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Abstract

This theoretical paper shows how a central government can induce a policy concerning a municipal matter through a package of a policy requirement and a grant. We find that, due to fiscal competition and the possibility for citizens to move between municipalities, the central government can make all municipalities adopt the policy requirement despite the grant not being sufficiently high to make them gain from the reform. We apply this model to a recent Swedish child-care fee reform and can explain why all Swedish municipalities implemented the maximum child-care fee although it had a negative impact on many municipalities' finances.

Keywords: child care, fiscal competition, municipality, intergovernmental grant

JEL classification: H77, H42, H72, R23

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1 Introduction

A central government wants to implement a policy concerning a municipal matter. However, for political reasons, it does not want to intervene too much and does not want to take away the sovereignty of the municipalities. Hence, it has to make an offer that the municipalities cannot resist. By offering a grant, conditional on implementing the policy, the central government can make all municipalities implement the policy voluntarily.¹ The question is how large such a grant would have to be. With independent municipalities, the grant would need to be sufficiently large to cover the municipal costs of the reform. In this paper we show that, when there is fiscal competition between municipalities, the grant does not have to be sufficient to cover the cost of the reform for the municipalities – they will implement it anyway. Hence, in a matter where there is fiscal competition, it is much cheaper for the central government to make the municipalities come their way, than without fiscal competition.

Jurisdictions may compete with low taxes so as to attract firms and high income citizens (Wilson, 1999), with low levels of social assistance so as not to attract welfare recipients (Brueckner, 2000), or with high levels of public good provision to compete for residents (Wilson and Gordon, 2003). Brueckner (2000) sketches a model showing that welfare migration decreases benefit levels compared to a situation without migration; states choose lower benefit levels than they would have if the poor could not move into their state. Hence, this fiscal competition creates a "race to the bottom."² Fiva and Rattsø (2006) and Dahlberg and Edmark (2008) find evidence for strategic interactions among local jurisdictions concerning welfare benefits in Scandinavian countries, and the latter study shows a significant race-to-the-bottom. In Fiva and Rattsø (2006) this is prevented mainly due to grants from the central government. Day and Winer (2006) only find small effects of public policy on moving patterns in Canada. In a recent paper, McKinnish (2007) finds some evidence of welfare migration when comparing welfare participation at state borders to participation rates in state interiors.

¹That central governments use grants to promote their own interest has received a lot of attention in the literature since Musgrave and Musgrave (1976). Johansson (2003) finds empirical evidence of this in Sweden, and Borck and Owings (2003) is one of many empirical papers finding strategic distribution of intergovernmental grants in the US.

²Brueckner (2003) categorizes these models into spillover models and resource-flow models; our model is of the latter kind.

In this paper, we study user-fee competition. To our notion, the only previous paper looking at this specific kind of fiscal competition is Fuest and Kolmar (2007), who show that user-fee competition tends to make decentralized solutions inefficient. The literature on fiscal competition has mainly been concerned with the fact that competition leads to inefficiently low taxes or levels of public spending.³ In this paper, we do not analyze the efficiency aspects of fiscal competition, but rather its consequences for policy implementation. We find that fiscal competition among municipalities can enable a central government to make municipalities implement a reform that is costly to the municipalities but favorable to mobile citizens.

Child care is a central feature in many economies, whether provided by the private or the public sector. How the care system is organized has effects on who bears the costs, on female labor force participation, on children's wellbeing, and on fertility. Even though there are vast differences between different child care systems, the coverage is high and the subsidies are large in many Western countries. Furthermore, increasing female labor force participation by improving child care is a political objective for the European Union (Roit and Sabatinelli, 2007). Hence, publicly subsidized child care is an increasingly important task in many countries. In this paper, we explicitly regard subsidized child care and fiscal competition arising from the magnitude of the subsidies.

We present a model where there is fiscal competition among municipalities, which use combinations of taxes and child-care fees to attract families with children. In spite of the costs of providing child care, families are net contributors to their municipalities, and are therefore attractive to them.⁴ In such a setting, we show that when the central government wants to induce a policy that favors mobile families, namely reduced child-care fees, competition among municipalities enforces the implementation even if it is costly to municipalities. Moreover, we illustrate the implications from the model with a recent Swedish child-care fee reform.

We argue that child-care fees are a matter of fiscal competition for Swedish municipalities. Families with preschool children are more mobile across municipalities

³However, Fuest and Kolmar (2007) also find that inefficiency may imply either too high or too low levels of user fees and Wilson and Gordon (2003) find that expenditure competition actually increases efficiency. Brueckner (2004) finds that both results are possible under different conditions. Eggert and Sørensen (2008) find that tax base mobility may be welfare-enhancing up to some point.

⁴E.g., Swedish municipalities gain from having additional families with working parents moving to them, judged by comparing marginal incomes from additional inhabitants (Berggren and de Beer, 2007) and costs of child care (Central union of local authorities, 2006).

than other citizens (Statistics Sweden, 2003, 2006a), and municipalities can therefore compete for them using mixes of child-care fees and municipal income tax rates. In 2002, a reform was induced by the central government, which implied radical reductions in child-care fees for most Swedish families with young children. One of the central government's official reasons for implementing the maximum child-care fee was to improve the economic wellbeing of families with young children. Another aim was to make parents with young children increase their labor supply. However, since fees used to be income-based and had now become low and constant, families with the highest incomes were those who gained the most. High-income earners pay a state income tax in addition to the municipal income tax paid by everyone. If high income earners increase their labor supply, then not only the municipal budget but also the central government budget are affected positively. Thus, from a total tax-revenue perspective, municipalities may not have sufficient incentives to increase labor supply among high income earners, which we could suspect was another reason for the central government to want the maximum child-care fee reform.

Since child care is a municipal matter in Sweden, the central government could not directly implement the maximum fee. While the reform was voluntary to municipalities, they were given a grant if they decreased their child-care fees to a rather low maximum fee. For many municipalities, the conditional grant was not large enough to cover the losses from the fee reduction (Central union of local authorities, 2003; Wikström, 2007), yet every single municipality chose to implement the reform. The theoretical model presented in this paper explains this perhaps surprising outcome as fiscal competition over families with young children. As other municipalities implemented the reform, local governments felt forced to do the same in order not to have a relatively lower attractiveness among families with children and thereby risk suffering an even greater loss due to families moving to other municipalities.

This paper contributes to the literature in that it models a situation where a central government can make use of competing municipalities to reach its goals. It also explicitly models a conditional grant, which makes it possible to assess the relation between central and local governments in general and in the context of a reform like the recent Swedish maximum-fee reform.

The rest of the paper is organized as follows. In Section 2 we present the fiscal competition model and derive an equilibrium between two local jurisdictions. In Section 3 we analyze how a central government can make both municipalities adopt

a policy that might make them both worse off. Then follows Section 4 where the model is applied to the Swedish child-care fee reform. Section 5 concludes the paper.

2 The Model

Before analyzing in Section 3 what happens when a reform is implemented, let us derive the pre-reform equilibrium.

