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Is There An Association Between Fiscal Decentralization And Declining Role Of State Governments In Highway Finance In The US?

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Abstract

This paper examines relationship between fiscal decentralization and the level of state government's funding for highways in the US. Studies have suggested that greater fiscal decentralization leads to decline in state governments' funding for highways. The national trends show otherwise. Consistent with the theory and empirical studies in the context of general state and local government finance, results from regression analysis of uniquely complied data show that there is a negative association between fiscal decentralization and state government's budget for highways. Additionally, the paper finds that the federal funding of highways has a negative influence on the level of funding from state governments.

Key Words: US Highway Finance; Fiscal Decentralization; Motor Fuel Tax; Leviathan Model; Government Size

1. Introduction

Public funding of highways in the US is facing important challenges in recent decades. The funding of highways from the federal and state governments inadequate. The motor fuel tax, which has been a primary source of revenue has not kept pace with the growing costs of system maintenance, repair and new projects (Goldman and Wachs 2003; Hajiamiri and Wachs 2010; O'Connell and Yusuf 2013;Yusuf et al. 2011). The federal gas tax rate has not been revised since 1993 and the states too have generally failed to revise tax rates for inflation and fuel efficiency. This situation has resulted in mismatch between revenue collection and expenditure needs (O'Connell and Yusuf 2013; Schweitzer and Taylor 2007; Sorensen and Taylor 2006; Wachs 2006). With the focus of public policy on increasing fuel efficiency further through sale of hybrid cars, Hajiamiri and Wachs (2010, p. 121) estimate that "the combined federal and state trust fund contributions could decline by as much as 5% because of new hybrid electric cars to be sold in 2020 and as much as 12.5% because of those to be sold in 2030."

The local governments however are bridging this gap by increasingly sharing the fiscal burden of financing of highways- a phenomenon Yusuf et al. (2011) term as "de-facto devolution." This fiscal decentralization process, however, has not been uniform across states in the US (Chen 2014; Goldman and Wachs 2003). This is because the fiscal policies of state governments differ in significant ways and face greater constitutional and statutory constraints relative to the federal fiscal policy (Lowry 2008). Furthermore, voters in several states have used the ballot initiative to impose restrictions on raising revenues and expenditures beyond specified limits (Bowler and Donovan 2008). Within these constraints, however, the state governments in the US rely on various tax instruments to raise revenue for meeting the cost of public programs. In the context of highway finance, O'Connell and Yusuf (2013) suggest that the public will be more amenable to increase in the gas tax if state governments restructured it by directly connecting it to measures of need and adjusting the tax rate upward in small, regular increments. However, many states have not been able to incrementally fill transportation funding gaps (Chen 2014; Holeywell 2012). Moreover, there are policy concerns about the simultaneous occurrence of diminishing role of states and increasing reliance on local funding of highways (Goldman and Wachs 2003; Yusuf et al. 2011). This paper examines this changed structure in the fiscal devolution of highways in the US by analyzing state level data on highway finance.

The paper situates decentralization of highway finance in theoretical contexts of the Leviathan and the Public Choice models that explain the relationship between fiscal decentralization and size of governments (Craw 2008; Lyons and Lowery 1989; Yeung 2009). The two models propose that greater decentralization of public finance is associated with decreased amount of funding from higher levels of governments. This paper empirically examines this relationship and makes several contributions to the literature. In addition to showing descriptive trends, the paper uses linear regression model for estimating the hypotheses. To this author's knowledge, no other study has employed linear regression method in investigating the relationship between state fiscal size and the level of fiscal decentralization in the context of highway finance and within the contours of a theoretical literature. The paper also brings out important policy relevant factors that have bearing on this relationship and therefore it informs the debate over policy alternatives for financing of highways.

2. Intergovernmental Structure of the US Highway Finance and Fiscal Devolution

Highways and roads became an intergovernmental responsibility with the passage of the Federal Aid Road Act of 1916 (Netherton 1968; Yusuf et al. 2011). Subsequently, the states and the federal governments have raised revenues from fuel taxes for financing highway programs, whereas the local governments have traditionally relied on property taxes for funding local streets (Brown et al. 1999; Goldman and Wachs 2003; Sorensen and Taylor 2006; Wachs 2003). Economists have justified this pay-as-you-go "user fee" because they are directly charged to the consumers of government provided services (Sorensen and Taylor 2006). Although fuel taxes constitute the major portion of user fees, they also include toll taxes, fares, vehicle registration fees, driving license fees, and truck weight fees (Goldman and Wachs 2003). Local governments have relied on revenues from earmarked property taxes (Enoch, Potter and Ison 2005) and intergovernmental transfers (Goldman and Wachs 2003) to finance neighborhood streets, roads and public transit.

