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Measuring Fiscal Sustainability on the Municipal Level: A German Case Study

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Measuring Fiscal Sustainability on the Municipal Level: A German Case Study

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The consequences of ageing populations for federal and state fiscal policies are, due to the research efforts of the last two decades, well known. However, it is rather less well known how the municipal level is affected. Therefore, by using a modification of the sustainability definition formulated by Blanchard, Chouraqui, Hagemann, and Sartor (1990) and the concepts of Auerbachs, Kotlikoffs and Gokhales Generational Accounting (1991) we define a new framework focusing on capital stock, financial management and depreciation of municipal assets. This papers purpose is to deliver a concept which is able to provide sound indicators for long-term budgeting by local authorities. We apply this framework to three German cities with different typologies, Munich, Freiburg and Schwäbisch Hall.

JEL-Classification: H61, J10, R51

Keywords: Fiscal sustainability, demographic transition, municipalities

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1 Introduction

The adjustment of public budgets and fiscal policies to a changing demographic and internationally transparent environment has been one of the major tasks for OECD governments over the last two decades. Academic research has contributed to these adjustment processes in various ways. One was the development of methods measuring fiscal sustainability. Frequently used are the so called "fiscal sustainability approach" by Blanchard, Chouraqui, Hagemann, and Sartor (1990) and the concept of Generational Accounting by Auerbach, Gokhale, and Kotlikoff (1991, 1992, 1994). However, most studies using these measurement concepts have put hardly any focus on municipalities. As municipal populations decline, whether caused by low fertility rates or migration, one might think not only of the reconstruction of drain systems or streets, but also consider long-term consequences for the financial sustainability of municipalities. Obviously, pay-as-you-go pension schemes or health insurance systems which are highly sensitive towards demographic mutation, do normally not belong to the municipal remit (perhaps with the notable exception of some Scandinavian countries like Norway). But in most developed countries, many social security or child care measures as well as schools and cultural facilities are borne by municipal governments.[1] This can lead to significant deficits and vertical expenditure imbalances between the federal and the local level (see Seitz and Kempkes (2007)). Moreover, changes in the age structure and migration might have effects on business location decisions and, consequently, create an impact on the revenue side of municipal budgets. As profound demographic changes do occur in most OECD countries and particularly in Europe a long-term perspective might help to restructure municipal finance on local and legislative basis and to cope in time with future shortages. Thus, the main goal of this paper is to adjust existing concepts of measuring fiscal sustainability appropriately to the municipal governments. Therefore, we develop a set of indicators which measure fiscal sustainability on a municipal basis like it has been done in various ways for the level of general governments.

Our method can be applied to every kind of local authority, no matter whether the scope of duties is large or small, whether municipalities have significant taxation authorities or none. For a first empirical implementation, we chose three differently sized and indebted German municipalities (Munich, Freiburg and Schwäbisch Hall). For each of those we calculate several indicators, run sensitivity analysis and compare policy scenarios. The choice of German municipalities is based not only on our background, but also on the fact that many German municipalities have recently reformed their accounting system from cameralistics to a corporate accounting system which provides new data about public asset values and equity.

So far, only a few other studies concentrate on the interdependence of ageing and municipal finances. For Germany, Geys, Heinemann, and Kalb (2008), Seitz and Kempkes (2007); Seitz, Freigang, Högel, and Kempkes (2007) and Baum, Seitz, and Worobjew

[1] Apart from German speaking countries, in which a significant portion of public sector decision-making is done on municipal level, all Scandinavian countries, Italy, Spain, the Netherlands and Belgium do have a pronounced sector of local public authorities (see OECD (2008).)

(2002) explore the consequences of the demographic transition on municipal coffers, however, only on an aggregate level (municipalities in one state, smaller vs. larger municipalities, etc.) and without any focus on capital stocks. For Finland, Lundsgaard (2005) discusses some consequences of ageing and the fiscal sustainability on the local level. MaCurdy and Nycherba (2001) as well as Montén and Thum (2008) build theoretical models to show the effects of demographic changes for the fiscal competition between municipalities.

The remainder of the paper is structured as follows: Given the variety of municipal structures, legally and economically, we start in section 2 by developing a set of municipal sustainability indicators which can be used generally. Section 3 then presents the data and the results of the empirical analysis for each of three German municipalities. Finally, section 4 provides a summary and discusses future research opportunities.

2 Measuring fiscal sustainability on the municipal level

2.1 Fiscal differences between the local and supranational level concerning the measurement of fiscal sustainability

At first glance, municipalities are fiscal authorities like others. They have a certain tax authority and an expenditure side which is defined by federal, state or municipal law. However, in most developed countries one can see empirically a major difference between the fiscal structure especially of the expenditure side. While on the federal or state level, the vast majority of expenditure types are monetary by nature (public pension, health or unemployment benefits, wages for civil servants, etc.), public goods on the municipal level often come in form of capital goods i.e. parks, schools (without teachers), streets, etc. This is a crucial point for the assessment of fiscal sustainability on the municipal level. In most studies concerning fiscal sustainability on the general governmental, federal or state level governmental assets are often ignored either because there are no good evaluations of governmental assets or because investments are not a significant part of a country's fiscal policy compared to say social security, health or other social programs.[2] In case of municipalities both arguments against an inclusion of governmental assets into a fiscal sustainability framework are weakened. Firstly, at least in the case of Germany, municipalities have begun to estimate their assets due to new accounting practises and political pressure.[3] Secondly, the value of governmental assets compared to the municipal balance sheet is quite large. Consequently, an appropriate framework to analyze fiscal sustainability on the local level should not just focus on

[2] One exception in traditional fiscal sustainability analysis due to its vast natural resources, is Norway. Therefore, Fichtner and Hagist (2008) include the measurable part of the governmental capital stock of Norway into their calculations. Most general governments, however, do not posses good evaluations of their assets. As a result, most researchers do focus just on public debt and not on changes in public capital stocks.

[3] Over the last decade many German communities tried to privatize some of their services or assets and therefore also began to evaluate their wealth.

conventional cash flows, but rather include the performance of municipal asset management as an additional object of the analysis. As a consequence, fiscal sustainability is not only about the secured provision of public services measured by public spending but also includes the maintenance of the publicly owned capital stock, no matter whether public assets are regarded as a foundation for many services provided by the local authority or as reserve funds.

2.2 Thinking municipal finance as corporate finance

As the recent financial crisis and also the technical literature (e.g. Lang and Makin (2007)) show, most cities in developed countries try to manage their financial assets professionally according to the doctrines of modern finance. Hence, in order to find a sound theoretic foundation for our basic question of how sustainable the supply of public goods offered by a municipality is, we start with the public balance sheet. It is therefore assumed that the balance sheet total in period t, K_t, is composed of explicit public debt, B_t, as well as public equity, E_t. Within this simple liability structure E_t is the key variable as it represents the municipal wealth owned by the community. Changes in E_t can be illustrated by the public budget constraint. The municipal equity of period t decreases (increases) by the deficit, D_t, if $D_t > 0$ (if $D_t < 0$):

$$D_t = S_t - R_t + r_B B_{t-1} - (r_k - d)K_{t-1} \tag{1}$$

S_t represents all expenditure for the provision of public goods and services whereas R_t equals the public receipts through taxes, fees and assignments from higher political divisions. r_B denotes the average (real) interest rate on public debt and $r_k - d$ represents the (real) interest rate on the nominal capital stock of the municipality which consists of rents, interest earnings etc. (r_k) as well as the average depreciation rate of the municipal asset structure (d). Equation (1) focuses just on all contributions to capital formation and does not include all municipal cash flows. Current investments for example have no effect on municipal equity and can be ignored as long as they haven't started to depreciate. Analogically, accrued liabilities can not be observed as cash flows although they effect municipal equity directly. So, while S_t does not include new investment expenditures, it does include accrued liabilities. However, new investments can lead to costs as well. Firstly, investments lead to future depreciation. Secondly, there might be costs of financing. The difference between the debit interest rate and the real rate of return on public capital, $r_B - r_k + d$, can be perceived as the yearly cost of widening the municipal capital base through credit by one monetary unit. If we combine the definition $E_t = K_t - B_t$ and equation (1), we get:

$$\begin{aligned} E_t &= E_{t-1} - D_t \\ &= K_{t-1} - B_{t-1} - (S_t - R_t + r_B B_{t-1} - (r_k - d)K_{t-1}) \\ &= R_t - S_t - (1 + r_B)B_{t-1} + (1 + r_k - d)K_{t-1}. \end{aligned} \tag{2}$$

