor). A municipality's sales tax base can be computed by dividing the tax collections by the tax rate.

The local option sales tax data offer a reliable, annual source of data on sales tax base for bypassed and non-bypassed communities of all sizes. A particular benefit of the data is the ability to control for any potential relationship between a community's decision to impose local option sales taxes with economic growth prospects by analyzing impacts only for those that impose the tax. While there are some issues concerning the scope of the tax base (i.e., it excludes gasoline sales and labor on car repairs) the data provides an invaluable means of quantitatively tracking a local economy, particularly the growth in a small business district. The existence of such data makes our methodological approach possible.

In 1966, thirteen cities implemented the first local sales taxes in Oklahoma. Other municipalities followed suit in later years. By 1998, 486 localities imposed the tax in the State. In Oklahoma, as in most states allowing local option sales taxes, state and local tax collections are remitted to the state. The local portion is subsequently returned to the municipality of collection. The Oklahoma Tax Commission reports the local tax data in annual reports, *State Payments to Local Governments.* In recent years an appendix table, "City Sales Tax Collections Returned to Cities and Towns," provides the rates and fiscal year total tax collections. In cases where a jurisdiction changed rates during the year, collections associated with both rates are listed. To compute the sales tax base in years with tax changes, the tax collections are divided by the associated rate and added together.

For the purpose of this study as well as future analyses, we have constructed a database with a complete record of the sales tax base for all local jurisdictions in Oklahoma from 1966 to 1998. The database is included in the project CD-ROM in a file called *taxbase.xls.* This file can be updated as new tax collections data become available. Currently, the Oklahoma Tax Commission reports the rates for all communities and provides a summary of all the municipalities that changed rates during the year on their web site *http://www.oktax.state.ok.us/salesuse.html#New Rates and Effective Dates.*

Population Data

The United States Census provides historical population data for the census years from 1890 through 1990 for each state in a single file available on the Census web site. This file provides census estimates for city population by county of residence. It is available on the project CD-ROM in a file called *okhistpop.xls.* The 1990 population data are also listed on the Oklahoma Department of Transportation 1999-2000 Official State Map.

Population estimates for 1990-1998 were prepared by the Oklahoma State Data Center, Oklahoma Department of Commerce for the U.S. Bureau of the Census. The data are saved on the project CD-ROM in a file called *okcitypop90-98.xls.* While it is possible to use the yearly figures for analysis of bypasses in recent years (i.e., Stonewall), it is not clear how reliable the data are, particularly for very small communities. Furthermore, the population estimates are not likely to change much from year to year for non-census years. Consequently, we rely mostly on the census year estimates for our analysis.

General City Information

The Oklahoma Department of Commerce (ODOC) maintains an on-line database with community profiles for all but the very smallest cities in the state. The profiles provide a variety of data, including population, racial composition, government administrative and tax structure, utility providers, transportation systems, accommodations, medical facilities, recreation facilities and attractions, local development organizations, employment, and major employers. The database provides an excellent starting point for assessing location factors for bypass and comparison communities. The profiles are available through the community profiles link at the ODOC website at http://domino1.odoc.state.ok.us/index.html.

Highway Bypass Information

ODOT provided system route maps detailing the configurations of the relevant bypass projects in the state. They also provided information on available let and completion dates as available. This information was essential for setting up the appropriate data for the before and after analysis. In particular, we use the let dates as guides to when the bypass construction started. Information about proposed US 70 bypasses was available in the *US 70 Feasibility Study* conducted for ODOT in 1997.

Traffic Volumes

Traffic volumes on access routes are important factors when considering bypass impacts. It is important for use as matching criteria when constructing control groups as well as for predicting impacts on business activity for cities of different size. Of particular value are before and after volumes for a location in the central business district. While the Oklahoma Department of Transportation provided various data concerning traffic volumes, the ability to incorporate these data in our analysis was very limited.

Our ability to incorporate traffic volume data was limited by missing or incomplete records, insufficient documentation of count locations, and reliability concerns. For example, city count data were not available for years prior to 1977. Maps and locations were provided for years 1977 to 1994 and for 1998. This data covered mostly urban locations. Consequently, the data were available for some, but not all, relevant cities used in the analysis.

County maps and average weekday daily traffic counts for 1963 to 1993 and later years were also made available. The county data was also problematic for our purposes. One issue is that the data were smoothed over the years. This reduces the amount of information provided by yearly data. Also, given that the maps were county locations, there were not sufficient location data for smaller, rural places. Generally it was possible to identify locations on the approaches for relevant cities. However, data for central business district locations were limited for the smaller cities used in the analysis. Furthermore, count locations seemed to change over time creating discontinuities in the data. From a practical standpoint, it was very tedious and time consuming to use the count maps to find the appropriate count location data. The photocopies of the count location maps were not clear. Consequently, counter locations had to be hand copied from originals to large size county maps to conduct our analysis.

The most useful maps for our purposes were the semi-annual, annual average daily traffic volume maps. These were provided for the years from 1952 onward. From these statewide maps, it was possible to investigate traffic flows for the approach routes for the cities in our study. Using the state maps, it was easy to generate time-series data for relevant cities. However, the data were limited in scope since there were few counters located in central business districts for the smaller, rural cities. Furthermore, it was not possible to analyze changes in flows from bypassed routes to new routes in a consistent manner. In some cases, counter locations were moved from old routes (bypassed) routes to new routes. In other cases, the counter locations were sufficiently far from the city so as to capture traffic on both old and new routes.

Due to the limitations of this data, it was used only in the matching process and not for assessing more general impacts of highway bypasses.

Underground Storage Tank Information

All underground storage tanks in the state are required to be registered with the Oklahoma Corporation Commission (OCC). The Petroleum Storage Tank Division of OCC maintains a database with summary information for every underground storage tank in the state. The data include tank location, owner name and address, tank installation dates, capacity, compliance status with EPA regulations, closing and removal dates.

These underground storage tank data provide a practical way to track activity of gasoline retailers in a given city. The data were particularly useful for investigating the timing of tank closures relative to bypass construction and effective compliance dates of the EPA UST regulations. They were also helpful for supplementing survey information and verifying information provided by individuals in bypass cities about the timing of station closures. The storage tank data assembled for the project are available on the project CD-ROM in a file called *storagetank.xls*.

Location and Proximity Features

The Oklahoma Department of Transportation Official State Maps were extremely valuable for identifying location specific features of bypassed and comparison cities. The maps identify such factors as county seat, universities, airports, proximity to toll roads and interstates, tourism activity, and road infrastructure. Consequently, the maps were used as a general guide for developing matching criteria and for selecting comparison cities.

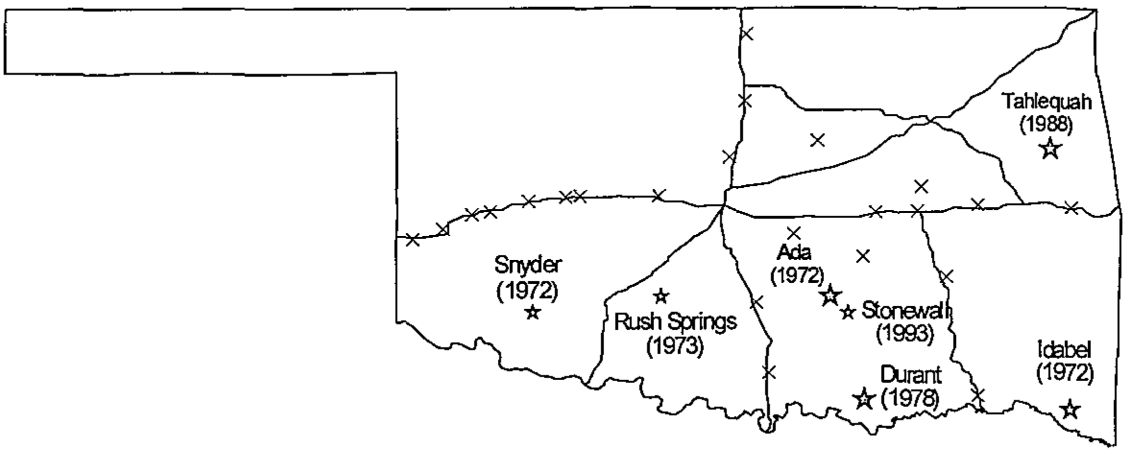
METHODOLOGY FOR ASSESSING BYPASS IMPACTS

Identifying Bypass Case Studies

Figure 3.1 identifies the completed bypass projects in Oklahoma identified by ODOT in the Request For Proposal regarding this project. The cities marked with an X are eliminated as potential case studies because they do not meet the project criteria. Table 3.1 identifies the criteria used and the projects eliminated for each reason. The criteria reflect our primary focus--the predicted impact of proposed US 70 bypass projects. Consequently, bypasses of interstates and toll roads are not appropriate. In addition, several bypasses were built prior to collection of the city sales taxes making them unusable for our analysis. Although, the Cushing project was relatively recent, it did not divert traffic from the main business district. Consequently, the

Cushing project is representative of the proposed bypasses of US 70. The stars in Figure 3.1 identify the cities with bypasses that met our basic criteria. These are grouped by population size where the smallest cities are marked with the smallest markers, the medium sized cities with medium markers, and the largest cities with the largest markers.

Figure 3.1 Oklahoma Bypass Projects



X - Bypass eliminated from the study
☆ - Case study bypass in a small city
☆ - Bypass of a medium city considered for analysis
☆ - Bypass of a large city considered for analysis

Table 3.2 identifies three small bypassed cities that meet our case study selection criteria. These cities are similar in size and other features to Boswell, Soper, Valliant, and Kingston where US 70 bypasses are proposed. Accordingly, the focus of our study will be on developing a methodology appropriate for analyzing impacts of these bypasses.

Idabel, with a 1990 population of almost 7,000, is the only medium-sized bypassed city that meets our criteria. The Idabel bypass, completed in 1970, diverted US 70 traffic around the south edge of the city. Idabel, however, doesn't provide a good case for our study for several reasons. First, local option sales taxes were not collected in Idabel until 1969. Thus, city tax data from the pre-bypass construction period are not available. Second, the bypass happened so long ago that there is little reliable knowledge about impacts on the business district. A preliminary site visit revealed that few individuals had good memories about the events surrounding the bypass construction. In addition, there are few cities with similar characteristics (particularly population) available to use as comparison cities. The size of the city and the business district also increases the complexity of analyzing the impacts on distribution of activity within the city. While our site visit did show that some travel-related businesses were located around the intersections of the old routes and the bypass routes, the timing and reasons for these business location decisions are difficult to determine. Further, the Idabel bypass is not representative of the proposed US 70 bypasses since it is much larger than Madill (population of

3,000) and smaller than Durant (12,000). Thus, analyzing the Idabel bypasses has limited value for the particular focus of this study.