There are two jurisdictions inhabited by a number of immobile citizens who are deciding on how much to subsidize a service that they themselves do not use. The immobile citizens outnumber the mobile ones, who are the users of the service and for whom the two jurisdictions compete by means of user fees. We present the model in terms of two municipalities providing subsidized child care, for which mobile families with children pay user fees. However, the model is applicable to any other kind of user-fee competition.

Consider two municipalities ($i = A, B$), of which both have a number $M \geq 1$ of immobile inhabitants without children. For simplicity, everyone has the same gross income, y , while permanent inhabitants in B have a stronger preference for the public good than those in A , in a Tiebout fashion. In the economy, there is also a continuum of families with young children of unit mass, families who are mobile between the two municipalities. For simplicity, each family has only one child.

2.1 Families

The first part of the model illustrates the mobile users'; i.e., the parents' choice of which municipality to reside in. This choice depends on the child-care fees φ_i and the tax rates t_i in the two municipalities ($i = A, B$), and on the degree of attachment to the municipalities, described by $k = [0, 1]$. k is uniformly distributed among parents and those with a low k prefer municipality A and those with a high k prefer B .⁵ The utility of a parent in a specific municipality is described by an extremely simple quasi-concave function of private consumption and the municipal preference

⁵This is in line with the original Hotelling model on spatial competition (Hotelling, 1929), and is also used by, e.g., Mansoorian and Myers (1997).

$$V_A = V(x_A - k), \quad (1)$$

$$V_B = V(x_B - (1 - k)), \quad (2)$$

where x_i is private consumption allowed in municipality i , $i = A, B$. The budget constraint if one lives in municipality i is

$$y(1 - t_i) = x_i + \varphi_i, \quad (3)$$

where y is the fixed income and t_i is the proportional tax rate in municipality i . All parents are assumed to work (and receive income y) and to utilize publicly provided care for their child to the same extent, priced at the fee φ_i . In equilibrium, the marginal parent (with the marginal value $k^*(\varphi_A, \varphi_B, t_A, t_B)$) is indifferent between the two municipalities. Setting $V_A^* = V_B^*$ gives the equilibrium:

$$k^* = \frac{1}{2} + \frac{y(t_B - t_A) + \varphi_B - \varphi_A}{2}. \quad (4)$$

All parents with $k < k^*$ locate in A , and those with $k > k^*$ locate in B . The number of parents residing in A can therefore be denoted $N_A = k^*$. Differentiating (4) shows how parents would migrate in response to changes in tax rates and child-care fees:

$$\frac{\partial k^*}{\partial \varphi_A} = -\frac{1}{2} < 0, \quad \frac{\partial k^*}{\partial \varphi_B} = \frac{1}{2} > 0, \quad (5)$$

$$\frac{\partial k^*}{\partial t_A} = -\frac{y}{2} < 0, \quad \frac{\partial k^*}{\partial t_B} = \frac{y}{2} > 0. \quad (6)$$

Hence, parents choose where to live depending on the differences in child-care fees and tax rates between the municipalities.

2.2 Municipalities

The second stage of the model considers the municipalities' choices. Since $M \geq 1$, the median voter is an immobile non-user in both municipalities.⁶ We could, for instance, think of these permanent inhabitants as older citizens who have become very much attached to their municipality and therefore would not think of moving. The median voter is assumed to not only care about private consumption, as the families with children, but also to receive utility from a publicly provided public good, G . We assume that this good is of use for the immobile inhabitants only, and not for the mobile ones. Although this is a simplification, we could think of G as, e.g., spending on cultural activities, elderly care, or museums that are generally visited by the elderly to a larger extent than by families with children.⁷ Although the median voters have no interest in child care *per se*, they would be willing to subsidize it in order to attract families with young children, so as to increase the tax base (see, e.g., Bergstrom and Blomquist, 1996).

We assume that, in a Tiebout fashion, municipality A is inhabited by permanent individuals with a stronger preference for private consumption, whereas municipality B consists of permanent inhabitants with a stronger preference for the public good. Thus, for given levels of public and private consumption, the marginal rate of substitution between the goods will not be equal in the two municipalities, but

$$\frac{U_G^A(\bar{c}, \bar{G})}{U_c^A(\bar{c}, \bar{G})} < \frac{U_G^B(\bar{c}, \bar{G})}{U_c^B(\bar{c}, \bar{G})}. \quad (7)$$

The median voter in municipality i solves the following problem taking the behavior of mobile parents and of municipality j into account:

$$\max_{t_i, G_i, \varphi_i} U^i(c_i, G_i), \quad i = A, B, \quad (8)$$

where $c_i = y(1 - t_i)$ and $U^i(c, G)$ are quasi-concave with $U''_{cG} \geq 0$, implying that increasing the amount of the public good would not reduce the marginal utility of private consumption. (8) is maximized subject to the municipal budget constraint, that total tax revenue from inhabitants both with and without children are to be

⁶That the median voter is immobile has been common practice in the literature on fiscal competition since the seminal papers by Brown and Oates (1987) and Wildasin (1991).

⁷The simplification that G does not enter the utility function of families with children is needed to assure that their moving decision is determined in one dimension only.

divided into public good provision and provision of child care for families with children. We normalize the cost of child care provision to one, and denote user fees φ . Hence, the budget constraint reads

$$G_i = t_i y(M + N_i) - N_i(1 - \varphi_i), \quad (9)$$

where N_i and M are the number of inhabitants with and without children in municipality i . Maximizing (8) subject to (9) and the actions of municipality j , we can rewrite the resulting first-order conditions as

$$y \frac{U_c^{i'}}{U_G^{i'}} = y(M + N_i) + \frac{\partial N_i}{\partial t_i} (t_i y - (1 - \varphi_i)), \quad (10)$$

$$N_i = (1 - \varphi_i - t_i y) \frac{\partial N_i}{\partial \varphi_i}, \quad (11)$$

which can be used to solve for the equilibrium relation between fee and tax:

$$\varphi_i = \frac{2 + \varphi_j + y(t_j - 2t_i)}{2}, \quad j \neq i. \quad (12)$$

Hence, there is a competing interaction between the two municipalities. The higher the tax rate and child-care fee in municipality j , the higher the child-care fee in i can be, but if j is cheap for a family to live in (low t_j and/or low φ_j), then i must have a lower child-care fee for a given tax rate in order to attract the mobile parents.⁸

Assuming that both municipalities make their decisions in the same way gives an equilibrium where

$$\varphi_i^* = 2 - yt_i^*, \quad i = A, B. \quad (13)$$

Using φ_i^* in (4) gives

$$\tilde{k}^* = \frac{1}{2}. \quad (14)$$

There will thus be equally many inhabitants in both municipalities in equilib-

⁸Note though that $\varphi_i \leq 1$, or parents would buy child care in the private market instead.

rium. The child-care fee is set so that the marginal revenue of an extra parent equals the marginal cost, and in equilibrium the fee is a negative function of the own tax rate. From (13) the total amount of money that the mobile families have to pay in equilibrium is constant; their utility does not change with different proportions taken out as tax and fee.