If we consider the conservation of public equity as one requirement for a policy that is fiscally sustainable, we can focus just on two variables. A change in equity can result just from different evolutions of the total debt on the one hand and the balance sheet total on the other. Equation (1) does not show whether the deficit comes from a melt-down of the capital stock while debt remains constant or vice versa from a rise of municipal debt given a constant capital stock. To model changes in B_t and K_t we assume that a certain part of a possible surplus, $\alpha_t(R_t - S_t)$, is invested and another part, $\beta_t(R_t - S_t)$, is used to repay debt. From this, we get both the equation of motion for K_t and B_t:

$$K_t = K_{t-1}(1 + r_k - d) + \alpha_t(R_t - S_t) \tag{3a}$$
$$B_t = B_{t-1}(1 + r_B) - \beta_t(R_t - S_t) \tag{3b}$$

Obviously, α_t and β_t are not independent from each other, as it is not possible to invest anything without funding the investment. Assuming R_t exceeds S_t, β_t has to decrease proportionally as α_t rises and vice versa. Hence, for future calculations of E_t, β_t is substituted by $1 - \alpha_t$ (given $\alpha_t + \beta_t = 1$).

As we are interested in the evolution of equations (3a,3b) given the expected demographic development of one municipality and GDP as a measurement of the output is not quantified on a local basis in most countries, we continue by turning these values into relative numbers. Therefore, we assume the following simple production function:

$$Y_t = N_t A_t$$

Y_t denotes the potential output of the municipal economy in period t and N_t is the number of potential workers within the local authority district.[4] A_t represents the average output per year and worker. [5]

We assume a constant average output of one and label A_t in the following *level of labor productivity*, A. Using this assumption and dividing Equation (1) by the potential municipal output yields to

$$\frac{D_t}{N_t A_t} = d_t = s_t - r_t + (1 + n_t + g)^{-1}(r_B b_{t-1} - (r_k - d)k_{t-1}). \tag{4}$$

Consequently, s_t, r_t, b_t, and k_t denote per worker values of S_t, R_t, B_t and K_t, n_t denotes the growth rate of the potential labor force and g represents the growth rate of A for all t. Furthermore, we can express E_t in relative terms by subtracting b_t from k_t:

$$\frac{E_t}{A_t N_t} = e_t = k_t - b_t$$

[4] In the empirical application we take the number of people between the ages of 16 to 65 years.

[5] This implies that changes in A_t are caused theoretically not just by technical progress but also by changes in capital intensity and fluctuations of the labor force participation rate.

This crucial expression of municipal wealth relative to the output potential of the municipality allows us to derive an accurate definition of the fiscal sustainability of municipalities (see 2.3).

2.3 Strict fiscal sustainability

According to the definition of Blanchard, Chouraqui, Hagemann, and Sartor (1990), one could say, a municipal budget is only designed in a sustainable way if the current set of rules with respect to public in- and outputs (goods, services, taxes and other receipts) can be maintained as well as the level of municipal equity relative to the municipal production potential. But to ensure that e_t is not going to decrease over time, the level of public spending and receipts must be designed in a way that the accumulated compounded primary deficits cancel out the financial gap resulting from the interest based differences in the evolution of capital stock and public debt. As equation 5 holds, this is true for a certain time horizon T:

$$\begin{aligned} &\sum_{t=0}^{T} \alpha_t (r_t - s_t)(1 + r_k - d - n_t - g)^{T-t} \\ &+ \sum_{t=0}^{T} (1 - \alpha_t)(r_t - s_t)(1 + r_B - n_t - g)^{T-t} \\ &= b_0(1 + r_B - n_t - g)^T - k_0(1 + r_k - d - n_t - g)^T + e_0 \end{aligned} \tag{5}$$

$$\forall\ t \in \{0, T\}$$

In other words, a municipality has to create as many surpluses from its primary budgets ($r_t - s_t$) to hold the ratio of equity to the production potential of the municipality constant over time in spite of the debt burden, capital interest and allowance. As a consequence, the concept of a sustainable municipal budget requires returns on equity (r_e) on a level that approximately equals $g - n_t$, the growth rate of labor productivity minus the growth rate of the potential labor force. Investments and new borrowing are substitutes as they should be from a theoretical as well as from a practical perspective. The gap between real interest on capital and debt interest already gives a first hint about possible adjustment strategies and efficient ways to cope with a lack of sustainability.[6]

[6] So far, it has not been defined which part of the yearly surplus/deficit is used for investment and which part is used for debt repayment. α_t can be perceived as a strategic variable which can be optimized with respect to the evolution of e_t. Central to the question of an equity-maximizing α_t is the difference between the debit interest rate and the real rate of return on public capital. If on the one hand, debt interest exceeds the rate of return on capital, it seems favorable to minimize α_t in order to lower the debt burden as far as possible. On the other hand, if the municipality is able to produce positive financial results by attaining high returns on invested capital, it is probably far more reasonable to reinvest most of the cash-flows instead of paying back debt. This of course, is a very simplified view. Firstly, most municipalities do definitely not operate in an environment with negative financial costs, and secondly, capital financed either by equity or debt is needed to provide a certain variety of goods and services.

As α_t is unknown, we continue by deriving a general sustainability condition which can be used for empirical application. To do this, we define each period's α_t so that capitalization (k_t) and debt (b_t) per output stay constant over time.[7] Additionally, we introduce an error term (Δ) into Equation (7a) to ensure that there exists any α_t that makes both Equations (6a) and (7a) solvable at the same time. If Δ_t is positive this represents the amount of money that is needed to stabilize debt. Vice versa a negative Δ_t denotes a surplus that reduces debt. We can thus define a dynamic equilibrium condition for both k_t and b_t:

$$K_t = \alpha_t(R_t - S_t) + K_{t-1}(1 + r_k - d) \tag{6a}$$

$$k_t = \alpha_t(r_t - s_t) + k_{t-1}\frac{1 + r_k - d}{1 + n_t + g} \tag{6b}$$

$$if\ k_t = k_{t-1}\ \forall t\ \Rightarrow\ \alpha_t(r_t - s_t) = k_t\frac{n_t + g - r_k + d}{1 + n_t + g} \tag{6c}$$

$$B_t = (1 - \alpha_t)(S_t - R_t) + B_{t-1}(1 + r_B) - \Delta_t \tag{7a}$$

$$b_t = (1 - \alpha_t)(s_t - r_t) + b_{t-1}\frac{1 + r_B}{1 + n_t + g} - \delta_t \tag{7b}$$

$$if\ b_t = b_{t-1}\ \forall t\ \Rightarrow\ (1 - \alpha_t)(s_t - r_t) = b_t\frac{n_t + g - r_B}{1 + n_t + g} + \delta_t \tag{7c}$$

Combining conditions (6c) and (7c) yields:

$$r_t - s_t = k_t\frac{n_t + g - r_k + d}{1 + n_t + g} - b_t\frac{n_t + g - r_B}{1 + n_t + g} - \delta_t,\ \forall t\ \Rightarrow\ e_t = e_{t-1} \tag{8}$$

Equation (8) shows that the yearly deficits (surpluses) per output, $r_t - s_t$, have to be equal to the net changes in b_t and k_t to avoid any decrease of e_t. As soon as δ_t gets positive this condition is not met. Hence, we can formulate a strict sustainability condition by noting:

$$r_t - s_t \geq k_t\frac{n_t + g - r_k + d}{1 + n_t + g} - b_t\frac{n_t + g - r_B}{1 + n_t + g}\ and\ e_t = e_{t-1},\ \forall t \in \{0, T\} \tag{9}$$

This condition can be called strict as it prohibits any decrease in $e_t\ \forall t$. Although we do not want to follow this strict definition of fiscal sustainability, equations (8) and (9) built up the foundation for the empirical application of our framework.

