

The Fiscal Implications of Municipal Annexation:
The Roles of Local Government's Revenue Structure and Land Use

by

Jing Wang

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Graduate Supervisory Committee:

Jeffrey I. Chapman, Chair
Paul G. Lewis
Christopher M. Herbst

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ABSTRACT

This research investigates the relationship between municipal annexation and local government's financial condition. It addresses a significant gap in the literature by focusing on the roles of local government revenue structure and land use situations in affecting annexation's fiscal implications. The major research question is how these two categories of local circumstances affect annexation's fiscal implications, and what patterns may emerge based on the empirical evidence.

With two parts of empirical analyses, I explore the features of the moderating effects of these two local circumstances: how the interactions between annexation and local circumstances influence local government's financial condition. The first part of the analyses examines the role of local government's revenue structure in affecting annexation's fiscal implications. Using a sample of more than six thousand municipalities, empirical analyses of OLS and interactive regression models show the effects of local taxing authority and revenue reliance. The second part underscores the effects of land use along with annexations in municipalities in the Phoenix metropolitan area across two decades. Utilizing GIS data for annexation and land use, it presents spatial patterns of annexation activities and land use changes. A fixed effects model with panel data is used to investigate the joint effects of annexation and land use on local government's financial condition. The complicated effects of different land use situations are identified.

The findings suggest that annexation has the potential for fiscal gains to local government, but its positive fiscal effects may diminish if the municipality has less capability to make suitable revenue arrangement, and if a high proportion of land in the municipality that remains undeveloped. Above all, this research offers a comprehensive perspective regarding municipal annexation, land use and local government finance, to inform a larger debate of urban growth and local financial management.

DEDICATION

For my mother Qun Hong, father Keqi Wang, and my love Yingda Lu

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CHAPTER I

INTRODUCTION

1.1 Problem Statement

General-purpose local governments in the United States, including counties, cities, towns and townships, regulate urban growth and land use within their borders; and they collect local revenues to provide public goods and service, such as police and public education. To urban governments (cities, towns and townships), growth management and local public finance are two features of local governance which fundamentally shape urban spatial patterns, and the welfare of citizens. Rapid outward sprawl and fiscal constraints of providing municipal services are currently two important issues that most local governments in the U.S. are facing. There are several different ways to achieve urban growth, such as city-city consolidation, city-county consolidation, extra-territorial application of zoning, and creation of regional government structures (Carr & Feiock, 2001; Gallop & Landis, 1986). However, annexation by far is the primary mechanism of municipal boundary adjustment in most of the regions in the U.S. (Carr & Feiock, 2001; Edwards & Xiao, 2009; Facer, 2006).

The National League of Cities (1966) provides the most widely accepted definition of annexation:

“Annexation is the addition of territory to a municipal corporation as an integral part. Generally, it involves joining all or part of the territory of an unincorporated, less populous, or subordinate local

unit to that of a larger unit, usually incorporated, offering a more complex array of municipal services...The major purpose of annexation is to promote orderly urban growth.”

According to this definition, annexation is first of all a legal process by which certain territory is taken from an unincorporated local unit (usually a county) and added to an incorporated local unit (usually a municipality). Also, it is a process through which the municipality extends its services, regulations, voting privileges and taxing authority to new territory. Here municipality refers to subdivisions of counties that serve as general purpose governmental units, such as cities and townships. Annexation is usually initiated by the annexing municipal government, developers, residents, and land owners on the area to be annexed, and the procedure is regulated by the laws of respective states.

Annexation has played a central role in US municipal growth for more than a century (Carr & Feiock, 2001). Historically, it has been pursued to offset the negative fiscal implications caused by the migration of middle- and upper-income people from central cities to suburbs. Its historical significance in city growth has been well studied by Bollens (1949), Bromley and Smith (1973), Kaufman and Schnore (1975), and Klaff and Fuguitt (1978) among others. Dating back to the early 1800s, annexation is one of the oldest and the most common forms of municipal boundary change (Edwards, 2008). According to the Census Bureau, between 1950 and 1970, annexation accounted for 98% of the growth in municipal land area; for the decade between 1970 and 1979, three-fourths of the

461 cities with 50,000 or more residents reported boundary changes, resulting in a gain of 2,718 square miles (Census Bureau, 1990; ICMA, 1993).

Although annexation activity is not as intensive and extensive as it once was, it continues to be a popular growth tool of local government today, and “its use has been central to the economic and political development of cities” (Carr & Feiock, 2001). In recent decades, although municipalities in the Northeast generally had stable boundaries, those in the Midwest, South and West regions were still often modifying their boundaries through annexations. Municipal land areas increased substantially between 1990 and 2000 in these regions. The municipalities in the South experienced a 17.8% increase in land area, and municipalities in the West and the Midwest increased area by 13.1% and 11.4% respectively (Johnson, Perry, & Lollock, 2004). The most recent statistics by the Census Bureau shows that 61,218 annexations took place during 1990 and 2005, adding 7,174 square miles of lands to municipalities across the country (Census Bureau, 2007) (See Table 1).

Table 1.1

Annexation Activities by Region (1990–2005)

Region	Number	Population	Square miles
West	10,545	346,779	1,783
Midwest	17,264	139,065	1,228
South	33,341	522,723	4,161
Northeast	68	800	2.05
Total	61,218	1,009,367	7,174

Note. Data sources are US Census Bureau, Boundary and Annexation Survey, 1990–1999 & 2000–2005; Edwards, 2010

Similar to many other local public policy issues, annexation is never a simple and straightforward process. Local governments often confront the controversies that emerge with annexations. A large annexation may dramatically transform a small place into a major city, and even a small annexation may have great implications. To deal with annexations, practitioners need to have a range of skills and knowledge, such as the understanding of relevant state laws and local ordinances, political motivations, potential fiscal and social consequences, and land development information (Edwards, 2008).

Local governments have a variety of reasons to pursue annexation. Annexation could be a growth management strategy which accommodates or controls growth; it could be a part of an overall urban development plan by promoting coordinated land use planning and offering fringe residents with public services (Edwards, 2008; Edwards & Xiao, 2009); and it could be a way to change the demographic and economic characteristics of the city (Austin, 1999;

Edwards, 2008; Jackson, 1985). Annexation is also stimulated by local economic interests, such as increasing and diversifying the tax base, and promoting economic development (Steinbauer et al., 2002). Since annexation to some extent prevents the emerging of new independent local governments, it is regarded to be “a solution to the political, social, and economic problems caused by fragmented governments in growing urban areas,” such as fiscal disparities and urban sprawl (National League of Cities, 1966). However, the dominant idea of the driver of annexation is that local governments pursue annexation for its perceived fiscal benefits (Edwards, 1999; Edwards, 2008; Liner, 1992; Rusk, 2006). Rusk (2006) believes that the attempt to obtain fiscal benefit is still the predominant force driving annexations today.

Just as there are multiple reasons for a municipality to annex, the implications of annexation are complicated and far-reaching. The direct effects of annexation to a municipality are the gain or loss of land, people, and tax base. And these gains and losses often lead to heated debates and conflicts among parties. Based on the findings of five forums on annexation across the State of Indiana, Lindsey and Palmer (1998) provide a thorough categorization of the issues related to annexation, including political issues, economic and fiscal issues, administrative issues, public health, environmental, and quality of life issues, and miscellaneous annexation issues. Among these issues, the economic and fiscal issues received most attention as people during the debates commented that the primary motivations for annexation are economic and financial; however in practice the outcomes are usually not as expected (Lindsey & Palmer, 1998).

Annexation has profound implications on the community's fiscal landscape. In local governments' perspective, for a long time, annexation has been pursued to offset the fiscal stress caused by the migration of upper- and middle-class people away from the central cities. By annexing the fringe areas, the city is able to capture the residents and businesses there to increase the city's tax base. Territory expansion via annexation brings revenues to a city by adding its tax base; meanwhile, the costs of public service expenditures are shared by larger and usually a more prosperous population. In this view, the marginal costs of services are less than the marginal revenues brought by the annexation, thus resulting in a fiscal surplus to the city (Muller & Dawson, 1973). As Heim (2006) argues in her study on "border wars" in Phoenix metropolitan area, the fiscal consideration is an important motivation for municipal annexation. Rusk (2006) achieved national attention for his argument that annexation is fiscally beneficial to central cities and helps small and young metropolitan areas to maintain unity. Elastic cities - cities pursuing more vigorous annexation policies according to Rusk (2003) - have healthier public finances since they have more capability to reap the benefits of a greater tax base.

However, empirical research on the fiscal effects of annexation is inconclusive. There are opponents to the idea that annexation is fiscally beneficial (Knaap & Juelich, 1992). Scholars notice that due to various local circumstances, cities sometime are fiscally constrained because of the annexation activities (Breen, Costa, & Hendson, 1986). At the time of annexation, a city may hope to increase the tax base by the developments that will eventually take place in the

area. But in the short-term the city must issue bonds to pay for capital expenses, such as water and waste services, to the areas that are not fully developed. The city may annex more with the hope that the debts will be paid off by future development. Thus the city may put itself in financial trouble by providing services to the areas where the full development may never occur (Edwards, 2008; Edwards & Xiao, 2009). These arguments challenge the fundamental assumption of fiscal benefits which motivates annexation activities.

1.2 Purpose of the Research

In the complex urban arena, the narrow perspective of annexation's fiscal consequences is both inaccurate and unpractical (Edwards, 2008). Annexation's impacts on local government finance depend to a great extent on specific local circumstances. The question facing local administrators is where and when annexation is an effective policy solution to their fiscal problems. Understanding the relationship between annexation and local government's financial condition, and the effects of local circumstances are important because of their far-reaching policy implications to urban development and financial management. Examining the related local circumstances helps to understand both the municipality's annexation behaviors and their policy consequences.

Many studies examining broader issues of annexation infer that annexations' impacts on local government finance depend to a great extent on the specific local circumstances surrounding their annexation activities (Breen et al., 1986; Edwards, 1999; Edwards, 2008; Edwards & Xiao, 2009; Knaap & Juelich,

1992; Liner, 1992). The local circumstances range from the level and quality of service to the new area and to the rest of the community, proximity of the annexed area to central facilities; from the population and density on the area, to the type of development on the annexed land; from the financial structure of the local government, to the intergovernmental aid programs in the specific county and state (Edwards, 2008). However, few of the local circumstances have been systematically studied with proper methodologies.

Among the multi-dimensional issues influencing the fiscal implications of annexation, the local government revenue structure and its land use situation are particularly important but remain unaddressed in the literature (Edwards, 2008; Lindsey & Palmer, 1998; Netzer, 2003). The local government revenue structure reflects the state-level constraints on the capability of local government to raise revenues from multiple sources, and also the local options of revenue collection. Under a certain revenue structure, usually defined by state laws, local government receives revenues through taxes, intergovernmental transfers, and other fees and exactions to finance public services. The revenues generated by development on annexed land may be related to the increased property taxes, or through the local sales tax, added by the retail activities on the new territories. User fees and charges are generally paid by residents and so basically increase or decrease with population changes. To the local governments which rely heavily on property tax revenue, annexation may be fiscally beneficial by adding additional tax bases to the cities; for those governments which rely mainly on sales tax and other fees and exactions, annexing commercial land has more significant implication to its

fiscal benefits (Heim, 2006; Lewis, 2001; Netzer, 2003). In addition, changes in intergovernmental revenues because of annexation may also depend on certain intergovernmental revenue formulas designed the state or federal governments (Edwards, 2008). Therefore, the possibility of achieving fiscal gains from annexation to some extent depends upon the legal framework that constrains a local government's accessibility to revenue sources. However, it is a challenge to study this effect because of the complex feature of local government's revenue structure (Pagano and Hoene, 2010). The role of two dimensions of revenue structures, local taxing authority and revenue reliance, are investigated in this research since they are closely related to local officials' capabilities and options of financial management related to annexation.

The local land use situation is another important factor affecting the relationship between annexation and local government's financial condition. Annexation brings new lands to the municipality along with the various land uses on the new lands. Land use refers specifically to the different types of functions for which land is used, such as residential, commercial, public, and even vacant land, each of which reflects distinct taxation activities, and requires different demands and costs on public service. For instance, retail land use contributes to sales tax intensively, but requires much lower costs in services compared to residential lands (Wassmer, 2003); public land uses, such as parks, and public school, ask higher service costs while contribute very little to local revenues. Therefore, the changes in tax revenue to the annexing city may occur not only as a result of the additional tax bases, but also the various land uses being developed

on the annexed lands. Although the fiscal effects of land use are widely recognized, its role in the dynamics of annexation policy and local financial condition has not been particularly studied in the literature. This research introduces land use factors into the assessment of the fiscal consequences of municipal annexation.

The primary purpose of this research is to investigate the relationship between municipal annexation and local government's financial conditions based on the data of more recent decades (1990s and 2000s). In a comprehensive perspective not previously considered in the literature, I consider the roles of local government revenue structure and land use situation in affecting annexation's fiscal implications. The major question addressed is how these two categories of local circumstances affect annexation's fiscal implications, and what patterns may emerge based on the empirical evidence. I explore the features of the moderating effects of these local circumstances, which are about interactions between annexation and these local circumstances, and how these interactions influence local government's financial condition.

As mentioned above, in the current literature, these important issues have not yet been systematically studied with proper methodologies. This research applies theories in public administration, public policy, political science, economics, and urban planning to explain the dynamics of municipal annexation as an urban growth policy; meanwhile, multiple samples of local governments are studied to provide empirical evidence to test the arguments being generated from the theories. Overall, this research offers a comprehensive perspective regarding

annexation, land use and local government finance, and to inform a larger debate of urban growth and local finance management.

1.3 Research Questions

To serve the purpose of this research, I have developed three general sets of research questions. The discussion above has framed the basic relationship of municipal annexation and local government's financial condition, and also the potential roles played by local government's revenue structure and land use situation. Therefore, Question Set I is about the overarching issues of the relationship between municipal annexation and local government's financial condition. These questions will be investigated using two sets of empirical analyses with different datasets and methodologies. Question Set II focuses on the role played by local government's revenue structure; and Question Set III explores the role of the land use situation on annexation's fiscal implications to local governments.

Question Set I:

- What are the effects of annexation on local government's financial condition?
- What are the patterns and policy implications of the relationship between municipal annexation and local government's financial condition?

Question Set II:

- Does local revenue structure (including local taxing authority and local revenue reliance) influence local government's annexation activities?
- Do the features of local taxing authority and revenue reliance affect annexation's fiscal implications? If they do, what are the effects?

Question Set III:

- What is the role of land use in the relationship between annexation and local government's financial conditions? In other words, are annexation's fiscal implications conditional on the locality's land use situation?
- What are the spatial patterns of annexation activities and land uses?
- How is annexation related to land use changes at the municipal level?
- What are the fiscal implications of land use at the municipal level?

1.4 Overview of the Dissertation

This dissertation consists of five chapters. The next chapter reviews the theoretical bases and literature on the nexuses of annexation, local government's revenue structure, land use, and local government's financial condition. Based on the theories and current literature, a series of hypotheses are established to investigate the core research questions listed above. Chapter III focuses on the role of local government's revenue structure in affecting annexation's fiscal implications. Using a sample of more than six thousand municipalities, empirical analyses of OLS and interactive regression models show the complex effects of

local taxing authority and revenue reliance. These results are discussed to provide some insights on the formation of the analysis in Chapter IV. Chapter IV highlights the effects of land use along with annexations in municipalities in the Phoenix metropolitan area across two decades (1990 to 2009). Utilizing GIS data of annexation and land use, it presents spatial patterns of annexation activities and land use changes. A fixed effects panel data model is also used to investigate the joint effects of annexation and land use on local government's financial condition. The analyses indicate no clear relationship between annexation and land use changes, but find "profitable" land uses are associated with positive fiscal consequences of annexation. Chapter V summarizes the findings from the empirical analyses in Chapter III and Chapter IV, and discusses theoretical and practical contributions, policy implications, and limitations of this research, as well as the future research agenda.

CHAPTER II

THEORIES, LITERATURE REVIEW, AND HYPOTHESES

This chapter provides an overview of the theories and relevant literature concerning the nexus of municipal annexation, local revenue structure, land use and local government's financial condition. Based on these theories and the literature review, a series of hypotheses are established with regard to the general relationship between annexation and local government's financial condition as well as specific concerns on the roles of local revenue structure and land use. The theoretical foundation and methodological advantages of this research compared to previous ones are summarized in the end.

2.1 Relevant Theories

There are many theories beneath the complicated process of municipal annexation. The long existing debate between metropolitan government reformists and public choice theorists has attracted most of the attention on urban and metropolitan boundary change issues (Edwards & Xiao, 2009). The metropolitan reform movement advocates regional government, city-county consolidation, and annexation as approaches to promote greater efficiency and equity at the local level. In contrast, the works of public choice theorists, including Tiebout (1956) and Ostrom, Tiebout, and Warren (1961), argue that fragmentation is an optimal local government organizational strategy, as it fosters competition among local governments and allows residents to find best matches

to their tax and service preferences. Local governments that use annexation extensively to expand their influence may be less cost conscious and accountable to their constituents. Thus, spending and taxes may rise with annexation.

