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Household Mobility and Local Government Finance in U.S. Cities

Working Paper WP20WL1

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February 2020

Abstract

In this paper, we examine how household mobility is affected by the choice of local government finance method (taxation versus debt finance) for U.S. cities. We develop a discrete time dynamic optimization model that implies the optimal strategy for a resident household is to remain in the city during periods of debt finance and move out when future tax liabilities come due. The optimal strategy for households outside the city is to avoid moving into a city that is paying off past debt with high current taxes. To investigate the degree to which tax and debt policy affect household relocation decisions we estimate empirical models of in- and out-migration for a panel dataset of 150 Fiscally Standardized Cities between 2007 and 2012. Results indicate that although both increases in debt finance and taxes are associated with greater out-migration, the tax effects are much stronger. Further, higher current taxes have large negative effects on in-migration whereas debt finance has insignificant effects. The importance of these results is that the equivalence of taxation and debt finance suggested by the Ricardian Equivalence Theorem does not hold for U.S. cities. The observed difference is due to the greater salience of taxes relative to the implied future tax liabilities associated with debt financing. The lack of equivalence follows directly from optimizing behavior with full current information in the presence of household mobility.

Keywords: city finances, taxation, debt finance, household mobility, migration.

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Acknowledgments

The authors acknowledge helpful comments provide by Randy Eberts, Howard Chernick, and Min Su on earlier drafts of this material. All remaining errors are the authors' responsibility.

Table of Contents

Household Mobility and Local Government Finance in U.S. Cities

1. Introduction

In the United States, local governments retain considerable powers with respect to how they are organized, what public services they provide, and how they finance expenditures. In terms of key finance methods, they can either collect tax revenue or issue debt in the form of municipal bonds. This leads to significant variations in reliance on tax finance and debt finance both across regions and over time among cities. For example, among the 150 Fiscally Standardized Cities in the United States between 1987 and 2014, the yearly per capita tax revenue ranges from $431 to $10,392 in 2014 real dollars, and the amount of yearly per capita long-term debt issued ranges from $0 to $12,634 in 2014 real dollars. The debt-to-tax ratio among these cities ranges from 0 to 7.22.[1]

Of course, tax and debt finance are related to each other. How to balance the use of these two finance methods strategically has always been a very important question for local governments. If local governments choose to rely less on taxes for a given level of public expenditure, that requires greater reliance on debt. The important question is whether a local government's greater reliance on debt finance or tax finance has any impact on economic activities and migration in particular.

In economic theory, there have been two popular views on the effects of public debt. The "conventional" view holds that the issuance of government debt increases households' perceived wealth which affects savings and capital accumulation. The alternative view of government debt is summarized in the Ricardian equivalence theorem which states that for a given pattern of government spending, tax financing and debt financing are equivalent and the government's choice between these two methods does not affect consumers' perceived wealth and economic behavior. In the basic setting of the Ricardian Equivalence Theorem, governments can rely less on current taxes and finance their expenditure by issuing municipal bonds to the public. The taxpayers are assumed to perfectly foresee the increase in tax liability required in future periods required for the government to pay off the debt. Therefore, instead of spending the extra income benefit from lower taxes, they increase their saving to prepare for the increase in the future tax burden. The additional income benefit from the lower tax in the current time period becomes savings, and therefore it has no significant effect on economic behavior.

[1] The Fiscally Standardized Cities (FiSC) database is constructed by the Lincoln Institute of Land Policy. It contains 150 largest cities in the United States across over 120 categories of government finance data. Motivation and methodology of constructing the FiSC database are provided in Section 4.1. Reliance of debt over tax is measured by the ratio of the amount of long-term debt issued and tax revenue in one year for a city. The larger this value, the more heavily a city relies on debt finance over tax finance. The minimum tax revenue per capita ($431) occurred in Dover, DE in 1987. The maximum tax revenue per capita ($10,392) occurred in Washington, D.C. in 2007. The minimum amount of long-term debt issued per capita ($0) occurred in several cities over the years. The maximum amount of long-term debt issued per capita ($12,634) occurred in Orlando, FL in 1987. The minimum debt-to-tax ratio occurred in several cities over the years. The maximum debt-to-tax ratio occurred in Orlando, FL in 1987.

Despite years of theoretical and empirical debate, the Ricardian equivalence theorem remains highly controversial. Barro (1989) discusses five major theoretical objections to the Ricardian equivalence theorem: finite lives, imperfect capital markets, uncertain future income, distortionary taxation, and the full employment assumption. When applied to state and local finance, household mobility across fiscal jurisdictions raises a further objection to the relevance of the Ricardian approach (Wellisch and Richter 1995). The possibility that households will, in the future, be in a different fiscal jurisdiction reduces the expected discounted value of tax liabilities associated with debt finance and implies that tax and debt finance will not have equivalent effects. The objection is related to the finite lives case in that the relevant lifetime is time spent in a particular jurisdiction. Because inter-jurisdictional moving rates are considerably higher than mortality rates, the objection has more force. Further, the "operational bequest motive" emphasized by Barro (1974) would be largely absent in the case of moving rather than dying. The countervailing consideration for homeowners is the extent to which future tax liabilities are capitalized in the price of homes. If higher future tax liabilities are reflected in housing prices, current residents will be end up paying for the future tax liabilities in the form of lower housing prices when they move.

One way in which this preference for debt over tax finance will be manifested is that households may make location choices based on tax and debt financing decisions. The optimal strategy would be to leave jurisdictions that choose current tax finance and move to jurisdictions that choose a policy of debt finance and low current taxes. In this way they can enjoy the amenities of debt financed public expenditures while avoiding the future tax liabilities. The traditional Tiebout (1956) model is based on household movement in response to local government public finance policies. In that model, the relocation decision is based on household preferences concerning the level of taxes and expenditures supporting local public goods provision, whereas in the case of debt versus tax finance, the relocation decision may be based on a tax avoidance motive.