[7] This makes sense because the provision of municipal goods and services needs a certain capital stock as a fundament.

2.4 Sustainability indicators

The extent of municipal sustainability can be measured in several ways, but each of the imaginable indicators has its weaknesses. Generally, sustainability indicators should be easy to grasp and to interpret as well as sound and meaningful. For instance, focusing only on fiscal gaps or just debt without any comparison with the future economic power of the debtor is inadequate. In this section we formulate four indicators which taken together cover most of the requirements.[8] Taking Equation (8) as a starting point, we can understand the error term as the deviation from a fiscally sustainable path. This means that for some periods there will exist budget sustainability surpluses which will lead to an increase in e_t, while for other years the municipality will run into debts respectively displays sustainability gaps as e_t decreases. To calculate these yearly deficits (surpluses) which we have denoted by δ_t, we simply reformulate (8) by solving for δ_t:

$$s_t - r_t + k_t \frac{n_t + g - r_k + d}{1 + n_t + g} - b_t \frac{n_t + g - r_B}{1 + n_t + g} = \delta_t \tag{10}$$

By multiplying this deficit (surplus) of period t with the production potential, we get exactly the amount that can be used additionally by the local authority in period t without endangering its conventional output capacities, in other words, without violating equation (5).

$$\Delta_t = N_t A_t \delta_t \tag{11}$$

If we take T as the time horizon and discount the single absolute deficits (surpluses) of all periods, we get a first indicator analogue to the widely used fiscal gap of the OECD method and the concept of generational accounting:

$$FG_0 = \sum_{t=0}^{T} \frac{\Delta_t}{(1 + r_B)^t} \tag{12}$$

Given a certain scenario, FG_0 represents the amount of money that is needed additionally today to ensure the current relative level of public spending and a constant e_t until T. If the present value of the yearly deficits is positive, FG_0 becomes negative, which indicates an absolute sustainability surplus, in other words, resources that are theoretically on-hand without jeopardizing the sustainable functioning of municipal finance over the long run. In order to interpret the fiscal gap, it might be helpful to express FG_0 by splitting it up in its different components:

[8] For a thorough discussion on the characteristics of sustainability indicators, see Benz and Fetzer (2006).

$$FG_0 = \sum_{t=0}^{T} \frac{S_t - R_t}{(1+r_B)^t} + \sum_{t=0}^{T} K_t \frac{n_t + g - r_k + d}{(1+n_t+g)(1+r_B)^t} - \sum_{t=0}^{T} B_t \frac{n_t + g - r_B}{(1+n_t+g)(1+r_B)^t} \tag{13}$$

$$primary\ budget\ gap = \sum_{t=0}^{T} \frac{S_t - R_t}{(1+r_B)^t} \tag{14a}$$

$$investment\ gap = \sum_{t=0}^{T} K_t \frac{n_t + g - r_k + d}{(1+n_t+g)(1+r_B)^t} \tag{14b}$$

$$repayment\ gap = -\sum_{t=0}^{T} B_t \frac{n_t + g - r_B}{(1+n_t+g)(1+r_B)^t} \tag{14c}$$

Each Equation (14a, 14b and 14c) illustrates one origin of possible fiscal gaps. Some municipalities might suffer from high debt whereas others are in store of high capital depreciations or fail in consolidate their primary budgets.

The fiscal gap as it is denoted by equation (12) and (13) is questionable, as the future size of the municipal economy is not considered. To compare the situation of different municipalities we can divide FG by the corresponding output potential. With fg_0 we get the first indicator for a comparison of different municipalities.

$$fg_0 = \frac{FG_0}{N_0 A_0} \tag{15}$$

However, the weakness of fg_0 is that the accumulation of future debt is set in relation to today's production capacities, whereas the future development of the population and with that the development of the economy are disregarded. Obviously, it is quite important whether the municipal population and therefore the financial potential of the defaulter is going to halve or to double. To exalt the validity of Equation (15) we relate the nominal fiscal gap to the discounted future production potentials.

$$tax_g = \frac{FG_0}{\sum_{t=0}^{T} N_t A_t (1+r_B)^{-t}} \tag{16}$$

This third indicator, tax_g, denotes the level of an additional fictive poll tax paid by the working population from which it would steadily have to increase by g in order to ensure fiscal municipal sustainability. Although this indicator might not be interpreted as easily as the fiscal gap, it contains more information and provides a more relevant picture with

respect to the real debt burden that has to be carried by today's and future generations.[9] Finally, it is probably interesting to express the potential fiscal gap in relation to the municipal spending:

$$sc_t = \frac{\Delta_t}{S_t}$$

If the necessary spending cut in period t, sc_t, is calculated $\forall t \leq T$, this gives an idea of the temporary distribution of the future debt. More general and tightened to one indicator, $sc_{average}$ denotes the average percentage cut in municipal expenditures that is needed to attain fiscal sustainability.

$$sc_{average} = \frac{FG_0}{\sum_{t=0}^{T} \frac{S_t}{(1+r_B)^t}} \tag{17}$$

2.5 Using Generational Accounting

The concept developed in Section 2 can be used in various ways and offers both valuable application options as well as several methodological traps. A first question is how to extrapolate public revenues and expenditures for decades to gain credible results? If we assume - besides the general growth implications - that age and sex-specific per capita budget values do not change, the main driving force of the aggregates of these future magnitudes is the evolution of the municipal population, which is fundamental for the amount of public revenues and probably even more crucial for the volume of public spending.[10] To reflect the upcoming demographic changes as precise as possible, we apply the concept of Generational Accounting (G.A.) (see Auerbach et al. (1991, 1992 and 1994)). [11]

2.6 Aspects of projecting local population

At least in Germany no official population projections beyond 2020 exist for municipalities. This is why we perform own population projections using the established cohort-component method. Fertility and mortality rates are commonly available at least for

[9] According to this poll taxation parameter it can be very useful to formulate analogical indicators for the particular municipal tax system of the country that is analyzed. For the case of Germany this would be e.g. taxes on profits.

[10] At this point it is probably worth mentioning that the theoretic concept, as mentioned in the introduction, can be used not just in order to measure future liabilities and receivables but also for long-term fiscal planning. Imagine a mayor wants to increase gradually education expenditures per pupil by 20 per cent. Then, the resulting increases of the established indicators provides solid estimates of the total long-term costs of the measure. Hence, it can be seen also as a tool to project costs of policies that depend strongly on changes within the age-structure of the municipal population.

[11] For a general description of G.A., we recommend Bonin (2001).

larger municipalities. As this is not the case, it is possible to utilize data from a higher jurisdiction regions or comparable municipalities. Data on migration is probably far more unspecific especially with respect to the age structure of netmigrants. In case of deficient data we estimate migration profiles by taking a time series of the municipal age structure and include the information from mortality probabilities. Without doubt, to do future projections on local migration is critical, as - especially in case of smaller municipalities - the evolution of a single firm can change the migration outlook over night already. To cope with this limited likelihood of any migration scenario, we have done several migration scenarios for each municipality. Outcomes of these scenarios are available upon request.

