Partial Fiscal Decentralization and Public-Sector Heterogeneity: Theory and Evidence from Norway

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Abstract

This paper provides an empirical test of a principal tenet of fiscal federalism: that spending discretion, when granted to localities, leads to public-sector heterogeneity, with public-good levels adjusting to suit local demands. The test is based on a simple model of partial fiscal decentralization, under which earmarking of central transfers for particular uses is eliminated, allowing funds to be spent according to local tastes. The model predicts that partial decentralization generates dispersion in the levels of public services as spending adjusts to local preferences. But the model also yields the more-general prediction that the characteristics of local jurisdictions should play a bigger role in determining the levels of public goods after a decentralization reform than before. Both predictions are confirmed by the paper's empirical results, which show the effects of the 1986 Norwegian reform.

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1. Introduction

With fiscal decentralization, subnational governments gain autonomy in the provision and financing of public goods. Such autonomy has been a longtime feature of fiscal arrangements in the United States, Canada and a few other countries. A greater degree of central management of the public sector, however, is common elsewhere, especially in developing countries. But partly in response to advice from the World Bank and other international agencies, many countries are embracing fiscal decentralization by attempting to devolve spending and taxing authority to subnational governments. This movement is motivated in part by the lessons of the Tiebout (1956) model, which show that local control of spending allows the public sector to better respond to heterogeneous demands for public goods.

Despite these developments, the fiscal decentralization pursued in other parts of the world often fails to match the North American pattern, being only partial in nature. Rather than gaining autonomy to set both spending and taxes, subnational governments often must rely on transfers from the central government to finance the provision of public goods.[1] With fixed transfers, subnational governments often have little latitude in choosing the levels of public goods, especially when transfers are accompanied by mandates that specify how the money is to be allocated across spending categories. This reliance on transfers, and the lack of discretion it entails, is often a result of a lack of tax capacity at the subnational level. For either historical or constitutional reasons, subnational governments may not have access to taxes capable of generating substantial revenue, in contrast to the situation in North America, where subnational income, sales and property taxes generate enormous revenue. Alternatively, productive subnational taxes may exist but their rates may be centrally controlled.[2]

Despite its relevance in much of the world, partial fiscal decentralization has received only

limited treatment in the public economics literature. One purpose of the present paper is to offer a simple new model that compares public-good provision under partial decentralization to the outcomes under centralized provision and, alternatively, "full" decentralization, where subnational governments gain complete fiscal autonomy. The model yields clearcut predictions showing how a movement from centralization to partial decentralization affects public-good provision, and these predictions are then tested using data from Norway. A 1986 Norwegian reform gave local governments more control over spending decisions while maintaining their reliance on central transfers as a source of funds, and the empirical work investigates the effect of this reform.

The model builds on the analysis of Brueckner (2009), which also compared outcomes under centralization, partial, and full decentralization. In a model like Brueckner's that has only a single public good (denoted z), a local government relying on a fixed central transfer under partial decentralization would ordinarily have no discretion in its choices. The z level would be automatically determined by the transfer amount, making the setup indistinguishable from the centralized case where the central government itself sets z. However, public-good levels in Brueckner's model are determined both by spending and by the "effort" level of local governments, breaking the direct link between the transfer and z. This decoupling allows public-good provision to respond under partial decentralization to heterogeneity in the demands for z despite a common transfer level for all localities. The response is narrower, however, than under full decentralization.

The present model differs by assuming provision of two distinct public goods (x and z), with local-government effort dropped as an input. Local discretion under partial decentralization now exists despite the fixed transfer because local governments are free to choose the *mix of the two public goods*, varying the levels of x and z to suit local preferences while holding total spending constant at the amount of the transfer. The simple prediction of the model is that, with per capita spending held fixed, moving from centralization (where the center sets uniform levels of the two public goods) to partial decentralization creates dispersion in the levels of the goods. Under partial decentralization, the x and z levels in different localties diverge from the common level under centralization, reflecting local demand differences, even though total

spending is held constant.