This paper estimates how the debt and taxation policies affect household location choices using a panel of 150 U.S. cities. The main finding is that the choice of debt versus tax finance by cities influences both in- and out-migration. Increases in current taxes have stronger effects on households leaving a city than equivalent increases in debt issues. Higher current taxes have stronger (negative) effects on households entering a city than equivalent increases in debt issues. These findings are consistent with differing salience of tax and debt policy. Households living in a given city may simply be more aware of the current levels of taxation than the implied future levels of taxation associated with debt finance. However, the differing response to tax and debt issue is predicted in our model by rational behavior of agents that are fully aware of future tax liabilities. They choose to remain in a city during the period of debt finance and strategically relocate when future tax liabilities are realized.

The research in this paper contributes to the literature on local public finance by examining the effect of local government debt and tax finance choices on migration behaviors at the city level in the United States. Most existing studies have used data at the state level or only focused on a small region, such as cities or counties within a specific U.S. state. In contrast, we use data for the 150 Fiscally Standardized Cities available in the Lincoln Institute of Land Policy FiSC database to obtain more meaningful comparisons of financing at the city level in the United

States. These data correct for varying city government responsibilities by standardizing the public service packages provided. The provision of public services differs among U.S. cities as some cities take the full responsibility for public services within their jurisdictions while other cities share responsibilities with other local governments such as the county government, school districts, and special districts. To account for the overlying government structures, the FiSC database is created by adding local government finance data of the city government to a portion of the finance data of the overlying governments. By doing so, this database permits more rigorous and meaningful comparisons among U.S. cities.

The paper is organized as follows. Section 2 reviews relevant literature. Section 3 presents a discrete time dynamic model in which we analyze the relationship of household mobility and local government choice of taxation and debt finance. Section 4 presents the empirical models and estimation results. Section 5 summarizes and provides policy implications.

2. Literature Review

Several earlier studies have focused on the Ricardian Equivalence Theorem. David Ricardo, in his work "Essay on the Funding System" (1820), was the first to consider whether it makes a difference to finance a war with tax revenue or to issue government bonds that are paid back by future taxes. He concluded that the two alternatives resulted in the same value of government spending. Barro (1974) provides the theoretical foundation for the Ricardian Equivalence Theorem within the context of an overlapping-generations model. He concludes that "changes in the relative amounts of tax and debt finance for a given amount of public expenditure would have no effect on aggregate demand, interest rates, and capital formation."

Previous literature tests the Ricardian Equivalence Theorem by either challenging the underlying assumptions or by showing empirically that neutrality does not hold. Wellisch and Richter (1995) develop a local public finance model that predicts the neutrality result does not hold in general when we allow for household mobility and debt serviced by local residence-based taxes. The main reason for the non-neutrality result is that such taxes create locational distortions. As for empirical analysis, Adj and Alm (2016) study the developing country of Indonesia and find that debt finance increases the interest rate and current consumption, stimulates imports, but dampens future consumption. Their findings support the conventional view on public debt. A similar study in the developed country context is that of Hayo and Neumeier (2017) which finds that only 7 percent of 2,000 surveyed Germans consume less and save more of their income in response to public debt accumulation during the period between 2008 and 2012 in Germany. Their finding challenges the Ricardian Equivalence Theorem. There are also studies that find negative effects of high government debt levels on economic growth. (for example, Cecchetti, Mohanty, and Zampolli 2011; Checherita-Westphal and Rother 2012; Reinhart and Rogoff 2010).

There is also a strand of the literature on mobility reactions by households to public policy. For example, Fox, Herzog, and Schlottman (1989) examine metropolitan fiscal structure effects on Tiebout-like voting with mobility and find that more progressive tax policy tends to encourage out-migration. Grassmueck (2011) focuses on intra-county migration in Philadelphia and finds that higher adjusted property taxes and higher government spending for certain local public goods and services play a positive role on attracting migration from other municipalities.

Our study also addresses policy salience which may contribute to the different reactions to debt and tax policy. Previous studies have examined the salience of some specific taxes. Chetty, Looney, and Kroft (2009) study of sales and excise taxes finds differing responses to taxes with varying degrees of salience. Consumers tend to react more to the taxes that are included in posted prices compared with the taxes that are applied at the register. Bradley (2013) discusses property tax salience in particular. He finds that the probability of delinquency decreases with increased salience of the property tax. Our study not only addresses tax policy salience, but also implicitly compares the relative degrees of salience for city tax and debt policies.

In the next section we present a discrete time dynamic model that is used to investigate the relationship between relocation choices of households and local public finance choices between taxation and debt.

3. Theoretical Model: A Discrete Time Dynamic Optimization Model

Consider the following two-state model. Agents begin in the "home" state (H) and face a constant probability, μ, per period, of permanently moving to the "away" state, (A). In all other respects, the model has the elements that ensure agents treat debt and taxes as equivalent. Agents live forever as dynastic families, agents have full knowledge of local government finance choices including future taxes and incomes in each state, taxing authorities are subject to binding intertemporal budget constraints, all taxes are non-distortionary (lump sum) and there are no credit (liquidity) constraints.