Fleischmann (1986) in his analysis of the politics of annexation applies the revisions of public choice theory and also the political economy paradigm to explain the interactions among participants (i.e. municipalities, counties, residents, and land developers, etc.). In the perspective of local governments, these two theories are particularly applicable to explain governments' annexation activities and their possible impacts on local public financial condition. Simply speaking, the revisions of public choice theory assume that local officials attempt to limit competition from other governments or to generate a per capita fiscal surplus. The political economy theory presumes that cities use annexation to develop property, capital, and stimulate economic growth. The following sections examine the applications of metropolitan government reform advocates, revisions of public choice theory, and political economy theory to the fiscal issues related to annexation activities.

2.1.1 Metropolitan government reform advocates

Advocacy of metropolitan government emerged as the result of annexation, city-county consolidation, and city-county separation experiences during the 19th century (Studenski, 1930). Metropolitan government reformists believe the fundamental problem of the metropolitan areas is the fragmented and decentralized character of local government. Fragmentation results in inefficiency

and ineffectiveness, and is regarded as the cause of many regional governance problems, such as fiscal disparity and crisis (Briffault, 1996; Gulick, 1962; Rusk, 2003; 2006; Stephens & Wikstrom, 2000; Studenski, 1930). The migration-tax base model of fiscal stress by Rubin (1982) attributes fiscal stress to population and employment outward shifts and their effects on the local government revenue base. In the process of suburbanization, the selective migration of population from the city to outlying areas left the economically disadvantaged groups behind. This increases expenditure demands and erodes revenue bases of the city. One approach that many cities have taken is to annex its periphery to capture the residents and businesses that relocated outside the city. Although annexation does not lead to establishing metropolitan government as advocated by the reformists, it reduces the possibilities of new incorporations of local government. With their focus on central cities, reformists' regard annexation as a solution to fragmentation as well as the fiscal disparities. To be specific, scholars argues that annexation helps to improve efficiency by achieving economies of scale, which reduces unit costs of government services and increases production efficiency, and annexation also lessen the extent of fiscal inequities across a metropolitan area (Edwards & Xiao, 2009; Liner, 1992; Mehay, 1981; Rusk, 1995; 2006; Stephens & Wikstrom, 2000).

2.1.2 Revisions of public choice theory

The public choice model has several basic assumptions: individual rationality, self-interest, and resource scarcity. Municipal boundaries are drawn to

distribute the benefits and costs of public goods to certain areas and residents (Ostrom, 1972). Tiebout's (1956) well-known phrase "vote with their feet" describes the situation in which residents are mobile to achieve an optimal combination of tax and service levels. In order to attract residents, local governments compete with each other by offering different tax and service packages (Ostrom, Tiebout, & Warren, 1961). However, their model failed to address how municipal boundaries are established or how they change (Fleischmann, 1986).

Some revisions of public choice theory allow it to better accommodate the issue of annexation. The first revision is about mobility and the ways for residents to express their preferences. Sharp (1984) demonstrates that residents use both "exit" and "voice" to satisfy their preferences. For citizens living in unincorporated areas who are unhappy with taxes or services, asking a neighboring municipality to annex them is a way of using "voice".

The second set of revisions focuses on the behaviors of local government bureaucrats. Schneider's (1985) bureaucratic demand models argue that bureaucrats have the desire to obtain control over resources, particularly fiscal and personnel resources. From the local bureaucrats' point of view, to promote their self-interest, local governments attempt to minimize competition from other local governments (Schneider, 1985). If this assumption is correct, they will promote annexation to prevent the formation of competing service providers (new incorporations). As a result, the metropolitan areas become less fragmented, and local governments have stronger monopoly powers with expanding territories and

populations to reap fiscal benefits through either fiscal policies or land use development.

2.1.3 Political economy theory

The political economy theory views urbanization as part of a larger process of capitalist development in which cities provide physical space for production and administration (Fleischmann, 1986). In a spatial context, local government plays a critical role of assisting capital accumulation and legitimating social arrangements (Dear & Scott, 1981). Urban form is determined primarily by actions of the developers, realtors, land speculators, and other elements of property capital whose profit is linked to the specific location of growth. Other types of capital, according to Cox & Nartowicz (1980) and Feagin (1982), are generally indifferent in terms of the specific location of growth.

Political economy theory relates annexation with the nature of land development. Land can be transformed to a variety of uses which produce wealth and power with appropriate “physical infrastructure and a regulatory environment” provided by local government (Cox & Nartowicz, 1980). Cities, particularly those in the same metropolitan areas, compete with each other for revenue sources and use annexation to capture the benefits of growth. Meanwhile, builders and developers are pressing local governments for capital improvements and zoning in exchange for new tax-producing development. Therefore, the capital of property redistributes its costs to local governments by playing one government off against another to get a better deal. In addition, residents may rely on boundary changes,

especially incorporation, to protect themselves from developments which threaten the status of their communities (Cox & Nartowicz, 1980; Molotch, 1976).

Annexation, by absorbing these communities into incorporated jurisdictions, is viewed as a way to avoid the incorporation of a new city, town, or district. And therefore, these annexing jurisdictions capture the capital growth in property.

Based on the assumptions of capital development, annexation may be associated with both high local government revenues from the capital growth in property and huge costs in providing services for the capital.

2.2 Literature Review and Hypotheses

These theoretical traditions described above generally imply a positive relationship between annexation and local government's financial condition. In terms of empirical work, in general, the evidence in previous studies find that annexation is related to positive changes in revenue levels, reliance on own-source revenues, while the findings of expenditure changes are more mixed. The following sections review major previous empirical work on the fiscal implications of municipal annexation, and the effects of local government's revenue structure and land use on annexations' financial consequences. And a series of hypotheses are established according to the theories and evidence from the literature.

2.2.1 Annexation and local government's finance condition

The majority of previous studies are large-scale, multi-city studies using quantitative methods. Some of the studies are dedicated to investigating annexation's impacts on the general fiscal health/power of the city (e.g. Rusk, 2006), while others consider either the local revenue or the local expenditure level changes associated with municipal annexation (e.g. Edwards & Xiao, 2009). They usually measure annexations by the area changes of the municipal territory within certain periods of time such as a year. The measure of local government's financial condition is more complicated. It is measured in basically two ways: one is using integrated indicators such as operations ratio (the ratio of total revenue to total expenditure) (Brown, 1993; Rivenbark & Roenigk, 2010), or city bond rating (Rusk, 2006); another way is using basic measurements of revenue or expenditure level (per capita dollar amounts from a certain source, or for a certain purpose) (Edwards & Xiao, 2009; MacManus & Thomas, 1979), and revenue reliance (the proportion of total revenues that a local government generates from one specific source or from several sources) (MacManus, 1977; Pagano & Hoene, 2010).

Among the studies examining annexation's impacts on local general financial condition, Rusk (2003; 2006) has attracted wide attention recently by his argument of "elastic cities". He believes that the city must be "elastic" in order to maintain its social and economic health. By "elastic" he means being able to expand and develop more land. In his 2006 study, Rusk finds that the flexibility to annex surrounding land and communities was more important to a city's bond rating (a sign of fiscal health) than the area's poverty rate or median household income. Therefore, he believes annexing land is "an important route to economic

health and development for urban areas” (Rusk, 2006). Earlier than that, MacManus and Thomas’ (1979) study on California cities concludes that expanding tax base through annexation improves the city’s fiscal solvency, which is the city’s financial independence with less reliance on outside revenues. Although there is no direct evidence about annexation’s impact on operations ratio, it is reasonable to believe that the operations ratio will be improved along with the increase of local government fiscal capacity through annexation (Edwards, 2008).

A number of other empirical studies have focused on either the revenue side or the expenditure side, or on both sides of annexation’s fiscal implications. Cho’s (1969) multiple regression analysis of Texas cities during the 1950s finds that annexation is associated with moderately higher taxes and higher per capita expenditures for fire protection, but lower per capita expenditures for highways. Using similar methodology to analyze a sample of 243 central cities, MacManus and Thomas (1979) find that cities which annexed heavily during the 1970s had much lower increases in per capita taxes than those that did not annex or had only low to moderate changes in their land areas. Liner (1992) conducts an analysis over 400 cities, and finds that annexation is negatively related to the growth of per capita costs in police and fire protection and municipal employment. This contrasts with the conclusions of the studies by Gonzalez and Mehay (1987) and Mehay (1981). Gonzalez and Mehay (1987) examine over 300 cities in 24 southern and western states and find that cities with higher rates of annexation experience higher per capita expenditures and higher municipal taxes. Similarly,

in Mehay's (1981) earlier multi-city study in California, he concludes that cities which grow rapidly through annexation have more rapid expenditure growth rates than other cities.

Although some of the previous studies have outlying conclusions, the majority are generally supportive of the positive fiscal effects of municipal annexation, including higher bonding rating, greater fiscal solvency, and higher per-capita revenue level. Based on the empirical evidence, as well as the theoretical arguments that annexation increases local government's monopoly power to reap fiscal benefits, the overarching hypothesis which goes through this study is formulated as following:

H1: Municipal annexation is positively associated with local government's financial condition (i.e. operations ratio, debt service ratio, revenue level, and expenditure level).

2.2.2 The role of local government's revenue structure

Beneath the overarching question, I focus on the roles played by two important local circumstances as suggested by literature. The first local circumstance is local government's revenue structure which has an influence on annexation's implications for local government's financial condition. Local government revenue structure in this research generally refers to the local authority of deriving revenues from different categories of sources, and the

reliance on the revenue retrieved from each of these sources. Local governments across the United States have generally three sources of revenues: taxes (property and non-property taxes), non taxes (user charges, fees, and miscellaneous revenues), and intergovernmental revenues (state and federal). The revenue structure of a municipality depends not only on its economic situation, but also on its institutional framework. Municipalities are constrained both legally and politically by the state governments in their ability to use these revenue sources. Therefore, revenue structure is a result of the local government's adjustment and adaption to its legal and economic environment (Fisher, 2007; Pagano and Hoene, 2010).

However, local government's revenue structures are too complicated for a broad stroke analysis. There is no one-size-fit-all municipal revenue structure across the nation. Historically, local governments depended almost exclusively on property tax revenues to fund local public services.¹ Municipal authority to tax property and land is one of the most powerful governance tools granted by their states. Although the local taxing authority was initially designed to generate a stream of tax revenue from the value of property, local government revenue structure has diversified as the state governments enlarged the fiscal discretion of local governments over time (Krane, Rigos, & Hill, 2001). With the greater fiscal discretion and the challenge of paying for public services, municipal revenue profiles shifted over the past decades. The shifts resulted in greater diversification

¹ While this statement is true for most of the municipalities, there are a few exceptions. For example, cities in Oklahoma restrict the property tax to debt retirement purposes; Mesa, Arizona, had no property tax authority at all until late 2009 when a property tax levy was approved by voters.

in local tax structures which include sales tax, incomes tax, and non taxes, and thus a decrease of the relative contribution of property tax (Heim, 2007; Krane et al., 2001; Pagano, 2003).

Previous studies indicate that local government revenue structure is an important factor influencing local government's financial condition (Edwards, 2008; Heim, 2006; Heim, 2007; Honadle, Costa, & Cigler, 2004; Lindsey & Palmer, 1998; MacManus & Thomas, 1979; Pagano, 2003; Pagano & Hoene, 2010). Pagano and Hoene (2010) argue that "understanding how well [a city] is doing does not entail a comparison to the average city but rather to the constraints and possibilities that uniquely affect the city's potential revenue structure...". Honadle et al. (2004) also assert that fiscal capacity and flexibility of local government are dependent on variety, appropriateness, and effectiveness of its revenue sources. According to their argument, it is key to have authority over varied sources in response to the changing and increasing demands for services. Furthermore, they emphasize the importance of achieving an appropriate mix of revenues to finance services and to meet other public responsibilities in an equitable manner (Honadle, et al., 2004).

Annexation's fiscal implications are influenced by local government's revenue structure in mainly three ways. First, local revenue structure has effects on municipal annexation behavior. Lindsey & Palmer (1998) find local governments are motivated to annex through their tax and fiscal policies. Especially when the property tax is the primary source of revenue, the annexing cities expect to have fiscal benefits from the newly added properties. Heim (2006)

links the dynamic annexation activities in Phoenix metropolitan area to the specific local revenue structure. She finds that the sales-tax-reliant local revenue structure in Arizona creates significant incentives on the competition for commercial land among neighboring municipalities. Other previous studies show the broader role of municipal fiscal structure, especially property and sales taxation, in shaping metropolitan growth patterns, including the spatial distribution of community growth and retail development in the region (e.g. Honadle, et al., 2004; Lewis & Barbour, 1999; Wassmer, 2003).

Second, local revenue structure affects land use and other economic activities along with annexation. Pagano (2003) in his case studies of vacant land finds that cities' specific development strategies (e.g. annexation and land use planning) are determined by their capacity of using public resources and by the nature of their tax or revenue structures. He categorizes cities as property-tax dependent and sales- or income-tax dependent according to the proportions of property tax and sales or income tax in their local own-source revenues. By regression analysis, he finds evidence that property-tax dependent cities are more aggressive in strategies of boundary expansion and land development. However, in contrast, Harvey and Clark (1965), in the tax payer's perspective, argue that local reliance on property taxation discourages the conversion of farmland to non-agricultural land use, because the land is subject to higher taxation once the development is done.

Third, local revenue structure affects the municipality's capability of collecting sufficient additional revenues to support the growing service demands

because of the annexed land. Lindsey and Palmer (1998) illustrate that local revenues change directly because of the changes in assessed value that result from annexation or indirectly because of the distribution methods for particular revenues. Edwards (2008) in her study discusses the various sources where the revenues are generated from annexation: property tax, local income taxes on the income of new residents, or local sales tax of their consumption, and the user fees and charges brought by the population. Although she argues that local fiscal structure is one of the important local circumstances which the fiscal impact of annexation depends on, no particular analysis on this topic has been done in her study.

Overall, little has been done in current literature to investigate whether and how the local revenue structure affects a municipality's capability of improving its financial condition by annexation. This is echoed by Bunnell's (1997) opinion on current planning literature, "surprisingly little consideration has been given to how changes in the structure of public finance might affect the fiscal impacts of development." I believe it is partially because of the complexity of local revenue structure, as there is no single dimension to effectively recognize the characteristics of the structure. This research will start with a categorization of local government's revenue structure, and explores its interactive effects on annexation's fiscal implications to the local governments with empirical evidence from large cross-sectional dataset.

The local government revenue structure is a multi-faceted concept without a uniform definition. Based on the literature (MacManus & Thomas, 1979; Heim,

2007; Pagano & Hoene, 2010; Wassmer, 2003), there are two most common dimensions to examine the structure: the local government's taxing authority, and its relative reliance on revenue sources. Through these two dimensions, I discuss the role of local government's revenue structure on the relationship between annexation and local government's financial condition. Two hypotheses are also drawn based on the discussion.

Local taxing authority is the first dimension of local revenue structure that I examine. The taxing authority of local government, also called local fiscal authority, refers to "state's proscribing and granting access to general taxes" for local governments (Pagano & Hoene, 2010). The general taxes include taxes on property, sales, and income. For each of these taxes, a local government is regarded as having the authority if it has a local control of the tax rate, and if the revenues from this tax are for general use (otherwise, it may be earmarked for certain purpose). Krane, et al. (2001) in their study of home rule in 46 states summarize that local governments have the greatest discretion in their governmental structure and the least discretion concerning their finance. The most fiscally autonomous local governments would be authorized a local option for all three tax sources, and revenues from those sources would all be for local general use. Traditionally, most of the municipalities only have property tax authority granted by state governments. But over time, state governments have increased the degree of local discretion over taxing authority. Although municipalities in many New England states still only have access to property tax, local revenue sources in states in other regions are greatly diversified (Dye, 2008).

The normative position for taxing authority is that more local authority is better. It is based on the basic assumption by Pagano and Hoene (2010): “local governments are in the best position to ascertain both the benefits of a diverse revenue-raising toolkit and the implementing such tax policies.” As the economic base varies from municipality to municipality, I believe that local officials obtain the information to best match their revenue-raising tools to their economy and service needs. This is also the reason that no state has an imposed uniform local revenue and tax structure since it ignores the within-state variation of local economic bases and diverse spending demands.

Linking the idea of “more local authority is better” to the issue of annexation, municipal governments with more taxing authority are more likely to make the most benefits from the boundary expansions. As mentioned before, annexation adds new territories to the municipality, as well as the population, property, and economic activities of the new territories. Having more revenue sources permits local officials to exercise various choices of taxation and thus they are able to spread the burden of taxation across different types of economic activity (Krane et al., 2001). Annexation physically puts additional economic activities within the expanded municipal boundary, while revenue source option allows the municipality to exercise the best ways of deriving fiscal benefits from these activities. Based this discussion, the hypothesis on the effects of local authority on annexation’s fiscal implications is established as following.

