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# Consequences of Debt Capitalization: Property Ownership and Debt/Tax Choice<sup>#</sup>

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## Abstract

Public debts capitalize into property prices. This so far neglected fact has important consequences for the tax vs. debt choice. Property owners suffer more from the debt burden and, thus, have a stronger preference for tax financing of government spending than tenants. As a consequence of the resulting democratic struggle between property owners and tenants, the property ownership rate in a jurisdiction negatively affects public debts. We provide empirical support for this hypothesis by analyzing a cross-section of the 171 communities in the Swiss Canton of Zurich in the year 2000.

**Key words:** Public Debts, Homeownership, Taxes, Ricardian Equivalence.

**JEL Classification:** H74, R51, H00.

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# 1 Introduction

Property prices reflect different packages of public services and taxes across jurisdictions (see Oates, 1969 and the subsequent literature on capitalization). Demand for property depends on the utility of the inhabitants living in a jurisdiction. The utility of inhabitants is affected negatively by the tax price which grows with the debt burden. Therefore, demand for property and, thus, property prices are lower in communities with higher debts, i.e. government debts capitalize into property values. While debt capitalization has been neglected in the literature (for an exception see Daly, 1969), recent papers show that debt capitalization does indeed occur to a large extent (Stadelmann and Eichenberger, 2008 and Banzhaf and Oates, 2008). Debt capitalization has some significant consequences. Most importantly, government debts are not a burden to future generations but to the present one as it owns the devalued property. Consequently, debt capitalization results in a so far neglected form of Ricardian equivalence that works also with purely selfish individuals.<sup>1</sup> However, debt capitalization also provides a new explanation for the extent of government debt accumulation.

In the politico-economic literature, debt accumulation is often explained by the strategic interaction of competing interest groups and political parties (Alesina and Drazen, 1991 and Drazen and Grilli, 1993). Debt capitalization provides a new argument which complements these approaches. With debt capitalization, the fight over deficits and debts is no longer an intergenerational conflict. Instead, it is an intra-generational conflict between today's property owners and today's tenants as property prices and rents are asymmetrically affected by debt capitalization. In a jurisdiction in which the debt versus tax choice is tilted towards debt financing, property values drop as the debts have to be repaid by future taxes which negatively capitalize into property prices. In contrast, rents may increase as the jurisdiction is becoming more attractive for tenants for they have to pay less taxes in the current period. If both markets – the markets for property and for renting houses – are fully flexible, there will be no asymmetric effects of debt versus tax choice on property owners and tenants. Property owners will be fully compensated for the losses in property values by higher present rents. However, the market for renting houses can be safely assumed to adapt slower to changes in the debt versus tax choice than the property market as rents are more intensively regulated than property prices. Thus, the debt/tax choice affects rents only partly. Therefore, tenants have a stronger preference for debt financing than property owners.

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<sup>1</sup> Barro (1974) and Barro (1989) model a Ricardian equivalence using generationally interdependent utility functions.

In this paper we theoretically and empirically analyze the economic conflict between property owners and tenants over debt versus tax financing of public expenditures. In a model of the local debt/tax choice, property owners and tenants face different tax costs per unit of local government expenditure due to capitalization of debts. Thus, they disagree over the debt/tax choice. Property owners know that higher debts decrease the value of their property. If the respective decrease in property prices is not instantly matched by an equivalent increase in rents, e.g. because rent adjustment is slow due to government regulation, long term contracts, or lobbying of pro-tenant groups, property owners will implicitly face higher tax costs in the future when debts rise. Tenants, on the other hand, do not see their tax costs increase as they do not suffer from losses in property values. Consequently, tenants have a stronger preference for financing government spending via debts than property owners. As a consequence, communities with a higher fraction of property owners (a higher fraction of tenants) tend to exhibit lower (higher) debts.

We analyze Swiss data to test whether a higher fraction of property owners in a community has a negative impact on local public debts. Swiss jurisdictions are strongly autonomous from the federal government in determining their tax, spending and deficit policies and therefore form an ideal laboratory to investigate our hypothesis. Empirical results indicate a strong and robust negative effect of higher property ownership on the debt to tax ratio as well as the deficit to tax ratio, thereby confirming our theory. We also run instrumental variable estimates, using a unique policy reform in 1963 which allowed ownership of apartments (condominiums) as an exogenous shock, which lend further support to our results.

The remainder of this paper is organized as follows: Section 2 provides a simple model and theoretical explanations for the negative effect of a higher fraction of property owners on debts due to debt capitalization. The data used for empirical tests of our theoretic implications and the econometric model specification is presented in Section 3. Empirical estimation results from 171 Swiss communities in the canton of Zurich are presented in Section 4. Our model is extensively tested for robustness by considering differential hypotheses and using Bayesian Model Averaging to investigate the effect of variable selection. Section 5 offers some concluding remarks.

## **2 Theoretical Considerations**

So far, debt capitalization has not yet been analyzed as a driving force of debt accumulation. Alesina and Perotti (1994) provide a survey of theoretical explanations of public debts and conclude that only a few politico-economic models are in accordance with persistently high levels of public debts and with cross-country variances in debt levels

within the OECD. However, models of the disagreement between different groups or parties in the decision-making process or models of distributional conflict contribute to the explanation of high levels of debts as argued in the seminal work of Alesina and Drazen (1991) and supported by Drazen and Grilli (1993). At the municipal level Feld and Kirchgässner (2001) argue that constitutional restrictions such as deficit referenda and direct democracy help against the debt bias inherent in political decision-making procedures.<sup>2</sup> Mierau, Jong-A-Pin and de Haan (2007) provide empirical evidence that fiscal adjustments are mainly driven by economic factors such as economic growth, the debt to GDP ratio, lagged deficits, and prior adjustments.

For the case of local public debts we assume that there are two groups of residents  $i$  in a community, property owners  $i = H$  and tenants  $i = R$ . We analyze two periods 0 and 1. In the current period 0 property owners and tenants are assumed have the same constant tax costs, i.e.  $t_0^H = t_0^R =: t_0$  independent of the debt share  $d$ . Because of debt capitalization in the presence of imperfect rental markets, the future tax costs  $t_1^i(d)$  for a unit of government expenditure increase in the debt share  $d$  for property owners  $i = H$ . Property owners suffer from lower property prices when debts increase and cannot charge higher rents due to government restrictions or the power of national pro-tenant lobby groups. Consequently, their future tax costs increase with the debt share, i.e.  $\partial t_1^H / \partial d > 0$ . High debts usually lead to intensive discussions in communities, pressure from higher federal levels or the application of fiscal rules. Moreover, when debts are high, sustainability becomes an issue and interest rates tend to increase which leads to higher debt capitalization rates. We thus assume that  $\partial^2 t_1^H / \partial d^2 \geq 0$  for property owners, i.e. the costs and the marginal costs of taxation increase with the debt share. Residents not holding property  $i = R$  in the community are assumed to have constant tax costs in period 1 which are lower than those of property owners for any debt share  $d \geq 0$  as they do not suffer from losses in property values due to debt capitalization, i.e.  $t_1^R(d) = \bar{t}_1 \leq t_1^H(d)$ .