Having done this, equation (10) together with (6) soon boil down to the standard Samuelson condition for both municipalities:

$$U_c^i{}' = MU_G^i{}', \quad i = A, B. \quad (15)$$

Using these solutions in the municipal budget constraint implies that

$$G_i^* = t_i^* y M + \frac{1}{2}. \quad (16)$$

We can thus conclude that even when there are mobile families, the tax rate and public good provision are entirely decided by the Samuelson condition concerning the immobile inhabitants. Hence, there will be Pareto efficient policy rules in both municipalities. Equation (15) assures that the tax rate and public good provision follow the Samuelson condition, and that the marginal rate of substitution is the same in both municipalities, i.e. $U_G^i{}'/U_c^i{}' = 1/M$. From (7) we know that if the tax rates and public goods provision were the same in both municipalities, they would differ in their *MRS*. In order for the median voter in *A* to have the same *MRS* as the one in *B*, there must be a lower tax rate and less public good provision in *A* than in *B*. Hence,

$$t_A^* < t_B^*, \quad G_A^* < G_B^*. \quad (17)$$

Since municipalities gain from having parents in the municipality ($G_i^* > t_i^* y M$), the child-care fee is set as a negative function of the municipal tax rate according to (13), which therefore implies that

$$\varphi_A > \varphi_B. \quad (18)$$

Hence, we have an initial Pareto efficient equilibrium where the two municipalities have different child-care fees and tax rates, but the same number of inhabitants

and net revenues from parents.⁹

3 Introducing a maximum fee

Let us assume that the central government has a preference for cheaper child care. One potential reason for this is that although the decentralized equilibrium is efficient, families with children may have rather low utility since the median voters maximize their own utility without taking the utility of mobile families into account.¹⁰ Therefore, a welfare maximizing government may want to decrease the economy-wide burden on families with children. Increased tax revenue at the national level could be another reason, as hinted in the introduction, and there could of course be other reasons as well. At any rate, the motivation of central policy makers is not the main concern in this paper, but rather the political economy mechanisms in and between municipalities. More exactly, we focus on how the central government can induce municipalities to implement a reform that they do not really like. The central government does not want any parent to pay a larger child-care fee than $\bar{\varphi}$, which is lower than the existing child-care fees, determined in Section 2.2.

3.1 Unchanged tax rates

Since child care is a municipal matter, the central government cannot impose the lower fee directly. However, by offering a *per child* grant, γ to municipalities conditional on decreasing their child-care fee to $\bar{\varphi}$, the central government can indirectly get the desired result. The question is, how large does γ have to be to make municipalities actually adopt $\bar{\varphi}$? Taxes are, for the moment, assumed to be fixed. The rationale for this is that the decision on the implementation of the reform and the tax decision are separate. In Section 3.2 we, however, release this constraint and let municipalities change their tax rates. In order to judge whether the median voters in the two municipalities are better or worse off implementing the reform, it is sufficient to only look at the effects on total net revenues collected from parents. This is because tax rates, and thereby private consumption are constant and that $U''_{CG} \geq 0$; hence, we can just look at the amount of public goods: if it increases, then utility

⁹Net revenues = $t_A^* y N_A - (1 - \varphi_A) N_A = \frac{1}{2} = t_B^* y N_B - (1 - \varphi_B) N_B$.

¹⁰Another potential reason is that families have quite homogenous preferences (or higher stakes as beneficiaries) and have become organized to make the central government come their way.

increases and vice versa.¹¹ When municipality i adopts the lower fee, it makes a loss of $\varphi_i - \bar{\varphi}$ per family. However, it also gets a grant γ per family and more families may move into the municipality thanks to decreased fees.

If a municipality implements the reform, then total net revenue from mobile parents, TR , will change in the following way:

$$\Delta TR = ty(N_1 - N_0) - N_1(1 - \bar{\varphi}) + N_0(1 - \varphi) + \gamma N_1, \quad (19)$$

where $N_0 = 1/2$ and N_1 is the number of parents in the municipality after the reform.¹² Whether the change is positive or negative depends not only on the actual fee loss ($\varphi - \bar{\varphi}$) and on the grant γ , but also on the actions of the other municipality, since migration depends on the *relative* taxes and fees in the two municipalities according to (4). The changes in total revenue for A and B are shown in Table 1 below. Each cell in the table presents $(\Delta TR_A, \Delta TR_B)$.

Table 1: $(\Delta TR_A, \Delta TR_B)$ depending on the two municipalities' actions.

	φ_A	$\bar{\varphi}$
φ_B	0 , 0	$\frac{\gamma(1+\varphi_A-\bar{\varphi})-(\varphi_A-\bar{\varphi})^2}{2}$, $\frac{\bar{\varphi}-\varphi_A}{2}$
$\bar{\varphi}$	$\frac{\bar{\varphi}-\varphi_B}{2}$, $\frac{\gamma(1+\varphi_B-\bar{\varphi})-(\varphi_B-\bar{\varphi})^2}{2}$	$\frac{\bar{\varphi}-\varphi_B-(\varphi_A-\bar{\varphi})(\varphi_A-\varphi_B)+\gamma(1+\varphi_A-\varphi_B)}{2}$, $\frac{\bar{\varphi}-\varphi_A-(\varphi_B-\bar{\varphi})(\varphi_B-\varphi_A)+\gamma(1+\varphi_B-\varphi_A)}{2}$

As is clear from Table 1, if neither of the municipalities adopts $\bar{\varphi}$, then of course nothing happens to TR , and if only one adopts the maximum fee, then the other municipality will for sure make a loss due to a resulting outflow of parents. The effects on TR in the other cases (i.e., when both municipalities adopt the maximum fee or for a sole implementor) depend on the size of the governmental grant, γ .

Proposition 1. *With migration possibilities and for all $\bar{\varphi} < \varphi_B < \varphi_A$, the lowest conditional grant that makes both municipalities adopt the child-care fee $\bar{\varphi}$ is $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$.*

¹¹Also Bergstrom and Blomquist (1996) make the analysis in terms of maximizing net revenues.

¹²This is applicable to both municipalities, and subscript i is suppressed for notational convenience.