This intergovernmental structure for funding of highways is facing important challenges in recent decades. The required expenditure has outpaced the revenues in the last decade because of growing costs of system maintenance, repair and new projects (Goldman and Wachs 2003; Hajiamiri and Wachs 2010; O'Connell and Yusuf 2013; Yusuf et al. 2011). The reason behind this mismatch lies mainly in the nature and design of fuel tax. Taxing users of highways on the basis of per gallon of fuel consumed and not revising tax rates for inflation and fuel efficiency periodically is bound to create gaps in revenue and expenditure (Hajiamiri and Wachs 2010; O'Connell and Yusuf 2013; Schweitzer and Taylor 2007; Sorensen and Taylor 2006; Wachs 2006). Fuel efficiency rates have improved from 10-12 miles per gallon during the energy crisis of the 1970s to more than 20 miles per gallon in recent years (O'Connell and Yusuf 2013; Wachs 2004). The fuel tax revenues per mile of vehicle traveled in inflation-adjusted terms are now less than half of the corresponding rates in the late 1960s (Brown 2001; Rufolo and Bertini 2003; Taylor 1995; Wachs 2003). The automobile users are paying much lower fuel taxes than they did three decades ago (Wachs 2004).

Table 1 supports this empirical argument on account of inflation alone. The table presents the state-wise motor fuel tax rate in 2002 in comparison to the inflation adjusted fuel tax rates. After the enactment of The Federal-Aid Highway Act of 1956, the states imposed motor fuel tax on per gallon fuel and not on the basis of fuel price. As can be seen from the table, on average states should have raised their motor fuel tax rates by 10.7 cents per gallon in 2002 just to account for inflation. However, New York, Rhode Island and Missouri have maintained fuel tax rates higher than that required for inflation adjustment. The most notable laggard state is Georgia, which is falling by 27.7 cents per gallon. The largely unchanged fuel tax rates in recent years point further to the increasing need for inflation adjustment of fuel tax rates. Furthermore, the overall increase in fuel tax rates would be much higher if the states follow Wachs' (2004) recommendation for increasing fuel tax rates on account of increased fuel efficiency also.

Table 1: 1957 Inflation-adjusted Motor Fuel tax in 2002 and the actual Motor Fuel tax rates

State	1957 Motor Fuel Tax (Cents)	1957 Motor Fuel Tax in 2002 prices (Cents)	2002 Actual State Motor Fuel Tax (Cents)	Difference (Cents)	State	1957 Motor Fuel Tax (Cents)	1957 Motor Fuel Tax in 2002 prices (Cents)	2002 Actual State Motor Fuel Tax (Cents)	Difference (Cents)
Alabama	7	37.9	18	-19.9	Montana	7	37.9	27	-10.9
Alaska	5	27.1	8	-19.1	Nebraska	6	32.5	25.4	-7.1
Arizona	5	27.1	18	-9.1	Nevada	6	32.5	24	-8.5
Arkansas	6.5	35.2	21.7	-13.5	New Hampshire	5	27.1	19	-8.1
California	6	32.5	18	-14.5	New Jersey	4	21.7	14.5	-7.2
Colorado	6	32.5	22	-10.5	New Mexico	6	32.5	18	-14.5
Connecticut	6	32.5	25	-7.5	New York	4	21.7	22.6	0.9
Delaware	5	27.1	23	-4.1	North Carolina	7	37.9	24.5	-13.5
Florida	7	37.9	13.9	-24	North Dakota	6	32.5	21	-11.5
Georgia	6.5	35.2	7.5	-27.7	Ohio	5	27.1	22	-5.1
Hawaii	5	27.1	16	-11.1	Oklahoma	6.5	35.2	17	-18.2
Idaho	6	32.5	26	-6.5	Oregon	6	32.5	24	-8.5
Illinois	5	27.1	19.3	-7.8	Pennsylvania	6	32.5	26.6	-5.9
Indiana	4	21.7	15	-6.7	Rhode Island	4	21.7	29	7.3
Iowa	6	32.5	20	-12.5	South Carolina	7	37.9	16	-21.9
Kansas	5	27.1	21	-6.1	South Dakota	5	27.1	22	-5.1
Kentucky	7	37.9	16.4	-21.5	Tennessee	7	37.9	21.4	-16.5
Louisiana	7	37.9	20	-17.9	Texas	5	27.1	20	-7.1
Maine	7	37.9	22	-15.9	Utah	5	27.1	24.8	-2.3
Maryland	6	32.5	23.5	-9	Vermont	5.5	29.8	20	-9.8
Massachusetts	5	27.1	21	-6.1	Virginia	6	32.5	17.5	-15
Michigan	6	32.5	19	-13.5	Washington	6.5	35.2	23	-12.2
Minnesota	5	27.1	20	-7.1	West Virginia	6	32.5	25.4	-7.2
Mississippi	7	37.9	18.4	-19.5	Wisconsin	6	32.5	27.3	-5.2
Missouri	3	16.3	17.1	0.8	Wyoming	5	27.1	14	-13.1
Average	5.7	31.0	20.3	-10.7	Average	5.7	31.0	20.3	-10.7

Source: Surface Transportation Policy Partnership: "Measuring Up: The Trend Toward Voter-Approved Transportation Funding," downloaded on 11/15/2009: http://www.transact.org/library/reports_html/measuring_up/exec_sum.asp#fuel_taxes.

The Federal government too has not revised the motor fuel tax rate since 1993. The 2009 report of the National Transportation Infrastructure Financing Commission recommends an increase of 10 cents in the federal gasoline tax from the current level of 18.4 cents per gallon along with increasing the federal diesel tax rate (NTIFC 2009). The Commission has asked the US Congress to link the new fuel tax rates with inflation and fuel efficiency. Per NTIFC's estimates, the current intergovernmental fiscal structure will raise only about one-third of the roughly $200 billion of necessary capital investment a year for maintaining and improving the nation's highways and transit systems. The expenditure requirements are substantially higher than the current levels of revenues raised at all levels of governments.