Table 3.1 Oklahoma Bypasses Excluded From Analysis

Exclusion Reason	*City*	*County*	*Bypass Year*
Bypass located on an Interstate			
	Ardmore	Carter	1970
	Blackwell	Kay	1963
	Canute	Washita	1967
	Checotah	McIntosh	1974
	Clinton	Custer	1971
	El Reno	Canadian	1969
	Elk City	Beckham	1971
	Erick	Beckham	1976
	Guthrie	Logan	1962
	Henryetta	Okmulgee	1965
	Hydro	Blaine	1967
	Okemah	Okfuskee	1965
	Pauls Valley	Garvin	1971
	Perry	Noble	1963
	Sallisaw	Sequoyah	1969
	Sayre	Beckham	1971
	Weatherford	Custer	1971
Bypass is linked to toll road			
	Hugo	Choctaw	1968
Bypass didn't divert traffic from business district			
	Cushing	Payne	1991
Bypass was constructed prior to collection of city sales taxes			
	Holdenville	Hughes	1965
	Okmulgee	Okmulgee	1968
	McAlester	Pittsburg	1958
	Tecumseh	Pottawatomie	1965

Table 3.2 Case Studies of Small Cities with Bypasses

City	*County*	*Population 1990*	*Let Date*	*Completion Date*	*Route*
Rush Springs	Grady	1,381	3/70	8/72	US81
Snyder	Kiowa	1,671	5/69 na	10/70 5/72	US62
Stonewall	Pontotoc	519	3/92	7/93	SH3

Table 3.3 identifies the largest bypassed cities in Oklahoma meeting our case study selection criteria. Bypasses of the larger cities generally connect two or more main routes that intersect in the city. The routes are rerouted to outer edge of the city. They are typically done in sections and evolve into complete loops around the city.

Table 3.3: Potential Case Studies of Large Cities with Bypasses

City	*County*	*Population 1990*	*Let Date*	*Completion Date*	*Routes*
Durant-1	Bryan	11,718	Na	5/66	US69 & US75
Durant-2			9/71	7/73	US69 & US75
Tahlequah-1	Cherokee	9,708	5/83	9/84	SH51
Tahlequah-2			9/86	5/88	US62 & SH10
Tahlequah-3			3/91	8/20/93	SH82
Ada-1	Pontotoc	14,347	Na	1958	SH3-99
Ada-2			Na	5/23/69	SH1
Ada-3			3/77	4/16/80	SH3W

We do not attempt to estimate the impact of the bypasses on the larger cities in this study. These cities make poor cases for the same reasons as discussed for Idabel. In fact, size is more of a limiting factor for analyzing the larger cities since there are very few non-bypassed cities with similar features to use as controls. In addition, the multiple bypass projects in a city further limits the ability to test for economic impacts, particularly over a longer period of time. Of the proposed US 70 bypasses presented in Table 1.1, Durant is the only large city. The proposed bypass will connect previously bypassed routes. Finally, while particular aspects of realignment decisions may generate concerns for local residents and business owners, proposed bypasses of larger cities are generally accepted as a necessary device for reducing congestion and improving safety. Accordingly, we focus on the bypasses of the smallest cities for our analysis.

Matching Procedure and General Criteria

Finding comparison cities for each bypass project is a central part of our methodology. We develop general criteria to use in the selection procedure. To the extent the data availability allows, the criteria are based on factors identified as important in the literature. In addition, cities were not considered as potential matches if they did not the meet the criteria for selecting bypass case studies discussed in Table 3.1 (i.e., were located on toll-roads or interstates, etc.) The basic criteria used to select comparison cities are listed in Table 3.4.

For each case study we identified all the non-bypassed cities that were similar with respect to the matching criteria. The discrete categories such as being a county seat or having a university involved exact matching. The remaining criteria required specifying an allowable level of closeness. For example, geographic location was generally limited to cities in the same region of the state using a case-specific definition of region. In addition, exact population and sales tax base criteria were also specific to the bypass under consideration.

The algorithm used for identifying matches was basic but thorough. We simply looked at a state map and considered every city on a case-by-case basis, starting with the bypass city and working outward within the relevant region. Given the limited number of matches and the limited available data, this method was well suited for our purposes.

Table 3.4 Matching Criteria

Population, level and growth trend
Sales tax base, level and growth trend
Number of US routes and state highways
Traffic volume and traffic volume trends on approach routes
Geographic location
Special Features: University Military base County seat Rural/metro area

Quasi-Experimental Control Group (QECG) Analysis

After selecting the control group, a QECG analysis was performed. Following the typical QECG approach, *B* in Equation (1) measures the impact of the bypass on City T,

$$(1)\quad Y_T - \Sigma Y_C/N = B + e,\ e \sim N(0, \sigma^2)$$

where *Y* represents the log of the growth rate in the sales tax base in the bypassed town (*T*) and control towns (*C*), and *N* is the number of places in the control group. The impacts can be estimated for single or multi-year periods following the bypass. The impact can be estimated by performing a difference in population means test, assuming normality and common variance between the treatment and control groups.

The quasi-experimental approach can be incorporated in a standard cross-section regression specification. Broder et al. (1992), for example, use the following specification:

$$(2)\quad Y_{Ti} = constant + B_1 Y_{Ci} + B_2 BYPASS_i + e_i,\ e \sim N(0, \sigma^2)$$

where Y_{Ti} and Y_{Ci} are the values of the economic outcome variable for the treatment and control place, respectively, $BYPASS_i$ is the bypass impact dummy that equals 1 after the bypass is opened, and e_i is the error term. The bypass and control cities are assumed to come from the same population, again given normality and a well-behaved error structure. The QECG specification in (1) is a special case of the model in equation (2). Assuming the constant equals zero and B_1 equals one, the estimated impacts in both equations would be the same (i.e., B_2=B).

Difference-in-Difference (DD) Estimation

The bypass impact can also be estimating by pooling the observations for the treatment and control cities in a cross-section, time series regression. A typical DD specification takes the following form:

$$(3) \qquad Y_{it} = B_1 BYPASS_{it} + B_2 R_t + B_3 C_i + B_4 X_{it} + e_{it},$$

where Y_{it} is a measure of economic activity for town *i* in year *t*, $BYPASS_i$ is a dummy variable that equals one if the observation is for the bypassed community in a year after the completion of the bypass, *R* is a vector of time dummy variables, *C* is a vector of city dummy variables, X_{it} are other explanatory variables, and t covers a specified number of years before and after the bypass. The error term, e_i, is assumed to be normally and independently distributed. The estimated coefficient for B_1 measures the bypass impact. Note that the measure of economic activity can include the level of sales tax base (in logs) or annual changes in the log of the sales tax base. Standard hypothesis testing methods are used to test for the significance of the bypass impacts.

In this model, cross-section, time series data are constructed for a period that spans several years before and after the bypass construction period. That is, there is an observation for each treatment and control city for each year of data. Unfortunately, reliable annual data for explanatory variables are not available for very small communities. Hence, our analysis relies on the matching and the city fixed effects to pick up the impacts of non-bypass factors. Note that the QECG framework retains the matches while the DD method uses a matched sample (the treatments and controls are pooled in the regression).

Anecdotal Methods

Site visits were conducted to evaluate bypass impacts within a community. The basic tools employed were personal interviews, photographs, and a business inventory. We attempted to inventory all the locations in the central business district of the bypassed city. The inventory involved interviewing individuals from various establishments about economic activity in the town before and after the bypass. Some individuals were able to provide information about other establishments and locations along the bypassed route. Table 3.5 lists the survey items requested during the interviews. The survey form used to conduct interviews is available on the project CD-ROM in a file called *survey.doc*. The data from the survey were used to make an inventory of the town's businesses and to track changes in business activities.

Table 3.5 Bypass Project Inventory Survey

1. Location, establishment name, contact person and phone number
2. Description of current establishment type (retail/service/private residence)
3. History of operation including first year of operation at current location, any previous locations, and reasons for relocating
4. History of location including type of activity, years of operation, reasons for change
5. If establishment is at a location on the bypassed route and was in operation prior to the bypass completion, what was the impact of the bypass on the establishment? (Collect supplemental materials if available, receipts, profit records, etc.)
6. If establishment is on new route, what was year of startup and previous location?

We also contacted key individuals in the town, including long-time residents, business leaders, local bankers, local newspaper editors/reporters, and employees of local chambers of commerce. These individuals were able to provide useful information, including leads about other individuals who were likely to have information about the town. Individuals who were interviewed were asked to sign a consent form. A copy of the release is available on the Project CD-ROM in a file called *waiver.doc*.

Another part of the anecdotal methodology involved taking pictures of the bypassed and control cities. The pictures were taken on weekdays. The focus was on the central business districts as well as the intersections of the business routes with the new highway configurations. Some photographs were also taken of surrounding residential areas. The photographs provide a visual account of business activity and traffic volume in the cities. All photographs taken during the project are available on the project CD-ROM in the *PICTURES* directory. There is a separate subdirectory for each city photographed, including Ada, Asher, Byars, Checotah, Erick, Locust Grove, Rush Springs, Roff, Snyder, Stonewall, Tahlequah. Some of the subdirectories contain an *index.doc* file that describes the location of the photographs.

SUMMARY

This chapter provides details about the data used in the project, including collection sources. The hallmark source of data is the city sales tax collections, which provide an annual measure of the business activity in the city jurisdiction. The chapter then outlines the basic approach developed for analyzing bypass impacts: identify past bypasses to use as case studies; develop a procedure for finding comparison cities to use as a baseline of post-bypass growth; estimate impacts using QECG and DD approaches; and supplement with anecdotal analysis. This project focuses on estimating economic impacts of bypasses on small communities that are similar to cities along US 70 which are scheduled for bypasses. The Stonewall, Rush Springs and Snyder bypass projects are identified as candidates for the case study analysis.

