Voluntary co-financing versus lobbying for public good provision

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Abstract: We study voluntary co-financing of a centrally provided public good by two local districts in a political economy framework. Taxes are collected by both local governments and by the central government. We compare outcomes with co-financing only, lobbying only, and with combined co-financing and lobbying to a surplus maximizing level of public good provision. We show that co-financing raises the provision of the public good as compared to the surplus maximizing provision. Both districts have an incentive to provide positive levels of co-financing. Co-financing and lobbying are substitutes to one another, so that co-financing can be used to reduce rent-seeking. Lobbying does not necessarily raise the level of public good provision, however, but this depends on the district’s tax share and its mean preference for the public good. Richer districts are more likely to lobby for lower provision of the public good. Combined co-financing and lobbying yield ambiguous results. High weight given to lobbying combined with co-financing exceeding some threshold value reduce the provision of the public good below the surplus maximizing level. The results are
relevant to, e.g., the on-going negotiations to build high-speed rail in Sweden with co-financing by municipalities along the planned route.

**Keywords**: co-financing; fiscal federalism; lobbying; political economics; rent-seeking
Introduction

The level of government, local or central, financing certain governmental outlays has traditionally been very strictly regulated in Sweden. For example, municipalities and county boards have been forbidden from financing national level transport infrastructure projects and higher education, which have been the sole responsibility of the central government. This has changed of late, however, with the introduction of the so called voluntary co-financing by municipalities, regions or the private sector.\(^1\) The possibility for the municipalities or county boards to co-finance national transport infrastructure investments, both roads, railroads and sea lanes, was introduced in 2010, in conjunction with the National Transport Infrastructure Plan for 2010-2021. The local-level government can co-finance the investment, either through pecuniary or in-kind contributions. Similarly, local governments have been allowed to co-finance higher education since 2009. (Statskontoret, 2014).

Over the period from 2010 to 2013, the receipts to the central government from local government co-financing towards national transport infrastructure projects were 4.1 billion SEK.\(^2\) The planned co-financing in 2013 and thereafter is 9.4 billion SEK. 29 % of this goes towards investments in roads, 19 % to roads and railroads, 50 % to railroads only, and 2 % to sea lanes. Local government outlays towards higher education (universities and university colleges) increased from 365 million SEK in 2009 to 481 million SEK in 2012. Most of these funds go to the nearest local higher education establishment. (Statskontoret, 2014).

Co-financing of transport infrastructure projects by private or local actors has been suggested as a possible remedy to the unreliableness of the cost-benefit analyses (CBA) that precede the building of such projects. Thus, according to this view, co-financing private actors would have an incentive to

\(^1\) Voluntary co-financing differs from obligatory outlays that the municipalities are required to make by law. An example of an obligatory outlay is the municipalities’ share of costs towards personal assistants. Moreover, voluntary co-financing differs from co-financing of, e.g., EU’s structural funds and programs, where local co-financing is a pre-requisite for obtaining funds. (Statskontoret, 2014).

\(^2\) The exchange rate on July 1\(^{st}\), 2010 was 9.61 SEK/EURO and 7.13 SEK/USD. On July 1\(^{st}\), 2013, the exchange rates were 8.71 SEK/EURO and 6.7 SEK/USD.
make a more reliable CBA and their willingness to co-finance would therefore add to information about a project’s profitableness, and eventually, stop the building of essentially unprofitable or risky projects (Flyvbjerg, 2009). As argued by Jussila Hammes (2013), however, if co-financing is provided not by private actors but by municipalities, the argument does not hold. Thus, as noted in the literature on fiscal federalism (e.g., Besley and Coate (2003); Knight (2004)), public goods such as transport infrastructure provide geographically concentrated benefits to recipient jurisdictions, but disperse costs on a national tax base. Since co-financing by municipalities usually only covers a part of the infrastructure cost (Mellin, et al., 2012), co-financing municipalities only have at best weak incentives to gather more information about the investment’s profitability, since even with co-financing the greatest part will be paid for by others. Moreover, at least in Sweden, the municipalities do not conduct their own CBAs for state-financed infrastructure. Consequently, Flyvbjerg’s idea cannot be used by the central government to assess the reliability of CBA.

Nevertheless, the preparedness of municipalities to co-finance, and hence take on some of the financial risk, may signal that the project has a high priority to them, even though the motives for this prioritization may be unclear. Therefore, co-financing and lobbying, while not giving the central government any reassurance on the value of the project, may give more information about local preferences. The stated aim of co-financing in Sweden has been to augment the available transport infrastructure budget.