The optimal debt share schedule is a function of current tax costs  $t_0$  and expected future tax costs  $t_1^H(d)$  and  $\bar{t}_1$  for property owners  $H$  and tenants  $R$ , respectively. In a two-period model, the price  $P^i$  of a unit of public expenditure to a resident of group  $i$  in any jurisdiction is written as<sup>3</sup>

$$P^i = (1-d)t_0^i + dt_1^i(d)(1-B)^{-1} \quad (1)$$

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<sup>2</sup> Feld and Matsusaka (2008) analyze the budget referendums and government spending at the Swiss cantonal level.

<sup>3</sup> See Temple (1994) for a similar formulation without the effect of debt capitalization on tax prices.

The first part of equation (1) gives the influence of current tax costs on the unit price of government expenditure and the second part gives the influence of future tax costs when debt finance is used.  $(1-B)^{-1}$  is a discount factor used to calculate the present value of future tax costs.

In our framework the population consists of two distinct groups, property owners,  $H$ , and tenants  $R$ , who represent a fraction of  $\lambda^H$  and  $\lambda^R = 1 - \lambda^H$  of the local population, respectively. Assume that the debt versus tax choice is determined in a town-meeting or by the municipal parliament which tries to minimize the cost per unit of public expenditures to the residents of the jurisdictions. More specifically, the communal parliament seeks to choose the debt share  $d$  that minimizes

$$\min_d (1-d)t_0 + d\lambda^H t_1^H(d)(1-B)^{-1} + d\lambda^R \bar{t}_1(1-B)^{-1} \quad (2)$$

where the first term represent current (constant) tax costs for both groups, the second future tax costs for property owners and the last future tax costs for renters when public expenditures are financed by debts.<sup>4</sup> The optimal debt share  $d^*$  is the value of  $d$  that equates the marginal costs of debt and tax finance, i.e.

$$(\lambda^H t_1^H(d) + d\lambda^H t_1^{H'}(d) + \lambda^R \bar{t}_1)(1-B)^{-1} = t_0 \quad (3)$$

The marginal cost of debt finance (the left-hand side above) incorporates the fact that property owners face higher future tax costs  $t_1^H(d)$  due to the capitalization of debts in their properties. Given the optimal debt share  $d^*$  implicitly by (3), we are interested in how this share varies with changes in the fraction of property owners in the population. Therefore, we apply the implicit function theorem to (3) considering that  $\lambda^R = 1 - \lambda^H$  and obtain

$$\frac{\partial d}{\partial \lambda^H} = -\frac{(t_1^H(d) + dt_1^{H'}(d) - \bar{t}_1)}{(2\lambda^H t_1^{H'}(d) + d\lambda^H t_1^{H''}(d))} \quad (4)$$

which is negative as  $\bar{t}_1 \leq t_1^H(d)$  for all values of  $d$ . Increasing property ownership  $\lambda^H$  in a community consequently decreases the debt share chosen to finance public expenditure. Property owners know that they bear the burden of additional debts. As public debts

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<sup>4</sup> A similar optimization problem could be obtained with a probabilistic voting model where political candidates seek to maximize average utility of voters by minimizing their tax costs.

decrease property values, they have a strong incentive to vote for lower debts to preserve the initial values.

### 3 Data and Estimation Strategy

For the purpose of evaluating the influence of homeownership on the debt/tax choice by local governments, we analyze data from the year 2000 of communities in the metropolitan area of Zurich, Switzerland.

The Canton of Zurich is the largest of all 26 Swiss cantons and has approximately 1.3 million inhabitants. The city of Zurich is the center of the largest urban agglomeration in Switzerland with over one million people living and working there. The metropolitan area consists of 171 communities (including the city of Zurich and the city of Winterthur). Heterogeneity is driven by, among other factors, the widely differing size of the communities (from 251 to 29321 inhabitants, excluding Zurich and Winterthur), their distance to the economic centers, and their proximity to the Zurichsee, a lake covering an area of 88.66 km<sup>2</sup> in the canton.<sup>5</sup>

The tax system of the Canton of Zurich is typical for Switzerland. Each community raises its own income taxes by annually fixing a communal tax multiplier on the state tax („allgemeine Staatssteuer“), which is a progressive income tax schedule at the cantonal level. Municipal tax multipliers are set either by the citizens in a town meeting or by the communal parliament. Thus, communal income tax multipliers differ to a large extent among the 171 communities in the metropolitan area. With respect to international standards, the communities also have a significant autonomy regarding public expenditures and the choice between debt versus tax financing.

In 1982 the canton's communities introduced a harmonized public accounting system for budgeting and book-keeping. These standards require all communities to follow the same legal framework concerning their current and capital accounts. In addition, they demand an annual financial statement and a balance sheet. The balance sheet as well as other book-keeping standards distinguish the Swiss communal finance framework from most other countries (see Oster, 2006). The harmonized public accounting system is based on a functional division, each representing local responsibilities. Swiss communities have full autonomy from higher government levels in domains such as the acquisition, the use or the

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<sup>5</sup> Supplementary information is available in the Statistisches Jahrbuch des Kantons Zürich 2007, 17th edition, Statistisches Amt des Kantons Zürich, Zurich.

disposition of these financial assets.<sup>6</sup> The performance of the harmonized Swiss public accounting system has exceeded its original expectations.<sup>7</sup>

Finally, homeownership rates are comparatively low in Switzerland (see Bourassa et al. 2009). In Zurich average homeownership rates are close to 50 percent with large heterogeneity across communities. Thus, there may indeed be a political struggle between property owners and tenants even outside major cities where ownership rates are also comparatively low in other countries.

As a result, the metropolitan area of Zurich is the ideal test case to gauge the impact property ownership on the local public debt/tax choice due to debt capitalization as implied by our theory.

To test the implications of debt capitalization regarding its effects through property ownership on the debt/tax choice, we develop an econometric model based on the empirical models of de Haan and Sturm (1994), Feld and Kirchgässner (2001) and Ashworth, Geys and Heyndels (2005), which intend to explain fiscal policy choices. The dependent variable is firstly the ratio of total debt to total tax revenue by natural persons (DebtToTax) and secondly new debts to total tax revenue by natural persons (NewDebtToTax). Our econometric model is as follows:

$$(\text{New})\text{DebtToTax} = \alpha_0 + \alpha_1 \text{PropertyOwners} + \sum_j \alpha_j x_j + \varepsilon \quad (5)$$

Equation (5) is theoretically motivated by the negative impact of a higher fraction of property owners  $\lambda^H$  on local debts  $d$  as shown in (4). In equilibrium, communities with a higher fraction of property owners  $\lambda^H$  should have a smaller debt to tax ratio as they accumulated lower debts in the past. Moreover, these communities should also accumulate lower new debts with respect to tax revenues. Thus, theory predicts  $\alpha_1 < 0$  for both measures, i.e. DebtToTax and NewDebtToTax.<sup>8</sup>

In common with the empirical literature, we include a number of economic and political control variables in the model. Their different impacts are represented by the coefficients  $\alpha_j$ .  $\varepsilon$  is an error term. Data for the independent control variables were obtained from the Statistical Office of the Canton of Zurich, the Secretary for Education of the Canton of

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<sup>6</sup> Communities associate local self-rule in financial matters with autonomy which makes it almost a holy issue.

<sup>7</sup> For a more detailed discussion concerning the harmonized public accounting system see Dafflon (2006).