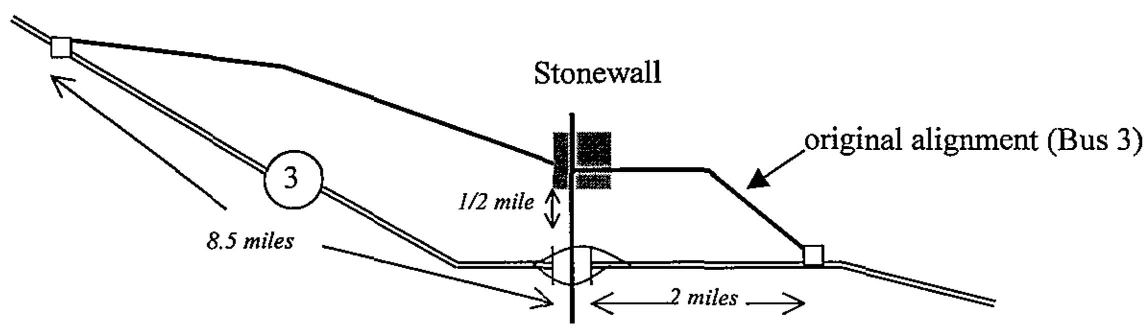
CHAPTER 4. STONEWALL BYPASS DEMONSTRATION

This chapter provides a demonstration of our approach using the Stonewall bypass completed in 1993. An article based on this analysis has been published in a special edition on Transportation Economics in the Review of Urban and Regional Development Studies (Rogers and Marshment, 2000). This summary follows the published article closely.

As shown in Table 3.2, the Stonewall bypass was one of three non-interstate bypass projects involving very small towns (towns with fewer than 2,500 people) in Oklahoma. Stonewall provides a good demonstration because of its recentness, as well as its similarity to the four small cities along US 70 that are scheduled for bypasses. It also provides a rare opportunity to analyze bypass impacts on a very small town.

Stonewall is located on State Highway 3 about 80 miles southeast of Oklahoma City. It is not the county seat, has no airport, and is not close to a metro area or to an interstate highway. Figure 4.1 shows the bypass configuration which involved a new, limited access, high capacity highway constructed around the city.

Figure 4.1 Stylized Map of Stonewall Bypass*



*Note: Map is not drawn to scale. All distances are approximations.

SELECTING CONTROL CITIES

The data set includes all comparable small, rural towns in the same region of the state as Stonewall. Comparable towns are those that meet the criteria described in Table 4.1. The criteria are meant to control for the observable factors likely to have important influences on economic growth. In addition to the fifteen towns that met all the criteria specified, we also included Stratford (with a 1990 population of 1,404) because it was so similar with regard to the other factors. Figure 4.2 shows the locations of the towns used in the analysis.

Three control groups were constructed for the Stonewall case study to investigate the trade-off between number of places included in a group and the closeness of the matches (Reed and Rogers, 2000). Larger control groups diminish the influence that an exogenous shock in a control community would have on estimated treatment impacts but also allow for more distant matches.

Table 4.1 Selection Criteria for Stonewall Bypass Analysis

1. Located south of I40, east of I35, and west of the Indian Nation Turnpike (see Figure 4);
2. Located in a non-metropolitan area;
3. Population in 1990 between 200 and 1000;
4. More than 5 miles from a toll road or interstate highway;
5. A maximum of two numbered highways passing through the town;
6. A minimum of 2 approaches on state highway system;
7. Not a county seat;
8. No airport; and
9. Town must collect local option retail sales tax in pre- and post-bypass period

Figure 4.2 Stonewall, Oklahoma and Control Towns

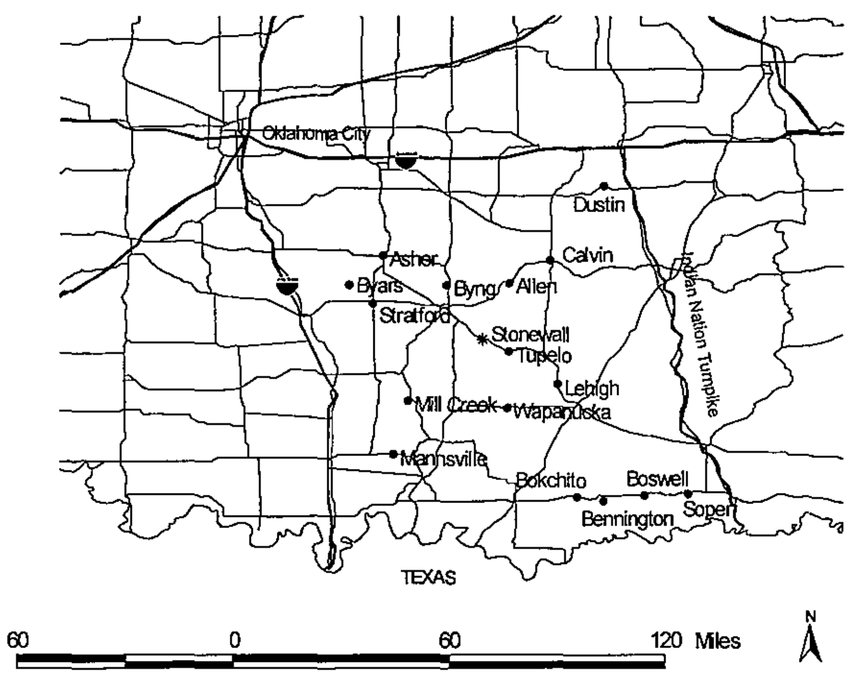


Table 4.2 describes the composition of the control groups. The first group, CG1, includes towns with the closest trend in retail sales in the pre-bypass period. The six "nearest neighbors" were selected by comparing the average differences in the growth rates in the sales tax base between each city and Stonewall for the 1990-93, 1991-93 and 1992-93 periods using 1993 as the base. The group was limited to six towns since there was a relatively large difference in this measure between the sixth and seventh closest places (.052 and .096 were the respective values). The second control group, CG2, expands the control group size to ten on the basis of the geographically closest places that met the general criteria. Four of the places in CG1 are also in CG2. The town of Stratford was included in CG1 and CG2 even though its population was over

the 1,000 threshold because of proximity and similarity to Stonewall in all other features. The third control group, CG3 includes the fifteen places satisfying all the selection criteria. CG3 includes places more distant from Stonewall than those in CG2, but excluded Stratford. The larger number of towns in this group reduces the likely influence of random external factors that may affect any given control town during the study period. This group also provides a broader comparison of Stonewall with other small towns in the same region of the state.

Table 4.2 Stonewall, Oklahoma and Control Cities

Town	*County*	*Control Group Designation*	*Population*			*Retail Sales ($1,000's)*		
			1980	*1990*	*Change*	*1990*	*1992*	*Change*
Allen	Pontotoc	1,2,3	914	860	-5.91%	3,029	3,004	-0.83%
Asher	Pottawatomie	1,2,3	659	449	-31.87%	1,231	1,377	11.86%
Bennington	Bryan	3	302	251	-16.89%	908	916	0.88%
Bokchito	Bryan	2,3	628	576	-8.28%	1,764	2,164	22.68%
Boswell	Choctaw	2,3	702	643	-8.40%	2,652	2,792	5.28%
Byars	Pottawatomie	3	353	263	-25.50%	206	234	13.59%
Byng	Pontotoc	2,3	833	755	-9.36%	1,081	1,081	0.00%
Calvin	Hughes	1,2,3	315	251	-20.32%	783	751	-4.09%
Dustin	Hughes	3	498	429	-13.86%	712	1,008	41.57%
Lehigh	Coal	1,3	284	303	6.69%	351	353	0.57%
Mannsville	Johnston	1,3	568	396	-30.28%	904	1,072	18.58%
Mill Creek	Johnston	2,3	431	336	-22.04%	602	878	45.85%
Soper	Choctaw	3	465	305	-34.41%	563	543	-3.55%
Stratford	Garvin	1,2	1459	1404	-3.77%	3,644	5,218	43.19%
Tupelo	Coal	2,3	542	323	-40.41%	644	537	-16.61%
Wapanucka	Johnston	2,3	472	402	-14.83%	916	1,224	33.62%
Control Group Averages								
Group 1 (n=6)			700	611	-12.76%	1,657	1,963	18.47%
Group 2 (n=10)			696	600	-13.75%	1,635	1,903	16.39%
Group 3 (n=15)			531	436	-17.88%	1,090	1,196	9.72%
Stonewall	Pontotoc		672	519	-22.77%	1,627	1,997	22.74%

Figure 4.3 shows the population trends for Stonewall and the averages of the three control groups. There was little change in the relative trends between the two groups in the post-treatment period. Figure 4.4 shows the trend in retail sales for Stonewall and its control group. Stonewall's trend suggests that, if anything, Stonewall was doing slightly worse compared with its control group in the period prior to construction of the bypass. Consequently the similar trend following the bypass would be consistent with a positive bypass impact.