In the literature, co-financing can both refer to transfers from the central government to the subnational governments in order to finance some policy, for which the subnational government is responsible for, or to the common financing of some policy by some pre-determined shares. An example of the former is Rodden (2002), who studies ‘fiscal indiscipline’ among subnational governments which leads the central governments to provide ‘special bailout transfers’ or otherwise assume their liabilities. It is, however, the latter type of studies that is prevalent. Thus, Kirschke et al. (2006) examine agricultural policy in Saxony-Anhalt, where different policies are being financed by
the EU and either both the federal and the state (Bundesland) governments, or only by the state
government. The co-financing share in this context is fixed for respective level of government, even
though the budget is not. Feld and Schaltegger (2005) discuss conditional and lump-sum transfers.
Conditional grants are available when certain restrictions are met by the recipient governments,
whereas lump-sum grants are unconditional. Conditional grants often take the form of matching
grants: A certain amount of a specified project is financed by the donating government, but has to be
supplemented by expenditure of the recipient government (co-financing). The focus of Feld and
Schaltegger’s analysis is on examining how voting may restrict the intake of intergovernmental grants
by Swiss cantons. Grossman (1994) considers the impact of state interest groups in order to explain
the distribution of intergovernmental grants. He formulates and tests a model in which grants are
assumed to buy the support of state voters, state politicians and state interest groups.

In this paper, we study voluntary co-financing together with lobbying as a means for the local
government to influence the central government. Therefore, it is not the central government that co-
finances the local government but vice versa – the local government co-finances the central one. We
show that co-financing and lobbying are substitutes to each other as means for influencing the
central government. Instead of using co-financing to reduce uncertainty, it can then be used to
reduce rent-seeking (see also Glazer and Proost (2014)). We build on the model by Besley and Coate
(2003), who develop a model for the centralized versus decentralized provision of local public goods
with citizen-candidates as legislators. We further draw on the district demand model in Helland and
Sørensen (2009). Lobbying is modelled as in Grossman and Helpman (1994) and Dixit et al., (1997),
who examine the effects of campaign contributions by special interest groups on public policy
decision-making. Here the political contribution is not a campaign contribution, however, but either
the use of a local government’s resources to influence central policy-makers by promises of future
positions in a municipality-owned company’s board or other such position (Cadot, et al., 2006), or
simply time spent away from more important concerns, trying to persuade the central government
to invest in a district (Glazer & Proost, 2014). Co-financing is a voluntary contribution by the co-financing municipality, drawing on its tax base, to the state budget.

The paper is organized as follows: In the next section we set up the basic model and reproduce the results pertaining to the surplus maximizing public good provision from Besley and Coate (2003) for reference. In Section 3 we study how co-financing only, without the inclusion of lobbying, influences the provision of a public good and what incentives the districts have to co-finance. In Section 4 we introduce political economics in the model by allowing lobbying, studying first the impact of lobbying alone on the provision of the public good, and then lobbying together with co-financing. The final section discusses the results and concludes.

The model

As in Besley and Coate (2003), the economy is divided into two geographically distinct districts indexed by \( j \in \{1, 2\} \). Each district has a continuum of citizens with a mass of unity. There are three goods in the economy; a single private good, \( c_j, j \in \{1, 2\} \), and two local public goods, \( g_1 \) and \( g_2 \), each one associated with a particular district.

We define utility for citizen \( i \) in district \( j \) over private and public consumption. Citizens in district \( j \) enjoy equal amounts of pre-tax income, \( y_{ij} = y_j \), private consumption, \( c_{ij} = c_j \), and consume a public good, each individual in municipality \( j \) consuming \( g_{ij} = g_j \) (e.g., national transport infrastructure or higher education). Moreover, each citizen in district \( j \) is characterized by a public good preference parameter \( \lambda_{ij} \). Utility function for citizen \( i \) in municipality \( j = \{1, 2\} \) is given by

\[
U_{ij} = c_{ij} + \lambda_{ij} \left[ (1 - \kappa)H(g_j) + \kappa H(g_{-j}) \right].
\]

The parameter \( \kappa \in [0, 1/2] \) indexes the degree of spill-overs; when \( \kappa = 0 \) citizens care only about the public good in their own district, while when \( \kappa = 1/2 \) they care equally about the public goods in both districts. While spill-overs are the same for all citizens, those with higher \( \lambda \)'s value public goods
more highly. (Besley & Coate, 2003). Utility is linear in private income, and we assume that $H'(\cdot) > 0$ with $H''(\cdot) \leq 0$.

In each district, the range of preference types is $[0, \bar{\lambda}]$. The mean type in district $j$ is denoted by $m_j$ and we assume throughout that this equals the median type. We assume that the average citizen in district 1 is at least as pro-public spending as her counterpart in district 2, so that $m_1 \geq m_2$. (Besley & Coate, 2003, p. 2615). Unlike in Besley and Coate, we do not consider electoral politics however, but assume that the central government attempts to maximize the mean citizen’s welfare in respective district.