<sup>8</sup> In a previous version of this paper we analyzed the impact of the property owners on the total debt level. Results confirm a strong negative impact of property owners on debt levels too. Unfortunately, a panel analysis with fixed effects is not feasible as owner-occupation rates do not have enough time variation.



Zurich, the Financial Statistics of the Canton of Zurich, the Swissvotes Database as well as the Cantonal Bank of the Canton of Zurich, and matched accordingly.

In addition to property ownership, we analyze the impact of higher mean incomes on public debts. For liquidity reasons, higher mean incomes can be assumed to be accompanied by lower debts. Moreover, if the inhabitants of rich communities have a preference for lower socioeconomic heterogeneity of their neighborhood, they will strategically prefer tax over debt financing as it deters potential poor immigrant tenants. On the other hand, jurisdictions with high incomes have to contribute higher sums to fiscal equalization systems and consequently may have an incentive to increase their debts (Feld and Kirchgässner, 2001).

Debts might be issued to finance public investment projects. Thus, we include the (log of) local investment expenditure per capita for the construction of roads, public transport, communication and waste disposal facilities as an explanatory variable. We expect a positive coefficient for this variable.

As described in the influential article by Meltzer and Richard (1981), the income distribution plays a significant role in redistributive matters. They propose that the higher the ratio of mean to median income, the higher the level of redistribution. Redistribution financed by issuing public debts may thus lead to a positive coefficient of the ratio of mean to median income.

In Switzerland interest rates for municipal debts vary little between communities. Moreover, public institutions and the Swiss banks do not provide any data on default risks (Feld and Kirchgässner, 2001). Therefore, we cannot control for the costs of raising capital in a community for the year analyzed. Nevertheless, we introduce the mean income tax multiplier to consider the price citizens have to pay for public goods. The role of the tax multiplier is also mirrored in the theoretical model. It is supposed that the tax multiplier enters the estimations with a negative sign as governments might substitute present taxes for new debts (i.e. higher deficits). As total debts only represent past substitution between past deficits and past taxes we do not expect a systematic relationship between the total debts and present taxes.

As in the literature (see, for example, Ashworth, Geys, and Heyndels, 2005) we introduce the size of the population of a community. Larger communities may profit (suffer) from economies (diseconomies) of scale. To further test the robustness of our theory we also look at the effects of a quadratic term of this variable. Communities near the center of the canton may have higher costs when providing public infrastructure. On the other hand, communities in rural areas at the border of the canton may also face additional expenditure needs. We control for such possible impacts by including dummy variables for communities close to the center (bordering at Zurich or Winterthur) and at the cantonal border.

From a politico-economic perspective, features such as the effectiveness of direct democratic instruments at the local level must be considered as argued by Eichenberger and Schelker (2007). Therefore, we include various indicators for democracy in our model. Democratic institutions at the local level are captured by a dummy which tells communities with town-meeting from communities with a parliament. We also employ a unique measure for fiscal conservatism based on the fraction of people in a community who agreed to a debt brake at the federal level in a nationwide referendum. Furthermore, we take into account whether a community has a separate school district or not (Frey and Eichenberger, 2002), and we control for the fraction of leftist parties in cantonal elections.

The main specifications also include the (log) communal equity of each community which serves as an indicator for the combined effects of public goods on local public debts not captured by other variables.

As a final test of robustness, we analyze a number of additional variables. As Tabellini (1991) argued, the bequest motive of altruism between generations may not be sufficient to prevent the current generation from accumulating debts. This argument is especially relevant with regard to the elderly. Thus, we control for the fraction of elderly in a community. Banzhaf and Oates (2007) suggest that renters are transient members of the community and thus prefer to defer payment of capital projects to the future. We control for this possibility in some estimations by including migration. Migration may also have an impact on local public debts as the community has to assimilate new arrivals. The employment structure, access to the rail network and average rents are included as further controls in additional robustness tests.

Our dataset contains these variables for all communities in the canton. We include a dummy variable for the cities of Zurich and Winterthur. In contrast to the other communities, they both consist of various separate districts which differ from each other with respect to mean and median incomes, etc. although they have the same tax multiplier, benefit from the same public expenditures and suffer the same debt burden.

All variables, their sources, and a number of descriptive statistics are given in Table 1.

< Table 1 here >

## 4 Empirical Results

### 4.1 Baseline results

Table 2 presents our main empirical results for the debt to tax ratio in specifications (1) to (5) and the new debts to tax ratio in specifications (6) to (10). In all estimates we report robust standard errors using a White heteroskedasticity adjusted sandwich estimator.

< Table 2 here >

Turning to specifications (1) and (6) first, we find that the fraction of property owners in a community has a negative and significant influence on the debt to tax ratio (DebtToTax) as well as the new debts to tax ratio (NewDebtToTax) as suggested by the theoretical discussion. A higher (log) mean income in a community is significantly associated with lower debts for both measures. Higher investments have no significant effect. If the mean income increases with respect to the median income additional redistribution takes place which results in a significantly higher debt to tax ratio and significantly more new debts to taxes. The mean tax multiplier on the other hand has no significant impact on the debt to tax ratio. However it has a large negative impact on the new debts to tax ratio which indicates that taxes and new debts are substitutes to some extent. Population size decreases both debt measures significantly. Whether a community is in the center or at the border of the canton has no impact on the debt to tax ratio.

In addition to the economic controls, we include a number of political variables in specifications (2) and (6). While the economic variables still work well, only the control for the agreement to a debt break has a statistically significant negative influence at the 10 percent level. Communal equity enters the estimations insignificantly in specifications (3) and (7).

The size of coefficient of interest is similar across specifications (1) to (3). It suggests that the property ownership rate has a rather large effect on the total debts and new debts. For instance, with an absolute coefficient size of 2.047 (lower bound), an increase in the property ownership rate by one percentage point implies that total debts fall by approximately 1.1 percent for an average community ( $2.047 * 0.01 * \text{avg}(\text{Taxes per Capita}) / \text{avg}(\text{Debts per capita})$ ). For new debts the effect is even stronger: With an absolute coefficient size of 0.278 (lower bound) a one percentage point increase in property owners decreases new debts by 5.5 percent for an average community ( $0.278 * 0.01 * \text{avg}(\text{Taxes per Capita}) / \text{avg}(\text{New debts per capita})$ ).<sup>9</sup>

So far, we reported only results from OLS estimations. However, such estimates could suffer from possible simultaneity bias. Even though property ownership only changes slightly and slowly over time it is not necessarily exogenously given but might be the result of fiscal preferences of citizens concerned with debts. It could be argued that because of debt capitalization property owners choose to live in jurisdictions which can be assumed to

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<sup>9</sup> The difference between the size of the impact of new debts and the size of the impact of total debts is no concern. It is plausible that property ownership shifts deficits by some absolute amount. As the level of new debts was historically quite low at the date of our cross-section, the relative impact of property ownership was sizeable at that time.