Figure 4.3

Population: Stonewall and Control Groups

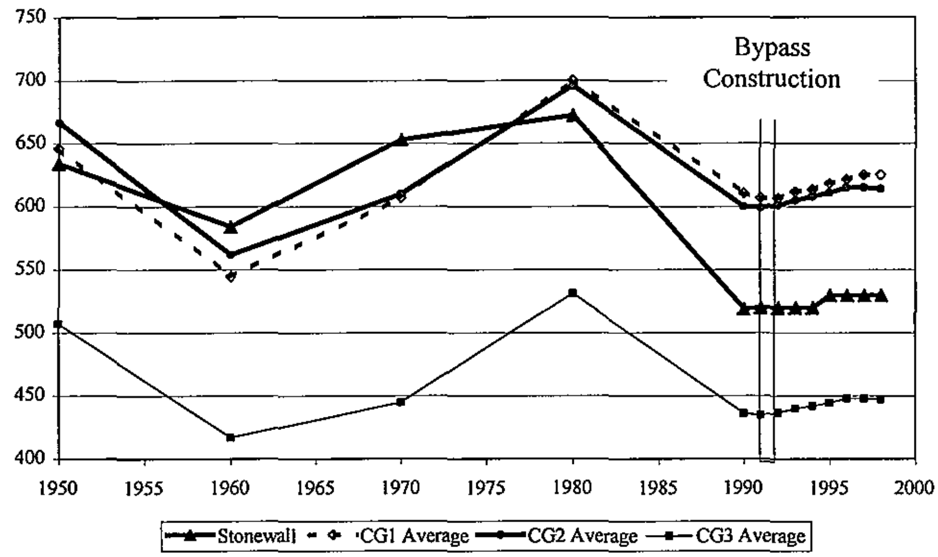
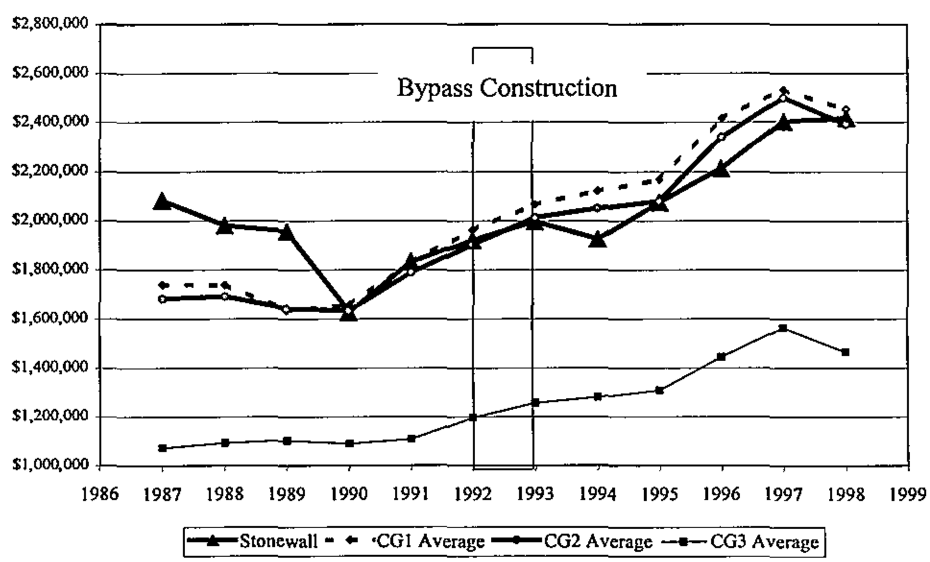


Figure 4.4

Retail Sales Tax Base: Stonewall & Control Groups



QUASI-EXPERIMENTAL ANALYSIS

As described in equation (1) we estimate the difference in log growth in the tax base, Y, between Stonewall (T) and the average of its control towns (C),

(1) $Y_T - \Sigma Y_C/N = B + e, e \sim N(0, \sigma^2)$.

The impacts are estimated for the one-, two-, three-, four-, and five-year time periods following bypass construction. Essentially, the impact is estimated by performing a difference in population means test, assuming normality and common variance between the treatment and control groups. Table 4.3 shows the empirical results using the three control groups for the single-year and multi-year impacts. The estimated coefficients are very similar across the three control groups for both the single-year and multi-year impacts. None of the mean differences were statistically different than zero.

Table 4.3 Estimated Bypass Impacts Using Difference of Population Means Test

	CG1 (N=6)			*CG2 (N=10)*			*CG3 (N=15)*		
	Mean Difference	***S.E.***	***t-Stat***	***Mean Difference***	***S.E.***	***t-Stat***	***Mean Difference***	***S.E.***	***t-Stat***
Multi Year Changes									
1993 - 1995	-0.0144	0.0982	-0.147	-0.0293	0.1089	-0.269	-0.0484	0.1418	-0.341
1993 - 1996	-0.0302	0.1114	-0.271	-0.0759	0.1228	-0.619	-0.0640	0.1299	-0.493
1993 - 1997	0.0339	0.1348	0.252	-0.0336	0.1101	-0.305	-0.0112	0.1398	-0.080
1993 - 1998	0.0443	0.1033	0.428	0.0015	0.1114	0.014	0.0235	0.1182	0.199
Single Year Changes									
1993 - 1994	-0.0313	0.1094	-0.286	-0.0775	0.0942	-0.823	-0.0804	0.1177	-0.683
1994 - 1995	0.0169	0.0996	0.169	0.0482	0.0484	0.997	0.0320	0.1075	0.298
1995 - 1996	-0.0158	0.0655	-0.241	-0.0466	0.0655	-0.712	-0.0156	0.1354	-0.115
1996 - 1997	0.0641	0.1019	0.629	0.0423	0.0977	0.433	0.0528	0.1088	0.486
1997 - 1998	0.0103	0.0739	0.140	0.0351	0.0825	0.426	0.0347	0.0908	0.381

The an ordinary least squares (OLS) alternative to equation (1) is estimated as

(4) $Y_{it} = constant + B_1 BYPASS + e_i, \; e \sim N(0, \sigma^2)$

where *BYPASS* is a dummy variable that equals one for Stonewall. Equation (4) is estimated for each multi- and single-year impact separately as above. The treatment and control cities are assumed to come from the same population, again given normality and a well-behaved error structure. As shown in Table 4.4, the estimated coefficients using OLS are very similar to those from Table 4.3. As one would expect, the standard errors are somewhat larger using OLS but the differences become less pronounced as the size of the control group increases (i.e., CG3 versus CG1).

The significance of normality and independence assumptions can be investigated using nonparametric tests. Discussion of such tests is available in the article based on the Stonewall demonstration analysis (Rogers and Marshment, 2000). The conclusions from such tests are consistent with the previous results. The QECG, OLS and nonparametric estimation techniques rely on asymptotic properties. Small sample sizes limit the strength of significance tests by making the rejection regions very small. Consequently, failure to reject the null hypothesis of no difference in the treatment and control group outcomes may not be very informative.

Table 4.4 OLS Estimates of Stonewall Bypass Impacts

	CG1 (N=6)			*CG2 (N=10)*			*CG3 (N=15)*		
	Estimated Coefficient	*S.E.*	*t-stat*	*Estimated Coefficient*	*S.E.*	*t-stat*	*Estimated Coefficient*	*S.E.*	*t-stat*
Multi Year Changes									
1993 - 1995	-0.0168	0.1240	-0.135	-0.0323	0.1253	-0.257	-0.0484	0.1513	-0.320
1993 - 1996	-0.0352	0.1401	-0.252	-0.0835	0.1390	-0.601	-0.0640	0.1386	-0.462
1993 - 1997	0.0396	0.1696	0.233	-0.0370	0.1265	-0.292	-0.0112	0.1491	-0.075
1993 - 1998	0.0516	0.1287	0.401	0.0017	0.1287	0.013	0.0235	0.1261	0.186
Single Year Changes									
1993 - 1994	-0.0365	0.1374	-0.265	-0.0853	0.1050	-0.812	-0.0804	0.1255	-0.641
1994 - 1995	0.0197	0.1257	0.156	0.0530	0.0530	1.001	0.0320	0.1147	0.279
1995 - 1996	-0.0184	0.0824	-0.224	-0.0513	0.0737	-0.696	-0.0156	0.1444	-0.108
1996 - 1997	0.0748	0.1245	0.601	0.0466	0.1118	0.416	0.0528	0.1161	0.455
1997 - 1998	0.0121	0.0933	0.129	0.0387	0.0944	0.41	0.0347	0.0969	0.358

DIFFERENCE-IN-DIFFERENCE ESTIMATION

Pooling the data for the Stonewall and its control cities we estimate the following cross-section, time series equation:

(5) $Y_{it} = B_1 BYPASS_{it} + B_2 R_t + B_3 C_i + e_{it}$, for t = 1988 through 1998,

where Y_{it} is the tax base (in logs) for city i in year t, *BYPASS* is a dummy variable that equals one if the observation is for Stonewall in the post 1993 (after completion of the bypass), R is a vector year dummy variables, C is a vector of city dummy variables. The estimated coefficient for B_1 measures the bypass impact.

Table 4.5 summarizes the regression results using the log of sales tax base as the dependent variable. This analysis includes all 16 of control cities in the three control groups for the years 1988 through 1998. Four models were estimated to check for robustness of results. The first two columns include the lagged value of the log of retail sales in the estimation. Columns (1) and (3) use dummy variables for each year where 1988 is the omitted value. Columns (2) and (4) use pre- and post-bypass dummy variables to control for time effects. The estimated coefficient for the bypass impact is negative and insignificant in all four models.

Equation (5) was also estimated using the log of the change in retail sales as the dependent variable for the same time period. In this case t refers to the particular year of change in the observed values in the observations (1987-88). The bottom portion of Table 4.5 gives the results for the same four models as described in top portion. Again, the estimated coefficient for the bypass treatment impact is insignificant in all of the specifications of the model.

Table 4.5 Difference-in-Difference Analysis of Stonewall Bypass

Dependent variable is Log of Sales Tax Base (Standard errors are in parenthesis)

	(1)	(2)	(3)	(4)
Bypass impact dummy	-0.0118	-0.0087	-0.0688	-0.0688
	(0.0644)	(.0646)	(.0755)	(.0787)
Lagged log sales	0.5119*	0.5394*		
	(0.0643)	(.0586)		
Town dummies	yes[a]	yes[a]	yes[a]	yes[a]
Year dummies (omit 88) 1989-1998	yes[b]		yes[c]	
Pre 1992 dummy		-0.0816*		-0.1202*
		(.0223)		(.0265)
Post 1993 dummy		0.0573*		0.14465*
		(.0233)		(.0260)
Adjusted R-Square	.9999	.9999	0.9999	0.9999
N	187	187	187	187

Dependent Variable is Log Change in Sales Tax Base (Standard errors are in parenthesis)

	(1)	(2)	(3)	(4)
Bypass impact dummy	-0.0118	-0.0087	0.0426	0.0426
	(.0644)	(.0646)	(.0745)	(.0750)
Lagged log sales	-0.4881*	-0.4606*		
	(.0643)	(.0586)		
Town dummies	yes[a]	yes[a]	yes	*yes*[c]
Year dummies (omitt 88) 1989-1998	yes[b]		yes	
Pre 1992 dummy		-0.0716*		-0.0300
		(.02223)		(.0253)
Post 1993 dummy		0.0573*		-0.0173
		(.0233)		(.0248)
Adjusted R-Square	0.2693	0.2636	0.0089	0.0043
N	187	187	187	187

Notes:

* indicates coefficients are significant at 1% level.

[a] all coefficients were significant at 1% level.

[b] Coefficients for 1992-98 were all significant at 1% level except 1993 which was significant at the 5% level

[c] Coefficients for 1992-98 were all significant at the 1% level.

A limitation of the cross-section, time series application to very small communities is the unavailability of time-series data for potentially important explanatory variables. Other data are not available for small communities on a yearly basis. While it is possible to include lagged values of some variables in the model, doing so precludes the use of the city dummy variables. When the models were estimated using lagged values of population (instead of city dummy variables), for example, the basic results did not change.