H2: Municipalities which have diversified taxing authority (more than the authority of property tax) are more likely to improve financial condition through annexation (compared to single authority municipalities).

The other dimension of local revenue structure I examine in this research is local revenue reliance. Krane et al. (2001) distinguish the “primary source of municipal revenues” by comparing the percentage of total municipal revenue by state, and argue that local governments in the same state have quite consistent finance structures. Pagano and Hoene (2010) define local revenue reliance as “the proportion of total revenues that a local government generates from one particular revenue source or from several sources.” In other words, it is about the extent to which a municipality relies upon certain revenue source as a share of its total revenues (Wassmer, 2003) or of its general revenues (Pagano & Hoene, 2010).

As we understand, local taxing authority refers to the municipality’s options of revenue sources permitted by the state, while revenue reliance is about the actual revenue collection practices the municipality takes with these options. Many studies have examined local reliance on elastic and inelastic revenues sources, and believe it makes a difference in local government’s fiscal health (MacManus & Thomas, 1979; Pagano, 2003). The elasticity describes how fast revenues from one single source respond to changes in the underlying economy. Elasticity measures the extent to which a tax structure generates revenue in response to taxpayer income increases without changing statutory tax rates.

The elasticity of these revenue sources varies. Normally, the property tax is regarded as a typical inelastic tax. The national conversation about the fiscal health of cities was rooted in the basic system of property taxation and its capacity to generate revenues in support of public goods and services (Pagano & Hoene, 2010). Early studies such as Netzer (1966) and Aaron (1975) find that the property tax does not provide the revenue elasticity to respond to the multiple service needs of municipalities. It is less reflective to the economy because it takes longer for the economic shifts to influence the real estate values which determine the property tax levy. Also, the assessment practice of the property and land values is usually not quite reflective to their market values. In contrast, the sales tax and income tax are more elastic. The sales and income tax collections increase fairly immediately in response to shifts in consumption and employment or wages. One study shows that cities with the authority to tax sales and income generate tax revenues at a higher growth rate than property tax cities during expansionary economic eras (Pagano, 2003). The non taxes (user charges, fees, and miscellaneous revenues) are also regarded as elastic revenue sources. However, the property tax tends to provide more stability through the business cycle than sales-, income-tax, and non tax collections.

Studies assert that optimally a combination of elastic and inelastic revenues sources provides municipalities with the stability to buffer against economic downturns, but also allows them to capture revenue growth during period of prosperous economy (Honadle et al., 2004; Pagano & Hoene, 2010). Annexation practices change the economic profile of the municipality (usually

increase its tax base). I argue that the elastic revenue tools are more effective in transforming economic benefits (if any) into fiscal benefits immediately, while property tax secures stable revenue from the annexed areas in the long run.

Although there are no previous studies particularly analyzing how the diversified revenue structure works to reap fiscal benefits from the annexation, the features of the “inelastic” and “elastic” revenue tools indicate the possible fiscal results of municipal annexation. I hypothesize the different effects of local revenue reliance as follows:

H3: Municipalities which have a combination of “inelastic” revenue source (property tax) and “elastic” revenue sources (sales tax, income tax, and non tax) are more likely to improve financial condition through annexation; while municipalities which rely on either “inelastic” or “elastic” revenue sources are less likely to benefit from annexation.

2.2.3 The role of land use

Land use is the result of the interaction of real-estate market and public policy in a mixed system. At community level, land use is a function of the demand for and supply of land in the community. It is guided and constrained by local land use planning and regulation, given state and federal laws and policies (Paulsen, 2004). The original land use “planners” are individuals or organizations who own, purchase, or sell land, and then decide how to use or improve the land.

Their uses of land are manifested in zoning, and include residential, retail, industrial manufacture, church, non-profit, farm, and even vacant lot. Public sector uses of land include airports, roads, schools, military, parks and recreation. Land use behaviors are based on the preferences, expectations, and financial capacities of the individuals and organizations.

The arguments of the effects of land use consist of two layers. The first layer generally refers to the fiscal effects of land use on local governments; and the second layer is about the role of the land use in the relationship between annexation and local government's financial condition. There are many previous studies focusing on the first layer while much fewer studies have investigated the relevant issues in the second layer.

Land use's fiscal effects

The concern of land use when discussing the fiscal implications of municipal annexation is based on the "fiscalization hypothesis" of research on land use. The "fiscalization hypothesis" is two-folded. It refers to the idea that "the system of local public finance exerts an influence on local land use decisions," (Wassmer, 2001) or "the tendency of communities to establish land use based on the net tax revenues they will generate for the city" (Kotin & Peiser, 1997). Land use decisions become "fiscalized" when they are influenced by the expectation of a fiscal surplus or deficit that a particular land use generates for a community.

It is not a new topic that local governments seize fiscal benefits through land use and growth management (Ladd, 1998; Lewis, 2001; Wassmer, 2003;

Wassmer & Edwards, 2005). There are multiple purposes of governments' land use planning and regulation (Ladd, 1998). Tools of land use planning and regulation have been used as mechanisms to sustain local government revenues and expenditures by helping to finance new infrastructures and public service. Early studies, such as Margolis (1957), observe that the city governments of residential suburbs estimate revenues and costs that arise from each possible land use, and then use zoning ordinances and capital improvement programs to encourage the fiscally most "profitable" land uses. Such studies usually find that commerce, industry, and high-income residences are "profitable." Therefore, the local governments encourage the expansion the "profitable" land uses while discouraging or excluding other non-profitable uses. Based on these current evidences, Hypothesis 4 is established to investigate land use's fiscal implications:

H4: A higher proportion of "profitable" land uses (e.g. commercial land) in a municipality is associated with better financial condition for local government.

The hypothesis compares the fiscal implications of different land use compositions of a city in terms of land use types (the percentages of vacant, commercial, residential, and public land in the city's total area). As indicated by many studies (e.g. Edwards, 1999; Lewis, 2001; Wassmer, 2003), commercial land provides the most tax revenue but demands relatively low costs in services; while public land requires service expenditures far more than revenue it brings

(see Appendix A for definitions). So cities and towns with higher commercial land use, for instance, are expected to be better off in public finance.

Land use's effects on annexation's fiscal implications

The second layer of the land use arguments is about the moderating effects of land use on the relationship between annexation and local government's financial condition. Annexing with "profitable" land is quite politically feasible to local governments because it allows them to get more money without creating new taxes or raising tax rates (MacManus & Thomas, 1979). The growth of metropolitan areas, usually through annexation, has brought non-uniform shifts in land uses within cities and thus dramatically altered the fiscal bases of city governments. These arguments are usually verified in fiscal impact analyses using a land use multiplier approach. Breen et al. (1986) use a land-use multiplier approach to examine the fiscal consequence of annexation in a village in Ohio. Their findings differentiate types of land use showing that commercial land tends to have the greatest return, while residential and open space have a net fiscal loss to the village. There are also larger-scale case studies which cover a number of comparable annexation cases. Edwards (1999) evaluates the fiscal impacts of annexation through ten cases, which cover a mix of annexations in terms of land-use types. The proportional valuation method she uses estimates per acre costs and revenues by land use, and is applied to the area of annexation to show the projected costs and revenues associated only with the area of annexation. The estimations are based on the property value of each land-use type relative to total

property value. However, the results find no consistent winners and losers among cities and towns in each annexation. Annexation can be either fiscally desirable or undesirable for both communities due to the land use variation.

To consider a municipality as a whole, annexation changes its land use composition, and thus results in its specific financial condition. Theoretically speaking, local governments compete with each other for the most “profitable” land (Fleischmann, 1986). However, when annexation is used as a tool for future growth management, the government usually is willing to add other land use types such as vacant and agriculture land. In this case, the annexation’s contribution to local government finance will not be so predictable. When other factors are controlled, different compositions of a municipality’s land use (percentages of land use types) are expected to have different influences on annexation’s fiscal consequences. The fifth hypothesis is formed as following:

H5: Annexation’s effects on a local government’s financial condition depend on the land use situation of the municipality.

This hypothesis makes two implicit assumptions. First, the relationship between annexation and local government’s financial condition is more likely to be positive when the municipality has bigger proportion of “profitable” land uses (e.g. commercial land and residential land), and second, vice versa. In other words, the land use composition of a municipality moderates the relationship between annexation and local government’s financial condition.

2.3 Summary

In summary, theories and previous studies imply a positive relationship between annexation and local government's financial condition in general. However, it is not conclusive since there are also studies which draw the opposite conclusion. The mixed results are somehow due to the ignorance of the effects of local circumstances, particularly the local government revenue structure and land use situation. These factors potentially play important roles in the relationship between annexation and local government's financial condition. Compared to the great volume of literature on municipal annexation's fiscal implications, there is less research examining the dynamics of local government revenue structure and land use composition of the city.

The inconclusive research findings are also due to the specific samples and methodologies being used. Both previous generalized studies and case studies to some extent suffer from methodological problems, rendering the results questionable. Statistical methods in multi-city studies are better in examining situations in which behavior is assumed homogeneous and routine, and therefore easier to generalize. Case studies produce much more detailed information than what is available through a multi-city statistical analysis. However, case studies are difficult to generalize because of inherent subjectivity and also because they are mainly based on qualitative subjective data, the findings can be applied only to particular contexts. Also, many of the studies are dated and examine annexations that happened in the 1960s, 1970s, or the 1980s.

This research proceeds to investigate effects of local government revenue

structure and land use which are under addressed in current literature of municipal annexation's fiscal implications. To avoid the disadvantages of a single methodology, this research employs cross-sectional regression analysis with a nation-wide sample of municipalities, as well as panel data analysis focusing on a group of geographically concentrated municipalities (i.e. Phoenix metropolitan area). GIS mapping is also used to present spatial changes of annexation, land use, and their interactions. In addition, all the datasets being used are not earlier than 1990 which helps to produce more recent and relevant research findings.

CHAPTER III

THE ROLE OF LOCAL GOVERNMENT'S REVENUE STRUCTURE: A NATION-WIDE STUDY

3.1 Introduction

This chapter empirically investigates the effects of municipal annexation on local government's financial condition. The chapter starts with a brief introduction of the research purposes, major questions, and the hypotheses to test. The next sections present the data and methodology with the cross-sectional regression models which specify local government's financial condition as a function of annexation, local revenue structure, and other institutional, and socio-economic variables. This is followed by the descriptive statistics, results of regression analysis, and a concluding discussion.

There are two major purposes for this research: to present the general trend of annexation's fiscal implications using a nation-wide sample of municipalities with a variety of characteristics; and to investigate the effects of local revenue structure in the relationship between annexation and local government's financial condition. As mentioned in Chapter I, this part of empirical analysis firstly addresses the overarching research question: what are the effects of annexation on local government's financial condition? Focusing on the role of local revenue structure, this chapter also explores a series of specific questions: does local revenue structure (including local taxing authority and local

revenue reliance) influence local government’s annexation activities? Do the features of local taxing authority and revenue reliance affect annexation’s fiscal implications? If they do, what are the effects?

This part of empirical work employs the multi-city cross-sectional regression analysis to test three hypotheses as presented in the previous chapter: **H1:** Municipal annexation is positively associated with local government’s financial condition; **H2:** Municipalities which have diversified taxing authority (more than the authority of property tax) are more likely to improve financial condition through annexation (comparing to single authority municipalities); and **H3:** Municipalities which have a combination of “inelastic” revenue source (property tax) and “elastic” revenue sources (sales tax, income tax, and non tax) are more likely to improve financial condition through annexation; while municipalities rely on either “inelastic” or “elastic” revenue sources are less likely to benefit from annexation.

3.2 Models

Guided by the literature (see Chapter II) and for the purpose of testing the three hypotheses, cross-sectional regression models are developed as follows. Model 1 is the base model investigating the general fiscal effects of annexation.

$$\Delta Finance_i = \beta_0 + \beta_1 \Delta Area_i + \beta \Delta X_i + \varepsilon_i \quad -- (1)$$

where $Finance_i$ is substituted by several local financial condition variables, including *Operations ratio*, *Debt service ratio*, *Per-capita total revenues*, and *Per-capita own-source revenues*. The details of these variables will be explained in next section. Each of the parameters is defined as the percentage change between 1992 and 2002. The annexation variable $\Delta Area_i$ is defined as the percent change in area of a municipality between 1990 and 2000. The other independent variables, ΔX_i , include a series of policy and socio-economic characteristics of the municipality that will be explained in next section (see Table 3.2).

To explore the role of local government revenue structure as specified in Hypothesis 2 and Hypothesis 3, Model 2, an interactive model is developed with the foci on the effects of local taxing authority and local revenue reliance.

$$\Delta Finance_i = \beta_0 + \beta_1 \Delta Area_i + \beta_2 Authority_i + \beta_3 Reliance_i + \beta_4 \Delta Area_i * Authority_i + \beta_5 \Delta Area_i * Reliance_i + \beta \Delta X_i + \varepsilon_i \quad -- (2)$$

Model 2 keeps the same cross-sectional structure as in Model 1, and four key variables for local government revenue structure are added in the model. $Authority_i$ identifies the taxing authority of the municipality by dummy. Pagano and Hoene (2010) categorize two major situations of municipal taxing authority: property tax authority only, and diversified authorities over property tax as well as one or two other taxes. I hypothesize that the later situation is more likely to associate with better financial condition through annexation (see Hypothesis 2). Another key independent variable is $Reliance_i$ which is also a dummy variable

describing the municipality's reliance on revenue sources. According to Hypothesis 3, I divide municipalities into two types of *Reliance_i*: those municipality has a combination of “inelastic” revenue source (property tax) and “elastic” revenue sources (sales tax, income tax, and non tax) , and those relying on either “inelastic” or “elastic” revenue sources otherwise. And I hypothesize the former ones are more likely to improve their financial conditions by annexation. In addition, two interaction terms of annexation variable and local revenue structure variables are also included in this model: $\Delta Area_i * Authority_i$ and $\Delta Area_i * Reliance_i$. According to Hypothesis 2 and Hypothesis 3, municipalities' responses to and fiscal achievements from annexation are affected by their revenue structures (both taxing authority and revenue reliance). These two interactions are used to explore how annexation's fiscal implications vary in municipalities with different taxing authority and revenue reliance situations. Model 2 is called an interactive model according to Kam and Franzese (2007) as it investigates the interactions between key variables; in other words, how does one key variable's effect on dependent variable depend on the values of other key variables. To facilitate the interpretation of this interactive model, all the continuous dependent and independent variables are centered on their means.²

3.3 Data and Methodology

² Mean centering makes coefficients easier to interpret, reduces multi-collinearity (Cronbach 1987), and it doesn't affect substance of results (e.g., R^2 is unaffected) (Young, 2006).

This research employs the 1990 and 2000 data for a sample of 6069 general purpose municipalities with population greater than 1,000. This sample is a result of several steps of data processing with the datasets from multiple sources (see Appendix A for details). These municipalities have had various practices of annexation during the decade such that 1967 of them had no boundary changes while 1260 of them annexed over 25% of their 1990 land areas (see Table 3.1). Like annexation, most of the other parameters are defined as the percentage change between 1990 and 2000, except the dummy variables. However, the financial condition variables are created based on 1992 and 2002 datasets from the *Census of Governments*, instead of the 1990 and 2000 datasets. So there is a two year lag created between the dependent variables and independent variables. The time lag also reflects the fact that the effects of annexation take time to have any impact. The data sources and measurement of dependent variables and explanatory variables are presented below.

Table 3.1

Extent of Annexation by City Size (1990-2000)

Population Size	Small (1,000-10,000)		Medium (10,000-100,000)		Large (100,000 and over)	
	%	N	%	N	%	N
Non Annexers	33.10	1,366	29.38	547	29.51	54
Light Annexers	21.23	876	24.92	464	36.61	67
Moderate Annexers	25.27	1043	24.60	458	20.22	37
Heavy Annexers	20.40	842	21.11	393	13.66	25
Total	100	4,127	100	1,862	100	183

Note. During the period 1990-2000, Non Annexers annexed no land; Light Annexers annexed less than 5% of their 1990 land areas; Moderate Annexers annexed between 5% and 25% of their 1990 land areas; Heavy Annexers annexed over 25% of their 1990 land areas.

Dependent variables

The dependent variables are indicators of local government financial condition. There are a number of financial dimensions and indicators that have been used over the past decades for analyzing, interpreting, and communicating financial condition of local government. These measurements range from simple per capita indicators (such as MacManus & Thomas, 1979; Edwards & Xiao, 2009) to ICMA's over 40 financial and environmental indicators which monitor financial condition, and take into account the characteristics of time, environment, multidimensional relationships, and implicit and explicit obligations (Nollenberger, Groves, & Valente, 2003). According to Groves, Godsey, &

Shulman (1981), complex dimensions and indicators make it difficult to communicate financial condition to a broad range of stakeholders. To facilitate effective interpretations, this study limits the number of indicators being used for analyzing financial condition.