Both the local and the central government can levy an ad valorem income tax on citizens in order to finance the provision of the public good, and to raise resources for lobbying. Let $0 \leq t_j \leq 1$ be the local income tax rate and $0 \leq \tau \leq 1$ the national income tax rate. The private budget constraint of a representative citizen in district $j$ is then

$$c_j = (1 - t_j - \tau)y_j.$$  

Substituting equation (2) into (1) yields the indirect utility function for the mean citizen in district $j$:

$$v_j(t_j, \tau, y_j, g_j) = (1 - t_j - \tau)y_j + m_j[(1 - \kappa)H(g_j) + \kappa H(g_{-j})].$$

Assume both levels of government must balance their budget. We can then define the two governments’, the local and the central government budget constraints as follows, respectively:

$$t_jy_j = \alpha_j g_j + L_j(g_j)$$

$$\tau y = \sum_{j=1,2} (1 - \alpha_j)g_j.$$  

$\alpha_j \in [0,1]$ is the share of the cost of the public good paid for by district $j$ (co-financing); if $\alpha = 1$ the public good is provided entirely by the district and if $\alpha = 0$, the central government alone provides the public good. $L(g_j) \geq 0$ is resources spent on lobbying.$^3$ The criterion for comparing the

$^3$L($g_j$) represents resources used for pure rent seeking.
performance of the different regimes is the aggregate public good surplus. With public good levels \((g_1, g_2)\), this is

\[
W(g, \alpha) = \sum_{j \in \{1, 2\}} [\alpha_j (1 - t_j)y_j + (1 - \alpha_j)(1 - \tau)y_j] + [m_1(1 - \kappa) + m_2\kappa]H(g_1) + [m_2(1 - \kappa) + m_1\kappa]H(g_2).
\]

\(g\) is the vector of public good provision in the two districts and \(\alpha\) is the vector of co-financing by the two districts. The surplus maximizing public good levels in the absence of co-financing are given by

\[
[H'(g_1^*), H'(g_2^*)] = \left[\frac{1}{m_1(1 - \kappa) + m_2\kappa}, \frac{1}{m_2(1 - \kappa) + m_1\kappa}\right].
\]

Because of the concavity of \(H(\cdot)\) a lower value of (7) indicates a higher level of provision of \(g_j\).

Therefore, \(m_1 > m_2\) indicates that the optimal provision of the public good is higher in district 1 for all \(\kappa < 1/2\) (Besley & Coate, 2003).

Co-financing of the public good

In this section we introduce voluntary co-financing of public service provision by the districts. Co-financing in Sweden has been a means for the central government to augment the funds available for investment. In this section, we do not further explain why the central government may want to allow co-financing but only study its consequences for public service provision and the districts’ optimal responses to co-financing. The next section introduces political economics including lobbying for public good provision, which offers one explanation to why co-financing may be preferable to other means of influence-seeking by districts.

Co-financing means that the local and the central governments share the financing burden of the provision of the public good. Since we are interested in public goods that even with co-financing are the sole responsibility of the central government, we will from here on diverge from existing literature and assume that the central government ultimately determines the level of public good provision even with full co-financing.
Maximizing equation (6) for both districts yields

\[
(8) \quad [H'(g_1^f), H'(g_2^f)] = \left[ \frac{\alpha_1^2 + (1 - \alpha_1) \sum_{j \in \{1,2\}} (1 - \alpha_j)y_j/y}{m_1(1 - \kappa) + m_2\kappa}, \frac{\alpha_2^2 + (1 - \alpha_2) \sum_{j \in \{1,2\}} (1 - \alpha_j)y_j/y}{m_2(1 - \kappa) + m_1\kappa} \right].
\]

The optimal provision of the public good is then a function of the degree of co-financing in both districts. The optimal level of public good provision for district 1 therefore depends on co-financing by district 2, and vice versa. This is depicted in Figure 1 for three values of $\alpha_{-j}$, and assuming that $y_j/y = 0.5$, choosing $m_1$, $m_2$ and $\kappa$ so that the denominator equals one. Depending on the value of $\alpha_{-j}$, equation (8) reaches a minimum (indicating maximum provision of the public good) in the interval $\alpha_j \in (0,1)$. Allowing co-financing can therefore raise the provision of the public good as compared to the surplus maximizing level shown in equation (7).

![Graph showing equation (8) for three values of $\alpha_{-j}$, 0, 0.5 and 1, and at $y_j/y = y_{-j}/y = 0.5$, choosing $m_1$, $m_2$ and $\kappa$ so that the numerator equals one.](image)

*Figure 1. Equation (8) in district $j$ at three values of $\alpha_{-j}$, 0, 0.5 and 1, and at $y_j/y = y_{-j}/y = 0.5$, choosing $m_1$, $m_2$ and $\kappa$ so that the numerator equals one.*

We formulate the first co-financing related results:
Proposition 1. (i) Co-financing in the interval \( \alpha_j \in (0, 1) \) raises the provision of the public good in district \( j, g_j \), above the surplus maximizing level. (ii) Co-financing in the interval \( \alpha_{-j} \in (0, 1) \) by district \( -j \) raises the provision of the public good in district \( j \). (iii) An increase in district \( j \)’s share of income, \( y_j \), raises the provision of the public good if \( \alpha_j > \alpha_{-j} \) \( \forall \alpha_j, \alpha_{-j} \in (0, 1) \) and lowers it otherwise.