One obvious policy recommendation for the federal and state governments is to raise fuel tax suitably to address this acute mismatch in revenues and expenditures. Indeed, O'Connell and Yusuf (2013) suggest that the public will be more amenable to increase in the gas tax if state governments restructured it by directly connecting it to measures of need and adjusting the tax rate upward in small, regular increments. But doing so is fraught with significant political liability (Wachs 2006).

Beginning with proposition 13 in California in early seventies, a series of "tax revolts" around the country has constrained state and local governments in raising property other taxes (Goldman and Wachs 2003). Subsequently, voters in several states have enacted property tax limits on local governments (Mackey and Rafool 1998; Mullins and Cox 1995). The voter approved tax limitations on states reflect sensitivity of the voters against tax increases and constrain states' fiscal policy (Lowry 2008; Yusuf et al. 2011).

However, a weak economy and high fuel prices have brought down state and federal fuel tax revenues (Goldman and Wachs 2003). The Highway trust fund's purchasing power has declined on account of rising construction and right-of-way costs. Consequently, an increasing share of revenue is needed just for basic maintenance and repair of existing highway infrastructure (Goldman and Wachs 2003). Therefore, given that the state governments are reluctant to suitably modify the main source of highway finance, there is scarcity of funds for system maintenance and major new projects.

This substantial shortfall in revenues from higher levels of governments has been accompanied by a greater fiscal burden on local governments in recent decades (Forkenbrock 2006; Goldman et al. 2001). Yusuf et al. (2011) term this phenomenon as de-facto devolution. This devolution entails decentralization in transportation planning, decision making, and financing from higher levels of governments to local levels of governments (Forkenbrock 2006; Goldman et al. 2001). State governments own and finance lower units of roads and highways, whereas local governments are responsible for more miles of roads (Yusuf et al. 2011).

One key aspect of this changing institutional structure is the trend in revenue transfers from higher levels of government to local governments. These intergovernmental transfers to the local governments from federal and state sources have declined proportionately over time. The transportation-related federal transfers significantly declined from 7% in early 1980s to 1.3% of total receipts of local governments in 2006 (Yusuf et al. 2011). Similarly, state transfers have declined from 30% to 21% of local government receipts for highways in recent decades (Fisher 2003; Yusuf et al. 2011). The increased ownership of roads and streets has put greater fiscal burden on local governments (Yusuf et al. 2011). Moreover, the local governments require ever more resources for operation and maintenance of roads because of steady increase in the vehicle miles traveled on locally owned roads (Yusuf et al. 2011).

Consequently, local governments are taking lead roles in raising resources for maintenance and repair of roads and bridges from their jurisdictions including highways (Sorensen and Taylor 2006; Wachs 2003; Yusuf et al. 2011). There has been a significant change in the composition of revenues used by local governments for highway purposes (Yusuf et al. 2011). Revenue from the general fund has increased from 28.3 percent in 1992 to 31.1 percent in 2007. The other charges and fees have also grown from 3 percent in 1992 to 7 percent in 2007. However, according to the Federal Highway Administration's latest Highway Statistics 2011, the revenue from general fund for highway purposes has declined in 2009 to the 1992 levels. This decline has occurred mainly due to the contraction in state revenues post economic recession since 2007. However, the other charges and fees have remained unchanged in 2009. This trend indicates greater use of general revenues, new charges and fees by local governments to pay for highways (Sorensen and Taylor 2006; Yusuf et al. 2011).

Increased reliance on local financing of highways has become possible partly because the local governments have additional instruments to raise revenues. The general context of limited revenue-generating power of local governments has undergone important changes in the last few decades (Forkenbrock 2006; Goldman and Wachs 2003; Sorensen and Taylor 2006; Yusuf et al. 2011). One important change in this regard is the implementation of local option transportation taxes (LOTTs) by local governments in many states. Goldman and Wachs (2003, p. 21) define LOTTs as "a tax that varies within a state, with revenues controlled at the local or regional level, and earmarked for transportation-related purposes." The LOTTs include fuel taxes, vehicle taxes, sales taxes, and income, payroll, and employer taxes (Goldman and Wachs 2003). Proceeds from fuel taxes are placed in a trust fund similar to the highway trust funds of the federal and state governments. As many as 46 states have adopted LOTTs in various forms (Yusuf et al. 2011). Since the early 1990s, at least 21 states have either adopted new laws authorizing local option taxes or saw significant expansion in their use (Goldman et al. 2001). According to Goldman and Wachs (2003), cities, counties, and transit districts are increasingly turning to LOTTs to fund new transportation investments. For example, local sales tax has been the fastest growing source of revenue for transportation in California (Crabbe et al. 2005). Table 2 summarizes the local option transportation taxes in states.