Of primary interest in our research are the measures of local government's ability to raise revenues from multiple sources to finance public services. These measures ought to be easily understood by local practitioners. Based on this rationale and the data availability, four indicators are used. The first two are basic per capita indicators of local government revenues, *Per-capita total revenues*, and *Per-capita own-source revenues*. The other two indicators of local government's financial condition are *Operations Ratio* (=total revenues/total expenditures), and *Debt Service ratio* (=total interest payment to debt/ total expenditures). They have been conceptualized in previous studies (Brown, 1993; Hendrick, 2004; Rivenbark, Roenigk, & Allison, 2009; Rivenbark & Roenigk, 2010; Wang, Dennis, & Tu, 2007) (see Table 3.2).

To develop these measurements, I relied on data from the Census of Governments -Finances of Municipal and Township Governments (1992 & 2002). The 2002 data are converted to 1992 US dollar value to adjust for the inflation. And then the percentage change between 1992 and 2002 are calculated as the dependent variables for the models.

Table 3.2

Dependent Variables: Indicators of Local Government's Financial Condition

Financial Dimension	Description & Calculation	Interpretation
<i>Per-capita total revenue</i>	The basic measurement of municipal revenue status. Total revenues divided by population	
<i>Per-capita own-source revenues</i>	The basic measurement of municipal own-source revenue status. Total revenues from municipal own sources divided by population	
<i>Operations ratio</i>	Addresses whether government's annual revenues were sufficient to pay for annual operations. Total revenues divided by total expenditures (plus transfers to debt service fund and less proceeds from capital leases and installment purchases)	Ratio of 1.0 or higher indicates that government lived within annual revenues.
<i>Debt service ratio</i>	Addresses service flexibility, or amount of expenditures committed to annual debt service. Debt service ratio (Total interest payments on long-term debt, including transfers to debt service fund) divided by total expenditures plus transfers to debt service fund	Service flexibility decreases as more expenditures are committed to annual debt service

Note. All the indicators are revisions of Hendrick, 2004; Rivenbark, Roenigk, & Allison, 2009; & Rivenbark & Roenigk, 2010

Explanatory variables

For the key explanatory variable, $Annex_i$, data are calculated based on municipal boundary GIS data 1990 and 2000 from the National Historical Geographic Information System (NHGIS, 2011). The annexation variable $Annex_i$ is defined as the percent change in area of a municipality between 1990 and 2000.

The variables of local taxing authority and revenue reliance are based on multiple data sources. I take several steps to create these two parameters. The taxing authority is distinguished by state. Our data source is the categories of revenue authority categories by Pagano and Hoene (2010). As mentioned before, $Authority_i$ is denoted as “1” if the municipality has diversified authority over property tax and other taxes, and “0” if the municipality is authorized to use only the property taxation as a tax source. Diversified authority includes municipal taxing authorities over “property, sales”, “property, income”, and “property, sales, & income” in Pagano and Hoene’s (2010) categories.

The municipal revenue reliance generally is also a product of state laws. Pagano and Hoene’s (2010) categories of revenues reliance by state provide guides to establish our reliance variable. However, the variety of municipal revenue reliance within a state should not be ignored (Honadle et al., 2004; Krane et al., 2001). With the increasing local discretion on revenue collection, municipalities have developed a variety of revenue structures to cope with their specific political and economic circumstances. Therefore, it is not accurate to define a municipality’s revenue structure based on the state it belongs to. Instead, I identify the revenue reliance of each municipality with public finance data from the Census of Governments (1992 and 2002). I use mean and standard deviation statistics to determine the categories of revenue reliance of each municipality. I firstly calculate the percentage share of total revenues from an individual tax source. I define a municipality as property tax reliant if the share of property tax is one standard deviation above the mean. Using the same methods I identified

municipalities which are reliant on “elastic” revenue sources including sales, income taxes and non taxes. $Reliance_i$ is denoted as “0” for both of these two types of municipalities, and “1” for other municipalities which are regarded to have a balanced combination of “inelastic” and “elastic” revenue sources. As a result, 6069 municipalities are identified as being in consistent revenue reliance categories in both 1992 and 2002. The dummy variable $Reliance_i$ is denoted as “1” if the municipality has no significant reliance on either “inelastic” revenue source (property tax) and “elastic” revenue sources (sales tax, income tax, and non tax) but a combination of both, and “0” if it is significantly reliant on certain source(s). Please also see Appendix A for the details of data processing.

In addition, eleven control variables (X_i) are also included in the estimations. First, two state annexation policy variables, $Impact_i$ and $Plan_i$ are included. $Impact_i$ describes whether state law requires the annexing municipality to do an impact report to examine the fiscal impacts of annexation.³ $Plan_i$ is about whether the state calls for service plans as part of the municipal annexation process. Service plans are required in 20 states,⁴ and they usually ask for a schedule with timelines for extending service to the newly annexed areas. I believe, with these two state law requirements, annexing municipalities are more prudent in their decisions of annexation, and more strategic in economic development and service delivery in the newly annexed area. So I expect positive

³ Impact report of annexation exists in seven states: Kentucky, North Carolina, Oregon, South Dakota, Texas, Utah, and Wyoming.

⁴ They are Arkansas, California, Colorado, Florida, Georgia, Indiana, Kansas, Maryland, Mississippi, Missouri, Montana, Nebraska, Nevada, North Carolina, Ohio, Oklahoma, South Dakota, Tennessee, Texas, and Wyoming.

effects of these two dummy variables in our estimates. Also considered are two state fiscal policy variables: $NOTELS_i$ and BB_i . $NOTELS_i$ denotes whether the municipality is constrained by state-imposed Tax and Expenditure Limits (TELS), and BB_i is about whether the municipality is required to balance annual budget (see details of the definition in Table 3.2). I expect that municipalities with balanced budget requirements but without TELS are better off in their financial condition. Other control socio-economic variables include density, median household income, percentage of population 25 or older with at least some college education, percentage of housing units being occupied, poverty rate, percentage of Non Hispanic white population, and whether the municipality is a central city. All these variables are presented as percentage change between 1990 and 2000, except for the dummy variables. And all of them, except for the poverty rate and central city dummy, are expected to have a positive relationship with local government's financial condition. Most of the data for control variables are compiled by the U.S. Census Bureau (1990, 2000). All together, they are meant to provide a comprehensive examination into the effects of annexation and local government finance structure on municipal financial condition. The details of the variables are provided in Table 3.3.

Table 3.3

Definitions, Measurements and Sources of Explanatory Variables

Variable	Definition & measurement	Sources
AREA	Percentage change in area because of annexation (1990-2000)	NHGIS, 2011
AUTHORITY	Dummy variable of 1 if the municipality has diversified taxing authority	Pagano & Hoene, 2010
RELIANCE	Dummy variable of 1 if the municipality has combination of “inelastic” and “elastic” revenue sources	Census of Governments, 1992 & 2002; Pagano & Hoene, 2010
NOTELS	Dummy variable of 1 if the municipality has no tax and expenditure limits (TELS) of any kind	Pagano & Hoene, 2010
BB	Dummy variable of 1 if the municipality is required to balance annual budget	Krane, Rigos & Hill, 2001
IMPACT	Dummy variable of 1 if impact report is required for annexation	Steinbauer et al., 2002
PLAN	Dummy variable of 1 if service plan is required for annexation	Steinbauer et al., 2002
DENS	Percentage change in persons per square mile (1990-2000)	Census Bureau
EDU	Percentage change in percentage of population 25 or older with at least some college education(1990-2000)	Census Bureau
OCC	Percentage change in percentage of housing being occupied (1990-2000)	US Dept. of Housing and Urban Development
HHINC	Percentage change in median household income (1990-2000)	Census Bureau
POV	Percentage change in poverty rate (1990-2000)	Census Bureau
NHWHT	Percentage change in percentage of Non Hispanic white population (1990-2000)	Census Bureau
CENTRAL	Dummy variable of 1 if the municipality is central city	Census Bureau

3.4 Descriptive Analysis

Two parts of the descriptive analysis are conducted. The first part is the descriptive statistics of the variables being included in the regression models; and the other part presents t-tests of the annexation and financial features of the municipalities with different revenue structures. Table 3.4 below provides an overview of the characteristics of both dependent and independent variables.

Table 3.4

Descriptive Statistics of Variables

Variable	Definition	Mean	Std. Dev.
TREV	Percentage change in per-capita total revenue	0.551	0.763
OTREV	Percentage change in per-capita total revenue from own sources	0.561	0.842
OR	Percentage change in operations ratio	0.053	0.544
DSR	Percentage change in debt service ratio	0.644	2.628
AREA	Percentage change in area because of annexation	0.185	0.648
AUTHORITY	Diversified taxing authority	0.732	0.443
RELIANCE	Reliance on both “inelastic” and “elastic” revenue sources	0.452	0.498
AREA*AUTHORITY	Interaction of AREA and AUTHORITY	0.134	0.579
AREA*RELIANCE	Interaction of AREA and RELIANCE	0.088	0.476
NOTELS	No tax and expenditure limits (TELS) of any kind	0.119	0.324
BB	Balanced annual budget required	0.409	0.491
IMPACT	Impact report required for annexation	0.187	0.39
PLAN	Service plan required for annexation	0.507	0.499

DENS	Percentage change in persons per square mile	0.017	0.614
EDU	Percentage change in percentage of population 25 or older with at least some college education	0.394	0.538
OCC	Percentage change in percentage of housing units being occupied	0.006	0.052
HHINC	Percentage change in median household income	0.102	0.139
POV	Percentage change in poverty rate	0.015	0.511
NHWHT	Percentage change in percentage of Non Hispanic white population	-0.075	0.14
CENTRAL	Central city	0.066	0.248

Note. For definition, every variable is presented as percentage change of the value between 1990 and 2000 (or 1992 and 2002 for dependent variables), except the dummy variable of AUTHORITY, RELIANCE, NOTELS, BB, IMPACT, PLAN, and CENTRAL.

In addition, I examine the differences of means of the annexation and financial features between the municipalities in different categories of local taxing authority and revenue reliance. I use independent sample t-test to compare their means (see Table 3.5 and Table 3.6). In both sets of comparisons, I find no significant differences in the extent of annexation between cities with different taxing authority or revenue reliance. It suggests that the local revenue structure doesn't significantly influence municipality's annexation behavior. However, local government financial condition variables show significant differences in means between each of the two categories of municipalities. T statistics in Table 3.5 shows that municipalities with diversified taxing authority have had significantly more increases from 1990 to 2000 in the per-capita total revenues, and operations ratio, and significantly less increase in debt service ratio (which is

also a positive sign) than those municipalities with single taxing authority. Results in Table 3.6 shows that municipalities which rely on a balanced combination of “inelastic” and “elastic” sources have had significantly more positive changes in per-capita total revenues, per-capita own-source revenues, and less positive changes in debt service ratio than other municipalities.

Table 3.5

Difference of Means: Municipalities with Diversified Taxing Authority vs. Municipalities with Single Taxing Authority

Variable	Diversified Authority		t statistic	Single Authority	
	N	Mean		N	Mean
AREA	4483	0.185	-0.701	1586	0.195
TREV	4325	0.562	1.763*	1619	0.523
OTREV	4354	0.567	0.893	1620	0.547
OR	4499	0.059	1.627*	1656	0.034
DS	2739	0.553	-3.317***	1150	0.859

Note. * $p < 0.1$, *** $p < 0.01$

Table 3.6

Difference of Means: Municipalities with Balanced Sources vs. Other Municipalities

Variable	Balanced Reliance		t statistic	Other Reliance	
	N	Mean		N	Mean
AREA	2772	0.192	0.848	3297	0.178
TREV	2669	0.654	9.434***	3275	0.468
OTREV	2692	0.648	7.266***	3282	0.490
OR	2781	0.063	1.230	3374	0.045
DS	1578	0.537	-2.106**	2311	0.717

Note. ** $p < 0.05$, *** $p < 0.01$

3.5 Results

Two models are estimated for each of the four indicators of local government's financial condition (*Operations ratio*, *Debt service ratio*, *Per-capita total revenue*, and *Per-capita own-source revenues*). Prior to the regression analyses, tests of correlation and multi-collinearity are performed on all independent variables to avoid invalid results or variable redundancy.

Model 1 is the base model which does not take into consideration the effects of local government revenue structure. Table 3.7 below presents the regression results for Model 1 with four dependent variables listed by column. The number of observations varies cross columns due to missing data problems. These results illustrate the general relationships between annexation and these financial indicators.

Generally, the estimates support the idea that municipal annexation is associated with local government's financial condition. The annexation parameter *Area* is positively and significantly associated with *Per-capita total revenues* and *Per-capita own-source revenues*, which is consistent to what I address in Hypothesis 1. However, there are also complex findings of the effects of annexation: it does not have significant impacts on *Operations ratio*, but is significantly associated with positive change in *Debt service ratio*. Great debt service ratio is a negative indicator of financial condition as it means a high expense on the interest payments on debt, and as a result, less local financing capability for public service. A possible explanation of this phenomenon would be that municipalities practicing aggressive annexation are more likely to invest in

public capital projects to meet the increasing public service demands. When they finance the investments through borrowing, the local expenditure on debt service rises. Thus, reflected in our estimates, annexation is associated with significant positive changes of the debt service ratio of the municipality.

The estimates of Model 2, the interactive model, highlight the effects of local revenues structure variables and the interactions. The results are shown in Table 3.8. *Reliance* doesn't have significant relationships with the financial condition indicators across the columns, while *Authority* is significantly and negatively associated with *Debt Service ratio* and positively associated with *Per-capita total revenues*, both of which indicate positive fiscal effects of diversified taxing authority for a municipality. Annexation generally is found to impact positively on *Operations ratio* and *Per-capita own-source revenues*.

What are more interesting are the significant effects of some of the interaction terms in these estimates. As mentioned before, interactions are used to investigate how the different taxing authority and revenue reliance influence annexation's fiscal implications to a municipality. In these interactive models, the coefficients of *Area* across the columns represent only one effect annexation may have, that is, the effect of annexation when *Authority* and *Reliance* are both kept at "0". In other words, these coefficients show the relationships between annexation and the financial condition indicators for those municipalities with taxing authority over single revenue source (*Authority*=0), and is only reliant on either "elastic" or "inelastic" revenues sources (*Reliance* =0). For municipalities

other than this type, the estimated effects of annexation should be recognized based on both the coefficient of *Area* and the coefficients of the interactive terms.

Significant effects of these two interactions are found across the estimates. I employ the differentiation method suggested by Kam and Franzese (2007) to interpret the interactive effects. For example, in our estimate of *Operations ratio* (the first column), both *Area* and the interactions (*Area*Authority* and *Area*Reliance*) are found to have significantly positive effects. They indicate there are four effects annexation may have on the dependent variable. For those municipalities with taxing authority over single revenue source (*Authority=0*, thus *Area*Authority=0*) and rely on either “inelastic” or “elastic” revenue sources (*Reliance=0*, thus *Area* Reliance=0*), every percentage increase in area is associated with 3.7% increase of *Operations ratio* from 1992 to 2002 while other variables are held constant; for municipalities with diversified taxing authority, and rely on either “inelastic” or “elastic” revenue sources (*Authority=1*, and *Reliance=0*), annexation is also positively associated with the *Operations ratio*, but with a greater effect, in that every percentage increase in area is associated with 7.5% increase of *Operations ratio* during the decade;⁵ for municipalities with single taxing authority, and rely on a balance of “inelastic” or “elastic” revenue sources (*Authority=0*, and *Reliance=1*), every percent increase in area is

⁵ $Finance_i = \beta_0 + 0.037\Delta Area_i + 0.038 \Delta Area_i * Authority_i + \varepsilon_i = \beta_0 + 0.075\Delta Area_i + \varepsilon_i$, when $Authority_i = 1$. So the coefficient for $\Delta Area_i$ is 0.075 in this condition.

associated with 7.6% increase of *Operations ratio*; ⁶ and for municipalities with both diversified taxing authority, and rely on a balance of “inelastic” or “elastic” revenue sources (*Authority*=1, and *Reliance*=1), one percentage area change is linked to 11.4% increase in *Operations ratio*.⁷

Similar significant positive effects of the *Area*Authority* are found in the estimate of *Per-capita total revenues-own-sources*. However, in the estimate of *Per-capita total revenues*, annexation is not found to be a significant factor, but the interaction *Area*Reliance* has significant positive effect. They indicate that only for municipalities with a balance of “inelastic” and “elastic” revenue sources (*Reliance*=1), annexation is positively associated with the *Per-capita total revenues*, for other municipalities, annexation’s effect is insignificant.