2.7 Aspects of projecting municipal budgets

As economies in general, local economies follow a certain growth pattern as well. Thus, public receipts and spending per capita must grow by the same rate as the local economy to prevent a continuous contraction of the public sector. At least in developed economies growth potential is driven primarily by the level of productivity growth. In our approach, we use a projection that implies steady increases of s and r by an estimation of structural growth in the area observed.[12] The discount rate, on the contrary, is relatively easy to choose, as it basically represents the real opportunity costs of municipal investment which is the average real debit interest rate of the last period(s). As a municipality is free of any debt we use a long-term risk free interest of around three per cent. If there exist significant accrued liabilities, these should be subtracted in order to avoid a distortion of the rate of interest:

$$discount\ rate = \frac{Interest\ on\ debt_t}{\frac{1}{2}(debt_{t-1} - accruals_{t-1} + debt_t - accruals_t)} - inflation_t$$

Besides growth and discount rates, the application requires general information about the municipal capital stock and the yearly depreciation rate. For countries with cameralistic accounting systems which purely focus on cash flows estimates have to be used. In Germany, most states have decided to shift to an accounting system that is based on the common rules of corporate finance which opens the opportunity to report municipal equity as well as all expenditures including depreciations and accrued liabilities. Generally, the depreciation rate of municipalities has the tendency to be lower than those of firms. This is due to the fact that municipal capital portfolios include usually high shares of real estate and land. Finally, the quality of the results depends on the detailedness of the single budgetary items. The more age- and sex-specific items can be generated from the budget data the more precise is the result. If the available data on local public finance does not allow for the estimation of age-sex-specific micro profiles, it is still

[12] As far as a municipality does not show any special dynamics or stagnation, we use the average rate of productivity growth within the superior jurisdiction (e.g. state).

possible to apply estimated profiles for appropriate age groups (see Hofmann and Seitz (2007), Bertelsmannstiftung (2006)).

As soon as all input data has been collected we extrapolate all budgetary items according to the demographic projections (scenarios) and growth assumptions. We are aware of the fact that per capita values do change, even if policy decisions do not cause any change. Cost remanence which appears once the population of a certain age declines or changes in per capita expenditures due to participation effects can have some significant impact for some years. However, we neglect these effects in this paper as well as any kind of economies of scale in order to control for complexity. Another question is how sensitive the results react on business-cycle fluctuations. Using cross-section budgetary data from one single year might distort the results significantly due to economic boom or recession. In general, empiric evidence shows that the results of Generational Accounting analysis are quite robust with respect to economic fluctuations (see Benz and Hagist (2008)). Anyhow, business cycles do have a significant impact on municipal primary deficits in all countries in which municipalities are financed via taxes.[13] Therefore, if financial results of the base year are highly disturbed by business cycles, we adjust the data thoroughly and calculate an additional scenario.

In the following, we calculate the sustainability indicators for three German municipalities. Besides one standard scenario we also carry out some sensitivity analysis by varying netmigration, fertility and per capita growth.

3 Empirical Application

3.1 Assumptions and data sources

The bulk of municipalities in Europe, Japan and partly also in the US are in the middle of a double-aging process, caused by steadily rising life expectation and structurally low fertility rates. If fertility rates do not fall again during the next decades, demographic imbalances will have vanished mostly until 2060. We, therefore, have chosen a time horizon of 50 years for our analysis. All values indicate real values as we do not model any price changes. Data source of all budgetary inputs we use in this study are the official municipal statements of accounts.[14] Demographic data of German municipalities is mostly publicly available.[15] All micro profiles that have been used for the budget

[13] German municipalities, e.g., participate heavily in local profit tax revenues which are influenced strongly by business fluctuations.

[14] The accounting reports (Rechnungsergebnisse des Verwaltungs- und Vermögenshaushaltes) are available by request at the municipal finance departments. For Freiburg im Breisgau and Schwäbisch Hall the public capital stocks have been estimated according to the available information.

[15] Websites:
$www.muenchen.de/Rathaus/dir/statistik/37879/index.html$;
$www.freiburg.de/servlet/PB/menu/1156915_l1/index.html$;
$www.schwäbischhall.de/de/informationsstadt/daten\text{-}fakten.html$.
Details on migration or mortality might be not accessible but are commonly provided, if desired.

projections can are shown in the appendix and are provided by us upon request.

3.2 Munich

Munich is the third largest city of Germany. However, Munich is the largest municipality as Berlin and Hamburg are separate states. In 2006, the city has been populated by more than 1.3 million inhabitants of which 70 per cent have been in the age of 15 to 65. This relatively high proportion is portrayed by the current demographic structure which can be described by a tree with a strait trunk at its bottom (see Figure 1). Whereas the age group of the 25 to 45-year-old represents the majority of the working population with its large cohorts, less than 17 per cent of all inhabitants are younger than 21. Accordingly, the average age of 42 is relatively high. The fertility rate fluctuates around 1.2. Nevertheless, Munich is well-known as an attractive metropolis in the south of Germany with sound labor market conditions which leads regularly to significant inflow of migrants from other parts of Germany and foreign countries. Especially people in the age of 20 to 35 years move to Munich, mostly for studying and work. Hence, if fertility rates do not change significantly, our estimates predict that population will increase for another 15 years and start to decrease latest by the year 2025.

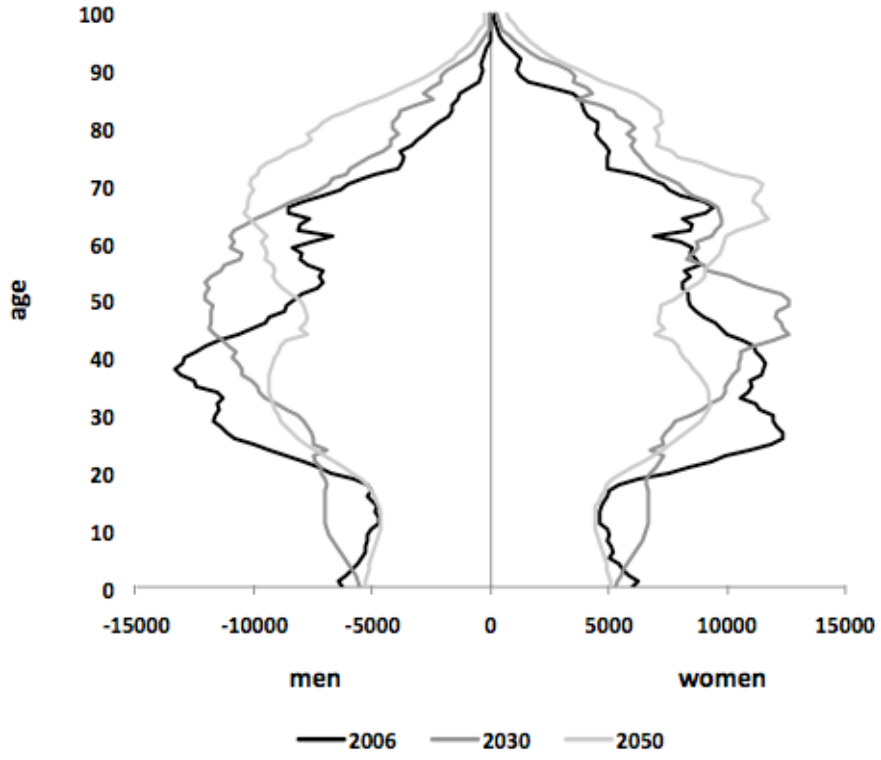

Figure 1: Basic population scenario – Munich

With respect to municipal finance, Munich is one of the first large municipalities that is going to apply the new German accounting standard for municipalities which basically follows the accounting rules of the corporate world.[16] The first version of a municipal balance sheet reports assets that add up to €19.1bn which is equal to more than €14 000 per capita. Total equity amounts to €11bn, accruals and liabilities add up to €3.9bn and €4.1bn. The equity ratio of 58.1 per cent exceeds notably those equity ratios of private businesses, but is rather low in comparison to the cases of Freiburg and SchwäHall (see 3.3 and 3.5).