Proof. See Appendix B. □

Moreover,

Proposition 2. *The conditional grant $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$ is lower than what would have been required for both municipalities to adopt the reform in absence of migration.*

Proof. Without any migration possibilities, i.e., if parents are also permanent inhabitants, (19) is reduced to

$$\Delta TR_i = N_i(\gamma + \bar{\varphi} - \varphi_i), \quad (20)$$

which means that without migration, municipality i will adopt $\bar{\varphi}$ if and only if $\gamma \geq \varphi_i - \bar{\varphi}$ so that it does not make a loss from implementing the reform. Because $\varphi_A > \varphi_B$, a conditional grant $\gamma \geq \varphi_A - \bar{\varphi}$ would be required for both municipalities to adopt $\bar{\varphi}$ without mobility. Comparing the two grants, we find that a smaller grant is required in presence of mobility:

$$\gamma_{immobile} - \gamma_{mobile} = \varphi_A - \bar{\varphi} - \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}} = \frac{\varphi_A - \bar{\varphi}}{1 + \varphi_A - \bar{\varphi}} > 0. \quad (21)$$

□

Hence, it will be cheaper for the central government to make both municipalities implement the reform in the presence of mobility and thereby create fiscal competition. Actually,

Proposition 3. *With the grant $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$, both municipalities implement the reform, although they both make a loss from doing so.*

Proof. The per-family grant $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$ assures that $\Delta TR_A = 0$ if A is the sole implementor. However, according to Proposition 1, B will also implement the maximum fee, which will reduce A 's total revenues. The effect on total revenues for A when both municipalities adopt the maximum fee is:

$$\Delta TR_A = \frac{\bar{\varphi} - \varphi_B - (\varphi_A - \bar{\varphi})(\varphi_A - \varphi_B) + \gamma(1 + \varphi_A - \varphi_B)}{2} = \frac{\bar{\varphi} - \varphi_B}{2(1 + \varphi_A - \bar{\varphi})} < 0. \quad (22)$$

The effect on total revenues for B is:

$$\begin{aligned}\Delta TR_B &= \frac{\bar{\varphi} - \varphi_A - (\varphi_B - \bar{\varphi})(\varphi_B - \varphi_A) + \gamma(1 + \varphi_B - \varphi_A)}{2} = \\ &= \frac{(\bar{\varphi} - \varphi_A)(\varphi_A - \varphi_B)^2 + (\bar{\varphi} - \varphi_A) - (\bar{\varphi} - \varphi_B)(\varphi_A - \varphi_B)}{2(1 + \varphi_A - \bar{\varphi})} < 0,\end{aligned}\tag{23}$$

since $(\varphi_A - \bar{\varphi}) > (\varphi_B - \bar{\varphi})$ and $(\varphi_A - \varphi_B) < 1$.

□

Hence, we end up in a kind of prisoners' dilemma, where both municipalities adopt the reform despite making a loss.¹³

Comparing changes in total revenue in (22) and (23), we can also see that municipality B loses more than municipality A :

$$\begin{aligned}\Delta TR_A - \Delta TR_B &= \frac{\bar{\varphi} - \varphi_B}{2(1 + \varphi_A - \bar{\varphi})} - \frac{(\bar{\varphi} - \varphi_A)(\varphi_A - \varphi_B)^2 + (\bar{\varphi} - \varphi_A) - (\bar{\varphi} - \varphi_B)(\varphi_A - \varphi_B)}{2(1 + \varphi_A - \bar{\varphi})} \\ &= \frac{(\varphi_A - \varphi_B)[\bar{\varphi}(1 - \varphi_A + \varphi_B) + 1 - \varphi_B + \varphi_A(\varphi_A - \varphi_B)]}{2(1 + \varphi_A - \bar{\varphi})} > 0.\end{aligned}\tag{24}$$

When both municipalities adopt the maximum fee, parents will move from municipality B to A , since the decrease in child-care fee is larger in A . This means that, according to (4), the population in A is no longer $1/2$, but rather

$$N_A = \frac{1}{2} + \frac{\varphi_A - \varphi_B}{2} > \frac{1}{2}.\tag{25}$$

Hence, the former high-fee municipality will now have more inhabitants than the former low-fee municipality.

One may of course think of the possibility to adjust the tax rate and fee optimally as a response to the other municipality's implementation *instead* of introducing the maximum fee. However,

Proposition 4. *If the other municipality introduces the maximum fee, it is always at least as good for the municipality to introduce the maximum fee at a constant tax rate than to optimally change the tax rate and fee.*

¹³Note though that both municipalities still gain from an extra parent moving to the municipality: $t_i^*y + \gamma - (1 - \bar{\varphi}) > 0$. For A , the net gain is $\frac{1}{1 + \varphi_A - \bar{\varphi}} > 0$ and for B it is $\frac{1 + (\varphi_A - \varphi_B)(1 + \varphi_A - \bar{\varphi})}{1 + \varphi_A - \bar{\varphi}} > 0$.

Proof. See Appendix B. □

3.2 Changed tax rates

In Section 3.1 we showed that the central government can make both municipalities adopt the maximum fee $\bar{\varphi}$ by offering them a grant $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$. As shown in (22) and (23), both municipalities face lower net revenue and thereby a decrease in public good provision, implying that $U'_c < MU'_G$. This means that the median voter in each municipality would like to increase his tax rate in order to get more of the public good and thereby restore the equality $U'_c = MU'_G$. However, it is not as simple as that when there are mobile parents; a one-sided higher tax rate would induce an outflow of contributing parents.

The maximum fee $\bar{\varphi}$ can be viewed as an additional constraint on the median voter's maximization problem. Before the reform, the optimal mix of tax rate and public good was determined irrespective of parents, and child-care fees were thereafter set as a function of the tax rate so as to attract parents. This resulted in one municipality having a high tax rate, a large amount of the public good, and low child-care fees (B), whereas the situation was the opposite in the other municipality (A). The maximum-fee reform implies that some of the autonomy is taken away from municipalities, since they cannot freely choose their child-care fees anymore. When the municipalities, who both have implemented the maximum fee, decide on the tax rate, t_i , and the amount of public goods, G_i , the maximization problem therefore looks like

$$\max_{t_i, G_i} U^i(c_i, G_i), \quad i = A, B, \quad (26)$$

s.t. the budget constraint

$$G_i = t_i y M + \frac{1 + y(t_j - t_i)}{2} (t_i y - 1 + \bar{\varphi} + \gamma), \quad j \neq i, \quad (27)$$

where the number of mobile families in the municipality depends on the relative tax rate (since the child-care fee is the same in both municipalities). The first-order conditions give:

$$U_c^i{}' = U_G^i{}' \left[M + \frac{y(\hat{t}_j - 2\hat{t}_i) + 2 - \bar{\varphi} - \gamma}{2} \right], \quad (28)$$

where \hat{t}_i indicates the optimal tax rate after the reform. Equations (27) and (28) together determine the mix of tax rate and public good. This is no longer only a matter of the preferences of the median voter, since child-care fees cannot be used to please parents anymore. Hence, the Samuelson condition is violated and we get an inefficient solution. Tax rates and public goods in the two municipalities are implicitly determined by the following equation system:

$$U_c^A{}' = U_G^A{}' \left[M + \frac{y(\hat{t}_B - 2\hat{t}_A) + 2 - \bar{\varphi} - \gamma}{2} \right], \quad (29)$$

$$G_A = t_A y M + \frac{1 + y(\hat{t}_B - \hat{t}_A)}{2} (\hat{t}_A y - 1 + \bar{\varphi} + \gamma) \quad (30)$$

$$U_c^B{}' = U_G^B{}' \left[M + \frac{y(\hat{t}_A - 2\hat{t}_B) + 2 - \bar{\varphi} - \gamma}{2} \right], \quad (31)$$

$$G_B = t_B y M + \frac{1 + y(\hat{t}_A - \hat{t}_B)}{2} (\hat{t}_B y - 1 + \bar{\varphi} + \gamma) \quad (32)$$

Although this equation system cannot be solved analytically, a couple of things can generally be concluded.