Proof: We prove each of the three parts of Proposition 1 separately:

i. We prove the existence of an interior minimum of equation (8) by differentiating it with respect to (w.r.t.) \( \alpha_j \): \[ \frac{\partial H'(g_j^f, \alpha)}{\partial \alpha_j} = \left[ 2\alpha_j(y + y_j) - 2y_j - (1 - \alpha_{-j})y_{-j} \right]/y[m_1(1 - \kappa) + m_2\kappa]. \]

The second order condition (s.o.c.) is positive indicating that the function reaches a minimum at \( \alpha_j = \left[ (1 - \alpha_{-j})y_{-j} + 2y_j \right]/2(y + y_j) \). The function reaches a local maximum at \( \alpha_j = 0 \), where the first order condition (f.o.c.) is \[ \frac{\partial H'(\alpha_j = 0)}{\partial \alpha_j} = -\left[ 2y_j + (1 - \alpha_{-j})y_{-j} \right]/y[m_1(1 - \kappa) + m_2\kappa] < 0, \] that is, the function is falling at this point. It reaches another local maximum at \( \alpha_j = 1 \), where the f.o.c. is \[ \frac{\partial H'(\alpha_j = 1)}{\partial \alpha_j} = 2y - (1 - \alpha_{-j})y_{-j}/y[m_1(1 - \kappa) + m_2\kappa] > 0, \] that is, the function is increasing at this point.

Therefore, the point where \( \frac{\partial H'(g_j^f, \alpha)}{\partial \alpha_j} = 0 \) is an interior minimum in the interval \( \alpha_j \in [0, 1] \).

It remains to show that the supply of the public good with co-financing exceeds that at the surplus maximizing level, that is, that \( H'(g_j^f) < H'(g_j^*) \). We do this by showing that the opposite is impossible. Solving \[ H'(g_j^f, \alpha_j = 0) = [y_j + (1 - \alpha_{-j})y_{-j}]/y[m_j(1 - \kappa) + m_{-j}\kappa] > H'(g_j^*) = 1/[m_j(1 - \kappa) + m_{-j}\kappa] \Leftrightarrow -\alpha_{-j}y_{-j} > 0, \] which is impossible. Therefore, at \( \alpha_j = 0 \), co-financing will raise the provision of the public good compared to the surplus maximizing case, except if \( \alpha_{-j} = 0 \), too, in which case the public good is provided at the surplus maximizing level.
Similarly, solving $H'(g^f_j, \alpha_j = 1) = 1/[m_j(1 - \kappa) + m_{-j}\kappa] = H'(g^f_j)$. Thus, at $\alpha_j = 1$ the provision of the public good equals the surplus maximizing level.

ii. Differentiating equation (8) w.r.t. $\alpha_{-j}$: $\partial H'(g^f_j, \alpha)/\partial \alpha_{-j} = -(1 - \alpha_j) y_{-j}/y[m_j(1 - \kappa) + m_{-j}\kappa] < 0$, which is unambiguously negative. Co-financing by district $-j$ therefore lowers equation (8) and raises the public good provision to district $j$.

iii. Differentiating equation (8) w.r.t. $y_j$: $\partial H'(g^f_j, \alpha)/\partial y_j = (1 - \alpha_j)(\alpha_{-j} - \alpha_j)/y^2[m_j(1 - \kappa) + m_{-j}\kappa]$. This is positive as long as $\alpha_{-j} > \alpha_j$, indicating that an increase in $y_j$ lowers the provision of the public good. If $\alpha_{-j} < \alpha_j$, the first-order condition (f.o.c.) is negative and the provision of the public good increases as $y_j$ rises. ■