Formally, the individual agent chooses a sequence of consumption, c_t, to maximize the expected value of a time separable utility function with constant discount factor β,

$$\max_{\{c_t, c_{t+1}, \ldots\}} E_t \sum_{j=0}^{\infty} \beta^j U\left(c_{t+j}\right), \tag{1}$$

where the current utility function satisfies the standard restrictions, $U' > 0$ and $U'' < 0$. The maximization is subject to a sequence of state dependent budget constraints where the two states, $S \in \{\boldsymbol{H}, \boldsymbol{A}\}$, represent "home" and "away" respectively,

$$A_{t+1+j} = R\left(A_{t+j} + y_{t+j}^S - c_{t+j} - \tau_{t+j}^S\right), \qquad j = 0,1,2,..... \tag{2}$$

A_t consists of all financial assets at time t, y_t^S is labor income net of federal taxes, τ_t^S is local taxes and $R = (1+r)$ is the constant, gross real rate of return. The probability of leaving the "home" state is u in each period and all moves are permanent. That is, the transition probabilities $P(\mathbf{A}_{t+1} | \mathbf{H}_t) = \mu$ and $P(\mathbf{H}_{t+1} | \mathbf{A}_t) = 0$ are known and constant in each period. We also impose standard constraints on the disposable income processes in each state, $\sum_{j=0}^{\infty} R^{-j} (y_{t+j}^S - \tau_{t+j}^S) < \infty$

and impose a No-Ponzi-Game condition, $\lim_{t\to\infty} R^{-t} A_t = 0$ to rule out a strategy of unlimited borrowing.

This optimization problem is most conveniently expressed in the form of a dynamic programming problem. The Bellman equations in state ***H***, is,

$$V^H\left(A_t\right) = \max_{c_t} \begin{Bmatrix} U(c_t) + \beta\mu V^A\left(R(A_t + y_t^H - c_t - \tau_t^H)\right) + \\ \beta\left(1-\mu\right)V^H\left(R\left(A_t + y_t^H - c_t - \tau_t^H\right)\right) \end{Bmatrix}. \tag{3}$$

Equation (3) states that the value of being in the home state at time *t* with assets A_t is the maximized value of the utility of current consumption and the probability weighted average of the discounted value of being in the "home" and "away" states with assets A_{t+1} in time *t+1*.

The value of being in the "away" state is the maximized value of current utility and the discounted value of being in the "away" state in the subsequent period,

$$V^A\left(A_t\right) = \max_{c_t} \left\{U(c_t) + \beta V^A\left(R(A_t + y_t^A - c_t - \tau_t^A)\right)\right\}. \tag{4}$$

The first order conditions for the two Bellman equations are

$$U'(c_t^H) = \beta R\mu V^{A\prime}\left(R(A_t + y_t^H - c_t^H - \tau_t^H)\right) + \beta R\left(1-\mu\right)V^{H\prime}\left(R\left(A_t + y_t^H - c_t^H - \tau_t^H\right)\right) \tag{5}$$

and

$$U'(c_t^A) = \beta R V^{A\prime}\left(R(A_t + y_t^A - c_t^A - \tau_t^A)\right), \tag{6}$$

respectively, and the envelope conditions are:

$$V^{H\prime}\left(A_t\right) = \beta R\mu V^{A\prime}\left(R(A_t + y_t^H - c_t^H - \tau_t^H)\right) + \beta R\left(1-\mu\right)V^{H\prime}\left(R(A_t + y_t^H - c_t^H - \tau_t^H)\right) \tag{7}$$

$$V^{A\prime}\left(A_t\right) = \beta R V^{A\prime}\left(R(A_t + y_t^A - c_t^A - \tau_t^A)\right). \tag{8}$$

Combining equations (7) and (5) yields the Euler equation for individuals in the "home" state,

$$U'\left(c_t^H\right) = \beta R\left(\mu U'(c_{t+1}^A) + (1-\mu)U'(c_{t+1}^H)\right), \tag{9}$$

and combining equations (8) and (6) gives the Euler equation for individuals in the "away" state,

$$U'\left(c_t^A\right) = \beta R U'(c_{t+1}^A). \tag{10}$$

In the macroeconomic literature on Ricardian equivalence the focus is on how tax policy affects interest rates and aggregate levels of savings and consumption. Because our interest here is on state and local finance, we assume that the taxing authority is sufficiently small and capital is sufficiently mobile that any effects on interest rates would be negligible. To examine the effects on consumption behavior, it is useful to employ the common, but restrictive, assumptions of quadratic utility and the assumption that subjective rates of time preference and real interest rates are equal, $\beta R = 1$. In this case we can solve the individual problem analytically to obtain,

$$c_t^H = (1-R)\left(A_t + \sum_{j=0}^{\infty} R^{-j}\left((1-u)^j (y_{t+j}^H - \tau_{t+j}^H) + \left(1-(1-u)^j\right)(y_{t+j}^A - \tau_{t+j}^A)\right)\right). \qquad (11)$$

Equation (11) shows that, in making consumption decisions, future taxes in the home jurisdiction are discounted not only by the usual interest rate factor but by the probability of remaining, (1-*u*). The result is similar to Blanchard's (1983) with the probability of leaving playing the role of the probability of survival. The consumption implications are much stronger for two reasons. First, the probability of moving is much larger than the probability of death. Second, when individuals leave, they take their wealth with them. In Blanchard's formulation, individuals cannot "take it with them," so they sell contingency claims to their assets in the event of death. These contracts pay dividends to individuals while alive, equal to the probability of death. This raises the return on savings and hence tends to offset the discounting of future tax liabilities.

Testing the consumption implications of local Ricardian equivalence is somewhat problematic. Although retail sales data may be available by jurisdiction, consumption data are not readily available. Standard tests of Ricardian equivalence cannot be applied. Further, even if Ricardian equivalence fails, the fiscal stimulus of local tax policies may be relatively unimportant. The local spending 'multiplier,' which depends on how the stimulus affects the consumption of goods and services within the taxing jurisdiction, is likely to be small.