In 2006, the operational municipal activities, which exclude depreciation of the capital stock, capital yields and interest on debt, have led to a surplus of €364,7m. On average, the real interest rates on debt (without accruals) is moderate due to sound credit terms provided by the state of Bavaria and public banks. We therefore calculate with a rate of 1.8 per cent. The depreciation rate is almost balanced out by the returns Munich makes through its assets (see Table 1). In 2006, all contributions to capital formation amounted to €5.73bn, whereas total costs added up to €5.21bn.[17] Among revenues, taxes have contributed most strongly with a share of 42 per cent, whereas state and other assignments only cover 21 per cent of all receipts which is significantly lower than in the case of Freiburg (see 3.3). This high share of tax revenues can be explained by the potent manufactures and high-tech industries that are settled in the city of Munich causing comparable high corporate tax revenues. Besides taxes and assignments, returns on public assets such as rents or profits of public businesses contribute also to the municipal receipts with 10.6 per cent (see Table 2). The cost structure, on the other side, is relatively scattered. Social security (19.5 per cent) and education/child care (17.6 per cent) are the largest expenditure positions but compared to the other municipalities these shares are relatively low which can be explained mainly by the current demographic structure. However, as Figure 1 indicates, the demographic structure of Munich is going to change significantly. The aging process is unavoidable even if fertility rates recover partly over time. In spite of negative net migration that can be observed for migrants in the age of 40 to 60, the large cohorts of today's 20 to 50-year-old, will shift the demographic weight towards higher age groups as they get older and life expectancy continues to rise. Hence, it is very likely that the average age will increase to more than 46 until 2056. The number of people in the age from 15 to 64 is expected to increase for another 10 to 15 years, mostly driven by immigration. However, until the year 2056 it will have dropped by approx. 15 per cent whereas total population after having also increased until 2020 will return on its initial level. But even if the total population size is unchanged, within our basic scenario the share of inhabitants older than 60 will increase by approx. 48 per cent.

Taking this demographic scenario as given, this has fundamental implications for both future budget and balance sheet structures. In total, Munich would need €16.7bn

[16] This new accounting standard (Doppik) is going to be introduced in most German municipalities during the coming years.

[17] This results from a consideration of both kinds of municipal accounts in Germany (Verwaltungs und Vermögenshaushalt).

Table 1: Input data for basic scenario – Munich 2006

Demography	
Residents total	1 326 206
labor force N_t	938 175
Fertility rate	1.24
Net migration	5 000
Average Age	42.0
Balance sheet structure	
Equity per capita in €	8 391
Capital stock in m €	19 126
Debt in m €	8 016
Primary surplus in m €	364.7
Equity ratio in per cent	58.1
Interest rate, depreciation rate and productivity growth	
Debt rate in per cent	1.8
Depreciation rate in per cent	1.1
Capital interest rate in per cent	1.1
Growth of labor productivity	1.5

(€17.750 per potential worker) in order to stabilize the proportion of the public equity to the municipal tax base until 2056. This gap is basically the result of the expected demographic change towards an older and less productive population. Assuming a constant demographic structure and therefore a conservation of today's surpluses, the fiscal gap would turn even into a small sustainability surplus of around €0.65bn. This, however, might be a bit too optimistic due to the sound economic conditions with respect to 2006. But even if the numbers of the year 2006 are taken as unbiased by business cycles, surpluses will turn into steadily increasing deficits around 2015. Hence, the present value of investment gaps adds up to €10.3bn. To offset these demographic burdens Munich would have to decrease the present value of all future spending by 10.3 per cent or introduce a yearly poll tax of €386.7 for each person in the age from 15 to 64.

These results are becoming slightly better if we loosen our growth assumption. But even if we assume a moderate growth in output per worker of one per cent which would slowdown the increase of the tax base as well, the fiscal gap would remain on a critical level (€11.85bn). A stronger relief results from decoupling the equity condition from the evolution of the municipal tax base. In order to keep public equity per capita just on the same level in real terms, the requirements become more manageable. In this case, the fiscal gap decreases to €6.7bn which is comparable to an average spending cut of 4.1 per cent.

Hoping that these burdens can be reduced by an increase of fertility rates is problematic.

In fact, a rising fertility rate would widen the fiscal gap due to higher education expenditures for the next 20 years (see appendix). Increasing immigration is less harmful for the fiscal outlook due to the currently advantageous age-structure of migration flows. However, lower implicit burdens can also not be expected by a more active migration policy.

Table 2: Budget data – Munich 2006

Receipts and capital yields	in tsd. €	in %
Taxes	2 611 572	41.7
Fees, contributions	392 058	6.8
Assignments, grants	1 197 989	20.9
Other receipts	931 496	16.2
Capital yields	594 691	10.4
Sum	5 727 006	100.0
Spending and depreciation	in tsd. €	in %
General administration	407 458	7.8
Social security	1 016 986	19.5
Education, child care	1 021 139	17.6
Public safety	273 180	5.2
Residential construction, infrastructure	767 402	14.7
Financial equalization share	221 800	4.3
Other expenditures	1 154 356	22.2
Depreciation*	295 872	5.7
Debt interest*	158 565	3.0
Sum	5 212 825	100.0

*Cost of capital

Table 3: Growth and balance sheet scenarios – Munich

Growth scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
g = 1.0	11.85	12.58	306.6	8.2
g = 1.25	14.17	15.03	346.7	9.2
g = 1.5 (basic scenario)	16.72	17.75	386.7	10.3
Balance sheet scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Basic scenario	16.72	17.75	386.7	10.3
Out of debt	11.26	11.9	260.4	6.9
Constant equity per capita	6.70	7.11	154.9	4.1

3.3 Freiburg im Breisgau

Compared to Munich, Freiburg represents with close to 210 000 inhabitants a middle-sized city. Being located next to France, Switzerland and the Black Forest highlands it is well-known for its leisure time opportunities as well as for its academic facilities. According to the approximately 25 000 students the demographic situation of Freiburg is quite unique. It combines a relatively large number of women in the age from 15 to 45 and a very low fertility rate of 1.2 as most students leave Freiburg before having a family. However, the demographic outlook does not show a harsh population decline as it is the case for many municipalities in Germany. Due to the attractiveness of the region and sound labor market conditions it can be assumed that the level of net migration will hold on. In our basic scenario we have estimated that there will be 400 persons more on average who move in than move away from Freiburg year by year. This leads us to the population scenario, illustrated in Figure 2. Whereas today the average age is close to 40, it will most likely be higher than 43 in 2056. Comparable to Munich aging is driven basically by two factors. Firstly, life expectancy is going to rise steadily. Secondly, the relatively large cohorts of the 30 to 50 year old will not be replaced totally.

Freiburg which is like Munich on the way to a new accounting system definitely possesses a significant portion of equity. Although not all valuations have been completed yet, we have estimated the total capital stock to be around €4,6bn.[18] In 2006, liabilities added up to €319m which leads to an equity ratio of around 93 per cent which is much higher than in the case of Munich. However, the primary surplus without any capital returns amounted only to €0.029m.

The budget structure of the base year has been balanced as the slight deficit is indicating. Compared to other municipalities of this scale Freiburg has relatively high shares of social security expenditures (22 per cent). Another dominant category of expenditures are those in the field of child care and education (24 per cent). Besides some parts of infrastructure preservation these fields are the most sensitive ones with respect to demographic changes. On the other side, 38.4 per cent of all public receipts come from

[18] This number is not definite, but can be taken as a best guess according to the valid valuation rules.