Table 2: The Local Option Transportation Taxes (LOTTs) in states

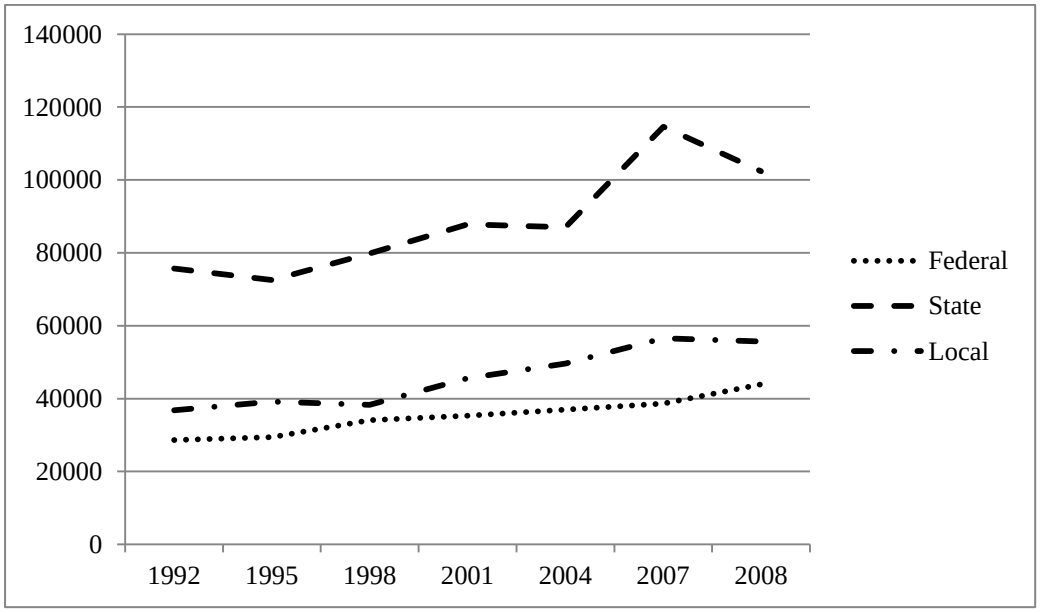
Major local option transportation taxes	No. of States	No. of States where voter approval is required	No. of States where voter approval is not required
1. Gasoline Taxes	15	7	8
2. Vehicle License and Registration Taxes	34	13	21
3. Sales Taxes for Capital Projects	30	25	5
4. Sales Taxes for Transit	20	18	2
5. Income and Payroll Taxes	16	9	7

Source: Compiled by author from Goldman and Wachs (2003) and Goldman, Corbett and Wachs (2001)

In sum, the state governments are spending less on highways, whereas the expenditure burden of local governments has increased. Highway finance in the US is being gradually devolved to local governments and there is less reliance on user fees at the state level (Wachs 2003). In the backdrop of tax revolts against raising property taxes, states have authorized local governments to levy a variety of transport-related taxes. For example, the reliance on LOTTs has occurred within the span of the last three decades (Goldman and Wachs 2003). According to Yusuf et al. (2011), local governments may have had to forgo much needed transportation infrastructure and services in the absence of LOTTs.

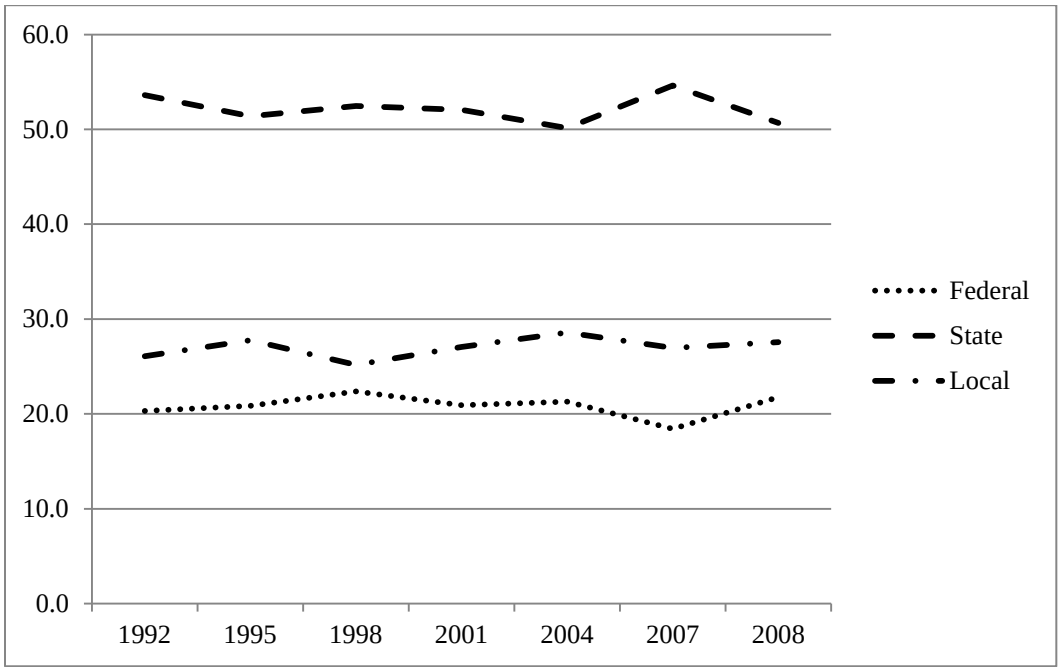
Although there is general agreement in the literature that state and federal governments are raising lower amount of resources for highways and devolving greater fiscal responsibility to local governments in recent decades, the aggregate trends below do not support this contention. The following two figures investigate trends in distribution of aggregate highway finance between federal, state and local governments. It is apparent from figure 1 that each of the three levels of governments has raised increasing amounts of revenues for highways in real dollars in recent decades. Moreover, figure 2 conveys that the state governments have raised more resources for highways than the combined contribution from federal and local governments. The respective shares of revenues raised for highways by the three levels of governments also remain stable in the last two decades.