Rather than focusing on the consumption response to tax policy, we examine the direct effect on individual welfare and preferences. Consider the effect of a tax increase on individual welfare at time *t+j* in the home jurisdiction. To derive the effect, it is useful to first expand the Bellman equation (3) by recursively substituting forward for the value of remaining in the home jurisdiction,

$$
\begin{aligned}
V^H(A_t) = & \max_{c_t} \Big\{ U(c_t) + \beta\mu V^A\left(R(A_t + y_t^H - c_t - \tau_t^H)\right) + \\
& \beta(1-\mu) \max_{c_{t+1}} \Big\{ U(c_{t+1}) + \beta\mu V^A\left(R(A_{t+1} + y_{t+1}^H - c_{t+1} - \tau_{t+1}^H)\right) + \\
& (\beta(1-\mu))^2 \max_{c_{t+2}} \Big\{ U(c_{t+2}) + \beta\mu V^A\left(R(A_{t+2} + y_{t+2}^H - c_{t+2} - \tau_{t+2}^H)\right) + \\
& \cdot \quad + \\
& \cdot \quad + \\
& (\beta(1-\mu))^j \max_{c_{t+j}} \Big\{ U(c_{t+j}) + \beta\mu V^A\left(R(A_{t+j} + y_{t+j}^H - c_{t+j} - \tau_{t+j}^H)\right) + \\
& \qquad \beta(1-\mu) V^H\left(R(A_{t+j} + y_{t+j}^H - c_{t+j} - \tau_{t+j}^H)\right)\Big\} \cdots \Big\}\Big\}\Big\}
\end{aligned} \tag{12}
$$

Now differentiating the value function with respect to taxes at time *t+j*, and using the envelope theorem gives,

$$
\begin{aligned}
\frac{\partial V^H(A_t)}{\partial \tau_{t+j}^H} &= -(\beta(1-\mu))^j \left(uR\beta V^{H\prime}(A_{t+j+1}) + (1-u)R\beta V^{A\prime}(A_{t+j+1})\right), \\
&= -(\beta(1-\mu))^j U'(c_{t+j})
\end{aligned} \tag{13}
$$

where the second equality follows from the first-order condition, equation (7).

Equation (13) is the utility-based equivalent to the consumption effect in equation (11). Future marginal disutility of a tax increase is discounted by both the subjective discount factor and the probability of remaining in the taxing jurisdiction. The welfare effect of a decrease in taxes at time *t*, financed by an increase in taxes in period *t+j* is given by

$$
-\frac{\partial V^H(A_t)}{\partial \tau_t^H} + R^j \frac{\partial V^H(A_t)}{\partial \tau_{t+j}^H} = U'(c_t^H) - (R\beta(1-\mu))^j U'(c_{t+j}^H) \tag{14}
$$

The welfare effect can be shown to be unambiguously positive. Moreover, under reasonable assumptions, the preference for debt financing can be quite large.

To quantify the differential welfare effect of tax and debt financing, we compare a current tax increase to an equivalent increase in debt finance. We model debt issue as a long-term bond that will be perpetually rolled over. The implied future tax burden is the constant stream of taxes needed to service the debt. The effect on individual welfare of a debt issue is then,

$$
\frac{\partial V^H(A_t)}{\partial D_t^H} = -\sum_{j=1}^{\infty}(1-R)\frac{\partial V^H(A_t)}{\partial \tau_{t+j}^H} = -(1-R)\sum_{j=1}^{\infty}(\beta(1-\mu))^j U'(c_{t+j}^H) \tag{15}
$$

And the effect on individual welfare of a current tax increase is simply,

$$\frac{\partial V^H\left(A_t\right)}{\partial \tau_t^H} = -U'(c_t^H) \tag{16}$$

Now assume, $U'(c_{t+j}^H) \approx U'(c_{t+j}^A), j = 0,1,...\infty$. This would be the case if the move neither increased nor decreased lifetime income. Under this assumption, the Euler equation (9) reduces to $U'(c_t^H) \approx (R\beta)^j U'(c_{t+j}^H)$ and then the relative welfare effect of debt and tax financing is simply

$$\frac{\partial V^H\left(A_t\right)}{\partial D_t^H} \div \frac{\partial V^H\left(A_t\right)}{\partial \tau_t^H} \approx \frac{r(1-\mu)}{r+\mu} \tag{17}$$

This simple expression gives key insight. It suggests that even for moderate values of the probability of moving, μ, individuals may show a high preference for debt financing.[2] For example, using a long-term real interest rate on municipal debt of 2 percent and a probability of moving of only 1 percent, the relative valuation is less than two thirds. That is, individuals would prefer a three-dollar bond issue to a two-dollar current tax increase. If the probability of moving is 6 percent, the relative valuation is less than one-fourth. That is, individuals would prefer an eight-dollar bond issue to a two-dollar current tax increase.

Because preferences are generally not observable, this utility-based departure from Ricardian equivalence requires an indirect test. One idea is to examine voting behavior. We would expect those with a higher probability of moving to express a higher preference for debt finance at the ballot box. This would be difficult to test without access to individual voting records. The implications for voting outcomes are not clear. If highly mobile residents expressed their preferences for debt finance at the ballot box, we might predict a positive correlation between degree of mobility and percentage of debt finance across jurisdictions. However, highly mobile residents are typically not politically active at the local level, and immobile residents may be the dominant voting bloc. The immobile residents may prefer current taxation to capture the revenue from those that are likely to leave.

An obvious way in which individuals may express their preference for debt is through location choice. The present model takes moving as purely exogenous, but the model has strong implications for location choice. Suppose individuals have a limited ability to switch locations, perhaps at a cost. In evaluating the desirability of a potential location, they will look at the current level of taxation; however, because they anticipate further moves, they will discount future taxation. As such, they rationally pay more attention to current taxes than the level of debt. This suggests that in-migration depends more on the level of current taxation than on the level of debt. High current taxation would also induce current residents to consider moving more than high current debt levels. High current debt levels imply future taxation, but given the probability of moving, those higher future taxes are discounted heavily. We would predict that high current taxes tend to induce out-migration more so than higher debt levels.

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[2] The approximation understates the preference for debt finance if the move decreases lifetime income and overstates the preference if the move increases lifetime income. In either case, the under- and overstatement is likely to be quite small.