For control variables, some significant relationships are also identified. The fiscal policy variables *NOTELS* (no TELs) and *BB* (balanced budget), as well as state annexation law variables *IMPACT* (impact report) and *PLAN* (service plan), have generally positive effects on municipal financial condition but with a few exceptions (For example, balanced budget is related to decrease in *Operation ratio*, and increase in *Debt service ratio*). The other socio-economic variables generally present the effects as expected. Some of them show strong differential effects, for example, central city (CENTRAL) has negative changes in all the four

⁶ $Finance_i = \beta_0 + 0.037\Delta Area_i + 0.039 \Delta Area_i * Reliance_i + \varepsilon_i = \beta_0 + 0.076\Delta Area_i + \varepsilon_i$, when $Reliance_i = 1$. So the coefficient for $\Delta Area_i$ is 0.076 in this condition.

⁷ $Finance_i = \beta_0 + 0.037\Delta Area_i + 0.038 \Delta Area_i * Authority_i + 0.039 \Delta Area_i * Reliance_i + \varepsilon_i = \beta_0 + 0.114\Delta Area_i + \varepsilon_i$, when $Authority_i = 1$ and $Reliance_i = 1$. So the coefficient for $\Delta Area_i$ is 0.114 in this condition.

financial condition indicators compared to suburban and rural cities and towns during 1990 and 2000.

Table 3.7

Results for the Estimates: Base Models

	Per-capita total revenues	Per-capita own-source revenues	Operations ratio	Debt service ratio
AREA	0.014 (0.016)	0.174*** (0.044)	0.001 (0.013)	0.674* (0.385)
NOTELS	0.057** (0.029)	0.026 (0.029)	0.048** (0.020)	-0.034 (0.180)
BB	-0.005 (0.035)	0.138*** (0.038)	-0.037 (0.026)	0.423*** (0.143)
IMPACT	-0.024 (0.031)	0.136*** (0.037)	0.010 (0.020)	-0.054 (0.184)
PLAN	0.028 (0.029)	0.113*** (0.038)	0.049* (0.026)	0.108 (0.124)
DENS	-0.001 (0.003)	0.012 (0.007)	0.001 (0.001)	-0.017 (0.015)
EDU	-0.090*** (0.026)	1.119*** (0.060)	0.021 (0.017)	0.055 (0.262)
OCC	0.778*** (0.290)	0.884 (0.379)	-0.268 (0.191)	-5.849*** (1.673)
HHINC	0.611*** (0.198)	0.569*** (0.197)	0.086 (0.138)	-0.055 (0.788)
POV	-0.006 (0.020)	0.147 (0.030)	0.012 (0.016)	0.050 (0.176)
NHWHT	0.085 (0.160)	0.187** (0.088)	0.058 (0.059)	-1.329*** (0.434)
CENTRAL	-0.109*** (0.025)	-0.136*** (0.034)	-0.111*** (0.024)	-0.643 (0.139)

INTERCEPT	0.162***(0.026)	-0.012(0.029)	0.019***(0.016)	0.675***(0.177)
N	5892	5460	6048	3858
R-square	0.090	0.439	0.073	0.034

Note. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors of the mean are presented in parentheses.

Table 3.8

Results for the Estimates: Interactive Models

	Per-capita total revenues	Per-capita own-source revenues	Operations ratio	Debt service ratio
AREA	0.025 (0.022)	0.117** (0.055)	0.037*** (0.014)	0.389 (0.298)
AUTHORITY	0.064** (0.031)	-0.057 (0.042)	0.026 (0.023)	-0.269** (0.104)
RELIANCE	0.002 (0.039)	0.003 (0.049)	-0.020 (0.031)	-0.009 (0.088)
AREA*AUTHORITY	0.038 (0.024)	0.013** (0.094)	0.038** (0.019)	-0.345 (0.298)
AREA*RELIANCE	0.039** (0.038)	0.120 (0.109)	0.039* (0.029)	0.611(0.378)
NOTELS	0.048* (0.026)	0.018 (0.027)	0.046** (0.019)	-0.011 (0.100)
BB	-0.001 (0.029)	0.135*** (0.032)	-0.038* (0.022)	0.254** (0.087)
IMPACT	-0.037 (0.027)	0.122 ** (0.036)	0.009 (0.020)	-0.106(0.137)
PLAN	0.037 (0.029)	0.121** (0.044)	0.058** (0.028)	0.117 (0.076)
DENS	0.001 (0.003)	0.013 (0.008)	0.003* (0.001)	-0.004 (0.009)
EDU	-0.088** (0.027)	1.112*** (0.059)	0.025 (0.017)	0.053 (0.164)
OCC	0.725** (0.276)	0.926 (0.368)	-0.226 (0.174)	-4.406*** (1.223)

HHINC	0.622** (0.198)	0.597** (0.192)	0.085 (0.136)	-0.243 (0.420)
POV	-0.010 (0.020)	0.143 (0.030)	0.012 (0.017)	0.018(0.118)
NHWHT	0.070 (0.169)	0.191** (0.085)	0.042 (0.060)	0.646** (0.302)
CENTRAL	-0.105* (0.024)	-0.133*** (0.033)	-0.109*** (0.023)	-0.329*** (0.079)
INTERCEPT	0.201*(0.029)	0.027 (0.034)	0.039**(0.017)	0.523*(0.104)
N	5892	5460	6048	3810
R-square	0.097	0.441	0.077	0.048

Note. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Robust standard errors of the mean are presented in parentheses.

3.6 Discussion

Understanding the fiscal implications of annexation is important to municipal planning, financial management, and service delivery. This study examines annexation in a multivariate context using municipal-level data. Hypothesis 1, 2 and 3 are all partially verified in our analyses. The base model shows annexation has various effects on different aspects of local government financial condition. It is associated with rise in per-capita total revenues-own sourced, but is also related to higher debt service ratio as a financing obligation. With many dynamic forces surrounding annexation activity nowadays, the narrow perspective on the fiscal effects of annexation masks many facts of local government's planning and financial management.

This research underscores the important role of local revenue structure in the relationship between annexation and local government's financial condition. Careful analysis of the variables in the interactive model reveals that the net fiscal outcome of annexation depends on the options and arrangements the municipality has in revenue collection, holding policy and socio-economic variables constant. Though there are exceptions, I generally find that municipalities with diversified taxing authority and/or with a balance of "inelastic" and "elastic" revenue sources are more likely to have improved their financial conditions through annexation. These municipalities present greater capabilities of retrieving fiscal benefits from the new territory and financing the increased public service demands in an effective manner. For other municipalities, the limited and inflexible taxing

authority and revenue reliance might have counteracted the efficiency benefits gained from annexation.

Although these analyses reveal important dynamics among annexation, local revenue structure and local government's financial condition, many questions remain. Limited by data availability, I am unable to do analyses with a longitudinal nation-wide sample, but a snapshot of the differences between 1990 and 2000. The various changes in financial condition and socio-economic situations within the 10 years are mostly unknown. The measures of local revenues structure are broad and are only approximations of fiscal behaviors of the municipalities. For example, just because some municipalities have more options as to sources of revenues does not mean they would aggressively raise more revenue. They examine the administrative costs and political feasibility prior to adopting or expanding revenue and taxing authority. The actual arrangement of revenue collection could be far more complicated. Even with the same local revenue structure, there are still many variations of local circumstances related to the actually fiscal results of annexation.

A practical question that arises beyond the role of local revenue structure is the effect of actual planning or development outcomes in areas that are annexed. Previous studies argue that the fiscal consequences are not only brought about by area expansion, but also by the fiscal activities in the new areas (Edwards, 2008; Edwards & Xiao, 2009). Further research on the specific circumstance of the developments along with annexation is necessary to better understand the fiscal

issues of annexation. In this sense, land use is a proper reflection of the developments and economic activities on the annexed areas.

To investigate the role of land use, and also avoid similar data and methodological weakness in this chapter, another empirical analysis with different dataset and methods are conducted in the next chapter. The next chapter aims to examine annexation's fiscal implications by focusing on the role of the land use situation of the municipality. Rather than a large cross-sectional dataset, the analysis in the next chapter employs a sample of municipalities with similar revenue structures, and uses a longitudinal dataset. The information from the annual data of the sample municipalities allows us to explore more details of annexation activities, financial condition's changes, and the important role played by the land use situation.

CHAPTER IV
THE ROLE OF LAND USE: THE CASE OF PHOENIX METROPOLITAN
AREA

4.1 Introduction

This chapter offers a comprehensive perspective of the relationships among annexation, land use and local government finance in one metropolitan region, to inform a larger debate of urban growth and local finance management. It addresses four research questions: (1) what is the role of land use in the relationship between annexation and the local government's financial conditions? In other words, are annexation's fiscal effects conditional on the local land use situation? (2) what are the spatial patterns of annexation activities and land uses? (3) how is annexation related to land use changes at the municipal level? And (4) what are the fiscal implications of land use at the municipal level?

In answering these questions, a sample of 24 municipalities in the Phoenix metropolitan area (1990 to 2009) is studied to test two hypotheses established in Chapter 2: **H2**: A higher proportion of "profitable" land uses (e.g. commercial land) in a municipality is associated with a better financial condition of local government; and **H3**: Annexation's effects on a local government's financial condition depends on the land use situation of the municipality.

The Phoenix metropolitan area is chosen for four reasons. First, as a typical southwestern metropolitan area, it provides most current features and characteristics of municipal annexation in the U.S.. Land-based growth and

annexation were regarded as key elements of the history of the Phoenix metropolitan area (Collins, 2005), and their nexus with local government finance in this area has obtained scholars' attention (Heim, 2006; Heim, 2007; Ramirez de la Cruz, 2007). Figure 4.1 shows the extensive annexation activities in this area between 1990 and 2009.

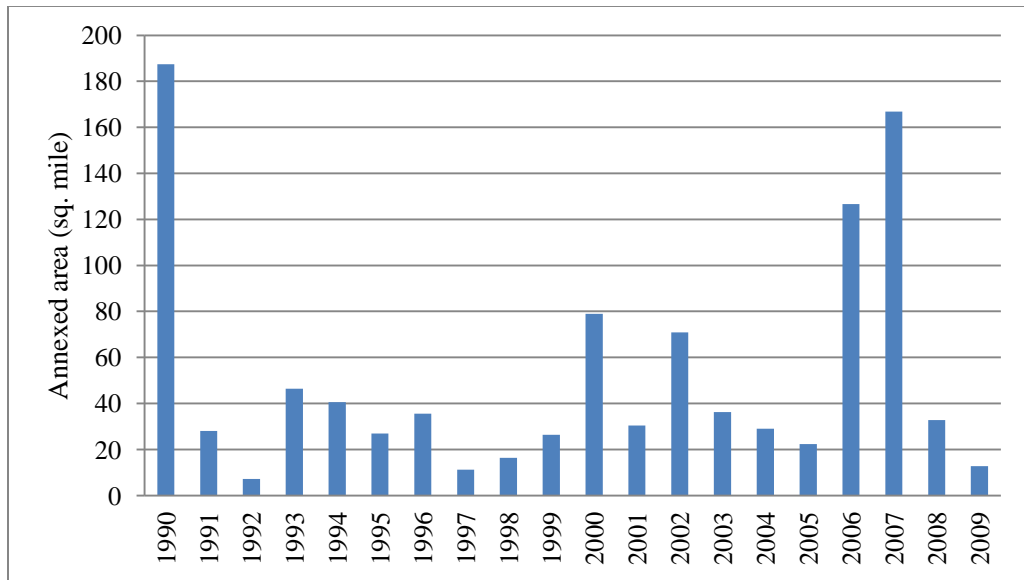
Second, cities and towns in this area present a spectrum of municipalities including large cities as Phoenix, and small towns such as Gila Bend with a population of less than 2,000 in 2009. The spectrum of municipalities provides various cases of annexations.

Third, by drawing the sample from a single county in a state, it is possible to control certain common factors of the intergovernmental system which greatly affects municipal fiscal behaviors and annexation practices. Local annexation behavior is authorized by state general enabling legislation. By shaping the incentives of local actors to pursue annexation and determining the range of powers available to local governments, state law potentially plays a significant role in facilitating or constraining local annexation activities (Carr & Feiock, 2001; Edwards, 2011; Liner, 1994). These municipalities in the same county face similar legal constraints in terms of the types of revenues available, and service categories required (Stainbauer et al., 2002).

Finally and mostly importantly, limiting the sample to only Phoenix metropolitan cities and towns guarantees a precise examination of the role played by the land use pattern and land use change. The measurement of land use is complicated as will be explained in this chapter. A nation-wide land use dataset

with consistent measurement is almost nonexistent. Sampling municipalities within a certain geographic region ensures the consistency of land use measurement.

Figure 4.1 Municipal Annexations: Area Annexed by Year in Maricopa County (1990-2009)



4.2 Data and Methodology

This research employs mainly three sets of variables for the 24 municipalities in Phoenix metropolitan area: one set of local government's financial condition indicators as the dependent variables; and two sets of independent variables including the annexations being implemented by these municipalities and land use compositions of these municipalities. These variables with the unit of per municipality per year are assembled in a panel data set from

1990 to 2009. The basic analytical strategy is to estimate the effects of annexation and land use composition on the conditions of municipal finance.

Dependent variables

Similar to the models in Chapter III, the dependent variables I use here are indicators of local government financial condition. Four indicators are used including *Per-capita total revenues*, and *Per-capita total expenditures*, *Operations ratio* (=total revenues/total expenditures), and *Debt service ratio* (=total interest payment to debt/ total expenditures). The only difference is that I include *Per-capita total expenditures* and eliminate the *Per-capita own-source revenues*. This change is made based on the expected effects of land use and annexation on not only the revenue side, but also the expenditure side of local government finance.

There are two data sources of these measurements: the Census of Governments every five years (1992, 1997, 2002, & 2007), and the Survey of Local Government Finance (Arizona) by the Census Bureau with a sample of local governments in the intervening years. Both surveys provide periodic and comprehensive statistics of revenue, expenditure, debt, and assets for local governments. To adjust for inflation over the years, the dependent variables used here are all converted to 1990 US dollar value.

Explanatory variables

To measure annexation, I draw on data from Maricopa County Government (requested by email). The original data are in Geographic

Information Systems (GIS) format with annexation information of the 24 municipalities in Maricopa County from 1885 to October 2010. The data between 1990 and 2009 are converted into Excel spreadsheets and aggregated by year and municipality. As a result of data processing, one parameter is used to describe municipal annexation: the *Percent Change in Area* of each municipality each year. Table 4.1 provides the general area change facts of the 24 municipalities in Maricopa County from 1990 to 2009.

Table 4.1

Land Area of Municipalities in Maricopa County (1990-2009) (Unit: square mile)

<i>Municipality</i>	<i>1990</i>	<i>2000</i>	<i>2009</i>	<i>Change 1990-2009</i>
Avondale	37.20	42.05	45.09	21.22%
Buckeye	81.42	145.19	375.44	361.12%
Carefree	8.78	8.80	8.80	0.23%
Cave Creek	22.56	27.89	37.62	66.76%
Chandler	47.74	59.07	64.36	34.81%
El Mirage	9.89	9.89	9.94	0.51%
Fountain Hill	16.74	18.27	20.32	21.39%
Gila Bend	8.65	29.45	50.53	484.16%
Gilbert	26.99	46.96	68.03	152.06%
Glendale	50.07	54.88	58.71	17.26%
Goodyear	113.94	116.75	191.20	67.81%
Guadalupe	0.79	0.79	0.80	0.39%
Litchfield	2.46	2.99	3.29	33.74%
Mesa	121.02	128.18	136.99	13.20%
Paradise	15.21	15.38	15.38	1.12%
Peoria	60.97	153.14	177.93	191.83%
Phoenix	421.63	476.66	518.32	22.93%
Queen Creek	10.72	26.43	27.95	160.73%
Scottsdale	183.03	183.44	184.47	0.79%
Surprise	60.64	71.67	105.89	74.62%

Tempe	39.57	40.03	40.04	1.19%
Tolleson	4.46	5.15	5.38	20.63%
Wickenburg	10.82	11.21	18.39	69.96%
Youngtown	1.26	1.48	1.49	18.25%
Total	1356.55	1675.73	2166.34	59.69%

Note. Data are aggregated based on GIS data from Maricopa County Government, Arizona

To measure land use, I rely on land use GIS data from the Maricopa Association of Governments (MAG). These data are available for the years of 1990, 1995, 2000, 2004, & 2009. The categories of land use across these years are not consistent, since the categories in the 2000s are different from the 1990s. Each city and the County Assessor’s Office have their own land use codes. MAG aggregates data by creating a proper cross-walk between different land use codes, thus making a single coherent code system. As a result, the coherent code system changes over time. To solve the problem of coding inconsistency, and to reduce the dimensions of land use variables, I aggregated the original categories of land use of both the 1990s and the 2000s into four categories: commercial, residential, public, and vacant (see Appendix A). Since the existing land uses of an urban area do not usually change dramatically, linear interpolation was used to impute the land uses for missing years.

By matching the recoded land use data with the municipalities’ annual territories on the GIS map, the annual land use information within each municipality can be determined. To measure a certain type of land use, I use the percentage of this land use in the area for the whole territory of a municipality

each year. For instance, the “Commercial” land use is described by the *Percentage of commercial land* of the total land of each municipality each year. Similar parameters are also used for other three types of land use: *Percentage of vacant land*, *Percentage of residential land*, *Percentage of public land*. In the regression analysis, the *Percentage of public land* is omitted to avoid multicollinearity.