accumulate less debt in the future. Then, property ownership could emerge endogenously without having an influence on the debt versus tax choice as postulated by our theoretical reasoning. This, of course, would leave our results biased upwards (absolutely). To address this problem, we estimate 2SLS regressions with a full specification in columns (4) and (5) for the debt to tax ratio and in columns (9) and (10) for the new debt to tax ratio. For identification we use we use an institutional reform in 1963: Until then property ownership could not flexibly react to debts as it was virtually impossible for the large majority to become property owners in dense urban settings as the civil code prohibited changes in construction of parts of a building such as apartments which ruled it out to construct condominiums. On December 19, 1963 the national government made it possible for citizens to own and reconstruct apartments (condominiums) in Switzerland which brought about a huge home ownership boom.<sup>10</sup> Thus, population density and the homeownership rate before the law change may serve as instruments. When explaining today's ownership rates with density and ownership rates before the law reform, we rule out the effects of property owners entering a community after 1963 due to its low debt to tax ratio. Similarly, owners before 1963 were usually long established in the community and obtained their property mainly through heritage as buying an own apartments was difficult. We use data from the population census in 1960. Population density and the homeownership rate in 1960 are highly correlated with the fraction of property owners today. Density and ownership in 1960, on the other hand, has no directly discernible influence on the debt versus tax choice today apart from their influence on the fraction of property owners. As shown in specifications (4) and (5) for the debt to tax ratio and in specifications (9) and (10) for the new debts to tax ratio, the F-Test for the first stage is highly significant concerning the quality of the instrument. In column (4) and (9) we only use population density in 1960 as an instrument while in (5) and (10) we also use the ownership rate in the first stage. The coefficient of the property ownership variable in the second stage for all specifications is significant and rises (absolutely) with respect to the OLS regressions both debt measures. That is, the point estimates suggest that examining the link between property ownership and debts using OLS understates rather than overstates the theoretical effect. None of the J-statistics in columns (5) and (10) which deal with the overidentifying restrictions point to problems with the instruments.

So far we have shown that the level of property ownership affects the debt to tax ratio as well as the new debts to tax ratio negatively which provides support for the theoretical mechanism. Local public debts result from a disagreement between property owners and renters. As debts increase property owners suffer from lower property values whereas rents

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<sup>10</sup> Introduction of §712a-712t ZGB (Zivilgesetzbuch, Civil Law) concerning Stockwerkeigentum (condominiums).

remain stable. Thus property owners try to avoid additional debts and prefer taxes instead. We will analyze this relationship more closely by providing robustness tests, considering differential hypotheses following from debt capitalization, additional variables and performing a Bayesian Averaging of different estimation results.

## 4.2 Robustness

All robustness tests are reported in Table 3.

< Table 3 here >

It can be assumed that the upward adjustment of rents as a consequence of a high share of debt financing is slower in large communities, as there is a larger fraction of the tenement houses owned by the government and cooperatives which are known to adjust rents only slowly to market demand. Thus, tenants in larger communities tend to favor debt over tax financing even more than tenants in small communities. Therefore, we expect that the negative effect of property owners increases with population size. In specifications (1) and (2) we estimate an interaction term with property owners and a measure of population size. The population variable is expressed as the population of a community in thousands minus average population in thousands over all communities, denoted as DiffPop. This allows us to analyze changes in property ownership rates with respect to an average communal population. The impact of property ownership itself remains negative and significant. The interaction term (IntPropertyPop) is negative and significant. The larger the population size the more negative is the impact of the property ownership on the debt/tax choice in estimation (1) as well as on the new debts to tax ratio in estimation (2) as predicted by theory.

Debt capitalization may not occur at the same rate in all communities. In communities close to the center where land for construction is scarce, capitalization is more pronounced while at the urban edge close to the cantonal border capitalization is less so (as also suggested by Brasington, 2002). Thus we include two interaction terms with property ownership and the dummies indicating which communities are in the center and which communities are at the cantonal border. For communities in the center we expect that property ownership has a more negative impact on debts while for communities at the cantonal border property ownership influences debts less. Thus, we expect that interaction term for property owners in center communities (IntPropertyCenter) is negative while the interaction term for property owners in border communities (IntPropertyBorder) is positive. Empirical estimates in specifications (3) and (4) confirm these hypotheses for

both debt measures but interaction terms are not statistically significant.<sup>11</sup> Base effects of property ownership are comparable to Table 2.

In specifications (4) and (5) we include the fraction of elderly as an additional test of robustness. Property owners in the Canton of Zurich are often the elderly and at the same time the elderly might prefer debts to taxes, especially if debts do not capitalize at 100 percent.<sup>12</sup> The inclusion of this variable has a minor effect on the size of the coefficients of property ownership. The impact of our variable of interest, i.e. property ownership, remains negative and significant.

Next, we include net immigration to the community in estimations (6) and (7) to account for changes in the population and the possible impact of short term interests of tenants. However, net immigration does not have a significant impact. The coefficient for property ownership is negative and significant for both measures of the communal debt situation and its size does not change. We also split up net immigration into gross immigration and gross emigration. The inclusion of these variables had no noticeable effect on the results for homeownership which stayed statistically significant. While gross immigration had a positive and gross emigration had a negative effect on debts (which is consistent with the assumption that citizens select into communities with good financial conditions), these variables did not reach statistical significance (results are available upon request).

The basic methodology to analyze different variables on debts and other fiscal variables consists of running cross-section (or panel) regressions including the main variable of interest and a number of other controls (see de Haan and Sturm 1994, Feld and Kirchgässner, 2001 or Goeminne, Geys and Smolders, 2008). The problem with this approach is that empirical economists might not exactly know which independent control variables should be included in their regressions. Clearly the choice should be guided by theory. It is also clear thought, that regressor selection can have an important effect on the results and missing out explanatory variables might introduce considerable bias. In final robustness tests, we deal with the problem of variable selection by performing Bayesian Model Averaging (see Raftery, 1995 and Raftery, Madigan and Hoeting, 1997).

The main idea behind Bayesian Model Averaging (BMA) is to estimate the distribution of unknown parameters of interest across a large number of different models (model space). In contrast to classical estimation, model averaging copes with model uncertainty by allowing for all possible models to be considered, which consequently reduces the bias of the parameters of interest. BMA asks the researcher to specify possible regressors that might have an impact on the debt measure. The Bayesian approach is feasible and has been

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<sup>11</sup> Whether capitalization is really lower when more land is available such as in communities at the urban edge is still a discussion in the literature (see Brasington, 2002)

<sup>12</sup> Stadelmann and Eichenberger (2008) show that debt capitalization is significant and that capitalization rates are usually above 60 percent.

applied to various problems in economics by other authors such as Fernandez, Ley and Steel (2001) or Sala-i-Martin, Doppelhofer and Miller (2004). Hoeting et al. (1999) give various other examples and mention possible applications. The interpretation of the estimates from BMA is straightforward as we can calculate conditional means and standard deviations which can be interpreted similarly to standard OLS coefficients and standard errors. Furthermore, a posterior inclusion probability for any variable can be calculated which gives the probability that any specific variable is included in a model.<sup>13</sup>

Columns (9) to (11) present the results of BMA for the dependent variable debt to tax ratio.<sup>14</sup> We include all variables of our dataset for the BMA procedure, i.e. population squared, employment in the third sector, rail network access and (log) average rents enter the estimation too. The conditional mean of the variable for property ownership is negative and significant (column 9). This indicates that the average effect of property ownership on the debt to tax ratio regarding all estimates over the whole model space is negative. The economic variables have the same signs concerning the conditional mean in BMA as they have in the OLS estimates. They are also significant apart from investments and the tax rate. Concerning the additional control variables, only the agreement to the debt brake and the fraction of elderly turn out to be significant when looking at the whole model space.<sup>15</sup>

In column (10) we perform a Wilcoxon signed-rank test for the sign of the posterior mean conditional on inclusion. In the averaging procedure of BMA different models are estimated. In each of these models the sign of the variable under consideration is taken. It might be the case, for example, that the property ownership has a positive impact on debts to taxes in some specific models but a negative impact in others and on average. We test for this possibility and present the resulting p-values in column (9), i.e. we test whether the coefficients of the diverse models have the same sign as the reported posterior conditional mean. At the 1 percent level we can reject that the property ownership enters other models of the whole model space positively. Finally, we calculate the posterior inclusion probability of all variables. The inclusion probability of the property ownership rate is 24.2 percent indicating that property ownership is more important than most political and demographic control variables when analyzing local public debts.