Why would the districts co-finance the provision of the public good to a level that exceeds the surplus maximizing one? Maximizing the districts’ indirect utility function, equation (3), w.r.t. $g^f_j$ and solving for the optimal provision of the public good from the district’s point of view yields

$$H'(g^f_j) = \frac{\alpha_j y + (1 - \alpha_j)y_j}{ym_j(1 - \kappa)}.$$

Equating equation (8) with equation (9) allows us to solve for district $j$’s reaction function. In order to be able to solve the resulting second order condition we must assume that $8y_j^2 + 6y_j y_{-j} + (2 - \alpha_{-j})y_{-j} = 2y_j y_{-j} + \alpha_{-j}y_{-j}^2$, however. One of the roots yields $\alpha_j > 1$. We therefore concentrate on the root within the allowable range. This yields

$$\alpha_j = \frac{y_{-j}(1 - \alpha_{-j})}{2y_j + y_{-j}}.$$

$\hat{\alpha}_{-j}$ is the co-financing share of district $-j$, taken as given by district $j$. District $j$ will therefore provide co-financing in relation to its own and district $-j$’s income. District $j$’s co-financing increases in district $-j$’s income, $y_{-j}$, and it decreases in district $j$’s own income, $y_j$ and in district $-j$’s co-financing, $\hat{\alpha}_{-j}$. District $j$’s optimal level of co-financing equals zero only if district $-j$ co-finances the
entire provision of its public good, that is, if \( \hat{a}_{-j} = 1 \). Optimal co-financing may approach 1 if district \( j \)'s income is very low compared to the income of district \(-j\), and given that the co-financing share of district \(-j\) is 'sufficiently' low.

A political economy approach

We proceed to construct a political economic model of co-financing. We build on models by Grossman and Helpman (1994) and Dixit et al. (1997). From equation (3) using (4) and (5) the mean citizen in district \( j \) attains the utility level

\[
(10) \quad v_j = w_j(g, \alpha) - L(g_j, \alpha_j),
\]

where

\[
(11) \quad w_j(g, \alpha) \equiv \left[ 1 - \frac{\alpha_j g_j}{y_j} - \sum_{k \in \{1,2\}} (1 - \alpha_k) g_j \right] y_j + m_j \left[ (1 - \kappa) H(g_j) + \kappa H(g_{-j}) \right].
\]

Equation (10) decomposes the district’s welfare into two components: welfare from consumption attainable at public service levels \( g \) in the absence of lobbying, \( w_j(g) \), and the utility loss associated with the political payments, \( L(g_j) \).\(^4\)

The central government cares about the total level of resources spent on lobbying and co-financing, and about aggregate welfare. The government values lobbying either as a source of future private benefit or as information. Social welfare is a concern of the incumbent government if voters are more likely to re-elect a government that has delivered a high standard of living. The government then has a preference function \( G(g_j, L(g_j)) \), where \( L(g_j) \) is the vector of the principals’ outlays for lobbying. Principal \( j \) can choose a payment function \( L(g_j) \) from a set \( L \) and the agent can choose \( g \) from a set \( \mathcal{H} \). These sets describe feasibility and institutional constraints. The function \( G \) is increasing in each component of \( L(g_j) \). Thus, for any given action, each principal dislikes making contributions

\(^4\) We do not consider lobbying as campaign contributions, as is the case in, e.g., Grossman and Helpman (1994). Instead, \( L(g_j) \) should be seen as a post-politics position in a board of a municipality-owned company or other such position (Cadot, et al., 2006) or simply time spent away from more important concerns, trying to persuade the central government to invest in a district (Glazer & Proost, 2014).
and the agent likes receiving them. Each principal determines her contribution taking the
contribution of the other principal as given.

We do not prove the existence of a truthful equilibrium in this paper; the reader is referred to Dixit et
al. (1997). We assume that the preference functions of the principals and the agent have the quasi-
linear form. Thus, the central government’s objective function is given by

\[ G(g, L(g), \alpha) = W(g, \alpha) + \gamma \sum_{j \in \{1, 2\}} L_j(g_j, \alpha_j). \]

\( W(g, \alpha) \) is defined in equation (6). Consider then a truthful equilibrium in which the action is a
vector \( g^0 \) and all payments \( L(g_j) \) are in the set of feasible policies and payment functions. Solving
for

\[ (g^0, \alpha^0) = \arg\max_{(g, \alpha) \in \mathcal{H}} W(g, \alpha) + \gamma \sum_{j \in \{1, 2\}} w_j(g, \alpha), \]

yields the politically optimal allocation of public services in the two districts.

Optimal lobbying

\( L'(g_j) \) can be solved for by maximizing (10):

\[ L'(g_j) = -\alpha_j - \frac{(1 - \alpha_j)y_j}{y} + m_j(1 - \kappa)H'(g_j). \]

The marginal lobbying function is determined by two factors. The first is the tax cost of public good
provision, which comprises of the two first terms on the right-hand side (RHS). The second is the
benefits arising from the consumption of the public good, the last term on the RHS, which is
determined by the mean voter’s preferences for public goods, the extent of spill-overs, and finally,
the marginal public good benefit function \( H \).