The DD estimates are consistent with the results from the QECG model. Analyzing various model specifications, none of the results indicated that the level of, or the growth in sales tax base was different in Stonewall compared with the control towns in the post-bypass period. As with the QECG application, the results must be interpreted with caution due to the small number of observations. In particular, concerns about attributing normality to the error distribution, as well as relying on asymptotic properties for testing the impacts, are pertinent. For our particular application we included all comparable small towns in the same region as Stonewall for which data were available. Consequently concerns about the small sample size cannot be addressed using our particular methodology. There are no other small, rural towns that meet our selection criteria. Small sample size concerns can only be addressed by extending the sample to include small, rural towns in different regions, which would involve trying to control for regional influences.

SUPPLEMENTAL ANALYSIS

Stonewall Site Visit

Stonewall's central business district occupies three blocks of Main Street. Immediately prior to the bypass, a grocery and feed store, a bank, a post office, a hair cutting business, two bars, an auto parts store, a surveying company, a restaurant, a car wash, and an insurance company lined Main Street. Two of the non-travel related businesses-- the auto parts store and grocery and feed store-- rely on non-local customers. The travel-related businesses included the gas stations, cafés, and bars. Of the several businesses selling gas, two were combination convenience stores, one was combination auto body and repair, and one was mainly a gas filling station.

Site visits to Stonewall and interviews with business owners helped confirm the statistical results of no significant bypass impact. Two downtown bars were still operating, one under new ownership. One owner noted a reduction in business from truckers. One restaurant is still in business, while the other closed prior to the bypass. The owner of the latter claimed sit-down restaurants had "lost favor" with local residents. The owners of the non-travel-related businesses claimed the bypass did not affect their sales. Included among these were the auto parts store, the feed and grocery store, and the hair cut establishment. New owners acquired the auto parts store and the hair cut establishment in the period following completion of the bypass.

No businesses relocated from the old route to the new alignment and no new businesses were established along the new section of the highway subsequent to the construction of the bypass around Stonewall. This supports findings concerning spatial impacts for small rural communities in Andersen et al. (1992, page 30). While no businesses relocated to a position on the bypass route, some businesses changed the orientation of their merchandise subsequent to the construction of the bypass. Furthermore, it is not clear if the bypass had any impact on the businesses that closed prior to the bypass construction due to non-bypass related causes, such as retirement of owners. At a minimum, the spatial orientation of Stonewall's business district did not change after the bypass was constructed.

While we focused our analysis to business district impacts, our site visit to Stonewall revealed few vacant or decrepit dwellings. Other land uses, particularly residential use, may, and probably do, respond differently to highway bypasses. For example, enrollment in the Stonewall School District did not appear to be influenced by the bypass. This is seen in Figure 4.5 using data provided by the Stonewall School District. If anything, enrollment was slightly higher in the post-bypass period compared with the pre-bypass period. To the extent to which enrollments reflect residential location decisions, it doesn't appear that the bypass adversely affected demand for housing in the Stonewall area.

The major complaints of residents regarding the bypass were twofold. First concern was expressed about the safety of the southeast intersection connecting Business 3 with state highway 3. The turn off is sharp and has resulted in several accidents. It was referred to as a "death trap." The second complaint was the lack of signs along highway 3 indicating Stonewall's business district. It was also noted that signs identifying Stonewall were lacking at both the east and west intersection of Business 3 with Highway 3. There were no signs indicating a business district.

Gas Retailers

All but one of the gasoline retailers in Stonewall had stopped selling gas after the bypass was constructed. Several citizens commented about the decline in the number of retail outlets in the town. While a loss of gas retail outlet is consistent with findings in other (Andersen et al., 1993; Horwood et al., 1965), the bypass is not the whole story in Stonewall. Recall that the year in which Stonewall's bypass was completed, 1993, was a key year for EPA UST regulations. Tables 2.2 and 2.3 show that in 1993 owners were required to have leak detection in place and small outlets were required to meet specified financial obligations. By 1998 tanks were to be fully compliant with the new UST regulations. Table 4.6 sketches the UST tank status for the retail outlets in Stonewall using data provided by the Fuel Storage Tanks Division of the Oklahoma Corporation Commission. The first station near Stonewall opened in 1974, followed by a retailer along Main Street in 1976. Capacity was increased through 1984. The first action subsequent to the bypass was the removal of tanks at Kay's Quick Stop in November 1996 when the owner retired and sold the business. One station closed its tank in place in 1996 and another in 1997. At the same time, Longhorn Deli installed new tanks in 1997. After the 1998 compliance deadline the state locked 4 tanks in place at the Longhorn Deli site.

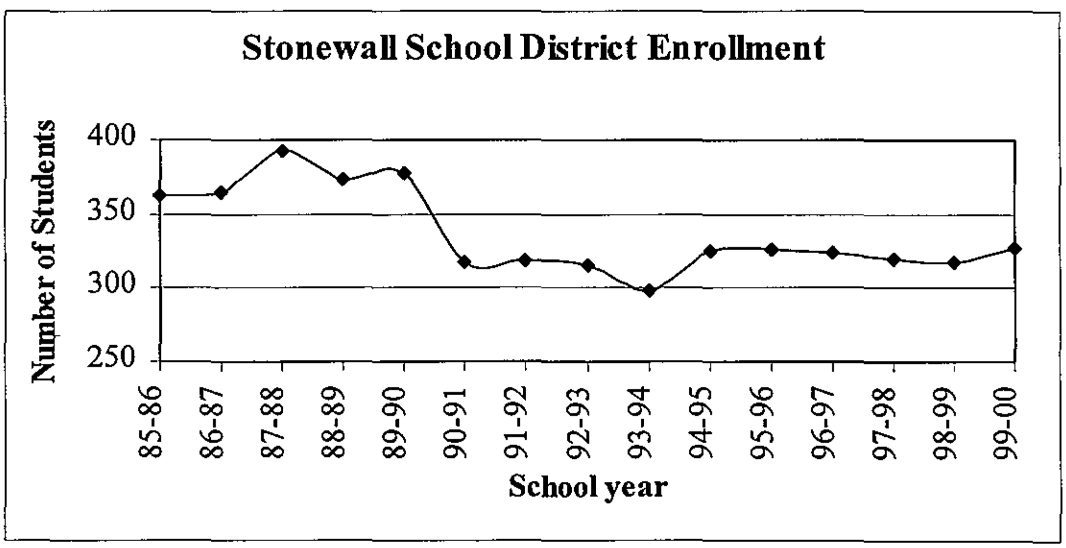
While it is true that Stonewall had (at one time) four gas stations before the bypass and only one after, it is not clear that the bypass caused the stations to close. Instead, the closures appeared to be in response to the UST regulations. This conclusion is supported by the timing and circumstances related to the closures (retirement and timed close to impending regulations). The conclusion is also supported by the installation of new tanks while others were closing down. The Stonewall experience is consistent with national trends--small independent gas retailers are closing down due to more stringent UST regulations and increased competition from large retail chains.

Table 4.6 UST Activity in Stonewall: 1974-1998

			Gallons of Capacity (1,000s)			
			Gasoline		*Diesel*	
Year	*Month*	*Activity Taken (* Federal Regulations)*	*Change*	*Total*	*Change*	*Total*
1974	June	Short Stop installs tank just 1/4 mile west of town on Highway 3	+6	6		0
1976	Feb.	Tanks installed at 200 West Main Street	+3	9		
	June	Additional 10,000 capacity tank at Short Stop	+10	19		0
1979	April	New station with 4 tanks at 300 W. Main Street	+18	37		0
1980	April	New small tank at 130 West Main Street	+.2	37.2		0
1983	April	Additional tank at 130 West Main station	+1	38.2		0
1984	March	Kay's Quick Stop added 3 tanks	+12	50.2	+4	4
1985	Jan.	Station at 130 West Main stops using tanks	-1.2	49		4
1986	June	Short Stop adds diesel tank		49	+4	8
1988	Dec.	*All new tanks must meet new federal regulations		49		8
1993	Dec.	*Regulation requiring leak detection in effect		49		8
		(Bypass Completed)				
1996	Nov.	Kay's Quick Stop removes tanks (Owner retired)	-12	37	-4	4
1997	Sept.	Short Stop closes tanks in place	-16	21	-4	0
1998	Sept.	Longhorn Deli adds 2 new tanks	+12	33	+2	2
	Oct.	200 West Main Street closes tanks in place	-3	30		2
	Dec.	*Compliance with federal tank regulations required		30		2
		Longhorn Deli has 4 tanks locked down by state	-18	12		2
1999	Feb	Longhorn Deli registers 4 non-compliant tanks as out of use				

Data were provided by the Fuel Storage Tanks Division of the Oklahoma Corporation Commission.

Figure 4.5



SUMMARY

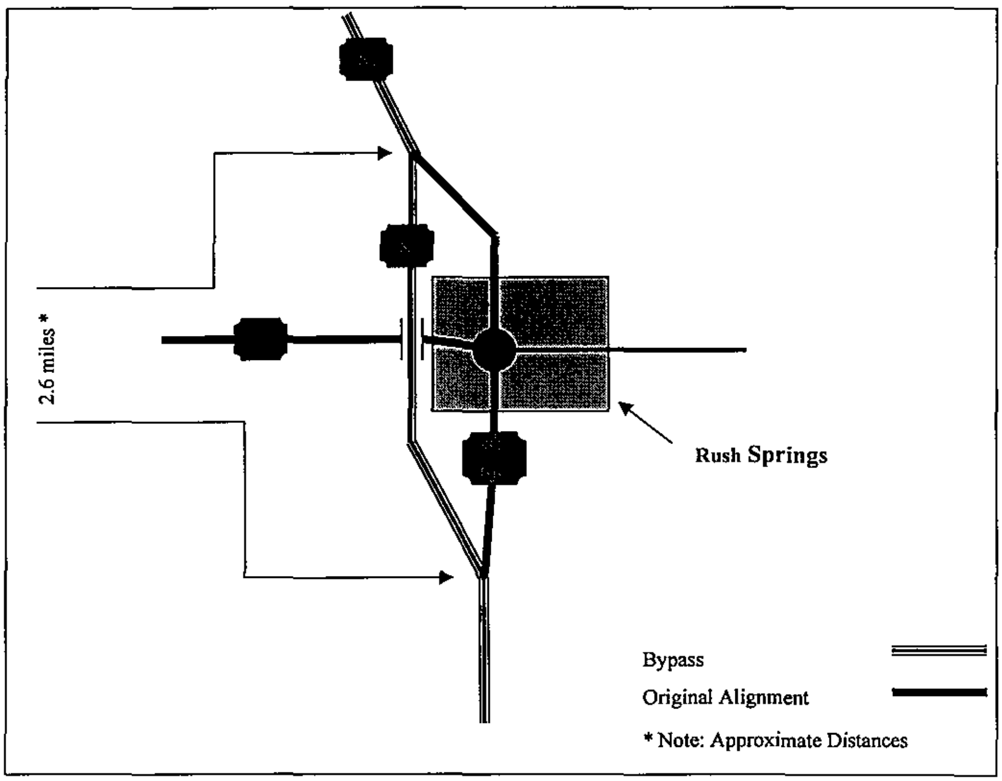
The empirical findings are consistent with a casual investigation of the trend graph for sales tax base. Stonewall, like many other small, rural Oklahoma communities experienced declining population from 1980 to 1990. In the period following the bypass, the sales tax base trend in Stonewall was comparable to that of its control groups. We cannot find that the bypass affected Stonewall's tax base in the post-bypass period.