Finally, columns (12) to (14) present BMA results when the dependent variable is the new debts to tax ratio. The posterior mean conditional on inclusion for property ownership is negative and significant at the 5 percent level. Moreover, the Wilcoxon signed-rank test for

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<sup>13</sup> Further explanations concerning BMA and applications can be found in the literature (Raftery, Madigan and Hoeting, 1997 and the follow up literature). We stipulate 1/2 as the prior probability of including any variable in the model.

<sup>14</sup> Note that we always include an intercept and the city dummy for Zurich and Winterthur by construction for the whole model space.

<sup>15</sup> The population growth rate is not significant in the OLS estimations. Its significance in the BMA results points to possible problems with multi-collinearity regarding this variable and other controls.

the sign of the posterior mean conditional on inclusion indicates that the negative sign is not just a statistical artifact of aggregation. We can reject the hypothesis that the conditional mean is positive at the 1 percent level. The posterior inclusion probability is 61.3 percent and again within the range of most economic variables. For the new debt to tax ratio only the mean income, mean to median income, the tax rate, and the population size have a higher inclusion probability.

## 5 Conclusion

Communities with higher debts face lower property values (Stadelmann and Eichenberger, 2008). The capitalization of debts in property prices is a form of Ricardian equivalence. Therefore, the fight over deficits and debts is no intergenerational conflict. It is an intra-generational political conflict between today's property owners and today's tenants.

Due to debt capitalization property owners suffer from lower property prices when debts rise. If rent markets are not perfect the burden of higher debts remains with current property owners but not with current renters. Future tax costs of property owners increase in the debt to tax share whereas debts have no influence on a tenants future tax costs. In the political process, property owners therefore have an incentive to vote for political platforms proposing lower local debts. Communities with a high fraction of property owners should consequently have lower debts.

We have modeled the theoretical mechanism outline above and provided empirical evidence to support it. Using a full dataset of all 171 communities in the Swiss Canton of Zurich we showed that higher property ownership rates are indeed related causally to lower debt to tax levels for total and new debts. Robustness results using Bayesian Model Averaging strongly confirm the negative impact of property owners on taxes.

## Bibliography

- Alesina, A. & Drazen, A. (1991): „Why are Stabilizations Delayed?“, *American Economic Review*, Vol. 81, p. 1170-1188.
- Alesina, A. & Perotti, R. (1994): „The Political Economy of Budget Deficits“, NBER Working Papers No. 4637.
- Ashworth, J.; Geys, B. & Heyndels, B. (2005): „Government Weakness and Local Public Debt Development in Flemish Municipalities“, *International Tax and Public Finance*, Vol. 12, p. 395-422.
- Banzhaf, H. S. & Oates, W. E. (2008): „On Ricardian Equivalence in Local Public Finance“, Available at SSRN: <http://ssrn.com/abstract=1248002>.



- Bourassa, S. C.; Hoesli, M.; Scognamiglio, D. F. (2009): Housing Finance, Prices, and Tenure in Switzerland. Swiss Finance Institute Research Paper No. 09-16.
- Barro, R. J. (1974): „Are Government Bonds Net Wealth?“, *Journal of Political Economy*, Vol. 82, p. 1095-1117.
- Barro, R. J. (1989): „The Ricardian Approach to Budget Deficits“, *Journal of Economic Perspectives*, Vol. 3, p. 37-54.
- Brasington, D. M. (2002): „Edge versus center: Finding common ground in the capitalization debate“, *Journal of Urban Economics*, Vol. 52, p. 524-541.
- Dafflon, B. (2006). Real property management in the Swiss communes. In O. Kaganova and J. McKellar (Eds.), *Managing Government Property Assets: International Experiences*, pp. 201-230. Urban Institute Press, Washington.
- Daly, G. G. (1969): “The Burden of the Debt and Future Generations in Local Finance”, *Southern Economic Journal*, 36(1), 44-51.
- Drazen, A. & Grilli, V. (1993): „The Benefit of Crises for Economic Reforms“, *American Economic Review*, Vol. 83, p. 598-607.
- Eichenberger, R. & Schelker, M. (2007): „Independent and competing agencies: An effective way to control government“, *Public Choice*, Vol. 130, p. 79-98.
- Feld, L. P. & Kirchgässner, G. (2001): „Does Direct Democracy Reduce Public Debt Evidence from Swiss Municipalities“, *Public Choice*, Vol. 109, p. 347-370.
- Feld, L. P. & Matsusaka, J. G. (2003): „Budget referendums and government spending: evidence from Swiss cantons“, *Journal of Public Economics*, Vol. 87, p. 2703-2724.
- Fernandez, C.; Ley, E. & Steel, M. F. (2001): „Model Uncertainty in Cross-Country Growth Regressions“, *Journal of Applied Econometrics*, Vol. 16, p. 563-576.
- Goeminne, S.; Geys, B. & Smolders, C. (2008): „Political fragmentation and projected tax revenues: evidence from Flemish municipalities“, *International Tax and Public Finance*, Vol. 15, p. 297-315.
- de Haan, J. & Sturm, J. (1994): „Political and institutional determinants of fiscal policy in the European Community“, *Public Choice*, Vol. 80, p. 157-172.
- Hoeting, J. A.; Madigan, D.; Raftery, A. E. & Volinsky, C. T. (1999): „Bayesian Model Averaging: A Tutorial (with discussion)“, *Statistical Science*, Vol. 14, p. 382-417.
- Mierau, J. O.; Jong-A-Pin, R. & de Haan, J. (2007): „Do political variables affect fiscal policy adjustment decisions? New empirical evidence“, *Public Choice*, Vol. 133, p. 297-319.
- Meltzer, A. H. & Richard, S. F. (1981): „A Rational Theory of the Size of Government“, *Journal of Political Economy*, Vol. 89, p. 914-927.
- Oates, W. E. (1969): „The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis“, *Journal of Political Economy*, Vol. 77, p. 957-971.