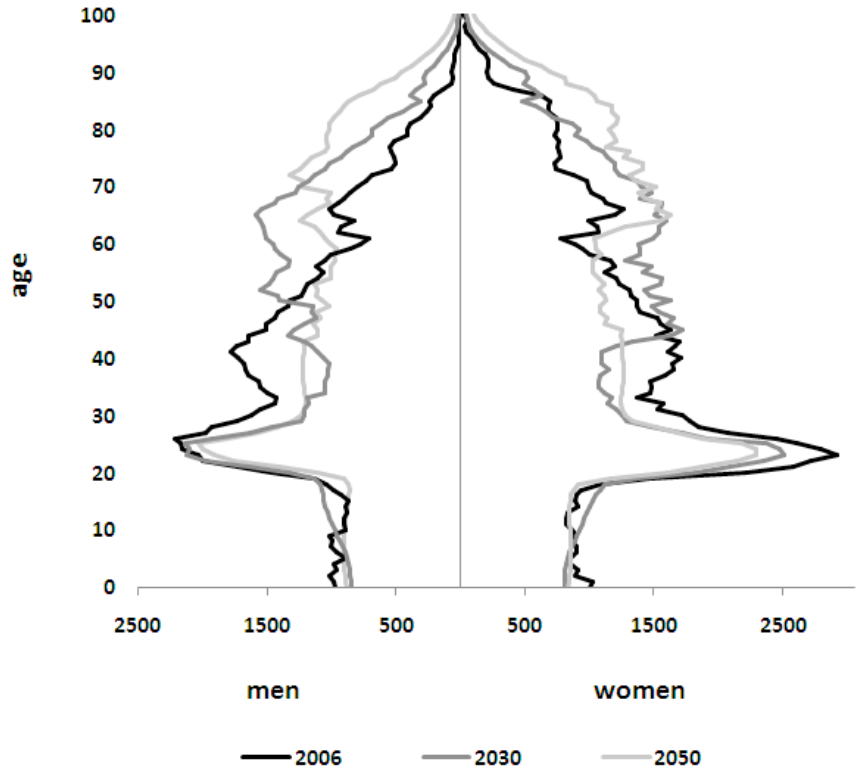

Figure 2: Basic population scenario – Freiburg im Breisgau

taxes and additional 37.0 per cent from assignments and grants. The comparably high share of grants and assignments from other districts and the superior state (Baden–Württemberg) can be explained mainly by the relatively weak industrial landscape of the region.

Although Freiburg is implicitly indebted as well, the results are not as severe as they are in the case of Munich. To ensure an increase of the quality of public goods and services and public equity according to the municipal tax base, Freiburg would need an additional capital stock of €1.57bn which equals €10 600 per worker. In other words, to fulfill this relatively tough sustainability condition the introduction of a yearly poll tax for the working population of close to €300 or an average spending cut of more than 7 per cent would be necessary. The fiscal gap can be split up into a $primary\ budget\ gap$ (48 per cent), an $investment\ gap$ (41 per cent) and a $repayment\ gap$ (11 per cent). This clearly indicates that changes of the demographic structure will lead to a significant increase of the primary deficits. Compared to Munich, the investment gap is rather small due to the relatively high rate of real capital interests ($r_k - d$) in present years (see Table 4). As in the case of Munich, these requirements become less weighty, if the assumed growth rate is lowered (see Table 6). Moreover, selling assets to repay debt totally can be

Table 4: Input data for basic scenario – Freiburg im Breisgau 2006

Demography	
Residents	209 599
labor force (N_t)	147 961
Fertility rate	1.21
Net migration	400
Average age in years	39.83
Balance sheet structure	
Equity per capita in €	20 432
Capital stock in m €	4 600
Debt in m €	318.6
Surplus in m €	0.029
Equity ratio in per cent	93.1
Interest rate, depreciation rate and productivity growth	
Debt interest rate in per cent	2.61
Depreciation rate in per cent	0.6
Capital interest rate in per cent (without depreciation)	1.4
Growth rate	1.5

an option to bound future burdens. The tax indicator decreases by 14 per cent to €247.7 for this scenario.[19] Although all indicators show significant imbalances over the long-run for different scenarios, one minimal sustainability criteria is fulfilled. Excluding public equity from general growth leads to a sustainability surplus of €0.33bn.[20] This, however, would mean that the ratio of public equity to the local tax base steadily decreases.

[19] See *Out of debt scenario in Table 6.*
[20] See *Constant equity per worker scenario.*

Table 5: Budget data - Freiburg im Breisgau 2006

Receipts and capital yields	in m €	in %
Taxes	238.9	38.4
Fees, contributions	72.7	11.7
Assignments, grants	229.9	37.0
Other receipts	15.8	2.5
Capital yields	64.7	10.4
Sum	622.0	100.0
Spending and depreciation	in m €	in %
General administration	48.3	8.0
Social security	132.1	22.0
Education, child care	144.6	24.0
Public safety	30.1	5.0
Residential construction, infrastructure	50.7	8.4
Financial equalization share	52.2	8.7
Other expenditures	99.4	16.6
Depreciation*	28.6	4.8
Debt interest*	15.1	2.5
Sum	600.7	100.0

*Cost of capital

Table 6: Growth and balance sheet scenarios – Freiburg im Breisgau

Growth scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
g = 1.0	0.71	4.79	144.7	3.6
g = 1.25	1.12	7.55	216.7	5.4
g = 1.5 (basic scenario)	1.57	10.59	288.3	7.1
Balance sheet scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Standard scenario	1.57	10.59	288.3	7.1
Out of debt	1.35	9.10	247.7	6.1
Constant equity per capita	- 0.33	- 2.05	- 60.0	-1.5

3.4 Schwäbisch Hall

After having discussed examples for large and middle-sized cities, Schwäbisch Hall, with only 36 000 inhabitants, represents a rather small town. Unlike Munich and Freiburg, Schwäbisch Hall is part of a local district so that the government responsibility is narrowed in some ways, especially for social care. The demographic situation is somewhat similar to the one of Germany in total. It is "urn"-shaped like many aging societies with their largest cohorts between the age of 30 to 50. Due to the lack of namable universities, school graduates partly move to other places what explains the indentation for those cohorts which have reached adulthood (However, over all we assume a positive net migration of 100 p.a.). Therefore, the average age of 41.7 is also slightly higher than in Freiburg, although fertility rates have been higher during recent years (1.39). Migration data characterizes Schwäbisch Hall as an attractive place for families and job applicants. However, as fertility is still far to low to replace today's generations totally and life expectancy is going to rise steadily, a significant aging process is inevitable as well (see Figure 3).

Figure 3: Basic population scenario – Schwäbisch Hall

With an equity ratio of 99 per cent and a budget surplus in the base year, Schwäbisch Hall

Table 7: Input data for basic scenario – Schwäbisch Hall

Demography	
Residents	36 304
Labor force (N_t)	23 895
Fertility rate	1.39
Net migration	100
Average age in years	41.7
Balance sheet structure	
Equity per capita in €	20 462
Capital stock in m€	750
Debt in m€	7.1
Surplus in m€	0.316
Equity ratio in per cent	99.05
Interest rate, depreciation rate and productivity growth	
Debt interest rate in per cent	2.4
Depreciation rate in per cent (real)	1.0
Capital interest rate in per cent (real)	1.1
Growth rate	1.5

might be considered as municipality under sound financial conditions. However, due to a higher share of real estate and infrastructure compared to Freiburg, Schwäbisch Hall faces higher depreciation rates and a lower capital interest rate at the same time (see Table 7).

Due to a more limited area of responsibility according to the size of the town the budget structure differs notably. On the one hand, tax incomes (64 per cent) play a far more important role than in Freiburg for example. On the other hand, Schwäbisch Hall does only receive a fifth of its receipts out of assignments and grants, which are distributed disproportionately to larger municipalities for externality internalization reasons. When it comes to municipal spending, Schwäbisch Hall has a relative small share of social security expenditures (18 per cent). One reason for that is that some services are provided by the superior district (Landkreis). This as well as the overall sound financial situation, however, explains the high payments into the financial equalization system (15.9 per cent) and parts of other expenditures (17.3 per cent). Nevertheless, in 2006, most spending have been used in the area of education and child care (25.2 per cent).