4. Empirical Methodology

In this section, we use an empirical strategy to examine the degree to which people's locational preference changes in response to the local government finance choice between tax and debt finance. A panel data set of large U.S. cities is used in estimation. The main empirical model is a fixed effects regression with instrumental variables (IVs).

4.1. Data

We use a panel dataset of 150 Fiscally Standardized Cities in the United States from 2007 to 2012 to investigate how local government finance choices have been affecting people's relocation decisions in U.S. cities. The local government finance data is collected from the Fiscally Standardized Cities (FiSC) database constructed by the Lincoln Institute of Land Policy. A significant advantage of this database is that it accounts for different government structures by adding local government finance data of the city government to a portion of the finance data of the overlying governments, including counties, independent school districts, and special districts. Consequently, this database allows meaningful comparisons across these Fiscally Standardized Cities.

Migration data is collected from the U.S. Census Bureau migration flow estimates based on the American Community Survey (ACS). The ACS program combines consecutive yearly datasets to produce average yearly county-to-county migration flow data within 5-year periods. There are six sets of estimates available covering the 2005–2009 period to the 2010–2014 period. Given that these estimates are the average estimates from survey data over 5-year periods, we consider the 5-year flow estimates as the estimates for the middle year in each 5-year period. For example, the 2005–2009 county-to-county flow estimate is considered as the estimate for 2007 and is used to match the 2007 FiSC data. We use the main county in which each FiSC is located to match the city finance dataset with the county migration dataset. As a result, we have 900 (150 times 6) observations in our panel dataset.

Summary statistics are reported in Table 1. All the FiSC finance variables are measured in 2014 real dollars.

Table 1: Summary Statistics

VARIABLES	Mean	Standard Deviation	Minimum	Maximum	Observations
Out Migration Rate	0.0586	0.0213	0.0307	0.2186	900
In Migration Rate	0.0570	0.0222	0.0013	0.1437	900
Long-Term Debt Issued Per Capita	926	773	0	5,959	1,050
Debt Outstanding Per Capita	6,976	4,057	637	23,970	1,050
Debt Issuance Tax Ratio	0.4664	0.3522	0	2.4208	1,050
Tax Revenue Per Capita	1,981	896	739	10,392	1,050
Intergovernmental Revenue Per Capita	2,072	920	606	6,191	900
Population	430,663	780,886	16,354	8,287,000	900
Population 0	0.1489	0.3562	0	1	900

VARIABLES	Mean	Standard Deviation	Minimum	Maximum	Observations
Population 1	0.2444	0.4300	0	1	900
Population 2	0.2033	0.4027	0	1	900
Population 3	0.1100	0.3131	0	1	900
Population 4	0.0722	0.2590	0	1	900
Population 5	0.0567	0.2313	0	1	900
Population 6	0.1644	0.3709	0	1	900

The variable definitions and their construction methods are as follows:

- $\ln(OutRate_{i,t})$: log of the probability that a representative resident moves out of a county within a specific year. County move-out probability is used as a proxy for the FiSC move-out probability. The move-out probability is constructed by dividing the population that moved out of a specific county over a year by the total county population at the beginning of that year.

- $\ln(InRate_{i,t})$: log of the probability of a representative resident move into a county within a specific year. County move-in probability is used as a proxy for the FiSC move-in probability. The move-in probability is constructed by dividing the population that moved into a county over a year by the total county population at the beginning of that year.

- $\ln(DebtIssue_{i,t})$: log of the amount of long-term debt issued per capita by a FiSC in a year.

- $\ln(DebtStock_{i,t})$: log of debt outstanding per capita kept by a FiSC in a year.

- $\ln(DebtReliance_{i,t})$: log of the ratio of the per capita long-term debt issued and tax revenue by a FiSC in a year. This is a measurement of reliance on debt finance over tax finance by the city government.

- $\ln(Tax_{i,t})$: log of per capita tax revenue by a FiSC in a year.

- $\ln(InterRev_{i,t})$: log of per capita intergovernmental revenue by a FiSC in a year.

- Population: dummy variables indicate city population bins as follows.
  Population 0 = 1 if population $\leqslant$ 100,000, 0 otherwise;
  Population 1 = 1 if 100,000 < population $\leqslant$ 200,000, 0 otherwise;
  Population 2 = 1 if 200,000 < population $\leqslant$ 300,000, 0 otherwise;
  Population 3 = 1 if 300,000 < population $\leqslant$ 400,000, 0 otherwise;
  Population 4 = 1 if 400,000 < population $\leqslant$ 500,000, 0 otherwise;
  Population 5 = 1 if 500,000 < population $\leqslant$ 600,000, 0 otherwise;
  Population 6 = 1 if population > 600,000, 0 otherwise.
  Population 0 is used as the reference group.

4.2. Empirical Models

In this section, we present the empirical strategy to investigate how differently local public finance factors affect household mobility. To provide a comprehensive picture of the analysis on mobility, we estimate the effects of public finance policy on both move-out and move-in decisions. Firstly, we estimate the model in log-log form to obtain elasticities. The log-log model is specified by equations (18) and (19). Then, to perform a direct test of the Ricardian Equivalence Theorem, we estimate equations (18) and (19) in levels of variables. Debt, tax, intergovernmental revenue variables are per capita 2014 real values.

$$ln(OutRate_{i,t}) = \beta_0 + \beta_1\, ln(Debt_{i,t}) + \beta_2\, ln(Tax_{i,t}) + \beta_3\, ln(InterRev_{i,t}) + \sum_{k=1}^{k=6} \gamma_k Population\_k_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (18)$$

$$ln(InRate_{i,t}) = \beta_0 + \beta_1\, ln(Debt_{i,t}) + \beta_2\, ln(Tax_{i,t}) + \beta_3\, ln(InterRev_{i,t}) + \sum_{k=1}^{k=6} \gamma_k Population\_k_{i,t} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (19)$$

The debt variable is specified in three ways: the amount of long-term debt issued per capita, debt outstanding per capita, and debt reliance. When the debt reliance variable is included in the estimation, the tax variable is dropped out of the regression to avoid potential correlation between the debt-to-tax ratio and tax revenue. Looking at equations (18) and (19) together raises the suspicion of error correlation across these two equations. We perform the Breusch-Pagan tests for three pairs of equations with different debt variable specifications. Detailed test statistics are reported in Table 2. The Breusch-Pagan tests for the three pairs of regressions all show that there is no significant correlation of errors across the move-out and move-in equations. Therefore, using seemingly unrelated regressions is not necessary.