While this conclusion is natural and straightforward, the analysis shows, interestingly, that a movement from centralization to full decentralization has less clearcut effects. In this case, the movement creates dispersion in the levels of one of the public goods but not necessarily the other. This qualification arises because the level of one good could remain (almost) unchanged in moving to the full-decentralization case. As a result, partial decentralization has simpler predicted effects, which are then subjected to an empirical test.

The test focuses on the effects of the 1986 Norwegian reform, which relaxed spending mandates for individual public goods, allowing new local discretion in the choice of the public-good mix while maintaining the system of intergovernmental transfers for support of local expenditures. In effect, the 1986 reform offers a natural experiment that allows a rare test of the effects of local discretion. The first set of empirical results explores the impact of the reform on interjurisdictional dispersion in the levels of public goods, providing some evidence that dispersion increased following the reform. While this empirical exercise focuses on the model's specific predictions regarding dispersion, the paper's second, and perhaps more important, empirical exercise tests the broader hypothesis that greater local discretion allowed local demographic and income characteristics to play a bigger role in determining public-good levels following the reform. Pre- and post-reform demand estimates show that local characteristics gained explanatory power following the reform, indicating that the reform allowed public-good provision to adjust in response to demand heterogeneity across jurisdictions.

This finding offers support for a fundamental tenet of fiscal federalism, namely, that local fiscal discretion enables the public sector to better respond to consumer preferences for public goods. Despite this idea's central importance in the vast literature on the Tiebout hypothesis, empirical work designed to explicitly test it is scarce. In one study, Ahlin and Mork (2008) exploit a similar natural experiment in Sweden that allowed greater local discretion in the determination of school spending, although they find mixed results that lend little support for the hypothesis. Earlier work by Borge and Rattsø (1993) also explored the effects of the Norwegian reform, but their approach did not deliver clearcut findings like those presented below. In contrast, Faguet (2004) found that when a Bolivian reform raised central-government

transfers and gave localities more control over investment projects, investment levels changed in ways that reflected local characteristics, mirroring the present results.[3]

Instead of addressing the role of local demand determinants and exploiting such natural experiments, most previous work in the Tiebout tradition has investigated the foundational aspects of the theory. Oates (1969) and the vast ensuing literature on capitalization validates the premise that public goods matter to consumers by showing that house prices rise in response to higher levels of provision. Another foundational notion, that consumers vote with their feet in pursuing ideal levels of public spending, is tested in various studies. Some papers, including Pack and Pack (1978), Eberts and Gronberg (1981) and Rhode and Strumpf (2003), carry out tests for convergence toward a homogeneous community structure (an implication of voting with one's feet), while Banzhaf and Walsh (2008) look more explicitly for evidence of such behavior. A related literature explores intercommunity residence patterns using more-sophisticated econometric methods, with the goal of inferring the existence of consumer sorting across jurisdictions (see, for example, Bayer and Timmins (2007)). The present paper complements all of this previous work by providing a more-direct test of a core idea of fiscal federalism.

The paper also adds to a recent resurgence of theoretical research on fiscal decentralization, which builds on the classic treatment of Oates (1972) (see also Wildasin (1986)). Recent papers include Lockwood (2002), Besley and Coate (2003), Brueckner (2004) and Lorz and Willman (2005), and Arzaghi and Henderson (2005), among others. The models of Besley and Coate and Lockwood offer a contrast to the present approach by assuming that, when it exercises control, the central government can differentiate the provision of public goods across local jurisdictions, blurring the distinction between the centralized and decentralized cases.