All this again leads to the question of how public equity will change, if the quality of public goods and services does increase according to the general progress. Naturally, Schwäbisch Hall has a smaller fiscal gap (€0.27bn) due to its size. Expressed in relative numbers, however, this gap (€11 100) is slightly higher than the one of Freiburg, but significantly lower than the gap of Munich (see Table 8). The poll tax that is needed to

Table 8: Budget data – Schwäbisch Hall 2006

Receipts and capital yields	in tsd €	in %
Taxes	49 152	64.3
Fees, contributions	2 965	3.9
Assignments, grants	15 244	20.0
Other receipts	1 293	3.9
Capital yields	7 540	9.9
Sum	76 408	100.0

Spending and depreciation	in tsd €	in %
General administration	6 387	7.4
Social security	14 079	18.0
Education, child care	21 567	25.2
Public safety	2 617	3.0
Residential construction, infrastructure	6 117	7 2
Financial equalization share	12 473	15.9
Other expenditures	13 804	17.3
Debt interest*	171	0.2
Depreciation*	7 500	8.8
Calculatory costs	-8.492	–
Sum	76 224	100.0

*Cost of capital

Table 9: Growth and balance sheet scenarios – Schwäbisch Hall

Growth scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
g = 1,0	0.13	5.2	163.7	4.7
g = 1,25	0.19	8.0	239.6	6.9
g = 1,5 (basic scenario)	0.27	11.1	315.2	9.0
Balance sheet scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Basic scenario	0.27	11.1	315.2	9.0
Improved asset management (1,5)	0.13	5.6	159.5	4.6
Constant equity per capita	- 0.06	- 2.5	- 71.8	-2.1

close the gap would have to collect €315 from each member of the working population which indicates a position right in the middle between Freiburg and Munich. To compensate FG_{2006} through a reduction of public spending, however, shows that the results are not far from the ones of Munich. If we split up the fiscal gap, around 25 per cent can be attributed to future operational deficits ($primary\ budget\ gap$), whereas 74 per cent accrue from theoretically required investments ($investment\ gap$). The missing percentage point arises from the inconsiderable volume of repayment duties ($repayment\ gap$). This shows that besides the burdens resulting from the demographic shift towards a smaller working population and an increase in the age group over 65 years, the bulk of Schwäbisch Halls fiscal gap has to do with the comparably high depreciation rates and low capital interests. If Schwäbisch Hall was able to increase its capital incomes from 1.1 to 1.5 per cent, most indicators would decrease by one half (see scenario $improved\ asset\ management$ in Table 9). For the scenario of a sole maintenance of today's equity per capita, Schwäbisch Hall, likewise Freiburg, reaches a sustainable outcome.

3.5 Comparison of results

Analyzing the results side by side gives an additional idea of what causes fiscal gaps on a municipal level. First of all, the results show that today's structural surpluses or deficits seem not to be the most determining factors for how fiscally sustainable municipalities work. In our sample, Munich starts with the by far highest surplus per capita but faces the largest fiscal gap as well. On the other side, without having a significant surplus, Freiburg ends up with the lowest burden (see Table 10). One crucial indicator to explain these differences is the relative change within the demographic structure. Today, over 70 per cent of the total population of Munich are part of the labor force. Our estimates show that this share is going to decrease to only 55.6 per cent in 2056. This is a drop of 15.1 percentage points and represents a significant shift of demographic weight that leads to an increase in relative expenditures for social security measures and reduces the relative tax base. In addition, Munich faces tremendous investment gaps due to its low capital returns and high depreciation of assets. The comparably high liabilities, however, contribute to only 7 per cent of the total fiscal gap, which might be less than expected.

Compared to Munich, Schwäbisch Hall currently has a less favorable age-structure (65.8 per cent of all inhabitants are in the age of 16 to 65). However, the town can expect this share not to drop as harshly as it is probable for Munich. Nevertheless, we have estimated a decline by 14.4 percentage points to 51.4 per cent. This alone, however, is probably not responsible for the better position compared to Munich. The capital stock per capita is significantly larger in Schwäbisch Hall compared to Munich but the real interest on public assets (incl. depreciation) makes hardly any difference. However, Schwäbisch Hall obviously profits from its debt-free starting point. Both elements, the slightly less intensive demographic shift as well as the low explicit debt, overcompensate the comparably low surplus in the base year and lead to a slightly better results (see Table 10).

Table 10: Comparison of results

Variables	Munich	Freiburg	Schw. Hall
Equity per capita in tsd€ 2006	8.4	20.4	20.4
Equity per tax base (e_t) in tsd€ 2006	11.9	28.9	31.0
Equity ratio in %	58	93	99
N_0 as % of total population 2006	70.7	70.6	65.8
N_0 as % of total population 2056	55.6	58.0	51.4
Primary surplus in 2006 in m€	364	0.0	0.3
Interest on public assets incl. depr. ($r_k - d$)	0.0	0.8	0.1
Debt interest rate	1.8	2.6	2.4
fg_0 in tsd€	17.7	10.6	11.1
tax_h in €	387	288	315
sc_0 in %	10.3	7.1	9.0
Primary budget gap in %	31	48	25
Investment gap in %	62	41	74
Repayment gap in %	7	11	1

Finally, Freiburg can be seen as the city with the smallest demographic burden which basically explains its leading position. With approx. 58 per cent the share of population in the age between 16 and 65 within our scenario remains at a relative high level, which can be mainly explained by the high share of university students. More crucial however are the high returns Freiburg has received on its public assets during recent years. As long as these returns are stable and depreciations remain manageable due to the large portion of land within the municipal portfolio, Freiburg is going to have far less investment gaps (41 per cent) than its counterparts.

Although all three municipalities are rather healthy in terms of labor markets and social issues, they are all underfunded according to the long-term perspective. Freiburg and Schwäbisch Hall just meet the basic sustainability criteria of maintaining per capita values of today's public equity but can not follow the expected growth path. The equity of Munich will decrease harshly and even turn negative under the current circumstances. At least these results can be alerting for politicians who support a future-oriented municipal policy.

4 Conclusion

This paper has introduced a method to measure fiscal sustainability on a municipal level. In contrast to the existing literature, we have not only considered the demographic impact on both, public expenditures and public receipts by using a Generational Accounting framework. Additionally, we have focused on today's municipal capital stocks, liabilities and, thus, municipal equity instead of just conducting a cash flow analysis. For us, the

evolution of equity in proportion to the municipal tax base can be seen as the crucial point for the question of how sustainable a municipal fiscal structure is. To measure the distance to a sustainable path of municipal finance, we have introduced four indicators. Deliberately, we have not included remanence effects or economies of scale which would have gone beyond the scope of this article. However, for future research such adjustments can be easily included into the framework according to the particular situation of a municipality. In general, the method is applicable in every country as long as the data of municipal accounting is adequately precise.

Due to the fact that most German states have introduced a new accounting system for municipalities we have analyzed the situation of three German municipalities of different scale. In each case implicit demographic burdens are far more weighty as today's explicit debt. These implicit burdens are caused particularly by a change within the age structure of the population, not by a declining number of inhabitants which itself rather leads to a rising level of public equity per capita. Although the examined municipalities obviously are not representative for Germany as a whole, we see these results as an indicator that most discussions that focus just on explicit municipal debt might be only the peak of the iceberg. This argument gains additional support from the fact that 2006, the base year of our calculations, has been rather a boom year than a normal one. For analyzing fiscal sustainability for all municipalities on an aggregated level, however, it is necessary to wait for a gapless implementation of the new accounting standards.

A Appendix

Table 11: Sustainability indicators - population scenarios Munich

Migration scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
High net migration (2500 p.a.)	16.74	17.76	400.7	10.5
Basic scenario (2000 p.a.)	16.72	17.75	386.7	10.3
Low net migration (1500 p.a.)	16.1	17.09	385.9	10.1
Fertility scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Standard scenario (1.24)	16.72	17.75	386.7	10.3
Increase of fertility to 1.5 until 2030	20.01	21.24	461.4	12.0
Increase of fertility to 1.8 until 2030	23.83	25.28	547.2	14.0

Table 12: Sustainability indicators - population scenarios Freiburg im Breisgau

Migration scenarios	FG_0 bn€	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
High net migration (600 p.a.)	2.26	15.47	405.9	10.1
Standard scenario (400 p.a.)	1.57	10.59	288.3	7.1
Low net migration (200 p.a.)	0.85	5.71	161.7	4.0
Fertility scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Standard scenario (1.21)	1.57	10.59	288.3	7.1
Increase of fertility to 1.5 until 2030	2.05	13.83	372.5	9.0
Increase of fertility to 1.8 until 2030	2.58	17.39	462.9	11.0