Figure 1: Revenues used for highways by federal, state and local governments in millions of 2011 dollars in recent decades



Source: Compiled by author from Federal Highway Administration, Highway Statistics (various years), Table HF – 10 (Funding For Highways and Disposition of Highway-User Revenues, All Units of Government).

Figure 2: Percentage share of revenues used for highways by federal, state and local governments in recent decades



Source: Compiled by the author from table HF-10 of FHWA's Highway Statistics for various years.

These counter-intuitive trends in financing of highways probably explain why studies that emphasize the phenomenon of greater fiscal decentralization in conjunction with diminishing role of state governments in highway finance have not included such aggregate trends in their analyses (see for example, Goldman and Wachs 2003; Sorensen and Taylor 2006; Yusuf et al. 2011). However, these aggregate trends may mask variations in highway financing by three levels of governments for each state. Therefore, concerns about the declining role of state governments and increasing decentralization of highway finance within states needs to be investigated more closely and at a more disaggregated level. Specifically, there is a need to systematically study whether greater fiscal decentralization in states is associated with declining role of the state governments in financing of highways. This paper investigates this research question in the context of the Leviathan and the Public Choice models. The linear regression approach is utilized for estimating the key hypothesis. Empirical investigation of this policy problem is important in informing policy debate and finding appropriate policy solutions.

3. The Theoretical Literature: Fiscal Decentralization and Size of Governments

There are two theories that seek to explain tax structure and fiscal size of the local and state governments (Yeung 2009): the Leviathan hypothesis (Brennan and Buchanan 1980) and the Public Choice theory (Tiebout 1956). The former views government size in terms of the magnitude of tax revenue collection and the size of expenditure (Craw 2008; Merrifield 1991 & 2000; Nelson 1986; Oates 1985; Poterba 1994 & 1996). The latter is concerned with the choice of efficient levels of goods and services made by the residents within a local jurisdiction. The Public Choice model argues that the higher levels of fiscal decentralization among local governments bring efficiency and economy in the provision of public goods and services. This is because the existence of more options for residents to realize their choice for most preferred bundle of taxation and public goods puts pressure on governments in providing public goods and services at lower costs. As a result, the aggregate size of government is comparatively smaller (Yeung 2009). The decentralization hypothesis under the Leviathan model similarly implies that the existence of more decentralized / fragmented local governments in a region constrains states in imposing higher taxation on residents. The existence of more options for residential mobility helps citizens express their spending preferences for public goods. This mechanism restricts state governments from imposing higher rates for a given level of public good and hence their relative size is smaller (Rodden 2003).

According to the public choice theory, higher levels of fiscal decentralization in states afford residents greater options to realize their choice for most preferred bundle of taxation and local public goods.

In other words, the residents seek to attain optimum size for the efficient delivery of public goods and services. The pursuit of optimum size is essential in lowering the average cost of public goods and services. If the public goods and services are not offered efficiently at some optimum size, the migration of residents will occur until that optimum size has been reached. Individuals' choose to reside in locations with tax-expenditure bundles that match their preferences or willingness to pay. This mechanism puts pressure on state governments to be productively efficient. Hence, state governments desist from raising incremental revenues to provide a given package of public goods and services. The Public Choice model therefore, hypothesizes that greater fiscal decentralization reduces government size as long as the former does not lead to diseconomies of scale (Yeung 2009). In case the greater fiscal decentralization and diseconomies of scale go together, the fiscal size of the state governments would be larger (Yeung 2009; Zax 1989).

The Leviathan model also relies on utility maximizing behavior of the government in expanding the size of revenues under constitutional, political, socio-economic and institutional constraints (Craw 2008; Merrifield 1991 & 2000; Nelson 1986; Oates 1985; Poterba 1994 & 1996; Yeung 2009; Zax 1989). These constraints are also the determinants of government size. Scholars have argued that greater decentralization of local governments in a state works against the natural tendency of state governments to extract higher taxes from residents (Brennan and Buchanan, 1980; Jimenez and Hendrick, 2010). This tendency of governments is also termed "Leviathan behavior" (Brennan and Buchanan, 1980; Craw, 2008; Yeung 2009).

In highway finance, the propositions from the Leviathan and Public Choice models imply that if the local governments within a state bear more fiscal responsibility for highways, then the magnitude (or size or extent) of funding for highways from the state government would be lower.

Empirical findings in the general government context on this hypothesis are divergent and inconclusive (Howell-Moroney, 2008; Jimenez and Hendrick, 2010; Yeung 2009) and sensitive to employed measures of key concepts (Yeung 2009). Some studies have found evidence that higher levels of fiscal decentralization lead to lower spending (Boyne 1992; Oakerson 1999). However, analyzing a sample of 822 metropolitan counties, Caruthers (2003) finds that decentralization of municipal and special district governments increased negative externalities and higher spending. Other studies report similar findings (Carruthers and Ulfarsson, 2002; Fulton et al., 2001; Rusk, 1993). The empirical literature on the Leviathan model is mixed (Campbell, 2004; Craw, 2008; Yeung, 2009). For example, Eberts and Gronberg (1990) and Zax (1989) support the Leviathan model, while Dolan (1990) and Oates (1985) find no evidence. Campbell (2004) offers mixed findings. Studies by Dolan (1990) and Santerre (1991) found that greater inter-local governmental competition was associated with higher city expenditures and government size. In contrast, Lalvani (2002) and Rodden (2003) confirm the findings in Eberts and Gronberg (1990) and Zax (1989) that higher level of decentralization is associated with lower level of government spending.