In addition to Brueckner (2009), recent work that explicitly focuses on partial fiscal decentralization includes an earlier paper by Schwager (1999), who analyzes what he calls "administrative federalism."[4] Peralta (2012) constructs a related model with imperfect information and rent-seeking politicians, where partial decentralization allows more scope for this activity than full decentralization.[5] The analysis of Hatfield and Padró i Miguel (2011) reflects a different view of partial decentralization. In their model, which has a continuum of public goods,

partial decentralization emerges when a portion of the continuum is provided locally, with the remainder provided by the central government.[6] In addition to these papers and those cited above, many more recent studies bear some connection to the present work.[7]

The plan of the paper is as follows. Section 2 presents the model, and section 3 gives an overview of the Norwegian reform on which the empirical work is based. Section 4 discusses the data and presents descriptive statistics and evidence on dispersion, while section 5 presents the demand regressions. Conclusions are offered in section 6.

2. The Model

Consider an economy where individuals consume two public goods, x and z, along with a private good e. Each public good is a publicly produced private good with cost per capita equal to 1. The economy has two consumer types denoted by $i = 1, 2$, who have different Cobb-Douglas preferences given by

$$u_i = \alpha_i log(e) + \beta_i log(x) + (1 - \alpha_i - \beta_i) log(z), \quad i = 1, 2, \tag{1}$$

and common incomes equal to I. The economy contains a number of local jurisdictions (referred to subsequently as "cities"), with decisions on their public-good levels made by majority voting in situations where local control is allowed. In "type-1" cities, type-1 consumers are in the majority, with public-good levels chosen to reflect their preferences, while type-2 cities have type-2 majorities. Although, in an extreme case, cities could be homogeneous, with the consumer types segregated in separate jurisdictions, the analysis applies regardless of the degree of intermixing of the types. But cities of both types are assumed to exist, so that one type of consumer is not in the majority everywhere. Once the analysis is complete, an extension to an economy with more than two consumer types is discussed.

2.1. Public-good levels under different degrees of decentralization

In the case of full decentralization, public-good choices are made locally, with spending financed by head taxes. The chosen levels of the goods in the different city types are given by familiar demand functions associated with Cobb-Douglas preferences. In a type-i city, the z

and x choices are

$$z_i^* = (1 - \alpha_i - \beta_i)I, \quad x_i^* = \beta_i I, \quad i = 1, 2. \tag{2}$$

Total per capita spending on the goods (equal to the city head tax T_i^*) is

$$x_i^* + z_i^* = T_i^* = (1 - \alpha_i)I, \quad i = 1, 2. \tag{3}$$

Suppose, on the other hand, that public-good levels are dictated by the central government, with the goods still provided locally but at levels that are uniform across cities despite differing majority preferences. The local expenditure is financed by uniform per capita grants (supported by nationally uniform head taxes) sufficient to fund the specified public-good levels.

Assume that the government knows individual preferences and chooses the mandated public-good levels to maximize total utility in the economy, which is proportional to $\theta u_1 + (1 - \theta)u_2$, where θ is the type-1 population share. Then, the uniform public-good levels under centralization turn out to be

$$z^* = \theta z_1^* + (1 - \theta)z_2^* = [1 - \theta(\alpha_1 + \beta_1) - (1 - \theta)(\alpha_2 + \beta_2)]I$$

$$x^* = [\theta\beta_1 + (1 - \theta)\beta_2]I. \tag{4}$$

Note that x^* and z^* are just weighted averages of the corresponding values in type-1 and type-2 cities under full decentralization, from (2). Total per capita spending on the public goods with centralization (equal to the uniform grant and head tax) is a weighted average of the T_i^* from (3) and equal to

$$x^* + z^* = T^* = [1 - \theta\alpha_1 - (1 - \theta)\alpha_2]I. \tag{5}$$

Suppose now that the central government switches to partial fiscal decentralization by providing the cities with equal per capita grants of T^* (again financed by uniform head taxes) *without specifying the particular levels of public goods that must be provided.* In other words, the central government allows freedom of choice in selecting public-good levels, subject to the

requirement that total spending is the same as under centralization. Again, the goods must be entirely paid for with grant funds. Each city faces the following constraints:

$$e = y - T^*, \qquad x + z = T^*. \tag{6}$$

The chosen public-good levels for the two city types are now

$$\widehat{z}_i = \frac{1 - \alpha_i - \beta_i}{1 - \alpha_i} T^*, \qquad \widehat{x}_i = \frac{\beta_i}{1 - \alpha_i} T^*, \quad i = 1, 2. \tag{7}$$

Note that each public-good level equals T^* weighted by the relative importance of that good, given by the share of the x and z coefficient sum associated with the good (from (1), this sum equals $1 - \alpha_i - \beta_i + \beta_i = 1 - \alpha_i$).