CHAPTER 5. RUSH SPRINGS AND SNYDER BYPASS ANALYSIS

The Snyder and Rush Springs bypasses were completed in 1972 and 1973, respectively. Since they occurred during the same period of time and both small towns are in the same region of the state, we included these bypasses in the same analysis.

Rush Springs is a small city located about 27 miles northeast of Lawton. In 1973 a US 81 bypass around Rush Springs was completed. The old route was renamed US 81 Business. The effect of the bypass was to divert US 81 traffic around Rush Springs. Figure 5.1 shows the highway configurations. Prior to the bypass, state route 17 ran east to west forming a "T" with US 81 at Rush Springs.

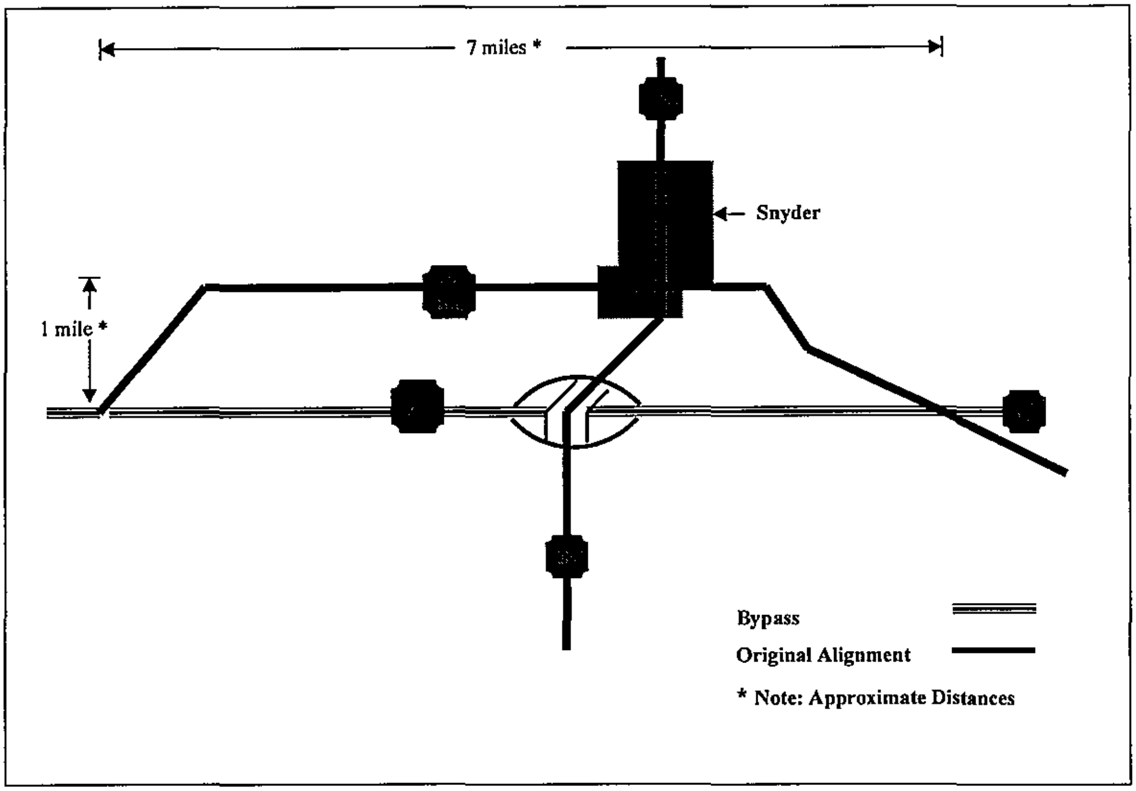
Figure 5.1 Stylized Map of Rush Springs



Snyder is located along US 62 about halfway between Lawton and Altus. Snyder's business district lies along US 183 with US 62 (now Bus 62) intersecting US 183 at the south edge of the main downtown district. Figure 5.2 shows the present highway configuration. Prior to the bypass, the average daily traffic flow going east and west on US 62 just about matched the flow going north and south on US 183. The bypass along US 62 was completed in 1972. As in Rush Springs, the old route was renamed as the business route.

Snyder has three exits off of US 62, the east and west marked as Business 62. The center exit gives the quickest access to Snyder and locations north along US 183. The affect of the new alignment is to allow east-west travelers to travel faster without passing through the town's business district and allowing quicker (although optional) access to locations along US 183.

Figure 5.2 Stylized Map of Snyder



SELECTING CONTROL CITIES

The criteria for selecting controls include are listed in Table 5.1. The final group of control cities is listed Table 5.2. The list exhausts all cities that meet the four criteria above.

Table 5.1 Selection Criteria for Rush Springs and Snyder Bypass Analysis

1. population < 3,000;
2. in same region of the state;
3. not a county seat;
4. same number of highway approaches and relative proximity to larger cities.

Figure 5.3 shows the population for Rush Springs, Snyder and the average of the control cities. On the basis of population, the control sample appears to be reasonable. Notice that the average of the controls splits the difference between the two bypass towns. Notably, the control group displays a similar pre-1970 trend in population as compared with that of Rush Springs and Snyder. Also note the common dip in population in the post 1980 period. This trend undoubtedly reflects factors in the state as a whole.

Table 5.2 Rush Springs, Snyder and Control Cities

	Population		
	1970	*1980*	*1990*
Bypassed Cities			
Rush Springs	1,381	1,451	1,229
Snyder	1,671	1,848	1,619
Average of bypass cities	1,526	1,650	1,424
Control Cities			
Comanche	1,862	1,937	1,695
Elgin	840	1,003	975
Grandfield	1,524	1,445	1,224
Hollis	3,150	2,958	2,584
Minco	1,129	1,489	1,411
Mountain View	1,110	1,189	1,086
Ringling	1,206	1,561	1,250
Ryan	1,011	1,083	945
Tipton	1,206	1,475	1,043
Waurika	1,833	2,369	2,088
Average of controls	1,487	1,651	1,430

Ideally, we would like to make sure that the control cities had a similar trend in the outcome measures before the bypasses were built. Unfortunately, this is not possible for our case studies. Snyder did not start collecting local option sales taxes until 1970 and Rush Springs until 1973. The let dates for the bypass projects were 1969 and 1970, respectively. Consequently we cannot compare trends in sales subject to sales taxes prior to the bypasses for either city. Figure 5.4 shows the tax base trend from 1966 through 1998 for Rush Springs, Snyder, and the average of the control cities. In the first few years subsequent to the bypass, the trends in the tax bases for the bypass cities relative to the control cities do not appear to be change. Both bypass cities experience a dip or slow down in 1977. The loss is regained by 1983. For our purposes, we evaluate the bypass impacts through 1984. This evaluation period should adequately allow for longer-term adjustments to the bypasses. Furthermore, other factors came into play in the mid-1980s that were likely to have major impacts on the sales tax base of the small Oklahoma towns.

QUASI-EXPERIMENTAL ANALYSIS

Quasi-experimental estimates of the bypass impacts using Equation (1) appear in Table 5.3. The bypass impacts are measured as the average tax base (measured in logs) of the bypassed cities minus the average tax base of the control cities. The standard errors are calculated using the usual difference in population means test. The table shows multi-year as well as single year impact estimates. While the mean differences are negative for most of the multi-year impacts, this could be due in part to the year chosen as the base. The single year mean differences are initially negative and then become positive from 1979 through 1983. None of the mean differences are found to be statistically significant.