Clearly, the extant literature does not offer indisputable evidence in favor of the argument that greater local fiscal decentralization in states produces greater productive efficiency and therefore the state governments spend less on public goods and services. This lack of consensus in the empirical literature warrants further empirical studies with new contexts and new data. This study test this hypothesis in the context of highway finance by utilizing FHWA data.

4. Hypothesis, Variables, Data and Methods

Consistent with the argument concerning fiscal devolution of highways to local governments and the Leviathan and the Public Choice models, this paper examines the hypothesis that greater the fiscal decentralization in the highway sector in a state, the lower would be the funding of highways from the state government. Evidently, this hypothesis entails two concepts. The dependent concept is fiscal size of the state government and the main independent concept is the degree of fiscal decentralization in the highway sector of a state. The empirical literature has operationalized the size of government in terms of either revenue per capita (expenditure per capita) or revenue (expenditure) as a proportion of personal income (Craw 2008; Nelson 1986; Oates 1985; Yeung 2009; Zax 1989). This paper employs both measures of the dependent variable in the context of highway finance.

There are several ways to measure the concept of the degree of decentralization in a state. For example, Nelson (1986) uses state's share in the total state and local taxes as one of the measures for fiscal decentralization. Oates (1985) on the other hand uses state's share in total state-local expenditure as one of the measures for fiscal decentralization.

These measures signify the degree of fiscal burden on the local / state governments for provision of public goods and services in general. In the context of the highway finance, the measurement of fiscal decentralization should similarly capture the degree of fiscal burden on the local / state governments for highways in a state. This measure should also take into account the fact that all three levels of government in the US share significant fiscal responsibility for highways (Marlow 1988). Therefore, this paper measures fiscal decentralization in the highway sector more directly in three ways. The first measure is the local share in total highway funding from all the three levels of government in a state and the second measure is the local share in total state and local funding for highways. The latter is simply one minus the state's share in total local and state funding as in Nelson (1986) and Oates (1985). The third measure is the local share in total revenues from local and federal governments. Higher values on local share in different types of total funding of highways denote greater fiscal decentralization. This paper expects to find that higher the value of local share in total funding of highways the lower would be the revenue per capita in a state. Similarly, the paper expects to find that higher the value of local share in total funding of highways the lower would be the revenue as a proportion of personal income in a state.

The paper includes a number of control variables. Several empirical studies control for average income and public demand for goods and services in the state (see for example, Grossman 1992; Lalvani 2002). The median household income denotes the average income of residents in a state. This variable is important to control because states with higher median incomes have the capacity to raise more revenues and hence one would expect higher levels of funding for highways in those states. Similarly, higher proportions of population living in urban areas in a state also affects public demand for goods and services (Zax 1989). In addition several variables specific to the highways sector may also influence public demand for highways. For example, higher per capita fuel use in a state may produce more revenue for funding of the highways. This paper therefore controls for per capita ownership of automobiles, gasoline tax per gallon and per capita vehicle miles traveled in each state. The latter is however, highly correlated with per capita fuel use. The paper therefore, includes only the per capita vehicle miles traveled annually in each state in the regression equation. This step avoids the Multicollinearity problem.

The data has been compiled from several sources. Table 3 below lists these data sources along with descriptive statistics. The source of data on population, median household income and urban population of states is the Census Bureau, while the data on personal income of states came from the Bureau of Economic Analysis. The data on revenues used for highways, automobile ownership, gasoline tax rates, fuel use and vehicle miles traveled came from the Federal Highway Administration's (FHWA) Highway Statistics Series for the years 2003-08. Specifically, tables LGF-21 and SF-1 are used to calculate local, state and federal share of revenues in respect of each state for financing of highways. Table MF-21 is used to calculate per capita fuel use for each state in various years. Similarly, table VM-2 is used to derive data on per capita vehicle miles traveled for each state in different years. The table MV-1 is the source of data on per capita private and commercial automobile ownership in states in various years. Finally, annual data on gasoline tax rate in cents for each state is derived from table MF-205 of the Highway Statistics, 2008.

The FHWA collects highway data from states. It analyzes the data for consistency against relevant data for past years. The highway data is then matched against other state and federal data sources. The FHWA data is the only comprehensive source of information on aspects of surface transportation including highways at the state level. The FHWA data is collected in accordance with requirements of the Government Performance and Results Act (GPRA) and is reliably used for apportioning Federal-aid highway funds under the Federal legislation.

The pooled cross-section dataset employed for statistical analysis in this paper avoids bias in regression results that may arise with cross-section data on account of an outlier time period. Also, pooled cross-section dataset has more observations and therefore it addresses the problems in statistical analysis on small samples in majority of comparative state studies. The unit of analysis in the pooled cross-section data is state-year. The paper relies on the conventional linear regression model for estimating and testing the hypotheses. The linear regression analysis of pooled cross-section data is susceptible to autocorrelation and heteroskedasticity (Meier, Wrinkle and Polinard 1999). The standard approach to handle the former is to include dummies for individual years in the dataset. This paper has followed this approach. With regard to heteroskedasticity, diagnostic tests ruled out the assumption of constant variance in errors for all regression models. Therefore, the robust standard errors are used to interpret the statistical significance of the coefficients of employed regression models.