- Oster, R. (2006): Aktueller Stand der Gesetzgebung in den Ländern und ausgewählte Fragen des neuen Rechnungswesens. In J. L. und Martin Junkernheinrich (Ed.), Doppelt gebucht hält besser?, Rehburg-Loccum.
- Persson, T. & Tabellini, G. (2000): „Political Economics: Explaining Economic Policy“, MIT Press, Cambridge (MA).
- Raftery, A. E. (1995): „Bayesian Model Selection in Social Research“, Sociological Methodology, Vol. 25, p. 111-163.
- Raftery, A. E.; Madigan, D. & Hoeting, J. A. (1997): „Bayesian Model Averaging for Linear Regression Models“, Journal of the American Statistical Association, Vol. 92, p. 179-191.
- Raftery, A., J. Hoeting, C. Volinsky, I. Painter, and K. Y. Yeung (2009, September). BMA: Bayesian Model Averaging. R package version 3.10, Available online on <http://CRAN.R-project.org/package=BMA>
- Sala-i-Martin, X.; Doppelhofer, G. & Miller, R. I. (2004): „Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach“, American Economic Review, Vol. 94, p. 813-835.
- Stadelmann, D. & Eichenberger, R. (2008): „Debt Capitalization: A New Perspective on Ricardian Equivalence“, CREMA Working Paper Series 2008-30, Center for Research in Economics, Management and the Arts (CREMA).
- Tabellini, G. (1991): „The Politics of Intergenerational Redistribution“, The Journal of Political Economy, Vol. 99, p. 335-357.
- Temple, J. (1994): „The Debt/Tax Choice in the Financing of State and Local Capital Expenditures“, Journal of Regional Science, Vol. 34, p. 529-547.
- Yinger, J.; Bloom, H. S.; Börsch-Supan, A. & Ladd, H. F. (1988): „Property Taxes and House Values: The Theory and Estimation of Intrajurisdictional Property Tax Capitalization“, Academic Press, Boston (MA).

Table 1

## Data Description and Sources

<i>Variable</i>	<i>Description and source</i>	<i>Range</i>	<i>Mean</i>	<i>S.d.</i>
DebtToTax	Debt to tax ratio, i.e. official indicator of total communal obligations (short/long term debts plus provisions and deferrals) divided by total tax revenue by natural persons. GEFIS Financial Statistics of the Canton of Zurich.	[0.039, 8.941]	2.051	1.486
NewDebtToTax	Increase in total communal obligations (five year average) divided by total tax revenue by natural persons. GEFIS Financial Statistics of the Canton of Zurich.	[-0.554, 0.517]	-0.037	0.165
PropertyOwner	Share of property owners in community (homeownership rate). Statistical Office of the Canton of Zurich.	[0.071, 0.733]	0.469	0.156
logMeanIncome	Log mean income to tax of natural persons. Statistical Office of the Canton of Zurich.	[10.57, 11.89]	10.97	0.209
logInvest	Log investments per capita in construction of roads, public transport, communication and waste disposal facilities in community per capita (five year average). GEFIS Financial Statistics of the Canton of Zurich.	[0, 9.76]	4.858	1.878
logMeanMedian	Log mean to median income. Statistical Office of the Canton of Zurich.	[0.06, 0.883]	0.227	0.122
TaxRate	Log population. Statistical Office of the Canton of Zurich.	[78, 132]	117.9	14.437
logPop	Mean income tax multiplier (without churches). Statistical Office of the Canton of Zurich.	[5.58, 12.72]	7.984	1.135
CommunityCenter	Community has common border with cities of Zurich or Winterthur. Statistical Office of the Canton of Zurich (GIS system).	{0; 1}	0.181	0.386
CommunityBorder	Community is at the cantonal border. Statistical Office of the Canton of Zurich (GIS system).	{0; 1}	0.363	0.482
Parliament	Dummy if community has communal parliament (value=1). Statistical Office of the Canton of Zurich.	{0; 1}	0.07	0.256
DebtBrakeYes	Agreement to debt break in percent: Eidgenössische Volksabstimmunge „Bundesbeschluss über eine Schuldenbremse“. Swissvotes Database.	[0.723, 0.936]	0.868	0.031
ElecLeft	Part of left parties in cantonal elections (sum of EVP, GP and SP). Statistical Office of the Canton of Zurich.	[0.163, 0.479]	0.302	0.065
NoSchoolComm	Dummy if the school is managed by the community itself (value=1) or a separate school community (value=0). Secretary for Education of the Canton of Zurich.	{0; 1}	0.199	0.4
logEquity	Log price in Swiss Francs of standardized and comparable single family house. Cantonal Bank of Zurich.	[0, 9.569]	8.083	0.941
Elderly	Fraction of population over 65 years. Statistical Office of the Canton of Zurich.	[0.065, 0.237]	0.125	0.031
ImmigSaldo	Relative immigration rate minus emigration rate in community. Statistical Office of the Canton of Zurich.	[-0.039, 0.073]	0.01	0.018
PopSquared	Population per 1000 persons squared. Statistical Office of the Canton of Zurich.	[0.07, 111800]	744.1	8560.43
Employed3sector	Fraction of labor force employed in third sector. Statistical Office of the Canton of Zurich.	[0.294, 0.954]	0.648	0.127
AccessFasttrain	Indicator for access to fast train railroad network (S-Bahn) as a fraction of the population. Statistical Office of the Canton of Zurich (GIS system).	[0, 99]	32.4	32.78
logAvgRent	Log average rent per month. Statistical Office of the Canton of Zurich.	[6.873, 7.556]	7.18	0.133
City	Dummy if community is Zurich or Winterthur.	{0; 1}	0.012	0.108
Density1960	Population density in 1960 before law reform in December 1963. Federal Census (Bern 1963).	[0.019, 0.865]	0.53	0.176
PropertyOwner1960	Share of property owners in community in 1960 before law reform in December 1963. Federal Census (Bern 1963).	[41.6, 5017]	352.5	557.253

Source: as mentioned in table.

The range, mean and standard deviations are based on 171 observations. Average taxes per capita are 2712.12CHF. Average debts per capita are 4958.19 CHF and average new debts per capita are -136.37 CHF.