Lobbying must always be non-negative, and the lobbying function is concave: \( L''(g_j) = m_j(1 - \kappa)H''(g_j) < 0 \) because of the concavity of \( H(\cdot) \). Thus, \( L \) is positive function with a maximum
at the point where \( m_j(1 - \kappa)H'(g_j) = \alpha_j + (1 - \alpha_j)y_j/y \). The optimal level of marginal lobbying is
determined by the point where the slope of the marginal benefits from lobbying to the district equal the slope of the government’s utility function, given lobbying by district \(-j\), the weight given to lobbying and general welfare and the truthfulness conditions delineated by Dixit et al. (1997).

We formulate the relationship between lobbying and co-financing in the following proposition:

**Proposition 2.** Lobbying and co-financing are substitutes.

**Proof:** Differentiating equation (13) w.r.t. the share of co-financing, \(\alpha_j\) yields \(\partial L'(g_j) / \partial \alpha_j = -1 + \gamma_j / \gamma < 0\), that is, marginal lobbying falls when co-financing increases. Co-financing is therefore a substitute to lobbying. \(\blacksquare\)

Co-financing can then be used to reduce rent seeking. This finding complements that in Glazer and Proost (2014), who show that a homogenous polity may go for universal provision of a public good in order to reduce rent seeking. Unlike Glazer and Proost, the present model does not include a measure of the society’s homogeneity.

We will next examine the impact that lobbying in the absence of co-financing has on the provision of the public good, before turning to the more complicated case with lobbying and co-financing.

**Lobbying without co-financing**

In the absence of co-financing, \(\alpha_j = 0, \ j \in \{1,2\}\), but in order to finance lobbying, the local tax rate must be positive, that is, \(t_j > 0\). The equilibrium provision of the public good in the two districts is

\[
(14) \quad [H'(g^1_1), H'(g^1_2)] = \left[ \frac{1 + \gamma \frac{y_1}{y}}{m_1(1 + \gamma)(1 - \kappa) + m_2 \kappa}, \frac{1 + \gamma \frac{y_2}{y}}{m_1 \kappa + (1 + \gamma)(1 - \kappa)m_2} \right]
\]

If the weight on lobbying equals zero, \(\gamma = 0\), this simplifies to equation (7).

We formulate the first lobbying related result:

**Proposition 3.** Whether lobbying raises or lowers the provision of the public good relative to the surplus maximizing level depends on the relative sizes of \(\gamma_j / \gamma\), \(m_j\) and \(\kappa\).
i. If \( y_j / y > m_j (1 - \kappa) / [m_j (1 - \kappa) + m_{-j} \kappa] \), the (negative) tax impact of the public good provision exceeds the (positive) benefit from greater provision to the mean citizen, and district \( j \) lobbies for the central government to lower the provision of the public good as compared to the case without lobbying.

ii. If \( y_j / y < m_j (1 - \kappa) / [m_j (1 - \kappa) + m_{-j} \kappa] \), the public good impact exceeds the tax impact and district \( j \) lobbies for a higher provision of the public good.

Proof: Examining when \( H'(g_j) \) from equation (14) exceeds \( H'(g_j) \) from equation (7), which indicates that the surplus-maximizing level of public good provision exceeds provision with lobbying, and solving yields \( y_j / y > m_j (1 - \kappa) / [m_j (1 - \kappa) + m_{-j} \kappa] \). Case (ii) is then a corollary.

Given the assumption that \( m_1 \geq m_2 \), all else equal, district 1 is at least as likely to lobby for a greater provision of the public good as district 2. The richer of the two districts (the one with higher \( y_j \)), all else equal, will lobby for less public good provision than the poorer district. The latter effect is due to the tax cost of public service provision: the richer district pays a greater share of the public good than the poorer district. This finding is in line with the district demand model (Helland & Sørensen, 2009), which shows that a district’s demand for the public good falls when the district’s tax share increases. The district demand model does not explicitly include lobbying, however.

Lobbying with co-financing

Given that co-financing is allowed, \( \alpha_j \in (0, 1), \forall \ j \in \{1, 2\} \). A government maximizing its objective function given by equation (12) with co-financing also takes into account the impact of lobbying on the local tax rate. Therefore, we use (13) to substitute for marginal lobbying in the general welfare function. Maximizing equation (12) then yields:

\[
H'(g^0_j) = \frac{y[a_j y + (1 - a_j)y_j] - (1 - a_j)[a_j y_j - \sum_{k \in \{1, 2\}} (1 - \alpha_k)y_k]}{y[m_j (1 - \kappa)(1 + y - a_j) + m_{-j} \kappa]}. 
\]
The first term on the right-hand side (RHS) in the brackets in the numerator is due to lobbying and arises from the impact on district \( j \)’s taxes from the need to raise taxes for public good provision. The term serves to lower the provision of the public good. The second term in brackets is of ambiguous sign. The first term in the second brackets, which arises from the impact that public good provision has on the local tax rate lowers the numerator consequently raising public good provision. The term enters the equation because the central government takes the cost of lobbying for the district into account in its welfare function. The second term in the second brackets, which arises from the impact of public good provision on the central tax rate is positive and lowers public good provision. Lobbying and co-financing change the denominator so that it becomes very difficult to compare it with the surplus maximizing equation (7). As long as \( \gamma - \alpha_j > 1 \), the numerator exceeds the numerator in equation (7), indicating a higher level of public service provision than the surplus maximizing one.