Proposition 5. *After both municipalities have adopted the maximum fee and optimally adjusted their tax rates, the former low-tax municipality will have increased its tax rate but will still have a lower tax rate than the other municipality.*

Proof. When the municipalities have implemented $\bar{\varphi}$, there is an unambiguously positive effect from increasing the tax rate from t_A^* for municipality A:

$$\begin{aligned} \frac{\partial U^A}{\partial t_A} &= -yU_c' + U_G' \frac{2M + 2 + y(t_B^* - 2t_A^*) - \bar{\varphi} - \gamma}{2} \\ &= -yU_c' + U_G' \frac{2M + y(t_B^* - t_A^*) + \varphi_A - \bar{\varphi} - \gamma}{2}, \end{aligned} \quad (33)$$

since $yt_A^* = 2 - \varphi_A$ initially. Initially, before the maximum fee was introduced or any taxes were altered, $U_c' = MU_G'$, which allows us to rewrite (33) as

$$\frac{\partial U^A}{\partial t_A} = U_G' \left[-M + \frac{2M + y(t_B^* - t_A^*) + \varphi_A - \bar{\varphi} - \gamma}{2} \right] > 0. \quad (34)$$

Hence, A will initially increase its tax rate until $\frac{\partial U^A}{\partial t_A} = 0$.¹⁴

However, even if A increases its tax rate and it is unclear what B does, also in the new equilibrium, $\hat{t}_B > \hat{t}_A$. If $\hat{t}_A = \hat{t}_B$ and both municipalities had the same child-care fee, then equally many parents would live in A and B , which in turn would imply that public good provision in the two municipalities would be equal and that the bracketed expressions in (29) and (31) would be identical. This in turn means that $U_c^A / U_G^A = U_c^B / U_G^B$. However, according to (7) this cannot be true.

By the same reasoning, \hat{t}_A cannot exceed \hat{t}_B . If $\hat{t}_A > \hat{t}_B$, then $c_A < c_B$. Moreover, the bracketed expression in (31) would exceed that of (29), implying that $U_c^A / U_G^A < U_c^B / U_G^B$. If this is to hold, it is necessary that $G_A < G_B$. However, from (30) and (32) we get that $G_A - G_B = \frac{y(\hat{t}_A - \hat{t}_B)}{2} [2M + 4 - \hat{t}_A - \hat{t}_B - 2\bar{\varphi} - 2\gamma] > 0$. Hence, \hat{t}_A cannot exceed \hat{t}_B . This means that also after any changes in the tax rates, $\hat{t}_A < \hat{t}_B$. \square

Since A still has a lower tax rate than B while the two municipalities now have the same child-care fee, A will be inhabited by more parents than B :

$$N_A = \frac{1}{2} + \frac{y(\hat{t}_B - \hat{t}_A)}{2} > \frac{1}{2}. \quad (35)$$

In order to assure that there will be a positive number of families living in both municipalities, i.e., $N_A \in (0, 1)$, we have to assume that the after-reform tax rates are not too diverse, i.e., $y(\hat{t}_B - \hat{t}_A) \in (0, 1)$.

Proposition 6. *After the introduction of the maximum fee and after optimal adjustment of tax rates, the median voter in the high-tax municipality is worse off than before.*

Proof. See Appendix B. \square

Hence, after the maximum fee is introduced the median voter in at least one municipality loses even after optimally adjusting the tax rates. Hence, the situation from Section 3.1 that municipalities implement the reform although they lose from doing so prevails also when they can adjust their tax rates to the new situation,

¹⁴It is, however, not clear what B will do, i.e., whether t_B will increase or decrease.

although we cannot generally show what happens to the utility of the median voter in A . Moreover, we have shown that the former low-tax municipality increases its tax rate, while we cannot generally tell what happens to the tax rate in B . In order to see what is likely to happen, we run some numerical simulations.

3.2.1 Suggestions from numerical results

Although we cannot generally find analytical solutions to the equation system (29)–(32), the numerical results suggest that both municipalities increase their tax rates, but not by as much as needed to restore the pre-reform level of the public good.¹⁵ Hence, the median voters in both municipalities get reductions in both private and public goods consumption and thereby lower utility as a consequence of the maximum-fee reform. However, also after the reform, A has a lower tax rate and less of the public good than B . Moreover, the simulations suggest that $U_c^A' > MU_G^A'$ and that $U_c^B' < MU_G^B'$ after the reform. This means that A has a slightly higher and B a slightly lower tax rate than what would have been optimal according to the Samuelson condition. Hence, according to the numerical results, taxes are more compressed after the reform than before.

4 The Swedish reform

We use the Swedish child-care fee reform as an illustrative example of the model and its implications, which should be applicable on a broad spectrum of user-fee reforms and intergovernmental relations also in other countries. The theoretical model in Sections 2 and 3 includes one-child families who face a maximum fee that is lower than the fee they paid before the reform. This is a simplification that grasps the main element in the Swedish reform: the maximum fee. In this section, we briefly describe the Swedish reform and discuss the implementation in the light of the model.¹⁶

In Sweden, subsidized child care is a municipal matter. Since 1995, municipalities are obliged to supply child care to all children aged 1–5. The financing comes from central government grants, local municipal tax revenues, and from parent fees. Even

¹⁵We assume that median voters have the utility function $U_i = \alpha \ln c + \beta_i \ln G$, where $\beta_B > \beta_A$.

¹⁶A more thorough description of the Swedish child-care fee system and the reform is presented in Appendix A.

though the actual pre-reform fee structure was more complex than the situation modeled in this paper, it is quite clear that some municipalities had relatively high fees and low tax rates, while others had the opposite situation. Hence, our model from Section 2.2 gives a fairly good illustration of the pre-reform situation in Sweden.

The maximum-fee reform, which took effect in 2002, aimed at improving the economic situation for families with young children by introducing a new fee structure for publicly subsidized child-care. The central government wanted child-care fees to be considerably lower. Since child care is the responsibility of municipalities, the reform was voluntary, but if municipalities agreed to adopt the new fee structure, they would receive a conditional grant from the central government.

The municipalities claimed that the reform was underfinanced (Central union of local authorities, 2003), and the risk of some municipalities losing money due to the reform was highlighted already in the proposition (Proposition, 1999).