Figure 5.3

Population: Rush Springs, Snyder and Control Cities

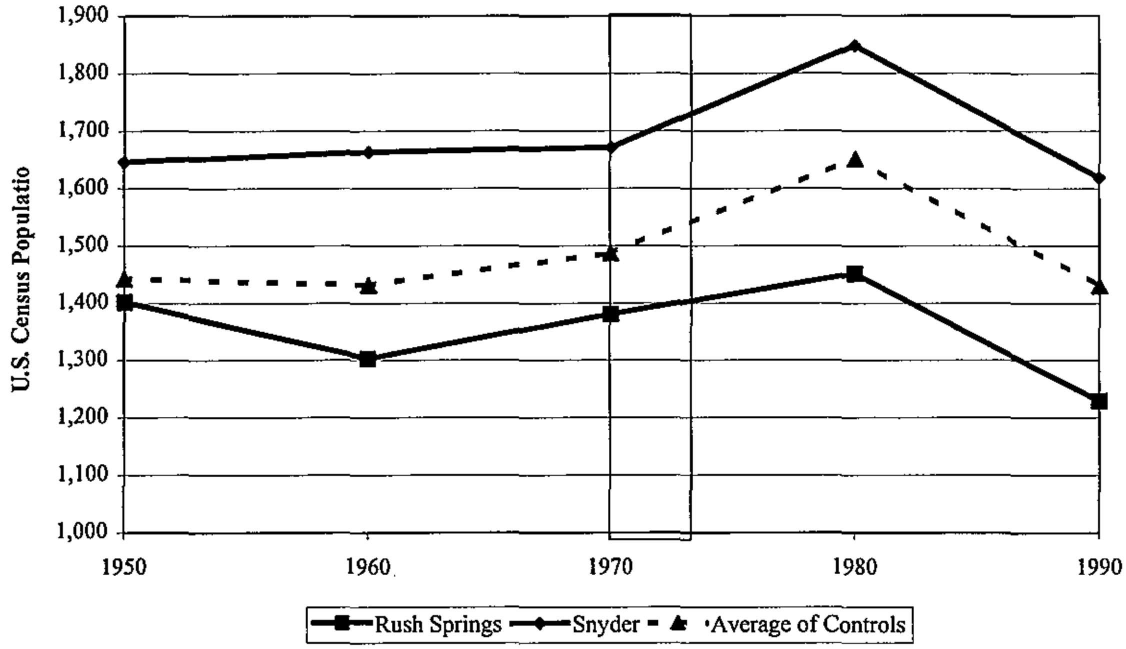


Figure 5.4

Sales Tax Base 1966-1998: Rush Springs, Snyder & Average of Controls

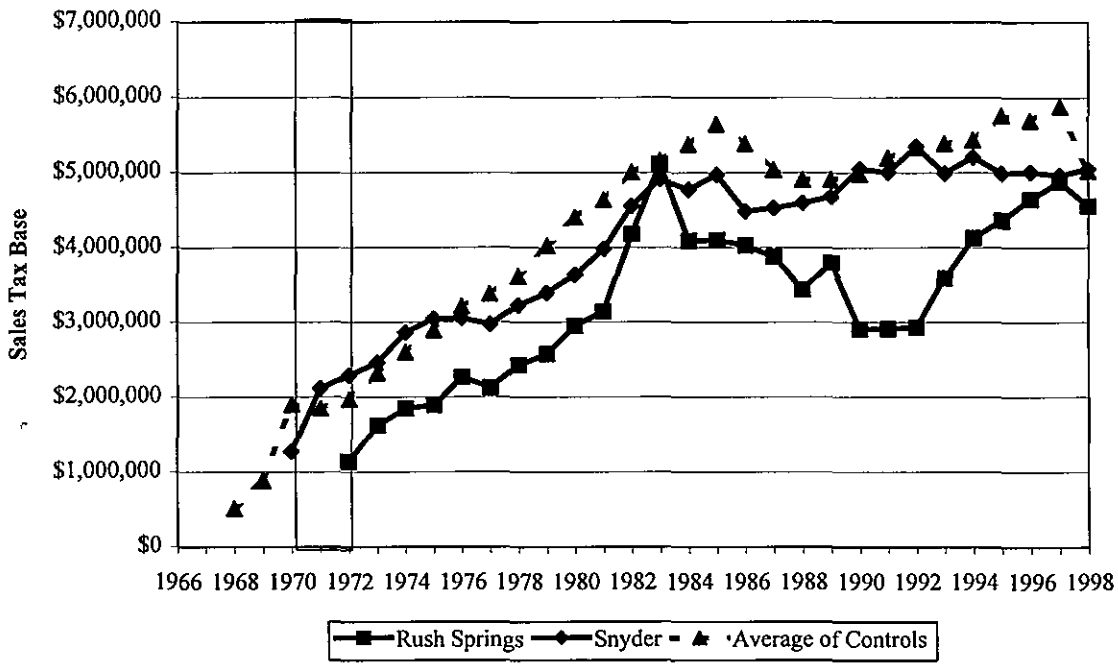


Table 5.3 Quasi-experimental Estimates of Rush Springs and Snyder Bypasses

	Mean Difference	*S.E.*	*t-Stat*
Multi Year Changes			
1974 - 1976	-0.0964	0.1419	-0.679
1974 - 1977	-0.1835	0.1528	-1.201
1974 - 1978	-0.1545	0.1629	-0.948
1974 - 1979	-0.2118	0.1789	-1.184
1974 - 1980	-0.1999	0.1716	-1.165
1974 - 1981	-0.1684	0.2084	-0.808
1974 - 1982	-0.0408	0.2068	-0.197
1974 - 1983	0.0538	0.2110	0.255
1974 - 1984	-0.0942	0.2191	-0.430
Single Year Changes			
1974 - 1975	-0.0623	0.0939	-0.664
1975 - 1976	-0.0195	0.0456	-0.427
1976 - 1977	-0.0872	0.0597	-1.459
1977 - 1978	0.0291	0.0397	0.731
1978 - 1979	-0.0574	0.0431	-1.330
1979 - 1980	0.0119	0.0279	0.426
1980 - 1981	0.0316	0.0642	0.492
1981 - 1982	0.1276	0.0554	2.304
1982 - 1983	0.0946	0.0368	2.570
1983 - 1984	-0.1480	0.0733	-2.019

CROSS-SECTION, TIME SERIES ANALYSIS

The quasi-experimental results are supported by cross-section, time series analysis for the same period. Due to the lack of pre-bypass tax data, we cannot estimate the difference-in-difference specification given in Equation (3), since the bypass impact dummy variable (*BYPASS*) is the same as a dummy variable that equals one for Rush Springs and Snyder. Thus, it is not possible to estimate the model with both city-fixed effects and a bypass dummy variable. Consequently alter equation (3) by eliminating the city-fixed effects while retaining a bypass-city dummy variable. Table 5.4 shows the cross-section, time series estimates of the levels of the tax base (in logs) for the bypassed and control cities for the years 1974 through 1984. The specification on the left uses a bypass dummy for the bypass cities and the other uses a separate dummy for each bypassed city. In both cases bypass dummy coefficients are negative and not statistically different from zero.

Single-year changes in tax burdens (measured in logs) are also estimated. Again two specifications are estimated. The results in Table 5.5 are consistent with the quasi-experimental results. The estimated coefficients for the bypass variables are negative but statistically insignificant. Consequently, we cannot reject the null hypothesis that the bypass communities grew at the same rate as the control cities during the period from 1974 through 1984.

Table 5.4 Regression Estimates of Log of Tax Base from 1974-1984

	Estimated Coefficient	*S.E.*	*T-Stat*	*Estimated Coefficient*	*S.E.*	*T-Stat*
Intercept	0.7298	0.2431	3.002	0.7190	0.2459	2.925
Lag Log Tax Base	0.9630	0.0166	57.854	0.9638	0.0168	57.256
Bypass City	-0.0169	0.0206	-0.820			
Rush Springs				-0.0099	0.0282	-0.353
Snyder				-0.0237	0.0280	-0.848
Year Dummies						
1975	-0.0780	0.0368	-2.122	-0.0781	0.0369	-2.116
1976	-0.0759	0.0369	-2.057	-0.0761	0.0371	-2.054
1977	-0.1500	0.0371	-4.038	-0.1502	0.0373	-4.029
1978	-0.0943	0.0372	-2.533	-0.0945	0.0374	-2.530
1979	-0.0723	0.0375	-1.931	-0.0727	0.0376	-1.932
1980	-0.0783	0.0378	-2.070	-0.0787	0.0380	-2.072
1981	-0.1153	0.0382	-3.016	-0.1158	0.0384	-3.015
1982	-0.0622	0.0385	-1.616	-0.0627	0.0386	-1.622
1983	-0.1010	0.0390	-2.588	-0.1016	0.0392	-2.591
1984	-0.1612	0.0394	-4.093	-0.1618	0.0396	-4.090
R-square	0.9731			0.9732		
Adj R-sq	0.9704			0.9702		
N	131			131		

The results do not yield persuasive conclusions about the bypass impacts. One limitation is the lack of data from the pre-bypass period. In particular, it is only possible to address whether the sales tax base was different in the period after the bypasses were built. Thus, while we do not find the post-period tax bases to grow at different rates, the implication for the bypass impact is not conclusive. We can only conclude that the bypass didn't have an impact (that was found to be statistically significant) if we assume that the trends were the same before the bypass. If however, the bypass cities were doing much worse (better) than their controls before the bypass, then this same finding of no difference in trends after the bypass would actually indicate that the bypass may have had a positive (negative) impact on the economies of the cities. The analysis is further limited by the small number of observations in the population of cities examined. Consequently, the standard errors are likely to be inflated making the rejection of the null hypothesis of no difference in the mean tax bases less likely.

RUSH SPRINGS SUPPLEMENTAL ANALYSIS

Rush Springs Site Visit

Downtown Rush Springs was quiet and pleasant. Residential neighborhoods were in good repair. There were few vacant retail spaces in the town. The center of town has a four-way stop sign. Traffic yielded to any pedestrian in sight. The old drive in on the south edge of town (along Bus 81) is still in business. The town appears to have an active business chamber as suggested by the signs on US 81, the promotion of the Watermelon Festival and other signs in town. For the most part, the town's business district is locally owned and serves local customers.

Table 5.5 Regression Estimates of Log Changes in Tax Base from 1974-1984

	Estimated Coefficient	*S.E.*	*T-Stat*	*Estimated Coefficient*	*S.E.*	*T-Stat*
Intercept	0.1931	0.0272	7.093	0.1931	0.0273	7.074
Bypassed City	-0.0141	0.0209	-0.677			
Rush Springs				-0.0023	0.0284	-0.081
Snyder				-0.0260	0.0284	-0.917
Year Dummies						
1975	-0.0824	0.0373	-2.209	-0.0824	0.0374	-2.203
1976	-0.0843	0.0373	-2.260	-0.0843	0.0374	-2.254
1977	-0.1623	0.0373	-4.349	-0.1623	0.0374	-4.338
1978	-0.1076	0.0373	-2.884	-0.1076	0.0374	-2.877
1979	-0.0888	0.0373	-2.379	-0.0888	0.0374	-2.373
1980	-0.0985	0.0373	-2.640	-0.0985	0.0374	-2.634
1981	-0.1389	0.0373	-3.723	-0.1389	0.0374	-3.713
1982	-0.0877	0.0373	-2.350	-0.0877	0.0374	-2.344
1983	-0.1304	0.0373	-3.493	-0.1304	0.0374	-3.484
1984	-0.1928	0.0373	-5.165	-0.1928	0.0374	-5.152
R-square	0.2370			0.2395		
Adj R-sq	0.1665			0.1622		
N	131			131		

The area along the south interchange of US 81 and Business 81 has built up since the construction of the bypass. According to an employee of Hamstead Ford, the Ford dealership located in downtown Rush Springs in 1975, replacing English Ford. It moved to the US 81 location in 1982. Hood's Discount Foods was already established along the US 81-Bus 81 interchange as of 1979, selling gas until 1983. CPC Produce was there before the bypass was built, as was Bennett Tire which had relocated there from Ninekah. Bennett tire moved into the building formerly occupied by C-Line, a travel trailer dealer, which had moved from downtown Rush Springs. J&L, a truck bed manufacturer also predated the bypass. Thus, while some of the development along US 81 pre-existed the bypass, some of the new development was at the expense of downtown locations and of other towns. According to a long-time local grocer, Elton Teel, the new route was annexed but the town so people would know that it town existed. Annexing the area also retained the city's sales tax base from business along the new route.