We formulate the impact of combined lobbying and co-financing on the provision of the public good in the following proposition:

**Proposition 4.** With lobbying, the impact of co-financing on the provision of the public good is ambiguous as compared to the surplus maximizing provision. Co-financing may raise the provision of the public good at values of \( \alpha_j \) below some threshold value if \( \gamma \) is ‘sufficiently’ low and income is ‘sufficiently’ equally divided between the two districts. At values of \( \alpha_j \) and \( \gamma \) above some threshold values and/or \( y_j/y \) below some threshold value, a marginal increase in co-financing unambiguously lowers the provision of the public good.

**Proof:** Differentiating equation (15) w.r.t. \( \alpha_j \) and simplifying yields
(16) 
\[
\frac{\partial H'(g^0_j, \alpha_j)}{\partial \alpha_j} = \frac{m_j(1-\kappa)(2a_j^2 + a_j - 2 + \gamma)y_j - [\alpha_{-j}(1 - a_j) - \gamma(1 + a_j)]y_{-j}}{[m(1-\kappa)(1 + \gamma - a_j) + m_{-j}\kappa]^2} \\
+ \frac{m_j(1-\kappa)(\gamma - a_j) + m_{-j}\kappa)[(4a_j - 3)y_j - (1 - a_{-j} - \gamma)y_{-j}]}{[m(1-\kappa)(1 + \gamma - a_j) + m_{-j}\kappa]^2}
\]

Depending on the parameter values, equation (16) can take either positive or negative values. At values of \(\gamma\) below some threshold and if income is ‘sufficiently’ equally divided between the two districts, the equation is negative if even \(a_j\) is below some threshold value. At sufficiently high values of \(\gamma\), or at an uneven division of income, the equation is unambiguously positive indicating that increased co-financing lowers the provision of the public good. ■

In order to illustrate equations (15) and (16) we depict them in Figures 2 and 3, respectively. From Figure 2 we can see how co-financing by district \(-j\), \(\alpha_{-j}\), and the weight given to lobbying \(\gamma\), influence the marginal benefits from the public good –function, \(H\). Public good provision is uniformly higher at high levels of co-financing by district \(-j\), that is, when \(\alpha_{-j} > 0\). Public good provision falls the greater is \(\gamma\), so that at sufficiently high levels of \(\gamma\) (not shown in the figure) and given that \(\alpha_{-j} = 0\), the provision of the public good is lower than the surplus maximizing level regardless of \(a_j\). At \(\alpha_{-j} > 0\) there exist some values of \(\alpha_{-j}\) below a threshold that yield a higher provision of the public good than the surplus maximizing level regardless of \(\gamma\), however.
Figure 2. $H'(g^0_j)$ from equation (15) at two different values of $\alpha_{-j}$, 0 and 1, $y_j/y = 0.5$ and $\gamma = (0.5, 1, 2)$. Choosing the parameter values so that equation (7) equals $H'(g^1_j) = 1$, values of $\gamma \leq 1$ unambiguously yield a higher level of public good provision than the surplus maximizing level, regardless of $\alpha_{-j}$. At $\gamma > 1$ the provision of the public good falls as the value of $\alpha_j$ exceeds some threshold value.

From Figure 3 we can see that the two parameters influencing the change in the public good provision with regard to co-financing most are the weight on lobbying, $\gamma$, and the division of income, $y_j/y$. The values of co-financing by district $-j$, $\alpha_{-j}$, and the level of spill-overs, $\kappa$, only have a marginal impact.
Figure 3. $\frac{\partial H'(g_j, \alpha_j)}{\partial \alpha_j}$ from equation (16) at different combinations of parameter values.

Depending on the values of the parameters $\gamma$ and $y_j$ the cross-derivative may take negative values at some $\alpha_j$, indicating that co-financing can raise the provision of the public good. For sufficiently large $\gamma$, or at sufficiently unequal division of income, $y_j / y$, the cross-derivative is positive at the entire range $\alpha_j \in [0,1]$.