Table 2

## Effects of Property Ownership because of Debt Capitalization

Variable	Debt Tax Ratio (DebtToTax)					New Debts Tax Ratio (NewDebtToTax)				
	OLS (1)	OLS (2)	OLS (3)	2SLS (4)	2SLS (5)	OLS (6)	OLS (7)	OLS (8)	2SLS (9)	2SLS (10)
PropertyOwner	-2.480 <sup>a</sup> (0.727)	-2.047 <sup>a</sup> (0.709)	-2.047 <sup>a</sup> (0.708)	-6.356 <sup>a</sup> (2.014)	-4.751 <sup>a</sup> (1.576)	-0.278 <sup>a</sup> (0.101)	-0.321 <sup>a</sup> (0.113)	-0.323 <sup>a</sup> (0.113)	-0.603 <sup>a</sup> (0.199)	-0.775 <sup>a</sup> (0.212)
logMeanIncome	-6.229 <sup>a</sup> (1.532)	-5.889 <sup>a</sup> (1.514)	-5.887 <sup>a</sup> (1.482)	-5.957 <sup>a</sup> (1.496)	-5.931 <sup>a</sup> (1.466)	-0.884 <sup>a</sup> (0.179)	-0.930 <sup>a</sup> (0.178)	-0.924 <sup>a</sup> (0.177)	-0.929 <sup>a</sup> (0.189)	-0.931 <sup>a</sup> (0.184)
logInvest	0.059 (0.080)	0.036 (0.076)	0.036 (0.077)	0.065 (0.080)	0.054 (0.076)	0.007 (0.007)	0.008 (0.008)	0.008 (0.008)	0.010 (0.008)	0.011 (0.007)
logMeanMedian	7.090 <sup>a</sup> (1.784)	7.092 <sup>a</sup> (1.758)	7.092 <sup>a</sup> (1.759)	7.370 <sup>a</sup> (1.770)	7.266 <sup>a</sup> (1.720)	0.980 <sup>a</sup> (0.224)	1.029 <sup>a</sup> (0.220)	1.029 <sup>a</sup> (0.220)	1.047 <sup>a</sup> (0.233)	1.058 <sup>a</sup> (0.228)
TaxRate	6.19e-3 (9.65e-3)	1.91e-3 (9.80e-3)	1.91e-3 (9.75e-3)	5.74e-3 (9.70e-3)	4.31e-3 (9.99e-3)	-4.04e-3 <sup>a</sup> (1.26e-3)	-4.16e-3 <sup>a</sup> (1.27e-3)	-4.15e-3 <sup>a</sup> (1.27e-3)	-3.90e-3 <sup>a</sup> (1.25e-3)	-3.75e-3 <sup>a</sup> (1.25e-3)
logPop	-0.546 <sup>a</sup> (0.157)	-0.554 <sup>a</sup> (0.178)	-0.554 <sup>a</sup> (0.180)	-0.976 <sup>a</sup> (0.279)	-0.819 <sup>a</sup> (0.204)	-0.088 <sup>a</sup> (0.020)	-0.091 <sup>a</sup> (0.022)	-0.092 <sup>a</sup> (0.022)	-0.119 <sup>a</sup> (0.030)	-0.136 <sup>a</sup> (0.029)
CommunityCenter	0.201 (0.177)	0.197 (0.190)	0.197 (0.191)	0.225 (0.181)	0.214 (0.183)	0.045 (0.027)	0.048 (0.029)	0.048 (0.029)	0.050 <sup>c</sup> (0.028)	0.051 <sup>c</sup> (0.028)
CommunityBorder	0.218 (0.204)	0.191 (0.198)	0.191 (0.203)	0.271 (0.209)	0.241 (0.210)	-0.036 (0.030)	-0.038 (0.030)	-0.039 (0.031)	-0.034 (0.030)	-0.031 (0.031)
Parliament		0.090 (0.302)	0.090 (0.302)	-0.322 (0.328)	-0.169 (0.320)		-0.024 (0.069)	-0.025 (0.069)	-0.051 (0.072)	-0.068 (0.072)
DebtBrakeYes		-6.616 <sup>c</sup> (3.383)	-6.622 <sup>c</sup> (3.417)	-4.154 (3.600)	-5.073 (3.336)		0.490 (0.442)	0.474 (0.453)	0.634 (0.489)	0.732 (0.492)
ElecLeft		1.247 (1.971)	1.248 (1.977)	0.015 (0.021)	0.014 (0.020)		0.202 (0.253)	0.203 (0.253)	0.002 (0.002)	0.002 (0.002)
NoSchoolComm		0.164 (0.201)	0.164 (0.201)	0.052 (0.216)	0.094 (0.212)		-0.035 (0.023)	-0.035 (0.023)	-0.042 <sup>c</sup> (0.023)	-0.047 <sup>c</sup> (0.024)
logEquity			-1.35e-3 (8.55e-2)	-2.00e-2 (8.57e-2)	-1.30e-2 (8.51e-2)			-4.03e-3 (9.34e-3)	-5.24e-3 (9.90e-3)	-5.99e-3 (9.77e-3)
City	4.181 <sup>a</sup> (1.166)	3.874 <sup>a</sup> (1.123)	3.872 <sup>a</sup> (1.122)	4.623 <sup>a</sup> (0.716)	4.343 <sup>a</sup> (0.828)	0.261 <sup>a</sup> (0.080)	2.98e-1 <sup>a</sup> (1.00e-1)	0.292 <sup>a</sup> (0.103)	0.340 <sup>a</sup> (0.095)	0.370 <sup>a</sup> (0.092)
(intercept)	73.135 <sup>a</sup> (17.730)	75.219 <sup>a</sup> (17.400)	75.213 <sup>a</sup> (17.286)	78.669 <sup>a</sup> (17.633)	77.381 <sup>a</sup> (17.066)	10.721 <sup>a</sup> (2.027)	10.794 <sup>a</sup> (1.970)	10.776 <sup>a</sup> (1.965)	11.000 <sup>a</sup> (2.118)	11.138 <sup>a</sup> (2.061)
N	171	171	171	171	171	171	171	171	171	171
Adj. R2	0.407	0.429	0.429	0.428	0.430	0.244	0.257	0.257	0.235	0.260
F-Test (1 <sup>st</sup> stage)				22.91	24.90				22.91	24.90
J-Test				-	0.594				-	0.596
Instruments				Density1960	Density1960, PropertyOwner 1960				Density1960	Density1960, PropertyOwner 1960

Source: own calculations

<sup>a</sup> indicates a significance level of below 1 %; <sup>b</sup> indicates a significance level between 1 and 5 %; <sup>c</sup> indicates significance level between 5 and 10 %. Robust standard errors using a White heteroskedasticity adjusted sandwich estimator are given in parenthesis. Columns (4) and (9) use the population density in 1960 (before law reform) as an instrument. Columns (5) and (10) use the population density and the rate of property owners in 1960 (both before law reform) as instruments.

Table 3  
**Effects of Property Ownership because of Debt Capitalization - Robustness Tests and Bayesian Model Averaging**