5. Results

Table 3 below presents descriptive statistics and data sources on the key variables that are included in regression models. Per capita fuel usage and per capita vehicle miles traveled are highly and positively correlated (Pearson's correlation coefficient is 0.85). Therefore, only per capita vehicle miles traveled is included in the regression models to avoid Multicollinearity problem. The Variance Inflation Factor (VIF) diagnostics also supported the existence of Multicollinearity problem. Multicollinearity problem may still exist if the correlation between the percentage of local share in total revenues from all three levels of governments and the percentage of federal share in total revenues from all three levels of governments is very high. The federal share has quite high negative correlation (Pearson's correlation coefficient is -0.7) with the local share in total revenues from local and federal governments, but its correlation with the other two measures of the fiscal decentralization is quite low (Pearson's correlation coefficient is less than |0.25|). Additional analyses using the VIF diagnostics however, ruled out the problem of Multicollinearity when federal share in total revenues from all three levels of governments is included in all the models. Therefore, all regression models include this variable as a control. Since the dependent variable is measured in two ways and key independent variables in three ways, six linear regression models have been estimated. Table 4 below provides heteroskedasticity corrected results for these six linear regression models. Coefficients of time dummies are not included for brevity.

Table 3: Descriptive Statistics and Data Sources

Variables	Data Source	Mean	Std. Deviation
Per capita state revenues for highways	Table SF-1 of Highway Statistics, FHWA for various years; state population data from the Census Bureau	327.87	149.78
State revenues for highways as a percentage of state personal income	Table SF-1 of Highway Statistics, FHWA for various years; state personal income data from the Bureau of Economic Analysis	0.93	0.42
Percentage of local share in the total revenues for highways from all three levels of government	Tables SF-1 and LGF-21 of Highway Statistics, FHWA for various years	25.29	10.14
Percentage of local share in total state and local revenue for highways	Tables SF-1 and LGF-21 of Highway Statistics, FHWA for various years	33.41	12.38
Percentage of local share in total federal and local revenue for highways	Tables SF-1 and LGF-21 of Highway Statistics, FHWA for various years	50.84	14.92
Percentage of federal share in the total revenues for highways from all three levels of government	Tables SF-1 and LGF-21 of Highway Statistics, FHWA for various years	24.02	9.58
Median Household income in dollars	Census Bureau	45887.43	7476.26
Proportion of urban population	Census Bureau	0.71	0.15
Private and commercial automobiles per capita	Table MV-1 of Highway Statistics, FHWA for various years	0.44	0.08
Per Capita Fuel Usage in Gallons	Table MF-21 of Highway Statistics, FHWA for various years; state population data from the Census Bureau	660.29	149.07
Per Capita Vehicle Miles Traveled	Table VM-2 of Highway Statistics, FHWA for various years; state population data from the Census Bureau	10768.67	1933.24
State Gasoline tax rates in cents per gallon from FHWA	Table MF-205 of Highway Statistics (2008), FHWA	21.06	5.33
Number of observations (state-year)	300		

Table 4: Linear Regression Results with Robust Standard Errors

Variables/Models	**Dependent variable = Per capita state revenues for highways**			**Dependent variable = State revenues for highways as a percentage of state personal income**		
Models	**1**	**2**	**3**	**4**	**5**	**6**
Percentage of local share in the total revenues for highways from all three levels of government		-8.01** (1.05)		-0.02** (0.003)		
Percentage of local share in total state and local revenue for highways	-5.87** (0.80)				-0.02** (0.0023)	
Percentage of local share in total federal and local revenue for highways			-7.58** (1.22)			-0.02** (0.003)
Percentage of federal share in the total revenues for highways from all three levels of government	-5.70** (1.04)	-8.47** (1.21)	-14.43** (2.00)	-0.024** (0.004)	-0.016** (0.003)	-0.04** (0.006)
Median Household income in dollars	0.005** (0.0014)	0.005** (0.0014)	0.005** (0.0014)	2.2E-06 (3.7E-06)	2.3E-06 (3.8E-06)	1.82E-06 (3.67E-06)
Proportion of urban population	-157.22* (63.08)	-159.07* (62.00)	-133.90* (63.21)	-0.71** (0.17)	-0.71** (0.18)	-0.64** (0.17)
Private and commercial automobiles per capita	-226.89** (77.70)	-242.29** (76.28)	-242.47** (77.18)	-0.93** (0.23)	-0.89** (0.24)	-0.95** (0.24)
Per Capita Vehicle Miles Traveled	0.012^ (0.008)	0.012^ (0.007	0.011 (0.008)	0.000022 (0.000018)	2.2E-05 (1.8E-05)	1.7E-05 (1.7E-05)
State Gasoline tax rates in cents per gallon from FHWA	0.21 (1.64)	0.51 (1.58)	-0.49 (1.64)	0.0035 (0.004)	0.0026 (0.004)	0.0004 (0.004)
Constant	507.25** (158.61)	582.82** (156.05)	937.03** (190.35)	2.522** (0.39)	2.31** (0.40)	3.61** (0.49)
R-Square	0.41	0.45	0.46	0.44	0.40	0.46
Number of observations (state-year)	300	300	300	300	300	300