Many individuals in Rush Springs thought the bypass hurt the town's development. However, they also recognized that other factors were important. The owner of the *Rush Springs Gazette*, Karen Goodwin, identified three factors influencing the development of the town-- the bypass, the oil bust, and Wal-Mart. As Peggy Hale of the Rush Springs Economic Development Agency commented, "the town might have dried up anyway."

The new route provided easy access to nearby towns of Marlow, Duncan and Chickasha. Marlow, with a 1990 population of 4,416, is located 8 miles south of Rush Springs along US 81. Duncan, a much larger town with a 1990 population of 21,000, lies another 5 miles south of

Marlow. Chickasha is also another nearby urban center with a 1990 population of approximately 15,000. Also along US 81, it lies about 26 miles north of Rush Springs.

Improved access to Marlow, Duncan and Chickasha increased competitive pressure on retailers in nearby communities. A Wal-Mart store opened in Marlow in the early 1980's. It followed the corporate strategy at the time, which was to locate stores in small towns with little competition from other chain retailers. It is not coincidental that Rush Springs' sales tax base began to fall in the early part of the 1980s and has never recovered. Duncan has a newer, bigger Walmart and is getting a new SuperCenter. Competition pressure from retail centers in Marlow and Duncan diminishes the prospects of Rush Springs being able to support its own department store. Simply put, small town retailers are unable to compete with the low prices offered by Wal-Mart, as well as other chain retailers.

At the same time, the improved access increased the viable job market radius for individuals living in Rush Springs. An employee of Mary's Resale shop who moved to Rush Springs in 1997 remarked about the number of jobs nearby. As evidence, she cited the 5 p.m. rush hour on US 81 between Chickasha and Duncan when factories in nearby towns let out for the day. Thus, the convenient access means that Rush Springs can continue to retain its small town flavor without losing its population due to lack of access to services and retail shopping.

Citizens acknowledged both positive and negative aspects of the US 81 improvements in general, and the Rush Springs bypass in particular. The major concern expressed during our interviews was the safety of the intersections of Bus 81 with US 81. Several individuals commented that these intersections were dangerous.

Retail Gas Outlets

The history of gasoline retailers in Rush Springs is very interesting. The only gas station in Rush Springs prior to the bypass was one at the corner of Blackely Ave. and Rush/3rd Ave. This station opened in 1965 and has been out of business for more than 10 years according to sources in town. Two other gasoline retailers have closed since the bypass. Notably, both locations began selling gasoline subsequent to the construction of the bypass. Hood's Discount Foods (at the junction of 81 and Bus 81) originally installed tanks in 1979 but closed them in 1983, the year that new federal UST regulations came into effect. The station at 117 S Rusht/3rd Ave installed tanks in 1972. These tanks have been closed for a long time and were removed in March 2000.

Today Rush Springs has two retail gasoline stations, Adamson's Full Service and the Hop & Sack. Both are located in the central part of the business district. Adamson's installed new tanks in 1999 after moving from 301 S. Rush/3rd Ave. New tanks had been installed in their previous location in 1997, which has subsequently been closed. The Hop & Sack installed tanks in 1974 a few years after the completion of the bypass. In 1992, new tanks were added and the original, non-compliant tanks were closed.

It is important to note that the new gasoline outlets are clustered in the main part of the business district rather than near the intersections of Bus 81 and US 81. Thus, the new route did not attract new or existing gasoline retailers as is often observed in other studies of bypasses. Further, the timing of station closures in Rush Springs suggests that the EPA UST regulations had some impact on the closure decisions. Consequently, the analysis does not identify a negative bypass impact on the gasoline retailers in Rush Springs.

SUMMARY OF SNYDER SUPPLEMENTAL ANALYSIS

Snyder is dominated by farm/agriculture related businesses. Besides the grain elevator there is a Coop building, and an insurance bureau. The town lies on a busy road with fast moving traffic. Unlike many other small towns with a highway passing through the central business district, there are no traffic lights or stop signs. While there are crosswalks, the traffic does not slow for pedestrians. About half of the town is comprised of vacant buildings, but the open businesses seemed to have activity.

There did not appear to be any movement of businesses in response to the new alignment of US 62. There are no businesses along US 62 at any of the intersections with US 183 or BUS 183. The east and west sections of BUS 183 do not have much on them (either new or old development).

An investigation of the USTs in town shows that no tanks were closed down in the period immediately subsequent to the bypass construction. Several locations installed new tanks in 1976 and in 1979. A few tanks were taken out of use in 1989 and 1990. Others were closed in 1998 probably due to new EPA regulations. The UST data suggest that there is no relationship between the bypass construction and activity of gasoline retailers in the town.

It appears that the town has experienced a general economic slump, probably reflecting its reliance on agriculture and the oil & gas industry. Our visit could not identify any relationship between the bypass and the town's economic development.

OTHER SITE VISITS

Our investigation included site visits to numerous other bypassed and non-bypassed communities in Oklahoma. These additional visits were conducted to broaden the scope of the analysis and to provide a better understanding of the factors affecting small, rural towns in Oklahoma over the past few decades. The major factors were changes in oil and gas industry, environmental regulations of underground storage tanks, and the proliferation of large chain retailers in small, rural cities. Pictures and conclusions based on these visits were incorporated into the PowerPoint presentation developed for ODOT.

CHAPTER 6. CONCLUSIONS AND RECOMMENDATION

CONCLUSIONS

Highway bypasses impact small town economies in ways that are not well understood. Previous studies indicate that highway bypasses can have both positive and negative impacts. Positive impacts include expanded local markets and reductions in business district congestion. Negative impacts include reduced demand for highway-related services and improved access to merchants in nearby towns. Non-transportation factors, such as the introduction of large discount retailers in rural markets, decline in agricultural demand, restructuring in oil and gas industry and environmental regulations may be more important than highway service in small town economies. State transportation agencies and small towns need a better understanding of highway bypass impacts in order to develop prudent policies and mitigation strategies.

The focus of this study was to develop a methodology for estimating bypass impacts on small town business districts. Economic impacts are measured by comparing changes in the sales tax base in the bypassed communities with those in similar non-bypassed communities. Two empirical techniques are specified to estimate bypass impacts. The methodology is demonstrated by investigating past bypass projects in Oklahoma. Three case studies were chosen for the analysis based on their relevance for predicting the impact of proposed bypasses along US 70. Of these cases, our methodology could only be performed for the Stonewall bypass of 1993. While our focus was on the impacts of tradition business districts, we also investigated changes of business activity within local jurisdictions. To this end, the quantitative methods were supplemented with anecdotal analysis including site visits and interviews.

The Stonewall bypass impact was estimated using several model specifications for single-year and multi-year time periods. We could not reject the null hypothesis that the bypass investigated had no effect on retail sales, i.e., we could not find that the bypass had a significant influence on Stonewall's sales tax base. While the investigations of the Rush Springs and Snyder bypasses were limited to a post-bypass analysis, they were consistent with the results for Stonewall. The results must be interpreted with care due to the small number of cases investigated and the small population of control cities available for the analysis. Without more and better data, we are unable to accurately predict the impacts of the proposed US 70 bypasses.

RECOMMENDATIONS

The anecdotal investigation offered useful insights for transportation planners. Local residents of bypassed towns stressed, for example, the importance of having a presence along the new routes. Many individuals complained about a lack of signs along the highway indicating the bypassed business district. An easy solution to this problem would be to include the installation of appropriate signs in bypass project implementation. From a public relations standpoint, transportation planners should consider installing such signs for business districts that were previously bypassed. A second common concern was the safety of the intersections of the new and old routes. While this problem may become evident only after projects are completed, planners should allow for follow up analysis to minimize such unintended outcomes.

In spite of our inconclusive results, we still suspect that highway bypasses influence small town economic performance. We are just not certain how and to what extent. Factors such as distance between the town and the bypass route, the volume and composition of traffic diverted, and distance to large discount centers, all contribute to the impact a bypass will have. Even if aggregate impacts are small, bypasses may have differential impacts on different constituents. Given our results, sensitivity to concerns about likely bypass impacts is warranted. For very small communities, even very small economic impacts could have major implications for marginally profitable retailers.

PROPOSAL FOR FUTURE BYPASS RESEARCH

Although our study did not find any significant economic impacts of highway bypasses, the results are not conclusive since we lacked a sufficient number of treatment cases, as well as usable data on traffic volumes and composition, residential property values, regional economic performance, and business climate during the pre-bybass years. The lack of baseline information was a major obstacle in our analysis.

In response, we propose that a similar but expanded study be applied to the four small towns situated along U.S. 70 in southern Oklahoma that will be bypassed over the next year and a half. The basic contribution of the extended research would be to make a baseline assessment of conditions in the pre-bypass period before bypass construction begins (rather than after the fact). The proposed research strategy is as follows. The first phase would be conducted prior to construction of the bypasses. It's purpose is to establish a baseline assessment of the four towns scheduled to be bypassed as well as of a set of control towns. Phase 2 would be conducted after the bypasses are completed. It would provide an assessment of bypass impacts using the methodology developed in this project. It would also investigate the effectiveness of bypass mitigation measures. Such an analysis would examine bypass impacts on retail sales, land uses, business location, business climate, residential property values, and population. Controls would include regional economic performance, traffic volumes and composition, and distance between the towns and the bypass routes, nearby towns, and discount retailers. The extended research could also examine the effect of different mitigation strategies.

The expanded research project would: (1) help agencies planning highway bypasses for safety and efficiency reasons and wishing to predict and mitigate economic impacts; (2) contribute to the body of research on highway bypasses, which to date is inconsistent in its findings; and (3) assist to small towns preparing for the changed economic climate accompanying a bypass.

IMPLEMENTATION STATEMENT

This project develops a methodology for assessing the impact of highway bypasses on small town business communities. Along with the published article based on the analysis, this project makes a methodological contribution to the academic research on bypass impacts. It also provides valuable analysis and insights that will help transportation planners in the development and implementation of bypass projects. Finally, the PowerPoint presentation and script summarizing the project will provide a valuable means of relaying the state of knowledge about bypass impacts to concerned constituents.

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