Control variables

Beyond the annexation and land use variables, four control variables of demographic and socioeconomic characteristics are also included in the analysis. *Density* is a “built environment” measurement which influences the demand of public services (Carruthers & Ulfarsson, 2008; Edwards & Xiao, 2009). Other control variables include *Median household income*, *Percentage of population 25 or older with at least some college education*, and *Percentage of population aged between 18 and 65*. All of them indirectly measure the preferences of the local population, and reflect their contributions to local revenues, and demands for local services (Edwards & Xiao, 2009). The measurements and sources of all the variables are provided in Table 4.2.

Table 4.2

Annexation, Land use, and Control Variables

Variable	Definition & measurement	Sources
ANNEX	Percentage change in area because of annexation	Maricopa County Government
VAC	Percentage of vacant land	Maricopa Association of Governments (MAG)
COMM	Percentage of commercial land	MAG
RES	Percentage of residential land	MAG
PUB	Percentage of public land	MAG
DENS	Persons per square mile (1000 unit)	Decennial Census, 1990 & 2000, & annual estimates
INC	Median household income (\$1000 unit, in 1990 dollars)	Census Bureau American Community Survey (ACS) & Decennial Census, 1990& 2000
EDUC	Percentage of population 25 or older with at least some college education	Census Bureau ACS & Decennial Census, 1990& 2000
AGE	Percentage of population 18 to 65 years old	Census Bureau ACS & Decennial Census, 1990& 2000

4.3 Descriptive Analysis

To estimate the hypothesized relationships, I first present a descriptive statistics (see Table 4.3) and GIS visualization which tracks the land uses and annexations in the Phoenix metropolitan area from 1990 to 2000. This is the first component of empirical analysis.

Table 4.3

Descriptive Statistics of Variables

Variable	Definition	Mean	Std. Dev.
<i>Dependent variable</i>			
OR	Operations ratio	1.05	0.25
SDR	Debt service ratio	0.08	0.16
TREV	Per-capita total revenue (\$1000 unit, in 1990 dollars)	0.96	0.45
TEXP	Per-capita total expenditure (\$1000 unit, in 1990 dollars)	0.97	0.52
<i>Independent variables</i>			
ANNEX	Percentage change in area because of annexation	0.02	0.07
VAC	Percentage of vacant land	0.53	0.25
COMM	Percentage of commercial land	0.05	0.05
RES	Percentage of residential land	0.28	0.18
PUB	Percentage of public land	0.14	0.11
DENS	Persons per square mile (1000 unit)	1.624	1.653
INC	Median household income (\$1000 unit, in 1990 dollars)	4.092	1.991
EDUC	Percentage of population 25 or older with at least some college education	0.559	0.204
AGE	Percentage of population 18 to 65 years old	0.592	0.061

GIS data allows us to identify spatial distributions of annexation activities and land use changes across years. Figure 4.2 shows the distribution of all the land areas being annexed during 1990 and 2009. It shows that the annexations

took place extensively in the cities and towns on the fringe while smaller scale annexations were going on within the inner-ring communities of the metropolitan area. Figure 4.3 and Figure 4.4 present the land use situation of all the incorporated areas with Maricopa County before and after the 20 years. They show that the land use situation changed in each municipality not only due to annexation, but also because development that happened in its existing territory. This is also a reason that in the regression analysis I consider the land uses for the entire territory of each municipality instead of considering land uses on only the annexed areas. The changes in land use in existing territory should not be ignored as they have potential fiscal implications as well.

In addition, Table 4.4 presents the land use characteristics of the areas being annexed during the 20 years, in which 82% of the annexed areas were vacant at the time being annexed, and only 0.5% of them were commercial land. It is possible that most of the big scale annexations on the metropolitan fringe brought vacant lands to the municipalities.

Figure 4.2 Annexed Area in Phoenix Metropolitan Area (1990-2009)

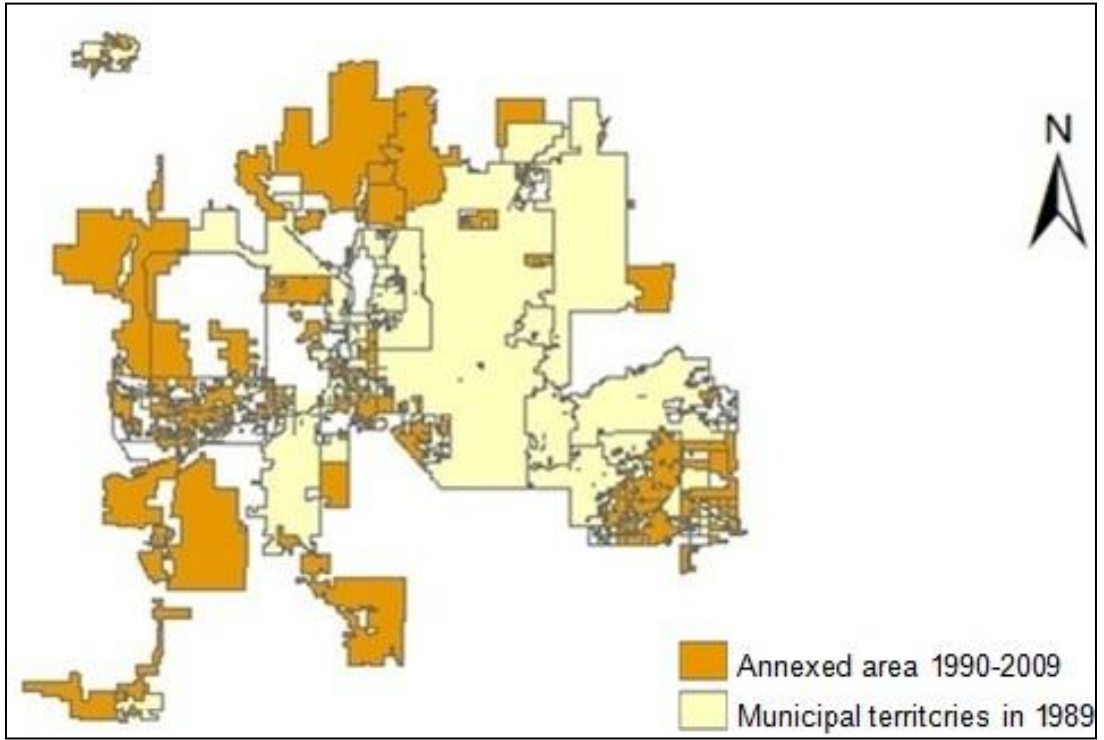


Figure 4.3 Land Use Situation in Phoenix Metropolitan Area (1990)

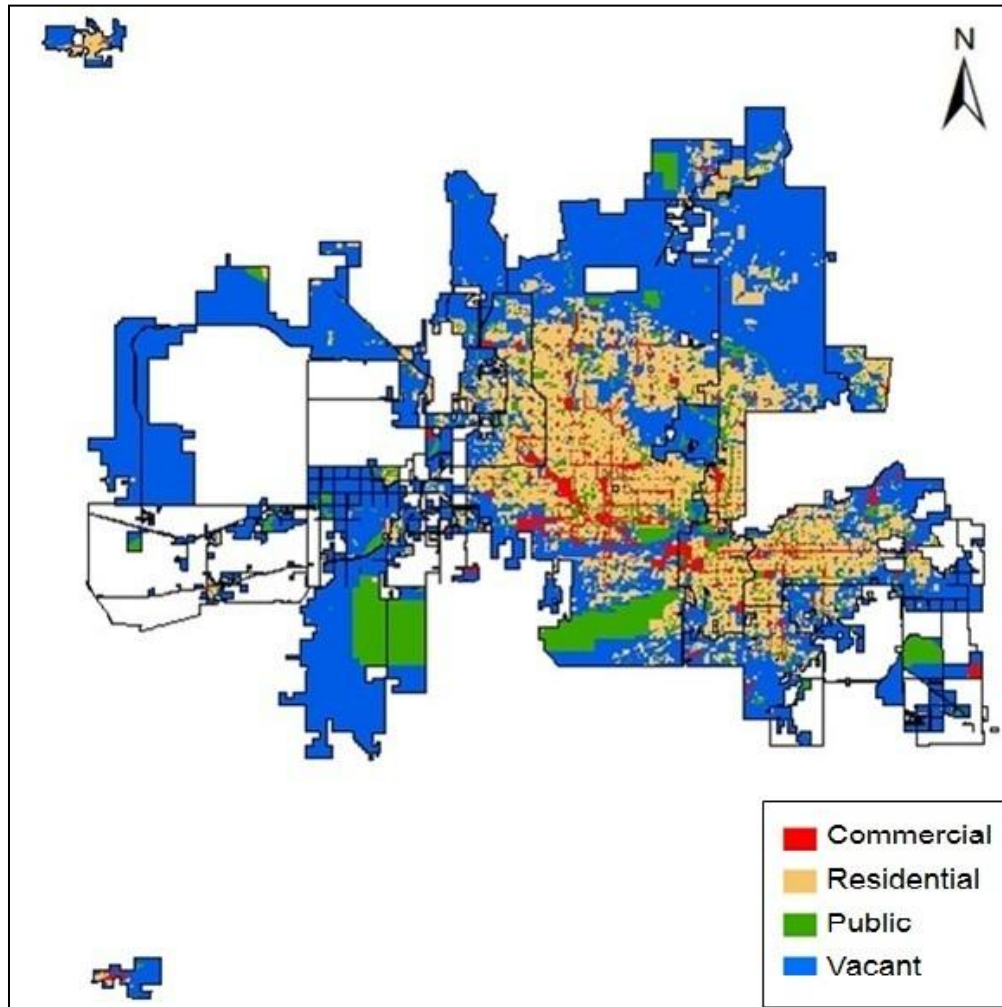


Figure 4.4 Land Use Situation in Phoenix Metropolitan Area (2009)

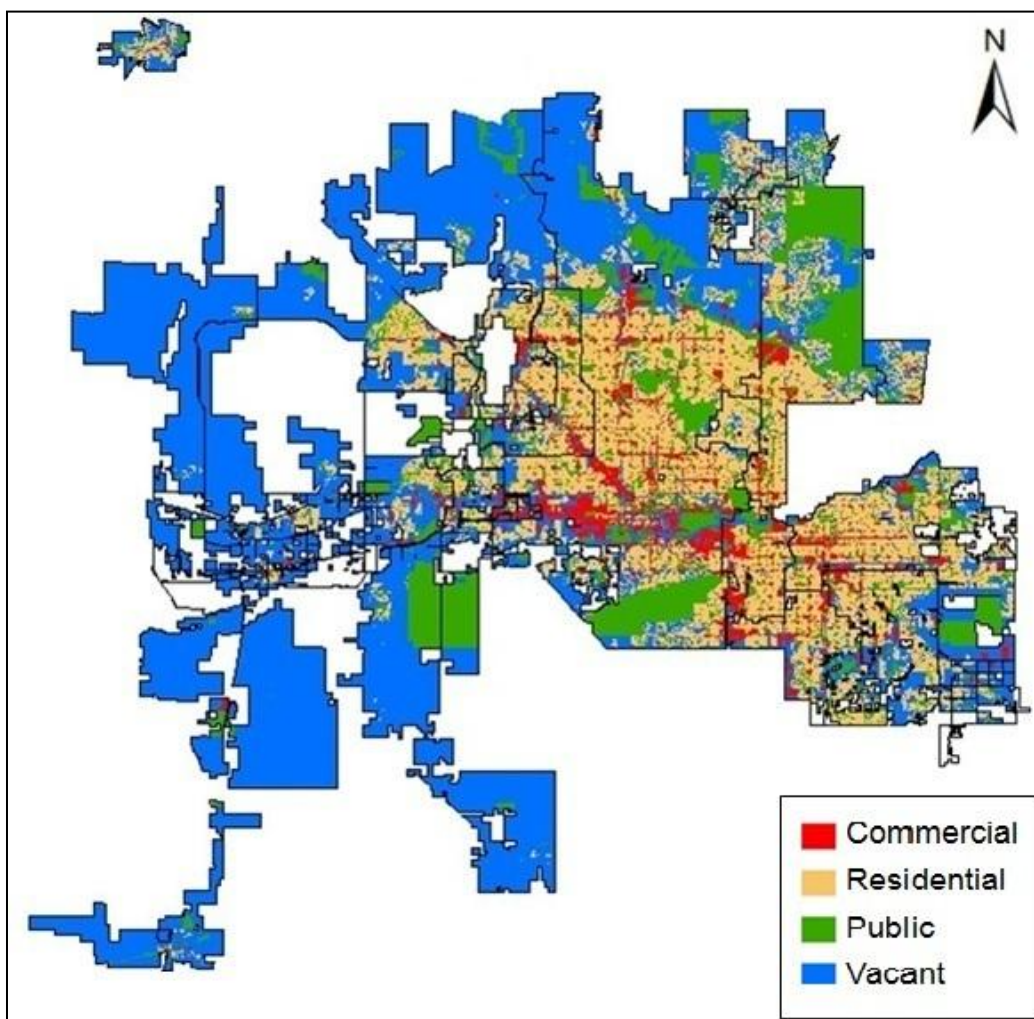


Table 4.4

Land Uses of the Annexed Areas in Phoenix Metro (1990-2009)

Land use type	Square miles	Percentage
Vacant	671.82	82.10%
Commercial	4.28	0.50%
Residential	29.60	3.60%
Public	112.69	13.80%
Total	818.38	100.00%

Note. Data are aggregated based on GIS data from Maricopa County Government, Arizona

4.4 Models of Fixed Effects Panel Data Analysis

The second component of the empirical analysis is a panel data analysis using fixed effects models. I begin with a base model which estimates the relationship between annexation and the local financial condition without considering the effects of land use. I estimate Equation 1, a fixed effects model of panel data:

$$Y_{it} = \beta_0 + \beta_1 Annex_{it} + \beta_{it} X_{it} + a_i + d_t + v_{it} + \mu_{it} \quad -- (1)$$

where Y_{it} refers to the four parameters of local government financial condition: Per-capita total revenues, Per-capita total expenditures, Operation ratio, and Debt service ratio, and I take the natural logarithm of all these four indicators;

$Annex_{it}$ is the percent change in area of each municipality each year; the X_{it} is a vector that includes the four control variables: Density, Median household

income, Percentage of population aged 25 or older with at least some college education, and Percentage of population aged between 18 and 65. I also include the city-fixed effects and year-fixed effects into the model to reduce the bias that unobserved variables could potentially produce. The city fixed effects (a_i) should capture unobserved variables that are constant over years within a given city, but different from city to city (such as city's specific government structure, and geographic location); the year fixed effects (d_t) should control for unobserved variables in a given year that are common to all cities (such as the national economic shocks, and federal policy changes). Besides, city-specific linear time trends (v_{it}), one for each city, are added to control unobservable factors that change linearly over time within a city and affect local government financial condition. All differences between individual municipalities, referred as individual heterogeneity, are assumed to be captured by fixed effects and time trends.

To investigate the effects of a municipality's land use situation on its financial condition as specified in Hypothesis 2, I estimate Equation 2 as the following. In this model, the key independent variables, *Vac*, *Comm*, and *Res*, are percentages of vacant, commercial, and residential area in each city each year. Since the sum of the percentages of all land use categories equates to 1, the fourth category of land use, public land, is omitted in the model to avoid the problem of multi-collinearity.

$$Y_{it} = \beta_0 + \beta_1 Vac_{it} + \beta_2 Comm_{it} + \beta_3 Res_{it} + \beta_{it} X_{it} + a_i + d_t + v_{it} + \mu_{it}$$

-- (2)

To further address the role of land use in the relationship between annexation and local government's financial condition, Equation 3 with both annexation and land use variables, and three interactions is estimated.

$$Y_{it} = \beta_0 + \beta_1 Annex_{itc} + \beta_2 Vac_{itc} + \beta_3 Comm_{itc} + \beta_4 Res_{itc} + \beta_5 Annex_{itc} * Vac_{itc} + \beta_6 Annex_{itc} * Comm_{itc} + \beta_7 Annex_{itc} * Res_{itc} + \beta_{it} X_{itc} + a_i + d_t + v_{it} + \mu_{it}$$

-- (3)

This is based on Hypothesis 3 that annexation's effect on local government's financial condition depends on the land use composition of the municipality. To facilitate the interpretation of the model with interaction terms of annexation and land use, all the dependent and key independent variables are centered on their means.⁸ The centered variable of annexation $Annex_{itc}$ is multiplied by centered variables of land use (Vac_{itc} , $Comm_{itc}$, and Res_{itc}) to yield three interactions in the model. This model allows us to see how annexation's fiscal effects change along with the change of the municipal land use composition. These coefficients of the interactions (β_5 , β_6 , and β_7) capture the differential effects of annexation on local government's financial condition with different land use compositions.