1. Numbers in parentheses are robust standard errors; 2. ^ = $p \leq 0.10$; * = $p \leq 0.05$ and ** = $p \leq 0.01$

The results of the regression analyses in table 4 offer interesting findings. The six regression models explain about 40-46 percent of variation in dependent variables. Future research might identify additional general and highway specific variables to include in the regression models for explaining even higher percent of variation in the dependent variable. The relationships between the measures of fiscal decentralization and the measures of state government's support for highway finance are negative and statistically significant in all six models. These models therefore confirm the key hypothesis that greater fiscal decentralization in highway finance is associated with lower fiscal size of the state governments in the highways sector. This finding is consistent with several empirical studies (as noted in section 3) that have investigated the Leviathan hypothesis on fiscal decentralization and government size in the general context (Craw 2008; De Mello 2001; Eberts and Gronberg 1990; Grossman 1989; Lalvani 2002; Nelson 1986; Rodden 2003; Yeung 2009; Zax 1989). Additionally, the greater fiscal responsibility borne by the federal government for highways is also associated with smaller state government size. The two results confirm the obvious expectation that the higher fiscal burdens shared by other levels of government lowers the fiscal size of the state government in the highway sector.

Several other state level factors influence the size of state governments in the highways sector. The median household income is positively related to the government size when measured as per capita revenues for highways. In regard to the other measure of government size, the median household income has no influence. Proportion of urban population and automobile ownership per capita are negatively related to government size in all six models.

The per capita vehicle miles traveled has positive influence, at a significance level of 0.10, on government size measured in terms of per capita state revenues for highways except in model 3 where fiscal decentralization is measured as local share in total federal and local revenues for highways. In other three models, there is no relationship in this regard. The gasoline tax rates did not have any influence on the size of state governments in the highway sector in any of the six models.

6. Conclusion, Discussion, and Policy Implications

This paper takes up a comparative policy study in the context of highway finance in the US. The extant literature on the intergovernmental financing of highways has underscored the inadequacy of funding from state and federal governments and the increasing reliance on local funding of highways (Goldman and Wachs 2003; Yusuf et al. 2011). The state and federal governments have not adjusted fuel tax rates on account of inflation. The federal and state transfers to local governments have declined in recent decades. At the same time, the local governments are raising more resources for highways from general funds and through new charges and fees. The local governments are also increasingly turning to local option transportation taxes. Therefore, the extant literature on highway finance point toward greater fiscal decentralization and declining role of federal and state governments. Furthermore, these studies not only prescribe the policy option of adjusting fuel tax rates for inflation and fuel efficiency, they also argue for implementing new forms of taxes to the direct users of highways. These taxes include tolls, land taxation and transportation utility fees among several others (Wachs 2003; Goldman and Wachs 2003; Chapman et al. 2009; Yusuf et al. 2011).

Notwithstanding the general inadequacy of funding from all levels of government and greater fiscal decentralization, the national trends show that the three levels of governments have actually mobilized more resources during the recent decades for highways. Moreover, the state governments have shared more fiscal burden than the combined share of the local and federal government in financing of highways. In light of these conflicting national trends, this paper specifically investigates the relationship between greater fiscal decentralization and the declining role of state governments in the highways at a more disaggregated level. Linear regression approach is used to empirically evaluate this relationship within the context of the theoretical literature on the Leviathan and the Public Choice models. There is no such study done in the context of funding of highways. This paper therefore makes a novel contribution to the literature.

The regression results based on the disaggregated data confirm the hypothesis that there is negative relationship between fiscal decentralization and state government size in the highway finance sector. This finding is consistent with empirical studies based on Leviathan and Public Choice models. Another important public policy relevant finding of this paper is that the fiscal share of the federal government also negatively influences the fiscal size of state governments. This means that the federal government has been unable to bring in parity in highway spending among state governments.

In addition to local and federal shares in total revenues for highways, several other state level factors also influence the size of state governments. The median household income is positively related to the government size when measured as per capita revenues for highways. This means that rich states spend more on highways. The per capita vehicle miles traveled also positively influences the size of state government in the highway sector. The gasoline tax rates, however, do not influence the size of state governments. This finding does not support the argument that raising fuel tax rates on account of inflation and fuel economy would increase the size of state governments.

Counter to what one would expect, the proportion of urban population and automobile ownership per capita are negatively related to the size of state government in the highway sector. Perhaps with greater urbanization residents can choose residences near their workplaces or they may have access to public transit options. In such a scenario, residents' utilization of personal vehicles and therefore motor fuel would be at lower levels. With lower fuel use, the state revenue from motor fuel tax for highway funding would also be lower. Similarly, higher automobile ownership per capita may simply denote the fact that residents are utilizing more fuel-efficient vehicles for regular commuting in addition to owning other utility vehicles. This situation would also result in lower levels of motor fuel use and hence lower levels of state revenue from motor fuel tax. The two variables indeed have negative correlation with fuel use although only the relationship between urbanization and fuel use is statistically significant. Further comparative public policy study of other relevant factors with respect to financing of highways would throw more light in this regard.

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