The basic estimating model we use is to estimate equations (18) and (19) separately by fixed-effect regressions with controls for both year and city fixed-effects. What's more, equation (17) shows a relationship between finance choice and moving probability but not causality. To control for the endogeneity, we use the one-year-lagged debt variables as IVs for the debt variable specifications. Then, we estimate the same model by using variables in levels to perform a direct test of the Ricardian Equivalence Theorem. By estimating the model in levels, we can check implications on how the absolute dollar values of financing between tax revenues and municipal bonds affect people's relocation decisions.

Table 2: Breusch-Pagan Test Results (in logs)

Debt variable: $ln\, DebtIssue_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move Out Equation	1.0000	
Move In Equation	0.0313	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 0.873$	p-value = 0.3501
Debt variable: $ln\, DebtStock_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move Out Equation	1.0000	
Move In Equation	0.0282	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 0.714$	p-value = 0.3980
Debt variable: $ln\, DebtTaxRatio_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move Out Equation	1.0000	
Move In Equation	0.0229	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 0.466$	p-value = 0.4946

4.3. Empirical Results

In this subsection, first we report the elasticities by estimating log-log models. Then, we perform the direct test of the Ricardian Equivalence Theorem by estimating the models in levels.

4.3.1. IV Regressions in Log-Log Form: Elasticities

Table 3 shows the estimates for the move-out equation (18) and move-in equation (19) using fixed-effect estimators with IVs. From columns (1)–(3), we can see that citizens in these 150 large U.S. cities are likely to move out when the local governments issue large amounts of debt or rely more on debt finance than tax finance, but they do not seem to react to the stock of debt outstanding. This finding is consistent with the hypothesis derived from the discrete time dynamic model, even though the relationship is marginally significant at the 10 percent level, with an elasticity estimate of 0.04 for debt issuance per capita and an estimate of 0.03 for the debt-to-tax ratio. The evidence indicates that citizens tend to move out to avoid future increase in tax liability. The estimates also indicate that the move-out reaction is significant and strong for changes in tax revenue. Increases in per capita tax liability induce local citizens to move out of the current city they live in. The relative size of the tax elasticity is approximately three times that of the debt issue elasticity, indicating that move-out decisions are more strongly affected by taxes than debt.

The difference in reactions to debt and tax policy may be explained by the different salience degrees of local public tax and debt policy. People pay sales tax, income tax, property tax, and all kinds of other taxes to their local governments in their everyday lives. But, they may be relatively uninformed about the debt financing used by their local governments. Therefore, they may know and care more about the tax policy changes than the debt policy changes. A second possible interpretation for the different reactions to debt and tax finance could be attributed to tax capitalization. On one hand, cities that rely more on debt finance may have relatively low property tax liability. According to the theory of tax capitalization (Yinger 1988), a decrease in property tax liability will increase the house value, making people wealthier. On the other hand, cities that rely more on tax finance may have relatively low housing values, making people less wealthy. Therefore, people who live in cities that rely more on tax finance may be more likely to move out than those who live in cities that rely more on debt finance. Given the relatively low house values caused by high tax capitalization, residents may tend to be wealthier in cities that rely more heavily on debt financing. A third possible explanation for the difference in reactions to debt and tax finance is that when debt finance is chosen over tax finance, even though the rational relocation strategy is to move out to avoid a future tax burden increase, some people may want to stay during the debt accumulation periods and benefit from the "free" public good financed by local public debt and start to move out as long as tax starts to increase. By doing so, they could avoid at least part of the future tax increase.

For columns (4)–(6) in Table 3, the estimating results for the move-in decisions are less revealing than those for the move-out decisions. The only variable that significantly and negatively affects people's move-in decision is tax revenue per capita, however even that effect is relatively weak. People are less likely to move into a city with a relatively large tax liability. The reason why most of the explanatory variables are insignificant in affecting people's move-in decisions could be that outsiders may not know about city finance conditions before they actually move in. In other words, public finance policy may be less salient for outsiders than insiders.

None of the estimated intergovernmental revenue effects are significant in the move-out and move-in equations. This result may also be attributed to the low salience of public policy regarding intergovernmental transfers to the general public as they are not directly apparent.

City size matters in the move-out equations. In larger cities it is less likely that people will move out. This may be because people living in large cities tend to get used to all kinds of amenities such as transportation networks, shopping malls, restaurants, super- centers, and a wide array of public goods and services provided by the city. Move-out decisions may also be discouraged by employment options in large cities that provide opportunities for earning a relatively higher income.