Table 13: Sustainability indicators - population scenarios Schwäbisch Hall

Migration scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
High net migration (200 p.a.)	0.31	12.9	352.8	10.0
Standard scenario (100 p.a.)	0.27	11.1	315.2	9.0
Zero net migration	0.25	10.4	302.6	8.7
Fertility scenarios	FG_0 (bn€)	fg_0 (tsd€)	tax_g(€)	sc_{av}(%)
Standard scenario (1.21)	0.27	11.1	315.2	9.0
Increase of fertility to 1.6 until 2030	0.35	14.7	411.4	11.5
Increase of fertility to 1.8 until 2030	0.44	18.2	502.8	13.8

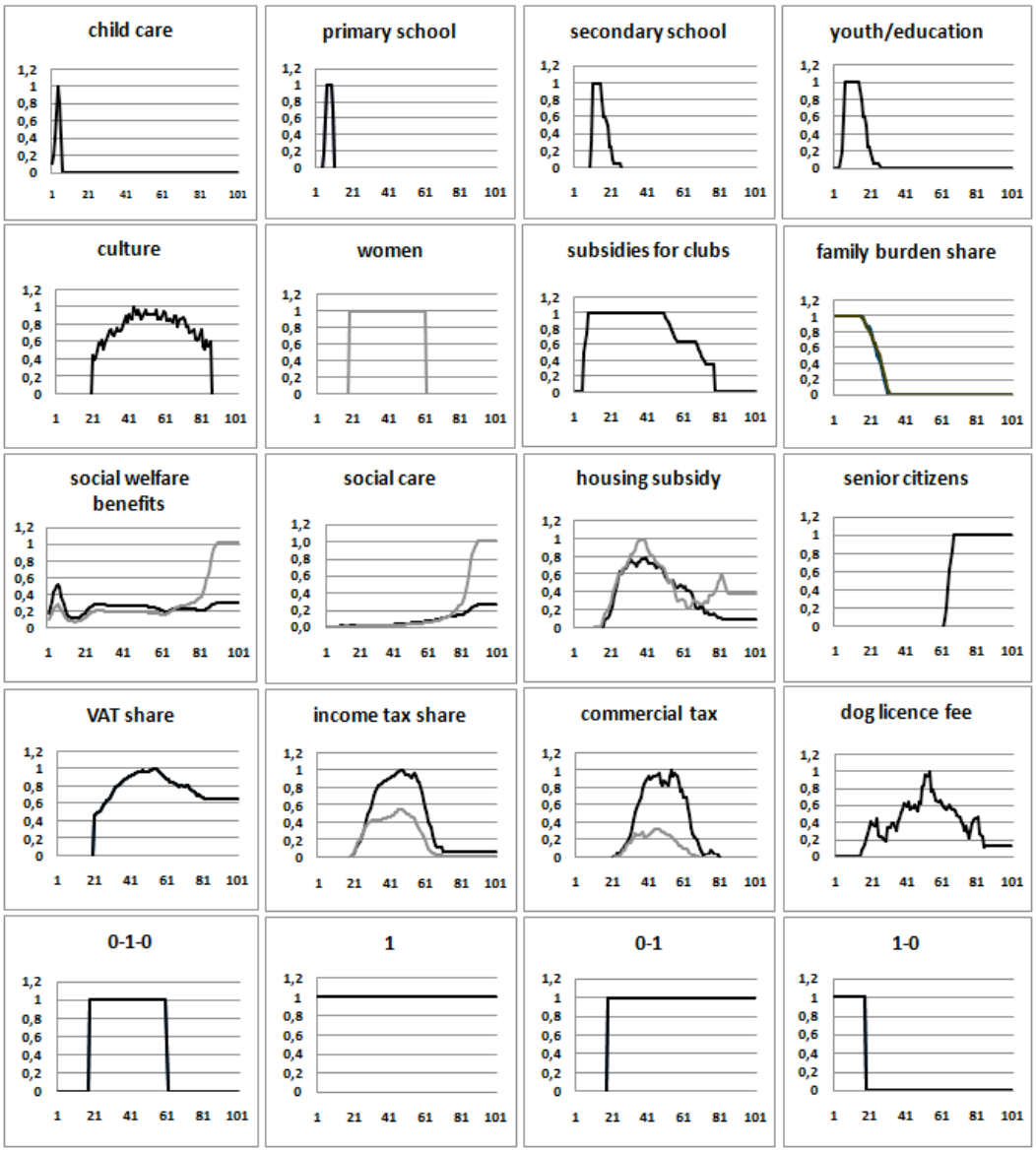

Figure 4: Municipal micro profiles

References

AUERBACH, A. J., J. GOKHALE, AND L. J. KOTLIKOFF (1991): "Generational Accounts: A New Approach to Fiscal Policy Evaluation," *Federal Reserve Bank of Cleveland. Economic Commentary*, pp. 1–6.

——— (1992): "Generational Accounting: A New Approach to Understanding the Effects of Fiscal Policy on Saving; Comment," *The Scandinavian Journal of Economics*, 94(2), 303–323.

——— (1994): "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy," *The Journal of Economic Perspectives*, 8(1), 73–94.

BAUM, B., H. SEITZ, AND A. WOROBJEW (2002): "Der Einfluss der Alters- und Familienstrukturen auf die Ausgaben der Länder und Gemeinden," *Vierteljahreshefte zur Wirtschaftsforschung*, 71, 147–162.

BENZ, U., AND S. FETZER (2006): "Indicators for Measuring Fiscal Sustainability - A comparison of the OECD-Method and Generational Accounting," *Finanzarchiv*, 62(3), 367–391.

BENZ, U., AND C. HAGIST (2008): "Konjunktur und Generationenbilanz - Eine Analyse anhand des HP-Filters," *Jahrbücher für Nationalökonomie und Statistik*, 228(4), 299–316.

BERTELSMANNSTIFTUNG (2006): "Wegweiser Demographischer Wandel 2020 - Analysen und Handlungskonzepte für Städte und Gemeinden," *Aktion demographischer Wandel*.

BLANCHARD, O., J.-C. CHOURAQUI, R. P. HAGEMANN, AND N. SARTOR (1990): "The Sustainability of Fiscal Policy: New Answers to an old Question," *OECD Economic Studies*, (15).

BONIN, H. (2001): *Generational Accounting: Theory and Application*. Springer, Berlin.

FICHTNER, F., AND C. HAGIST (2008): "Oil and Intergenerational Redistribution - the Case of Norway," *FZG Discussion Paper*, (32).

GEYS, B., F. HEINEMANN, AND A. KALB (2008): "Local Governments in the Wake of Demographic Change: Evidence from German Municipalities," *FinanzArchiv*, 64(4), 434–457.

HOFMANN, M., AND H. SEITZ (2007): "Demographiesensitivität und Nachhaltigkeit der Länder- und Kommunalfinanzen: Ein Ost-West-Vergleich," *Dreden Discussion Paper Series in Economics*, (17).

LANG, D., AND R. MAKIN (eds.) (2007): *Handbook for Municipal Clerks*. New Mexico Municipal League.

LUNDSGAARD, J. (2005): "Aging, Welfare Services and Municipalities in Finland," *Economics Department Working Paper*, (428).

MACURDY, T., AND T. NYCHERBA (2001): "How Does a Communicy's Demographic Composition Alter Its Fiscal Burdens?," in *Demographic change and fiscal policy*, ed. by A. J. Auerbach, and R. D. Lee, chap. 4, pp. 101–154. Cambridge University Press.

MONTÉN, A., AND M. THUM (2008): "Aging Municipalities, Gerontocracy and Fiscal Competition," *CESifo Working Paper*, (2469).

OECD (2008): "Ensuring fiscal sustainability: motivating regional and municipal governments," in *Economic Surveys*, vol. 2006, pp. 87–117. OECD.

SEITZ, H., D. FREIGANG, S. HÖGEL, AND G. KEMPKES (2007): "Die Auswirkungen der demographischen Veränderungen auf die Budgetstrukturen der öffentlichen Haushalte," *Perspektiven der Wirtschaftspolitik*, 8(2), 147–164.

SEITZ, H., AND G. KEMPKES (2007): "Fiscal Federalism and Demography," *Public Finance Review*, 35(3), 385.

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