Every single Swedish municipality has adopted the maximum fee structure, although the reform was voluntary. Some municipalities implemented the reform already in 2001, e.g., Gothenburg, Malå, Ragunda, Sundbyberg and Överkalix. From the perspective of our model, these municipalities found the benefits from being sole implementors to be high even without the governmental grant for the first year. In 2002, almost all of the other municipalities implemented the reform, although many of them were skeptical realizing that it would be costly. Comments from some municipalities (e.g., Nacka and Järfälla) show that they were not in favor of the reform due to its negative economic consequences. Still, they both implemented the reform in 2002. Also, the central union of local authorities argued that it would be hard for a single municipality not to implement the reform, although implementation was said to be voluntary (Proposition, 1999).

An illustrative example is a note from the centrist party (Centerpartiet) in the municipality of Högsby, which states that they did not want to implement the reform but felt forced to do it, due to competition from other municipalities (Högsby kommunfullmäktige, 2001). In the parliament debate, the right-wing parties claimed that the reform in fact was not voluntary because of how the reform was financed (Kammarens protokoll, 2000). These claims are clear indications that fiscal competition really played a role in the implementation of the child-care maximum-fee reform.

The two municipalities Karlstad and Kalix implemented the reform in 2003, i.e.,

some time after it had become possible to get the conditional government grant. These municipalities had higher than average tax rates and child care fees that were among the lowest in the country, making them most likely to lose from implementing the reform (as shown in Section 3). According to the municipalities' decisions, they indeed chose not to implement the reform initially because it would be too costly (Kalix's municipality, 2001; Karlstad's municipality, 2001).¹⁷ In terms of our model, being the only municipalities with child-care fees higher than the maximum fee could potentially have caused an outflow of families, which would have caused an even greater loss than adopting the maximum fee.

Again, all Swedish municipalities have adopted the maximum fee in accordance with the central government's intentions, although the reform was said to be voluntary and although the costs for providing child care in many municipalities have increased. Wikström (2007) shows that the change in cost after the reform has been quite small for most municipalities, although for some municipalities the costs have increased substantially. Hence, while some municipalities have lost from the reform, they have chosen to stick with it anyway, probably because they realize they would lose even more if they did not.¹⁸

From the numerical simulations in Section 3.2.1, we predicted both that municipalities would increase their taxes after the reform due to increased costs, and that taxes would become more compressed. It so turns out that the local income-tax rates have indeed increased on average since the implementation of the maximum fee, and that the variance has decreased (Statistics Sweden, 2006b), just as predicted by our model (although aspects other than child care admittedly do affect municipalities' tax rates). To summarize this discussion, the implementation of the Swedish maximum child-care fee is an example of how a central government can take advantage of user-fee competitions between local governments in the implementation of user-fee reforms, as described by our model.

¹⁷In terms of our model they realized that $\gamma < \varphi_i - \bar{\varphi}$.

¹⁸This is well in line with the study by Gustafsson et al. (2002) on an earlier Swedish child care reform, which concludes that local governments respond strongly to incentives set up by the central government.

4.1 Reforms and mobility

As described above, our model illustrates how a central government can take advantage of fiscal competition among local jurisdictions to implement reforms in its own interest. However, this can only be done concerning matters where fiscal competition can be assumed to be a real issue, for instance due to mobility, i.e., if mobility is high in the targeted group, then the scope for the central government to take advantage of the situation is higher.

An illustration of the applicability of the model is that in Sweden, where the reform took place, families with preschool children (0–6 years old) move between municipalities to a much larger extent than most other age groups (except for those aged 18–22), while pensioners are the least mobile citizens (Statistics Sweden, 2003, 2006a). When the government wanted a reform that favored highly mobile families, who municipalities actually gain from attracting and therefore compete over, it could be done without fully compensating the municipalities for their costs through the maximum child-care fee reform.

A similar reform was decided on and implemented just after the maximum child-care fee reform: maximum fees in elder care. The reforms were similar in their claimed purposes; to aid families with small children and the elderly, respectively. However, the reform on maximum fees in elder care was not voluntary for municipalities; on the contrary, they were obliged by law to implement the new fee structure (Proposition, 2000). This indicates that since pensioners are costly to municipalities and are very immobile across municipalities the central government did not have the possibility to underfinance and make this reform voluntary and still get it universally implemented. An illustrative example of the differences between the reforms is the comment in the parliament debate that the child-care reform was theoretically voluntary but in practice as compulsory as the maximum-fee reform in elder care (Kammarens protokoll, 2001).

So, the scope for this fiscal competition mechanism to work increases with the mobility of the group the reform is directed to. For the central government to universally implement a voluntary reform is cheaper for highly mobile groups. These general predictions of the model is in line with what has actually happened in the Swedish case.

5 Conclusions

Using a spatial competition model with mobile citizens and two local jurisdictions, we have shown that a central government can induce local governments to implement a reform they would not have implemented without mobility and fiscal competition. With a conditional grant from the central government, both local jurisdictions implement the reform due to fiscal competition although the grant is not sufficient to cover the losses. The reason is a kind of prisoners' dilemma, where they both find it more profitable to implement than not to, irrespective of what the other jurisdiction does. In general terms, the model illustrates how a central government can take advantage of fiscal competition between local jurisdictions to implement reforms in its own interest.

In this paper we illustrate this by investigating a reduction of child-care fees in a stylized economy with two municipalities. Both municipalities lose net revenues when they reduce their fees and receive the grant. This leads to inefficiency, where too little of a public good is provided in both municipalities. When municipalities alter their tax rates as a consequence of the implemented reform, we find that tax rates are likely to increase in both municipalities, implying that the median voters get a reduction in both private and public goods consumption.

We have modeled the competition in terms of families who are free to move between municipalities. This implies that it can be costly for a municipality not to implement the reform, since families can choose to move to a municipality that has. The results can also be generalized to account for competition in terms of votes and yardstick competition. An incumbent local government could face a very high political cost by not implementing the proposed reform if neighboring municipalities do, as in, e.g., Besley and Case (1995).

The model is applied to a recent Swedish child-care fee reform and can thereby explain the somewhat puzzling observation that all Swedish municipalities implemented a voluntary maximum child-care fee reform although it had a negative impact on the finances of many municipalities.

A Appendix: The Swedish child-care fees

Since 1995, Swedish municipalities are obliged to supply child care to all children aged 1–5, and in the year of the reform, 2002, 85 % of all eligible children were enrolled. The financing comes from central government grants, local municipal tax revenues, and parent fees. Before the maximum fee reform, child-care fees were entirely determined by municipalities, and in 1999 they covered about 16 % of the total costs (Swedish national agency for education, 2000). Before the maximum fee reform, child care fees varied a lot; the difference for a typical family was almost SEK 28,000 (EUR 2,905) per year between the municipalities with the highest and the lowest fees (Swedish national agency for education, 2004).¹⁹ In most municipalities, fees depended largely on family income.

In 2000, the social democratic government delivered Proposition (1999) on the maximum fee and related issues on child care to the parliament. A majority in the parliament (the social democrats and the left and the green party) decided to implement the proposition. A minority, consisting of the center and right wing parties, voted against the reform. The part of the reform that is analyzed in this paper is the maximum fee, which took effect on the first of January 2002. By the first of January 2003, all municipalities had implemented the reform.