4.5 Results

⁸ Mean centering makes coefficients easier to interpret, reduces the multi-collinearity (Cronbach 1987), and it doesn't affect substance of results (e.g., R^2 is unaffected) (Young, 2006).

As explained above, three models are used to investigate the determinants of these four financial condition indicators (*Per-capita total revenues*, *Per-capita total expenditures*, *Operations ratio*, and *Debt service ratio*). Results of these estimates provide mixed evidence for the hypotheses.

Table 4.5 provides the regression results for models with *Per-capita Total Revenues* as the dependent variable. In model 1, the base model without considering the fiscal effects of land use situation, no significant relationship between *Annexation* (percentage change in area per city per year) and *Per-capita Total Revenues* is identified. The results of model 2 present the effects of land use composition on city's per-capita total revenues when annexation is excluded. As mentioned before, the *Percentage of public land* is omitted to avoid multicollinearity in the regression analysis. Thus the public land use is regarded as the base group in interpreting the effects of the other three types of land use. *Percentage of commercial land* in the total area of each municipality each year compared to public land (the base group) is positively associated with local government's *Per-capita Total Revenues* (90% level). When annexation and other explanatory variables are held constant, 1% increase of commercial land use instead of public land within the municipality is related to a 2.223% increase in per-capita total revenues of the local government. This effect is qualitatively the same in model 3, the full model which includes both annexation and land use variables.

Model 3 presents a positive association of annexation and the dependent variable where 1% increase of area each city each year is linked to 0.403%

increase in per-capita total revenues of the local government. However, we cannot take this simple view of annexation's effects since all the three interactions (*ANNEX*VAC*, *ANNEX*COMM*, and *ANNEX*RES*) are found to have significant impacts. It is more complicated to interpret the joint effects of annexation variable and the interactions. For example, the effects of vacant land use are interpreted based on the coefficient of annexation (0.403) and the coefficient (-7.661) of *ANNEX*VAC*. These coefficients show that the effect of annexation on per-capita total revenues is conditional on the percentage of vacant land in the city while keeping other variables at their means (mean=0). To be specific, the effects of annexation is positive when the city has less than 2.1% of vacant land; the effect turns into negative when the city has more than 2.1% of vacant land.⁹

Table 4.5

Results on Per-capita Total Revenues

	Model 1	Model 2	Model 3
ANNEX	0.0423(0.155)		0.403*(0.234)
VAC		-0.151(0.164)	-0.234(0.159)
COMM		2.223*(1.228)	2.051*(1.218)
RES		-0.208(0.445)	-0.200(0.437)
ANNEX*VAC			-7.661**(2.213)
ANNEX*COMM			24.064**(10.163)

⁹ When other variables are held at their means, $\ln(\text{Per-capita Total Revenues}) = 0.403*ANNEX - 7.661*ANNEX*VAC = (0.403-7.661*VAC)*ANNEX$. The slope between $\ln(\text{Per-capita Total Revenues})$ and *ANNEX* is $(0.403-7.661*VAC)$ for their linear relationship. Therefore, slope > 0 when $VAC < 0.021$; slope = 0 when $VAC = 0.021$; and slope < 0 when $VAC > 0.021$.

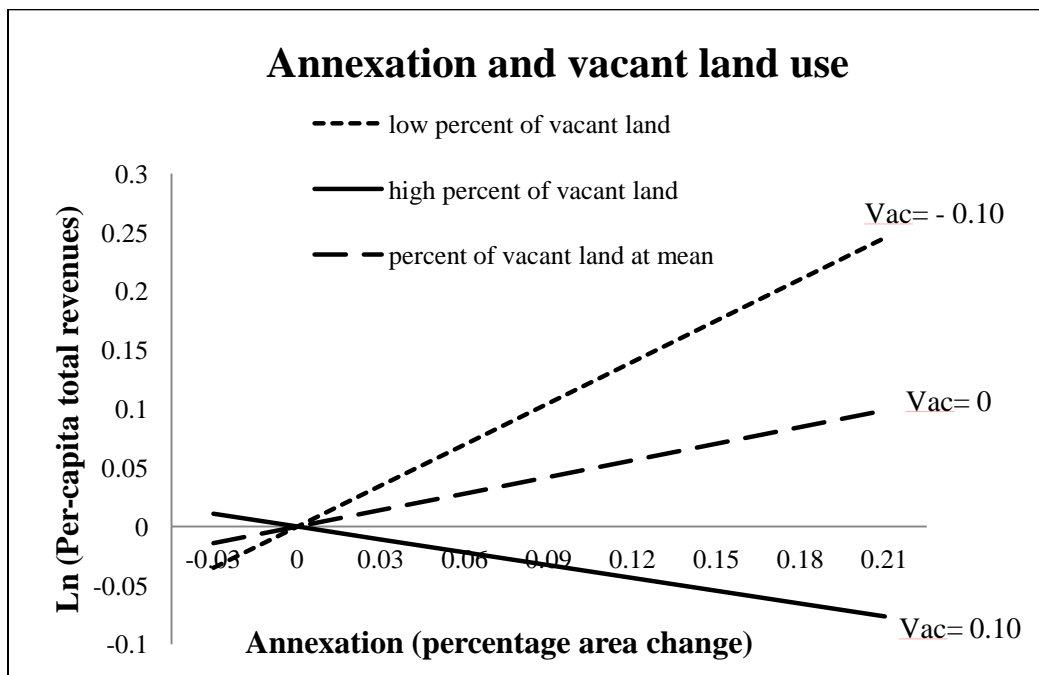
ANNEX*RES			5.911*(3.132)
DENS	-0.195**(0.063)	-0.209**(0.067)	-0.197**(0.072)
INC	-0.011(0.007)	-0.007(0.007)	-0.009(0.008)
EDUC	0.927(0.658)	1.112*(0.601)	1.188*(0.677)
AGE	12.809*** (3.093)	11.491** (3.466)	12.048*** (3.412)
INTERCEPT	-7.878*** (1.853)	-7.238*** (1.964)	-7.649*** (1.919)
N	274	274	274
R-square	0.943	0.944	0.948

Note. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Time trends, year-fixed effects and city-fixed effects are included in all models; Robust standard errors of the mean are presented in parentheses.

To visually present the dynamics of annexation, vacant land, and per-capita total revenues, Figure 4.5 depicts three scenarios of a city with different vacant land situations: low percentage of vacant land (e.g. 10% below the mean), percentage of vacant land at mean (0), and high percentage of vacant land (e.g. 10% above the mean). When a city has low proportion of vacant land, annexation is positively associated with per-capita total revenues (the dotted line); when a city has proportion of vacant land at mean, the effect of annexation is still positive but smaller (the dashed line); and when a city has high proportion of vacant land, annexation is negatively associated with per-capita total revenues (the solid line). To summarize, as the percentage of vacant land increases in a city, the effect of annexation on per-capita total revenues declines, from positive to zero, and then to negative, holding all the other variables at their means. That is, cities with higher proportion of land vacant are less likely to increase per-capita total

revenues via annexation. Moreover, based on the similar analyses, it can be summarized that as proportion of commercial or residential land increases, the effect of annexation on per-capita total revenues increase (see Appendix B and Appendix C).

Figure 4.5 *The Effects of Annexation and Vacant Land Use on Per-capita Total Revenues*



Note. All the three variables, Ln(per-capita total revenue), Annexation, and Vacant land are centered at their mean (mean=0)

The results of the estimations of *Per-capita Total Expenditures* are shown in Table 4.6. There are no significant effects of annexation or land use variables found in all models. In model 3, the interaction between annexation and proportion of residential land (*ANNEX*RES*) is negatively associated with the

dependent variable. It indicates that annexation has a greater negative effect on the city's per-capita total expenditures as the city has a larger proportion of residential land instead of public land, keeping other variables at their means; that is, annexation along with residential land development is associated with the reduction of per-capita total expenditures of the city.

Table 4.6

Results on Per-capita Total Expenditures

	Model 1	Model 2	Model 3
ANNEX	-0.155(0.250)		-0.048(0.423)
VAC		0.423(0.379)	0.330(0.373)
COMM		-0.992(2.283)	-1.252(2.265)
RES		1.087(0.832)	1.096(0.843)
ANNEX*VAC			-8.538 (3.728)
ANNEX*COMM			-15.363(22.052)
ANNEX*RES			-10.926*(6.124)
DENS	-0.188(0.122)	-0.215(0.141)	-0.235(0.150)
INC	-0.025(0.019)	-0.028(0.019)	-0.029(0.019)
EDUC	0.026(1.637)	2.417(1.676)	2.361(1.658)
AGE	0.22(7.743)	3.993(8.061)	5.673(8.224)
INTERCEPT	-1.922(4.235)	-3.056(4.427)	-4.084(4.566)
N	273	273	273
R-square	0.828	0.830	0.834

Note. * $p < 0.1$; Time trends, year-fixed effects and city-fixed effects are included in all models; Robust standard errors of the mean are presented in parentheses.

Table 4.7 provides the regression results for models with *Operations ratio* (total revenues/total expenditures) as the dependent variable. *Operations ratio*, is an indicator of a municipality's ability of financing public service. *Annexation* is found to have no significant effects on the dependent variable throughout the three models. Model 2 finds the *Percentage of vacant land* is negatively associated with local government's *Operations ratio*, while the *Percentage of commercial land* is positively associated with the dependent variable. Similar effects of these two variables are identified in model 3. They indicate that a higher percentage of vacant land area reduces local government's ability to finance public services, while an increase in commercial land is related to positive changes in local government's ability of financing public service.

Table 4.7
Results on Operations ratio (total revenues/total expenditures)

	Model 1	Model 2	Model 3
ANNEX	0.201(0.244)		0.458(0.375)
VAC		-0.577* (0.348)	-0.568*(0.344)
COMM		3.180*(2.088)	3.269*(2.084)
RES		-1.303(0.799)	-1.306(0.820)
ANNEX*VAC			-0.787(2.663)
ANNEX*COMM			8.862(18.812)
ANNEX*RES			4.932(5.108)
DENS	-0.002(0.118)	0.011(0.136)	0.044(0.145)

INC	0.014(0.019)	0.020(0.018)	0.020(0.018)
EDUC	-1.709(7.521)	-1.321(1.546)	-1.190(1.557)
AGE	10.528(2.792)	7.446(7.625)	6.306(7.906)
INTERCEPT	-5.925 (4.065)	-4.152(4.178)	-3.527(4.379)
<hr/>			
N	273	273	273
R-square	0.455	0.472	0.477
<hr/>			

Note. * $p < 0.1$; Time trends, year-fixed effects and city-fixed effects are included in all models; Robust standard errors of the mean are presented in parentheses.

The results of the estimates of *Debt service ratio* (interest payments on debt/ total expenditures) are presented in Table 4.8. As explained in Table 3.2, a lower debt service ratio is better sign of local government's financial condition as it means less expenditures are committed to debt service, which leads to more flexibility in financing public service. Model 1 finds a significant negative relationship between *Annexation* and *Debt service ratio* while controlling for other variables. It suggests that cities with more annexation have fewer expenditures being committed to annual debt service, and thus are able to increase expenditures on public service. In this sense, annexation has possible impacts on increasing local government service flexibility. Model 2, however, doesn't find significant association of land use and debt service ratio. In model 3, by contrast, both annexation and three interactions are significantly associated with debt service ratio, which means the relationships between annexation and debt service ratio are dependent on the situations of these three types of land uses. I interpret these dynamics and summarize each set of relationships while keeping other variables at their means: annexation is negatively related to debt service ratio

when a city is has low proportion of vacant land (<8.05%), and the relationship turns positive when a city has higher than 8.05% of vacant land; annexation is negatively related to debt service ratio when a city has a low proportion of commercial land (<2.65%), and the relationship turns positive when a city has higher than 2.65% of commercial land; and annexation is negatively related to debt service ratio when a city is has low proportion of residential land (<8.67%), and the relationship turns positive when a city has higher than 8.67% of residential land. Simply speaking, the more vacant, commercial, and vacant land compared to the public land that a city has, the more likely the city's annexation results in higher debt service ratio.

Table 4.8

Results on Debt Service ratio (Interest Payments on Debt/ Total Expenditures)

	Model 1	Model 2	Model 3
ANNEX	-2.006** (0.972)		-3.398*** (0.887)
VAC		-0.614 (0.850)	-0.140(0.839)
COMM		-12.818(9.088)	-12.186(8.927)
RES		0.898(2.062)	1.200(2.153)
ANNEX*VAC			42.184*** (7.941)
ANNEX*COMM			128.430** (45.128)
ANNEX*RES			39.186*** (10.897)
DENS	-0.603*(0.335)	-0.431(0.338)	-0.615*(0.36)
INC	0.027 (0.0586)	0.015(0.059)	0.024(0.060)
EDUC	-8.761** (3.942)	-8.803** (4.113)	-9.247** (4.024)

AGE	31.114(22.317)	31.805(23.954)	27.709(23.209)
INTERCEPT	-17.104 (12.302)	-16.689(12.982)	-13.848(12.521)
N	252	252	252
R-square	0.785	0.782	0.805

Note. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; Time trends, year-fixed effects and city-fixed effects are included in all models; Robust standard errors of the mean are presented in parentheses.

4.6 Discussion

The analyses of the models indicate that the fiscal implications of annexation actually depend on the land use situation of the municipality holding other socio-economic variables constant. The hypotheses are partially verified by the complicated findings. First, annexation alone, as shown in model 1, does not have significant relationships with local government finance indicators, except a negative relationship with debt service ratio. Municipalities with higher level of annexation are found to have lower debt service ratio, which leads to more flexibility in financing public service.

Second, considering only the land use variances (the proportions of the major types of land uses), local government's per-capita total revenues and Operations ratio are significantly influenced by the situations of vacant and commercial land uses; that is, a higher proportion of vacant land is generally related to worse local financial condition while higher proportion of commercial land is related to better financial condition.

Third, the most important finding is that the land use situation plays a significant role in relationships between annexation and local government's per-capita total revenues and per-capita total expenditures, and debt service ratio. According to the findings, a higher proportion of vacant land in a city is associated with smaller positive or greater negative fiscal effects of annexation (i.e. decline in per-capita total revenues, and increase in debt service ratio). Commercial and residential land uses have positive impacts on annexation's effects on per-capita total revenues. This is consistent with the literature which describes commercial and residential land use as "profitable" since they produce more revenues (property tax, sales tax, charges and user fees) than vacant and public land uses. On the expenditure side, a higher proportion residential land use is significantly related to the negative effects of annexation on per-capita total expenditures. This can be explained by the population increase brought by residential land use. Annexing residential land may result in greater total expenditures of the city. But since residential land comes with the population on it, the marginal expenditures and per-capita expenditures may actually decrease. The most controversial findings are about the effects of the interactions on debt service ratio. The results show higher proportions of commercial and residential land uses diminish annexation's negative effect on debt service ratio, and to certain point change the effect into positive. This can be explained by the increasing demands of public infrastructures (e.g. schools, streets and highways, sewer and water systems, and power utilities) due to expended commercial

activities and population growth via annexation. The debt service increases in the short run as the city invests in public projects through borrowing.

To sum up, annexation has the potential for fiscal gains to local government, but a narrow perspective of its fiscal consequences is both inaccurate and impractical. Land use plays an important role in the net effects of annexation. Annexation's positive fiscal effects may diminish if high proportion of land in the city is undeveloped. Therefore, for local governments, prudent land use planning and development along with annexation activities are needed for their long-term fiscal benefits.

CHAPTER V

CONCLUSION

5.1 Summary

This research brings insights to the current debate on the fiscal implications of annexation. While it is widely recognized that the narrow perspective of annexation's fiscal consequences does not have many policy implications, more and more research agendas are set to examine the related local circumstances. This study contributes to this agenda both theoretically and methodologically. It addresses a significant gap in the literature by examining the roles of local revenue structure and land use in determining annexation's fiscal implications. Similar to Liner and McGregor's (2002) and Edwards & Xiao's (2009) conclusion, I find that fiscal effects are complicated and depend on specific municipal circumstances. What conclusion can we draw from the findings presented above?

In both of the empirical analyses in Chapter III and Chapter IV, I firstly use annexation to estimate local government's financial condition without considering the effects of either its local revenue structure or land use situation. In the multi-city cross-sectional regression models, annexation is significantly associated with increase in per-capita own-source revenues, and the debt service ratio, while it is only negatively associated with debt service ratio in the panel data analyses of Phoenix metro municipalities. These findings show there is probably no straight forward relationship between annexation and local

government's financial condition due to the important roles played by local circumstances.

The further empirical analyses in both chapters unveil the dynamics of local government revenue structure and land use. The interactive models in Chapter III reveal that the net fiscal outcome of annexation depends on the municipality's options and arrangements of revenue collection, holding policy and socio-economic variables constant. Municipalities with diversified taxing authority and/or with a balance of "inelastic" and "elastic" revenue sources are more likely to have improved their financial conditions through annexation, setting aside a few exceptional findings. Tracking municipalities in the Phoenix metropolitan area across 20 years, the fixed effects panel data analyses have indicated that annexation's effects on a municipality's financial condition largely depend on the municipality's land use situation. That is, for the municipalities with higher proportion of vacant land, annexation is more likely to be associated with lower per-capita total revenue and a greater debt service ratio. The effects of commercial and residential land are generally positive but also complex. They could be explained by various possibilities of revenue and expenditure activities on these two types of land.