Variable	Interaction DebtToTax	Interaction NewDebtTo Tax	Interaction DebtToTax	Interaction NewDebtTo Tax	Robustness DebtToTax	Robustness NewDebtTo Tax	Robustness DebtToTax	Robustness NewDebtTo Tax	BMA (logDebtPe)			BMA (DebtToTax)		
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	BMA (9)	Sign Test (10)	Incl. Proba (11)	BMA (12)	Sign Test (13)	Incl. Proba (14)
PropertyOwner	-2.147 <sup>b</sup> (0.880)	-0.508 <sup>a</sup> (0.129)	-2.472 <sup>a</sup> (0.860)	-0.415 <sup>a</sup> (0.145)	-1.716 <sup>b</sup> (0.739)	-0.318 <sup>a</sup> (0.116)	-1.624 <sup>b</sup> (0.730)	-0.313 <sup>a</sup> (0.116)	-1.648 <sup>c</sup> (0.922)	0.000	24.2	-0.288 <sup>b</sup> (0.118)	0.000	61.3
DiffPop	0.015 <sup>a</sup> (0.002)	0.001 <sup>a</sup> (0.000)												
IntPropertyPop	-0.273 <sup>a</sup> (0.089)	-0.061 <sup>a</sup> (0.013)												
IntPropertyCenter			-0.136 (1.056)	-0.239 (0.190)										
IntPropertyBorder			2.203 (1.504)	0.098 (0.210)										
logMeanIncome	-6.056 <sup>a</sup> (1.501)	-1.001 <sup>a</sup> (0.180)	-5.614 <sup>a</sup> (1.458)	-0.915 <sup>a</sup> (0.175)	-4.741 <sup>a</sup> (1.469)	-0.908 <sup>a</sup> (0.180)	-4.686 <sup>a</sup> (1.447)	-0.905 <sup>a</sup> (0.180)	-4.111 <sup>a</sup> (1.427)	0.000	100.0	-0.777 <sup>a</sup> (0.205)	0.000	99.4
logInvest	-1.72e-3 (7.20e-2)	4.04e-3 (6.65e-3)	0.038 (0.078)	6.95e-3 (7.58e-3)	0.022 (0.074)	0.008 (0.008)	0.027 (0.072)	7.83e-3 (7.50e-3)	0.020 (0.056)	0.001	3.4	6.83e-3 (7.03e-3)	0.000	6.9
logMeanMedian	7.500 <sup>a</sup> (1.810)	1.183 <sup>a</sup> (0.225)	6.782 <sup>a</sup> (1.729)	1.026 <sup>a</sup> (0.216)	4.273 <sup>b</sup> (1.953)	0.989 <sup>a</sup> (0.241)	4.023 <sup>b</sup> (1.935)	0.976 <sup>a</sup> (0.245)	4.316 <sup>b</sup> (1.977)	0.000	44.9	0.862 <sup>a</sup> (0.245)	0.000	97.8
TaxRate	5.58e-3 (9.24e-3)	-3.86e-3 <sup>a</sup> (1.27e-3)	4.14e-3 (9.46e-3)	-4.03e-3 <sup>a</sup> (1.32e-3)	7.11e-3 (9.66e-3)	-4.08e-3 <sup>a</sup> (1.30e-3)	0.006 (0.010)	-4.13e-3 <sup>a</sup> (1.30e-3)	0.013 (0.011)	0.000	8.0	-4.15e-3 <sup>a</sup> (1.43e-3)	0.000	87.1
logPop			-0.516 <sup>a</sup> (0.170)	-0.092 <sup>a</sup> (0.023)	-0.539 <sup>a</sup> (0.169)	-0.092 <sup>a</sup> (0.022)	-0.539 <sup>a</sup> (0.167)	-0.092 <sup>a</sup> (0.022)	-0.385 <sup>a</sup> (0.128)	0.000	99.7	-0.065 <sup>a</sup> (0.022)	0.000	99.8
CommunityCenter	0.176 (0.189)	0.043 (0.029)	0.281 (0.426)	-0.051 (0.077)	-0.017 (0.194)	0.045 (0.030)	-0.038 (0.196)	0.044 (0.031)	-0.069 (0.259)	0.002	3.5	0.056 <sup>c</sup> (0.032)	0.000	21.4
CommunityBorder	0.160 (0.210)	-0.051 (0.032)	-0.951 (0.760)	-0.082 (0.111)	0.044 (0.195)	-0.041 (0.033)	0.050 (0.195)	-0.041 (0.033)	0.039 (0.214)	0.009	3.0	-0.048 <sup>c</sup> (0.028)	0.000	20.7
Parliament	0.024 (0.319)	-0.013 (0.061)	-0.098 (0.309)	-0.016 (0.073)	0.029 (0.300)	-0.026 (0.069)	0.023 (0.303)	-0.026 (0.069)	0.137 (0.436)	0.001	3.3	-4.62e-3 (5.90e-2)	0.363	3.5
DebtBrakeYes	-7.480 <sup>b</sup> (3.546)	0.338 (0.425)	-6.426 <sup>c</sup> (3.458)	0.423 (0.467)	-6.245 <sup>c</sup> (3.280)	0.479 (0.453)	-5.851 <sup>c</sup> (3.286)	0.499 (0.462)	-8.337 <sup>b</sup> (3.250)	0.000	68.2	0.335 (0.443)	0.004	5.0
ElecLeft	1.003 (2.070)	0.216 (0.241)	1.444 (2.054)	0.170 (0.266)	1.191 (1.849)	0.202 (0.253)	1.240 (1.823)	0.205 (0.253)	2.225 (1.722)	0.000	9.7	0.142 (0.208)	0.009	4.5
NoSchoolComm	0.077 (0.205)	-0.052 <sup>b</sup> (0.022)	1.24e-1 (1.96e-1)	-0.034 (0.022)	0.113 (0.205)	-0.035 (0.023)	0.115 (0.204)	-0.035 (0.023)	0.144 (0.244)	0.001	3.9	-0.016 (0.033)	0.014	3.9

Continued on next page.

logEquity	0.012 (0.086)	-1.08e-3 (1.00e-2)	-0.023 (0.090)	-4.20e-3 (9.71e-3)	0.010 (0.086)	-0.004 (0.009)	0.019 (0.083)	-0.003 (0.010)	0.026 (0.101)	0.002	3.2	-1.27e-3 (1.31e-2)	0.042	3.4
Elderly					11.110 <sup>b</sup> (4.744)	0.157 (0.405)	11.552 <sup>b</sup> (4.867)	0.180 (0.416)	13.682 <sup>a</sup> (3.776)	0.000	99.2	0.382 (0.530)	0.001	5.1
ImmigSaldo							-3.684 (6.085)	-0.190 (0.611)	-6.363 (5.101)	0.000	8.8	-0.168 (0.676)	0.059	3.6
PopSquared									2.58e-5 (1.57e-5)	0.000	18.2	1.17e-6 (2.05e-6)	0.009	4.1
Employed3sector									1.189 (0.759)	0.000	15.8	0.053 (0.108)	0.008	4.3
AccessFasttrain									-2.90e-3 (3.32e-3)	0.000	5.3	1.59e-4 (4.23e-4)	0.030	3.7
logAvgRent									-0.040 (1.092)	0.263	3.1	-0.103 (0.140)	0.003	5.0
City	4.772 <sup>a</sup> (1.247)	0.946 <sup>a</sup> (0.204)	3.687 <sup>a</sup> (1.101)	0.323 <sup>a</sup> (0.108)	3.557 <sup>a</sup> (1.047)	0.287 <sup>a</sup> (0.104)	3.598 <sup>a</sup> (1.047)	0.289 <sup>a</sup> (0.104)	3.238 <sup>a</sup> (1.156)	0.000	INC	0.250 <sup>c</sup> (0.128)	0.000	INC
(Intercept)	72.697 <sup>a</sup> (16.823)	10.924 <sup>a</sup> (1.997)	71.855 <sup>a</sup> (16.953)	10.756 <sup>a</sup> (1.925)	60.788 <sup>a</sup> (17.018)	10.572 <sup>a</sup> (2.007)	59.853 <sup>a</sup> (16.774)	10.523 <sup>a</sup> (2.017)	52.869 <sup>a</sup> (14.979)	0.000	INC	9.285 <sup>a</sup> (2.459)	0.000	INC
N	171	171	171	171	171	171	171	171	171			171		
Adj. R2	0.416	0.273	0.436	0.265	0.459	0.258	0.460	0.258						
BIC									-682.1			-682.5		

Source: own calculations

<sup>a</sup> indicates a significance level of below 1 %; <sup>b</sup> indicates a significance level between 1 and 5 %; <sup>c</sup> indicates significance level between 5 and 10 %. Robust standard errors using a White heteroskedasticity adjusted sandwich estimator are given in parenthesis. For the Bayesian Model Averaging (BMA) results in columns (9) to (12), the conditional mean and standard deviation are conditional on inclusion of the variable in the model. The sign-test in columns (10) and (13) is a Wilcoxon signed-rank test for the sign of the variable over all models. The p-value of the sign tests indicates whether the coefficient is on the same side zero as its posterior mean conditional on inclusion. Columns (11) and (14) give the posterior inclusion probability of all variables. "INC" denotes variables which are included by construction in the Bayesian Model Averaging procedure. BMA results were obtained using the software of the R Project for Statistical Computing with the BMA package.