Since the reform, municipalities are not allowed to charge fees higher than 3 % of gross family income for the first child in child care, 2 % for the second child and 1 % for the third. The fee for any additional children is zero. There is also a cap stating that there is a maximum amount that municipalities may charge per child. In 2002, the cap implied that no one was to pay more than SEK 1,140; 760; and 380 for the first, second, and third child in child care. Since 2004, the fees are SEK 1,260; 840; and 420 for families earning SEK 42,000 per month or more (Swedish national agency for education, 2007). As discussed by Brink et al. (2007), while families in all income groups faced lower fees after the reform, high income families gained the most in both absolute and relative terms.

Still, there are some possibilities for municipalities to choose a fee structure that is below the maximum. In 2006, 64 % (186 of the 289 municipalities) had fees that did not depend at all on the time children spent in child care. This is an increase

¹⁹Ragunda was the municipality with the lowest fee in 1999, while Täby had the highest. The municipality where the earned income tax was the highest was Ragunda, while Täby had one of the lowest.

from 3 % of all municipalities in 2001, i.e., before the reform was implemented (Swedish national agency for education, 2007).

The Proposition (1999) as a whole consisted of several issues regarding child care. First, children (at least one year old) with unemployed parents or parents on parental leave should be allowed to subsidized child care for at least 15 hours a week. Second, there should be a maximum fee (studied in this paper). Finally, free preschool should be offered to all children between four and five for at least 525 hours per year. The financing of the reform consists of a grant conditional on implementation of the reform. The grant depends on the characteristics of the municipalities. In 2002 and 2003 the grant was SEK 3.4 billion (Swedish national agency for education, 2007). To ensure quality, an additional 500 million SEK per year was granted. The grants are distributed to the participating municipalities according to the standard cost concept based on the number of children and the average cost of child care in Sweden (SFS 2001:160, 2001; SFS 2001:161, 2001).

B Appendix: Proof of Propositions

B.1 Proof of Proposition 1

Proof. Comparing ΔTR_B in Table 1, we see that if municipality A (with the highest initial fee) implements the reform, it is always optimal for B to also implement it, irrespective of the size of the grant, since

$$\begin{aligned} & \frac{\bar{\varphi} - \varphi_A - (\varphi_B - \bar{\varphi})(\varphi_B - \varphi_A) + \gamma(1 + \varphi_B - \varphi_A)}{2} - \frac{\bar{\varphi} - \varphi_A}{2} = \\ & = \frac{\gamma(1 + \varphi_B - \varphi_A) + (\varphi_B - \bar{\varphi})(\varphi_A - \varphi_B)}{2} > 0 \quad \forall \gamma \geq 0. \end{aligned} \quad (36)$$

Hence, it is sufficient to find a grant that makes A adopt $\bar{\varphi}$ to make sure that both municipalities adopt it.

Municipality A has a dominant strategy in implementing the maximum fee, irrespective of the actions of municipality B if the per-family grant $\gamma \geq \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$.²⁰

²⁰This grant leaves TR_A unchanged if A is the sole implementor. If B has already implemented the reform, a smaller grant is sufficient, $\gamma \geq \frac{(\varphi_A - \bar{\varphi})(\varphi_A - \varphi_B)}{1 + \varphi_A - \bar{\varphi}}$, for A to implement the reform as well. However, $\gamma \geq \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$ is the smallest grant for which it is a dominant strategy for A to implement

As shown above, this also implies that B implements the reform.

The next step is to show that there is no lower grant that makes both municipalities adopt the maximum fee. In order for B to have a dominant strategy of implementing the reform irrespective of municipality A 's behavior, it is necessary that $\gamma \geq \frac{(\varphi_B - \bar{\varphi})^2}{1 + \varphi_B - \bar{\varphi}}$. This grant is smaller than the grant needed to make A implement the reform since

$$\frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}} - \frac{(\varphi_B - \bar{\varphi})^2}{1 + \varphi_B - \bar{\varphi}} = \frac{(\varphi_A - \bar{\varphi})(\varphi_B - \bar{\varphi})(\varphi_A - \varphi_B) + (\varphi_A - \bar{\varphi})^2 - (\varphi_B - \bar{\varphi})^2}{(1 + \varphi_A - \bar{\varphi})(1 + \varphi_B - \bar{\varphi})} > 0.$$

Hence, it would be cheaper for the central government to offer a grant that makes B implement the reform and then hope for A to follow than the other way around. However, depending on the relations between φ_A , φ_B , and $\bar{\varphi}$, that grant may not be sufficient for A to also implement the reform. More exactly, if $(\varphi_B - \bar{\varphi}) < (\varphi_A - \bar{\varphi})(\varphi_A - \varphi_B) + (\varphi_B - \bar{\varphi})(\varphi_A - \varphi_B)^2$, then municipality A will not implement the reform conditional on B doing it. Hence, that grant is not sufficiently large to guarantee that both municipalities implement the reform.

Hence, the lowest grant that makes both municipalities voluntarily implement the reform irrespective of the relative difference between φ_A and φ_B is $\gamma = \frac{(\varphi_A - \bar{\varphi})^2}{1 + \varphi_A - \bar{\varphi}}$.

□

B.2 Proof of Proposition 4

Proof. Differentiating (10)–(11), we obtain the optimal reactions of municipality i if municipality j changes its fee φ for $i = A, B; j = A, B; i \neq j$:

$$\frac{\partial t_i}{\partial \varphi_j} = -\frac{(MU_G'' - U_{cG}'')(\varphi_j + yt_j)}{4y(U_c'' - 2MU_{cG}'' + M^2U_G'')} < 0, \quad (37)$$

$$\frac{\partial \varphi_i}{\partial \varphi_j} = \frac{1}{2} - y \frac{\partial t_i}{\partial \varphi_j} > 0, \quad (38)$$

$$\frac{\partial G_i}{\partial \varphi_j} = \frac{(MU_G'' - U_{cG}'')(\varphi_j + yt_j)}{4(U_c'' - 2MU_{cG}'' + M^2U_G'')} > 0, \quad (39)$$

the reform irrespective of B 's behavior.