Using a dataset of recent decades (1990 to 2000, 1990 to 2009), this research challenges the previous theories that support positive fiscal consequences of annexation. The fiscal implications of annexation are less predictable nowadays. Most of the theories and previous studies on annexation are from the perspective of central cities (e.g. Rusk, 2003; 2006; Fleischmann, 1986;

MacManus & Thomas, 1979). However, suburban cities and towns are increasingly active in urban and metropolitan evolution in recent decades. Annexation is widely practiced by municipalities of smaller size, and in non-central spatial locations. Therefore, instead of only strengthening the central city's monopoly power in financial management and fiscal policy, annexation might have helped suburban jurisdictions obtain more power to generate a balance with central cities. Annexation's fiscal implications are also not predictable because of the significant roles played by local circumstances which for long have been ignored in research. This research is one of the few which underscore the conditional effects of local government's revenue structure and land use situation in the evaluations of annexation's fiscal effects.

This research also has methodological contributions. To avoid the disadvantages of single methodology, this research employs cross-sectional interactive regression analysis with a sample of nation-wide municipalities, and panel data analysis focusing on a group of geographic concentrated municipalities (i.e. municipalities in the Phoenix metropolitan area). GIS mapping is also used to present spatial changes of annexation, land use, and their interactions. These methods serve their purposes, and all together present the issue of annexation's fiscal implications and the roles of local government's revenue structure and land use in a multi-perspective and sophisticated manner.

5.2 Policy Implications

The findings of this study are expected to draw more scholars' and practitioners' attention to the roles of local government finance structure and land use, as well as other local circumstances in assessing annexation policies. It raises a number of important policy questions regarding urban growth and municipal financial management, as well as intergovernmental relations.

The findings suggest that annexation has the potential for fiscal gains to local government, but its positive fiscal effects may diminish if the municipality has less capability to make suitable revenue arrangement, and if a high proportion of land in the municipality remains undeveloped. Also, the results in Chapter III show that municipalities with state required impact reports and service plans in the process of annexation have significantly more positive improvements in their per-capita own-source revenues, and operations ratio. Therefore, for local governments, comprehensive strategies, including land use planning and management, public service financing, and economic development policies are needed to make annexation fiscally successful.

This research also raises questions about intergovernmental fiscal relations. Annexation is a phenomenon with unequal regional impacts, that is, some municipalities may have more and better options of what and where to annex compared to others. The question is whether intergovernmental aid should be used to offset this physical inequity. Should there be a particular federal grant or revenue sharing formula to help municipalities which are unable to annex, or have annexed less populated lands with service obligation challenges? Since

annexation has the potential of improving municipal financial condition but is constrained on revenue structure and land use reality, should the states loosen their taxation restrictions on local governments? Whether the states should take it upon themselves to enhance the diversity of revenues allowable for use at the local level is long lasting question of intergovernmental fiscal relations.

5.3 Caveats and Limitations

There are several caveats and limitations in this research. First, limited by data availability, one single comprehensive statistical model including the variable of both local government financial structure and land use is not established. Optimally, the effects of these two local circumstances should be included in one model, instead of two separate models, to determine annexation's effects on local government's financial condition. However, land use data as one of the key independent variables are not available for large-scale cross-sectional analysis purpose. Therefore, the two variables are examined separately. It is a limitation of this study. On the other hand, using the two models can generate insights that might not be found if the estimation is restricted to a single format. It is anticipated that more robust findings will occur because of this advantage.

Second, the models using panel data analysis for municipalities in Phoenix metropolitan area to some extent suffers the problem of generalizability. Though it uses advanced statistics methods with a longitudinal dataset, questions still remain for the findings' applications to broad scenarios. In particular, the land-based economic development, heavy reliance on sales tax and construction related

charges and fees (Heim, 2006) in the Phoenix metropolitan area is not a usual case nationwide; also, for municipalities in the Northeast states which may have “annexed out,” annexation is not a major concern of land use management.

Finally, error may also come from the sources of data. Limited by the resource, all the data being used are second-hand, and some are from multiple sources. That requires the data processing to be very detail-oriented to avoid more potential errors.

5.4 Future Research

This study can be extended in the future to draw more conclusive findings which could have profound policy implications for urban development and public financial management. Future research should consider the following extensions. First, future research will distinguish the effects of annexation in different types of municipalities, such as snow-belt verses sun-belt, central city verses suburb, and municipalities of different sizes. These types represent municipalities in different stages of urban development. It is interesting to investigate annexation’s fiscal effects in each stage of urban development.

The second extension is to broaden the perspective on the effects of annexation. Instead of the fiscal perspective of the annexing municipalities, future study should also consider annexation’s effects on the counties or the de-annexing municipalities that have lost area because of annexation activities. Questions such as how the tax bases and service demands change in these counties and municipalities, and what are the factors that influence annexation’s

fiscal effects to them have not yet addressed in the literature. Another perspective unaddressed is annexation's fiscal implications for the residents on both in preexisting areas and annexed areas. Furthermore, evaluation of annexation should not be limited to fiscal effects, but include annexation's effects on urban politics and administration, economic development, and also public health, environment, and quality of life. Some of these effects have been covered in literature (e.g. Reynolds, 1992; Lindsey & Palmer, 1998), but more updated empirical evidence is needed. The intention of the research in these multiple perspectives will be to have a comprehensive understanding of annexation's implications to the parties being involved in the process.

Finally, we need to ask what will happen or has happened in the post-annexation era? Lang and LeFurgy (2007) regard annexation and governance as two options the "boomburbs" (large, fast-growing suburbs) have when they are nearing "build-out." If current trend of annexation continues in the South and West, all the unincorporated land will be eventually "annexed-out." In this sense, forward-looking financial management, planning, and urban policies should be adopted by municipalities before this occurs. As these "boomburbs" mature, they increasingly face big-city challenges that test their governance capacities. Recognizing the governance issues of affluent suburbs are different from the issues in traditional central cities, the study of regional governance in a post-annexation era will be an important area of future research.

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APPENDIX A

STEPS OF THE DATA PROCESSING FOR THE NATION-WIDE STUDY

Steps of the Data Processing for the Nation-Wide Study

The sample consisting of 6069 general purpose municipalities for the nation-wide study in Chapter III is obtained by processing data from multiple sources in several steps. The first step of processing is to merge data of the same municipalities from different datasets, including public finance, geographic area, and control variable datasets.

The first set of data is local level finance data for 1992 and 2002 from the *Census of Governments* surveys by the U.S. Census Bureau. The 1992 dataset contains finance data for 85,006 “places” (definition of “places” in the Census include census designated places, consolidated cities, and incorporated places), while the 2002 dataset contains data for 67,168 “places”. By matching the five-digit Federal Information Processing Standards (FIPS) code of the “places” in 1992 and 2002 datasets, 29,055 “places” with both 1992 and 2002 information are identified.

Geographic area data are from National Historical Geographic Information System (NHGIS) which is based on the U.S. Census Bureau’s *Boundary and Annexation Survey* data. By matching boundary data of 1990 and 2000 on the maps, the area changes of 20,612 “places” are calculated.

Another essential part of data is for local level control variables. Datasets from decennial census surveys of 1990 and 2000, and the State of the Cities Data Systems (SOCDS) of the U.S. Department of Housing and Urban Development are merged. This results in 24,041 “places” that are identified with information of

density, education attention, housing occupation, household income, poverty rate, and race.

The second step is to merge the public finance dataset (29,055 “places”), geographic area (20,612 “places”), and control variable datasets (24,041 “places”) that are created in the first step. Only those “places” that appear in all the three datasets are kept in the sample. As a result, 17,861 “places” remain in the merged dataset.

The third step of data processing is to exclude “places” of improper size and local government type. The types of “places” defined by the Census Bureau are incorporated place, such as a city, town or village, and census designated place (CDP). Since this study requires general-purpose local governments, I exclude CDPs, which “are closely settled, named, unincorporated communities that generally contain a mixture of residential, commercial, and retail areas similar to those found in incorporated places of similar sizes” (Census Bureau, 2000). Thus, these “places” that remain in the dataset can be called municipalities. I also exclude municipalities with population less than 1,000. As a result, 7,743 municipalities remain in the sample.

The final step of data processing is screening municipalities according to their revenue reliance situations. I identify the revenue reliance of each municipality with public finance data from the Census of Governments (1992 and 2002). I use mean and standard deviation statistics to determine the categories of revenue reliance of each municipality. First of all, I calculate the percentage

share of total revenues from an individual tax source in both 1990 and 2000. For example, I define a municipality as property tax reliant if the share of property tax is one standard deviation above the mean. Using the same methods I identified municipalities which reliant on “elastic” revenue sources including sales, income taxes and non taxes. Municipalities are assigned into categories of “Balanced reliance” and “Others” (including “inelastic” revenue source reliance, and “elastic” revenue source reliance). However, the revenue reliance categories of 1,674 municipalities are found to be inconsistent in 1990 and 2002. To facilitate the measurement of *Revenue Reliance*, these 1,674 municipalities are excluded from the model. Finally, 6069 municipalities are identified as the sample municipalities for the cross-sectional analysis in Chapter III.

APPENDIX B

MATCHING NEW LAND USE CATEGORIES WITH ORIGINAL LAND USE
CODES

Matching New Land Use Categories with Original Land Use Codes

New Categories	2005-2009 Categories	2000 Categories	1990-1995 Categories
Commercial	Commercial High ⁱ	General Retail	Regional Retail Center
	Commercial Low ⁱⁱ	Specialty Commercial	Neighborhood Retail Center
	Industrial	Neighborhood Commercial	Community Retail Center
	Mixed Use	Community Commercial	Industrial
	Business Park	Regional Commercial	Warehouse/Distribution Center
	Office	Super-Regional Commercial	Large Assembly Area
		General Industrial	Business Park
		Light Industrial	Office
		Industrial	
		Business Park	
		Office General	
		Office Low Rise	
		Office Mid Rise	
	Office High Rise		
Residential	Multi Family ⁱⁱⁱ	Rural Residential	Small Lot Residential
	Single Family High Density ^{iv}	Estate Residential	Large Lot Residential
	Single Family Low Density ^v	Large Lot Residential	Medium Density Residential
	Single Family Medium Density ^{vi}	Medium Lot Residential	High Density Residential

		Small Lot Residential	
		Very Small Lot Residential	
		Medium Density Residential	
		High Density Residential	
		Very High Density Residential	
Vacant	Vacant	Vacant	Vacant
	Water	Water	Water
	Agriculture	Agriculture	Agriculture
	Passive/Restricted Open Space/ Undevelopable	General Open Space	Rural
	Active Open Space	Active Open Space	Dedicated or Non-developable Open Space
		Passive Open Space	
Public	Airport	Airport	Airport
	Transportation	Transportation	Transportation
	Cemetery	General Transportation	Tourist Accommodations
	Tourist Accommodations	Cemetery	Recreational Open Space
	Golf Course	Golf courses	Educational/religious
	Educational	Tourist and Visitor Accommodations	Institutional
	Religious	Educational	Public Facility
	Medical/Nursing Home	Institutional	
	Other Employment ^{vii}	Public Facilities	

	Public/Special Event/Military	Special Events	
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Notes.

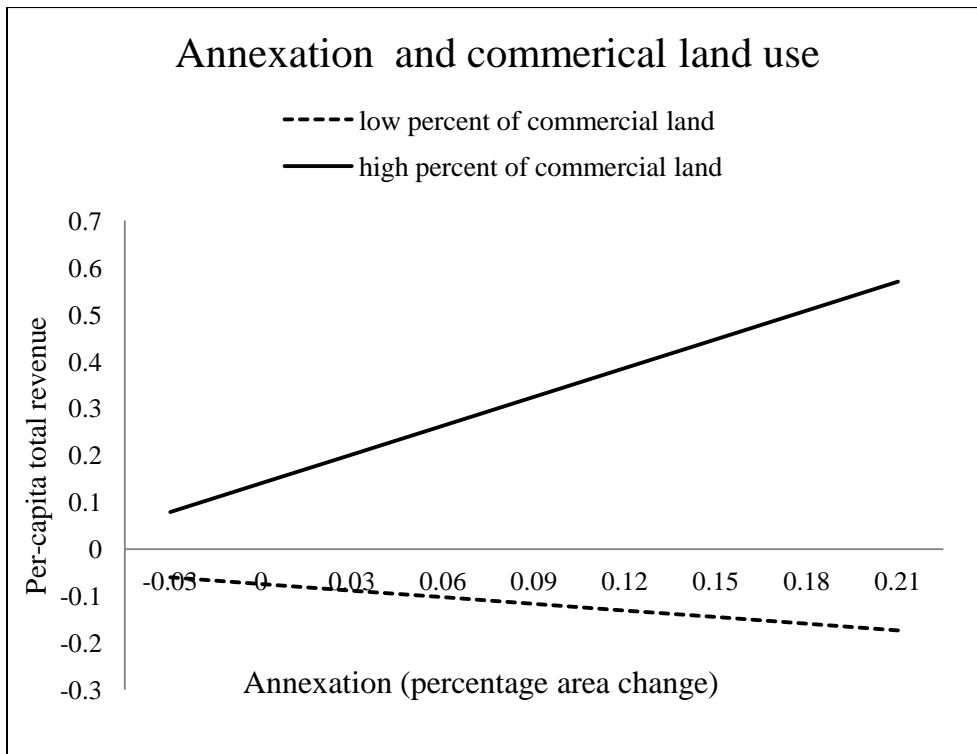
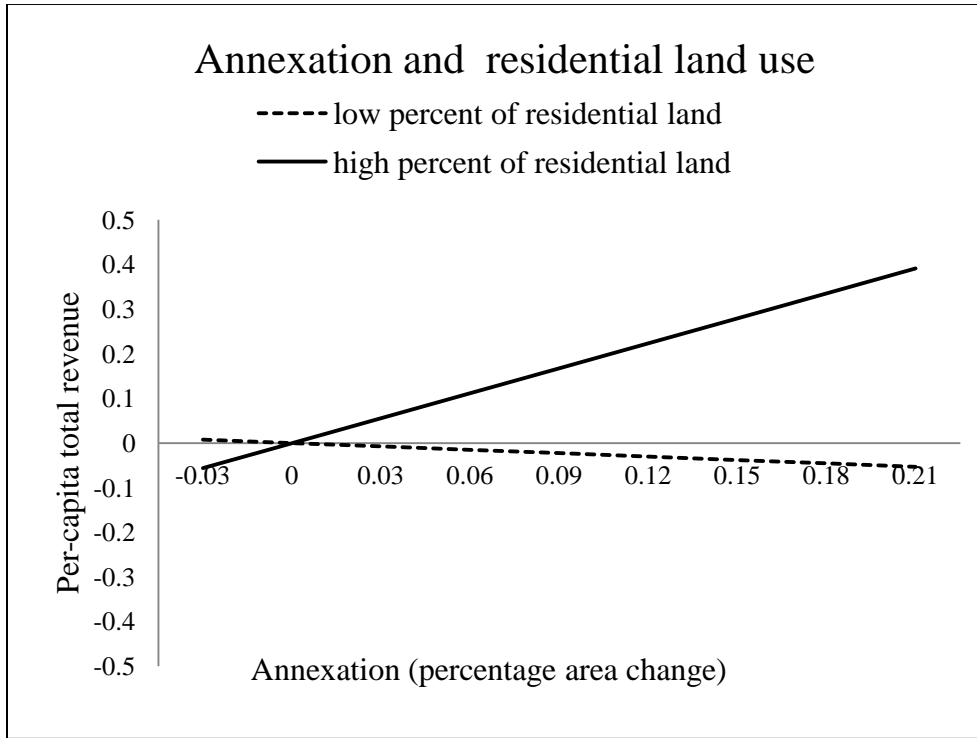
- ⁱ Community Retail/Regional Retail
- ⁱⁱ Amusement/Movie Theatre/Specialty Retail/Neighborhood Retail
- ⁱⁱⁱ Apartment/Condo
- ^{iv} Greater than 4 dwelling/acre, includes Mobile Homes
- ^v Less than 1 dwelling/acre
- ^{vi} 1 to 4 dwelling/acre
- ^{vii} Landfill/Proving Grounds/Sand and Gravel/etc.

Source: Maricopa Association of Governments' regional planning GIS datasets

APPENDIX C

INTERPRETING INTERACTION EFFECTS ON PER-CAPITA TOTAL
REVENUES

Interpreting Interaction Effects on Per-capita Total Revenues



APPENDIX D

INTERPRETING INTERACTION EFFECTS ON DEBT SERVICE RATIO

Interpreting Interactive Effects on Debt Service Ratio