In order to understand the impact of the weight put on lobbying ($\gamma$) and income ($y_j, y_{-j}$) better, we end with some comparative statistics with respect to these variables. This exercise yields the following proposition:

**Proposition 5.** An increase in the weight put on lobbying lowers the provision of the public good.

**Proof:** Differentiating (15) w.r.t. $\gamma$, the weight put by the government on lobbying yields:

$$
\frac{\partial H'(g_j^0)}{\partial \gamma} = m_j(1-\kappa)(1-\alpha_j)\left[\alpha_j y + \sum_{k \in \{1,2\}}(1-\alpha_k)y_k\right] + m_{-j}\kappa \left[\alpha_j y + (1-\alpha_j)y_j\right] > 0.
$$

$$
\gamma y[m_j(1-\kappa)(1+y-\alpha_j) + m_{-j}\kappa]^2 > 0.
$$
An increase in $\gamma$ therefore raises the marginal benefits from the public good. Because of the concavity of $H(\cdot)$ this indicates that a greater weight on lobbying lowers the provision of the public good. □

The impacts found in Proposition 4 and 5 are due to the tax cost of the public good provision. Therefore, the tax cost of public good provision overweighs the benefits from increased public good provision at a high enough weight to lobbying or sufficiently high levels of co-financing. The districts lobby for lower taxes to their citizens, and consequently, for lower provision of the public good.

The impact of a change in the income of the two districts has an ambiguous impact on the provision of the public good:

\[
\frac{\partial^2 H(g^0_j)}{\partial g_j \partial y_j} = \frac{(1 - \alpha_j) \left[ (\gamma - \alpha_j) \frac{y_j}{y} + 2 \alpha_j - 1 - \sum_{k \in \{1,2\}} (1 - \alpha_k) \frac{y_k}{y} \right]}{y [m_j (1 - \kappa)(1 + \gamma - \alpha_j) + m_{-j} \kappa]}
\]

\[
\frac{\partial H(g^0_j)}{\partial g_j \partial y_{-j}} = \frac{(1 - \alpha_j) \left[ (\alpha_j - \gamma) \frac{y_j}{y} + (1 - \alpha_{-j}) + \sum_{k \in \{1,2\}} (1 - \alpha_k) \frac{y_k}{y} \right]}{y [m_j (1 - \kappa)(1 + \gamma - \alpha_j) + m_{-j} \kappa]}
\]

Both these equations are of indeterminate sign. Given, however, that $\gamma$ is not very large in relation to the rest of the parameters, equation (18) is positive, indicating that an increase in the income of district $-j$ lowers the provision of the public good in district $j$. It is, at the present level of generality, impossible to determine the sign of equation (17).

Discussion and conclusions

We have constructed a model building on Besley and Coate (2003), Grossman and Helpman (1994) and Dixit et al. (1997) to examine how the political economics of lobbying influence the provision of a centrally produced public good when voluntary co-financing by sub-national districts is allowed. We show that co-financing as such raises the level of public good provision as compared to the surplus maximizing level of provision. It is optimal for both districts to provide co-financing.
Including lobbying in the model complicates matters, however. We can show that in the absence of co-financing, lobbying may either raise or lower the provision of the public good. Whether lobbying raises or lowers the provision of the public good in a district depends on that district’s tax share (the higher the tax share, the lower demand for the public good) and the mean voter’s preferences for the public good (the higher this preference, the greater demand for the public good). The spill-over effects may have a marginal impact.

Lobbying and co-financing are substitutes to one another. Therefore, allowing co-financing can, to some extent, reduce rent seeking by lobbying like in Glazer and Proost (2014). The mechanism that reduces rent-seeking in the present paper differs from that in Glazer and Proost, however. While Glazer and Proost show that homogenous societies may through universal provision of a public good reduce rent seeking, in the present paper the districts have two means for influence seeking that can substitute for one another. Moreover, co-financing does not eliminate rent seeking entirely.

Finally, we show that co-financing together with lobbying may actually reduce the level of public service provision as compared to the surplus maximizing provision. The finding is due to the tax effect of public service provision. Therefore, while the districts have an incentive to lobby for higher public service provision, this incentive is overweighed by the tax cost at a high weight on lobbying and/or high levels of co-financing, and gives the districts an incentive to lobby for lower provision, and therefore, lower taxes instead.

The results are relevant for the Swedish situation, in which co-financing negotiations between a centrally appointed negotiator and the municipalities are on-going. In 2013, a pact was made between the central state and a number of municipalities in Stockholm County about an extension to the subway network in exchange to co-financing and the building of new apartments. According to our model, if the central government was not very susceptible to rent-seeking lobbying, the negotiations may have yielded a higher level of public service provision. From a surplus maximizing point of view, according to our model, this was inefficient as it raised the provision of transport
infrastructure in the Stockholm area above the surplus maximizing level. A similar observation can be made with regard to the on-going negotiations to build a high-speed rail link between Stockholm and the other two major cities of Sweden, Gothenburg and Malmö.

We are not aware of the Swedish municipalities, in accordance to our model, lobbying for lower taxes. This might indicate that the lobbying effect identified in this paper is not very strong. Then it is likely that co-financing in Sweden serves to raise the provision of public goods above the surplus maximizing level. The taxpayer would therefore be better off without the possibility to co-finance.

References


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