since we assume that $U''_{cG} \geq 0$. Moreover, the overall effect on the median voter's utility in i is unambiguously positive when the municipality reacts optimally to a fee increase in j :

$$\frac{\partial U_i}{\partial \varphi_j} = -yU'_c \frac{\partial t_i}{\partial \varphi_j} + U'_G \frac{\partial G_i}{\partial \varphi_j} = \frac{U'_G(\varphi_j + yt_j)}{4} > 0, \quad (40)$$

according to (15). If j introduces the maximum fee, i.e., reduces its fee from φ_j to $\bar{\varphi}$, the change in utility for the median voter in i can be approximated by $\frac{U'_G(\bar{\varphi} - \varphi_j)}{2} < 0$, where we evaluate U'_G at the starting point, $U(c_0, G_0)$. This utility loss can then be compared with the utility loss in case of introducing the maximum fee, i.e., the $\Delta TR|\bar{\varphi}$ for municipalities A and B calculated in (22) and (23), multiplied by U'_G evaluated at the starting point. Denoting the utility change in case of altered taxation and fees $\Delta U|t$ and in case of implementing the maximum fee $\Delta U_A|\bar{\varphi}$, we find that

$$\Delta U_A|t - \Delta U_A|\bar{\varphi} = U'_G [(\varphi_A - \bar{\varphi})(\varphi_A - \varphi_B) - (\varphi_A - \bar{\varphi})(\varphi_A - \varphi_B)] = 0, \quad (41)$$

$$\Delta U_B|t - \Delta U_B|\bar{\varphi} = U'_G \left[\frac{(\varphi_B - \bar{\varphi})(\varphi_B - \varphi_A) - \gamma(1 + \varphi_B - \varphi_A)}{2} \right] < 0, \quad (42)$$

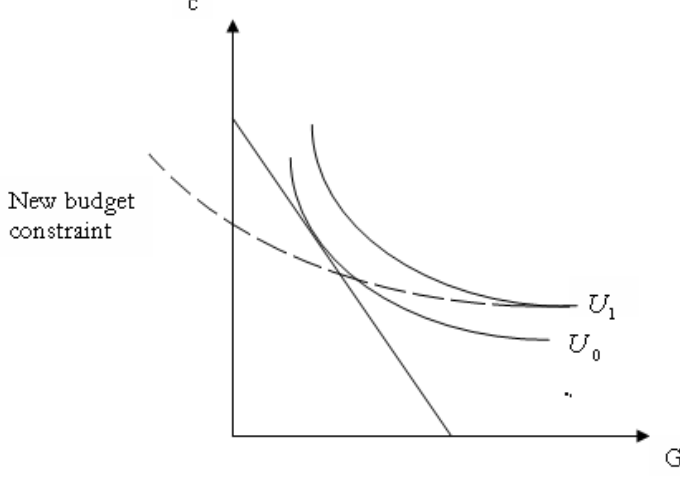
since $\varphi_A > \varphi_B$. Hence, for A it is equivalent to implement the maximum fee or to optimally react with an altered policy, while it is strictly better for B to implement the maximum fee; hence, none of the municipalities could be better off by not implementing the maximum fee. □

B.3 Proof of Proposition 6

Proof. According to the equation system (29) – (32), we cannot generally tell whether utility for the median voters will increase or decrease. We will, however, present two necessary conditions for a utility increase and show that they cannot be simultaneously fulfilled for municipality B . Figure 1 shows what the relation between the solutions before and after the reform must look like in order to have a higher utility for the median voter after the reform than before.

The initial budget constraint is linear with the slope $-M$ and we get a tangency

Figure 1: Possibly higher utility after the reform



point between it and the indifference curve at the initial utility level U_0 according to (15).²¹ After the maximum fee has been implemented, the budget constraint is no longer linear but instead convex and determined by (27). The derivation of the slope and end points of the after-reform budget constraint is presented in Appendix C, and its appearance would be something like the dashed curve in Figure 1. Hence, the two budget constraints will cross where G determined in (16) equals G determined in (27) for the same tax rate, i.e. where $\frac{1}{2} = \frac{1+y(\hat{t}_j - \hat{t}_i)}{2} (yt_i - 1 + \bar{\varphi} + \gamma)$. If the median voter in municipality i is to gain utility after the reform and changed taxes, a necessary condition is that the new tangency point between an indifference curve and the new budget constraint occurs to the right of this crossing; i.e., we require that

$$yt_i - 1 + \bar{\varphi} + \gamma \geq \frac{1}{1 + y(\hat{t}_j - \hat{t}_i)} \quad (43)$$

for the utility to be at least as high as before the reform. In this segment, to the right

²¹The budget constraint is linear, since the municipality can alter φ_i to affect the number of inhabitants.

of the crossing, more of the public good is provided in the new situation than in the old one with the same tax rate, due to an inflow of parents.²² By definition, the new budget constraint is flatter than the old one to the right of their crossing. Hence, a tangency point between the new budget constraint and a higher indifference curve requires that U'_c/U'_G determined in (28) is greater after the reform than before, when $U'_c/U'_G = M$. Hence, for the median voter in municipality i to have at least the same utility as before, the following must hold:

$$y(\hat{t}_j - 2\hat{t}_i) + 2 - \bar{\varphi} - \gamma \geq 0. \quad (44)$$

Hence, equations (43) and (44) are simultaneously necessary for the median voter's utility not to decrease, although they are by no means sufficient. We have shown that the former high-tax municipality still has a higher tax rate, i.e., $\hat{t}_B > \hat{t}_A$. Rewriting (44) for B gives

$$y\hat{t}_B - 1 + \bar{\varphi} + \gamma \leq 1 - y(\hat{t}_B - \hat{t}_A) < 1, \quad (45)$$

since $y(\hat{t}_B - \hat{t}_A) \in (0, 1)$. Rewriting (43) gives

$$y\hat{t}_B - 1 + \bar{\varphi} + \gamma \geq \frac{1}{1 + y(\hat{t}_A - \hat{t}_B)} > 1. \quad (46)$$

Hence, if they both are to hold, we must have the following

$$1 < y\hat{t}_B - 1 + \bar{\varphi} + \gamma \leq 1 - y(\hat{t}_B - \hat{t}_A) < 1, \quad (47)$$

which obviously is not true. Hence, the two necessary conditions for higher utility cannot be fulfilled at the same time in municipality B , and we can conclude that the median voter in B gets reduced utility also after having optimally modified the tax rate.

□

²²Note that this is a necessary requirement for higher utility; we have not shown that this segment actually exists.

C Appendix: The shape of the after-reform budget constraint

Differentiating (27) with respect to yt_i , we get the slope of the new budget constraint as

$$\frac{dG_i}{dc_i} = -M - \frac{y(\hat{t}_j - 2t_i) + 2 - \bar{\varphi} - \gamma}{2} < 0, \quad (48)$$

which is convex since

$$\frac{d^2G_i}{dc_i^2} = 2y > 0. \quad (49)$$

Its starting point, where $t_i = 0$ yields a negative amount of G_i :

$$G_i|_{t_i=0} = \frac{1 + yt_j}{2}(\bar{\varphi} + \gamma - 1) < 0, \quad (50)$$

and the endpoint where $t_i = 1$ yields a larger amount of G_i than before the reform:

$$G_i|_{t_i=1} = yM + \frac{1 + y(t_j - 1)}{2}(y - 1 + \bar{\varphi} + \gamma) > yM + \frac{1}{2}, \quad (51)$$

since the expression within parenthesis (the net contribution from one family) is positive and since $y(t_j - 1) > -1$ is required for both municipalities to be inhabited by a positive number of families with children. Hence, the new budget constraint will look something like the dashed curve in Figure 1.

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