Table 3: IV Regressions with Fixed-Effects (in logs)

VARIABLES	(1) Move-Out	(2) Move-Out	(3) Move-Out	(4) Move-In	(5) Move-In	(6) Move-In
$\ln DebtIssue_{i,t}$	0.0410*			0.1653		
	(0.0213)			(0.1139)		
$\ln DebtStock_{i,t}$		-0.0099			0.1166	
		(0.0314)			(0.1789)	
$\ln DebtTaxRatio_{i,t}$			0.0346*			0.1749
			(0.0209)			(0.1165)
$\ln TaxRev_{i,t}$	0.1187**	0.1521***		-0.4730*	-0.2704	
	(0.0491)	(0.0351)		(0.2627)	(0.1999)	
$\ln InterRev_{i,t}$	0.0121	0.0142	0.0282	-0.0576	-0.0512	-0.0884
	(0.0268)	(0.0229)	(0.0257)	(0.1434)	(0.1305)	(0.1435)
Population 1	0.0205	0.0319	0.0259	0.0788	0.1226	0.0692
	(0.0375)	(0.0315)	(0.0363)	(0.2006)	(0.1796)	(0.2028)
Population 2	0.0208	0.0097	0.0248	0.2246	0.1963	0.2163
	(0.0487)	(0.0414)	(0.0470)	(0.2601)	(0.2356)	(0.2627)
Population 3	-0.2057***	-0.2147***	-0.2091***	0.2300	0.2091	0.2359
	(0.0555)	(0.0472)	(0.0536)	(0.2965)	(0.2687)	(0.2996)
Population 4	-0.1873***	-0.1941***	-0.1985***	0.2073	0.1981	0.2282
	(0.0622)	(0.0530)	(0.0601)	(0.3323)	(0.3016)	(0.3356)
Population 5	-0.2048**	-0.1829**	-0.2210**	0.3110	0.4216	0.3436
	(0.0949)	(0.0802)	(0.0916)	(0.5074)	(0.4568)	(0.5117)
Population 6	-0.2173**	-0.1938**	-0.2289**	0.3137	0.4291	0.3376
	(0.0988)	(0.0836)	(0.0954)	(0.5281)	(0.4761)	(0.5330)
Constant	-3.9934***	-3.9185***	-2.9148***	-0.0934	-1.6431	-2.1775*
	(0.3590)	(0.3806)	(0.2013)	(1.9193)	(2.1676)	(1.1241)
Observations	885	900	885	885	900	885
Year Fixed-Effect	YES	YES	YES	YES	YES	YES
City Fixed-Effect	YES	YES	YES	YES	YES	YES

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.3.2. IV Regressions in Levels: Direct Test of the Ricardian Equivalence Theorem

To conduct a direct test of the Ricardian Equivalence Theorem, we estimate the same IV regressions in levels of all the variables for both move-out and move-in decisions. First, we perform the Bruesch-Pagan test of independence for each pair of the move-out and move-in equations. Test results reported in Table 4 show that we cannot reject the independence of these two equations; i.e., there is no significant correlation of errors at the 5 percent level. Therefore, we can estimate the two equations separately by using IVs to account for reverse causality.

Table 4: Breusch-Pagan Test Results (in levels)

Debt variable: $DebtIssue_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move-Out Equation	1.0000	
Move-In Equation	0.0559	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 2.808$	p-value = 0.0938
Debt variable: $DebtStock_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move-Out Equation	1.0000	
Move-In Equation	0.0557	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 2.794$	p-value = 0.0946
Debt variable: $DebtTaxRatio_{i,t}$		
Correlation Matrix of Residuals	Move-Out Equation	Move-In Equation
Move-Out Equation	1.0000	
Move-In Equation	0.0579	1.0000
Breusch-Pagan Test of Independence	$\chi^2(1) = 3.015$	p-value = 0.0825

Table 5 reports the regression results for equations estimated in levels using fixed effects and IVs. For the move-out equations in columns (1)–(3), the debt issuance, debt stock and debt-to-tax ratio variables are not significant indicating that debt policy does not affect move-out decisions of households. In contrast, the tax revenue per capita variable is positive and significant, indicating that increases in tax liability significantly encourage households to move out. For the move-in equations in columns (4)–(6), it is apparent that neither debt nor tax variables have significance. Here, again, we see different household reactions to city debt and tax policy. The significance level and signs of the intergovernmental revenue variable and population dummies are consistent as in the log-log models reported in Table 3.

Table 5: IV Regressions with Fixed-Effects (in levels)

VARIABLES	(1) Move-Out	(2) Move-Out	(3) Move-Out	(4) Move-In	(5) Move-In	(6) Move-In
$DebtIssue_{i,t}$[3]	0.0027			0.0060		
	(0.0025)			(0.0041)		
$DebtStock_{i,t}$		0.0003			0.0004	
		(0.0004)			(0.0006)	
$DebtTaxRatio_{i,t}$			0.0035			0.0136
			(0.0055)			(0.0092)

[3] Variables of $DebtIssue_{i,t}$, $DebtStock_{i,t}$, $TaxRev_{i,t}$, and $InterRev_{i,t}$ are in per capita values and in thousands of dollars.

VARIABLES	(1) Move-Out	(2) Move-Out	(3) Move-Out	(4) Move-In	(5) Move-In	(6) Move-In
$TaxRev_{i,t}$	0.0094***	0.0104***		-0.0033	-0.0010	
	(0.0020)	(0.0017)		(0.0034)	(0.0027)	
$InterRev_{i,t}$	0.0009	0.0010	0.0015	0.0004	0.0005	0.0005
	(0.0011)	(0.0011)	(0.0011)	(0.0018)	(0.0017)	(0.0019)
Population 1	0.0014	0.0019	0.0019	0.0023	0.0032	0.0020
	(0.0033)	(0.0031)	(0.0033)	(0.0054)	(0.0049)	(0.0056)
Population 2	0.0015	0.0003	0.0015	0.0039	0.0010	0.0039
	(0.0044)	(0.0041)	(0.0045)	(0.0074)	(0.0065)	(0.0075)
Population 3	-0.0278***	-0.0285***	-0.0288***	0.0011	-0.0008	0.0015
	(0.0049)	(0.0047)	(0.0050)	(0.0082)	(0.0074)	(0.0084)
Population 4	-0.0258***	-0.0263***	-0.0280***	-0.0004	-0.0020	-0.0002
	(0.0055)	(0.0052)	(0.0055)	(0.0091)	(0.0083)	(0.0093)
Population 5	-0.0250***	-0.0248***	-0.0275***	0.0050	0.0049	0.0050
	(0.0082)	(0.0079)	(0.0083)	(0.0136)	(0.0125)	(0.0140)
Population 6	-0.0269***	-0.0269***	-0.0295***	0.0075	0.0071	0.0066
	(0.0086)	(0.0083)	(0.0086)	(0.0142)	(0.0130)	(0.0146)
Constant	0.0494***	0.0478***	0.0687***	0.0585***	0.0568***	0.0511***
	(0.0056)	(0.0059)	(0.0052)	(0.0092)	(0.0093)	(0.0087)
Observations	900	900	900	900	900	900
Year Fixed-Effect	YES	YES	YES	YES	YES	YES
City Fixed-Effect	YES	YES	YES	YES	YES	YES

Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Our direct test of the Ricardian Equivalence Theorem is conducted by using a Chi-square test on the equality of the coefficients on the debt and tax variables for each regression (except for the regression with the debt-to-tax ratio which is not appropriate for this test). Test results are reported in Table 6. For the move-out equations, the coefficients on debt issuance per capita and tax revenue per capita are significantly different from each other at the 10 percent level and the coefficients on debt outstanding per capita and tax revenue per capita are significantly different from each other at the 1 percent level. The results indicate different effects of debt and tax policy on move-out decisions, challenging the Ricardian Equivalence Theorem. As for the move-in equations, we cannot reject the equality of the debt and tax effect on the relocation decisions, indicating that the choices between debt and tax finance do not matter for outsiders before they actually move into cities.

Table 6: Direct Test of the Ricardian Equivalence Theorem

Testable Hypothesis	Move-Out Equations	Move-In Equations
Debt Issue = Tax Revenue	χ^2 (1) = 2.95 Prob. > χ^2 = 0.0860	χ^2 (1) = 2.08 Prob. > χ^2 = 0.1496
Debt Outstanding = Tax Revenue	χ^2 (1) = 31.85 Prob. > χ^2 = 0.0000	χ^2 (1) = 0.25 Prob. > χ^2 = 0.6174

Our findings challenge the Ricardian Equivalence Theorem from three perspectives. First, when the Ricardian Theorem holds, people should be indifferent between debt financing and tax financing, yet our findings show that residents do react differently to local finance choices. Second, the results suggest that taxes have a much stronger effect on move-out decisions than debt issues, indicating the neutrality of debt and tax financing does not hold. Future tax liabilities associated with debt issue can be avoided by moving. Rational individuals would wait until the taxes come due and then move. Third, the argument on policy salience challenges the assumption of full knowledge of the finance policy required by the Ricardian Equivalence Theorem. Our findings show that the different salience of tax and debt policy may play an important role in people's reactions to the changes in these policies. Tax policy is likely to be more salient than debt policy, so people react to changes in taxes more than changes in debt. Furthermore, local residents know more about local public policy than outsiders.

5. Conclusions and Policy Implications

Our study examines household relocation decisions in response to local government finance choices between taxation and debt finance. The theoretical prediction from our discrete time dynamic optimization model indicates that in-migration depends more on the level of current taxation than on the level debt. High current taxation would also induce current residents to consider moving more so than high current debt levels. High current debt levels imply future taxation, but given the probability of moving, those higher future taxes are discounted heavily. We would predict that high current taxes tend to induce out-migration more so than higher debt levels. Our empirical results for move-out decisions are consistent with the testable hypothesis derived from the discrete time dynamic model.

The empirical findings from 150 U.S. large cities between 2007 and 2012 show that both increases in debt finance and increases in tax finance are associated with greater out-migration, but increases in current tax liabilities have much stronger effects. Furthermore, higher current taxes have large negative effects on in-migration, whereas debt finance has statistically insignificant results. These results suggest that taxation and debt finance have different effects, not the equivalence suggested by the Ricardian Equivalence Theorem.

Our results may be due to different policy salience for city debt and tax policy. Tax policy is more salient than debt policy as people pay taxes directly and likely have greater knowledge of taxation. What's more, some people may want to stay in a city during a debt accumulation period as they can enjoy the relatively "free" public services. When the tax liability starts to increase to repay the debt, they may move out. In that way, they can avoid at least part of the tax liability. This interpretation of policy salience is also supported by our insignificant finding for intergovernmental transfer reactions and the inactive reactions to public policy for outsiders.

Fundamentally, our findings challenge the Ricardian Equivalence Theorem as we find that people react to city tax and debt policy differently. City tax and debt finance clearly have different effects on peoples' relocation decisions. The full knowledge of public fiscal policy assumption required for the Ricardian Equivalence result may not hold in reality.

A city relying less on taxation and more on debt finance may stimulate aggregate demand as such public finance policy provides current residents greater income by reducing their tax burden. That can stimulate economic growth, at least in the short-run. However, debt finance may encourage people to move out as they may be afraid of the future increase in tax liability, especially when the local government is very heavily involved in debt finance. The move-out reaction may not be very strong for the city to worry about in the short-run, but in the long-run, the necessary increase in tax liability for paying off the debt will encourage some residents to move out. Importantly, increases in business-related taxes and personal income taxes may cause business, capital, and labor to move out, causing a negative effect on the local economy in the long-run. Another adverse outcome is that more residents and economic activity moving out may cause a shrinking tax base, reducing the local government's ability to pay off debt and forcing the local government to either issue more debt or increase tax rates. It is very likely that debt finance and tax cuts may benefit the local economy by encouraging consumption. Still, the local government should balance tax and debt finance carefully, not only considering the short-run effects of stimulating aggregate demand, but also considering the long-run potential outcomes. Naive policy focused on low taxes in the short-run followed by debt service in the long-run can have negative consequences such as: (a) driving out business, capital and labor; (b) higher tax liability in the future; and (c) reduced saving and capital accumulation.

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