2.2. Comparing public-good levels under the three regimes

This section carries out pairwise comparisons of public-good levels among the three regimes, starting with a comparison of partial and full decentralization.

<u>Partial vs. full decentralization</u>. Using (2) and substituting for T^* in (7) using (5),

$$\widehat{z}_1 > (<) \ z_1^* \quad \text{as} \quad (1 - \alpha_1 - \beta_1)I > (<) \ \frac{1 - \alpha_1 - \beta_1}{1 - \alpha_1}[1 - \theta\alpha_1 - (1 - \theta)\alpha_2]I$$

$$\text{or as} \qquad \alpha_1 > (<) \ \alpha_2. \tag{8}$$

For concreteness, assume that $\alpha_1 > \alpha_2$, so that the type-1's have the higher demand for the private good. Then $\widehat{z}_1 > z_1^*$ holds from (8), and further calculations like those in (8) yield the following full set of comparisons:

$$\widehat{z}_1 > z_1^*, \qquad \widehat{x}_1 > x_1^* \tag{9}$$

$$\widehat{z}_2 < z_2^*, \qquad \widehat{x}_2 < x_2^*. \tag{10}$$

Thus, relative to partial decentralization, full decentralization leads to lower public-good levels in the type-1 cities and higher levels in the type-2 cities. These conclusions follow because

total spending on public goods is lower in type-1 than in type-2 cities under full decentralization $(T_1^* < T_2^*)$ as a result of their higher demand for e, while the x/z mix is under local control in both cases. Since T^*, the spending level under both partial decentralization and centralization, is a weighted average of the T_i^*'s, full decentralization involves less total public-good spending in type-1 cities and more in type-2 cities than partial decentralization. As a result, x and z fall in type-1 cities and rise in type-2 cities in moving from partial to full decentralization.

Partial decentralization vs. centralization. Using the above solutions,

$$\widehat{z}_1 \quad > (<) \quad z^* \quad \text{as}$$

$$\left[1 - \frac{\beta_1}{1 - \alpha_1}\right][1 - \theta\alpha_1 - (1-\theta)\alpha_2]I \quad > (<) \quad [1 - \theta(\alpha_1 + \beta_1) - (1-\theta)(\alpha_2 + \beta_2)]I$$

$$\text{or as} \quad \frac{\beta_2}{1 - \alpha_2} \quad > (<) \quad \frac{\beta_1}{1 - \alpha_1} \tag{11}$$

Assuming for the moment that the inequality

$$\frac{\beta_1}{1 - \alpha_1} \quad < \quad \frac{\beta_2}{1 - \alpha_2} \tag{12}$$

holds, (11) yields $\widehat{z}_1 > z^*$, and similar calculations yield the following full set of comparisons:

$$\widehat{z}_1 \quad > \quad z^*, \quad \widehat{x}_1 \quad < \quad x^* \tag{13}$$

$$\widehat{z}_2 \quad < \quad z^*, \quad \widehat{x}_2 \quad > \quad x^*. \tag{14}$$

Thus, relative to centralization, partial decentralization creates dispersion in the public-good levels around the common centralized values, with z rising and x falling in type-1 cities and the opposite changes occurring type-2 cities. The inequalities in (13) and (14), and thus the movements for the two city types, are all reversed if the inequality in (12) is reversed.

To understand these conclusions, note that since total spending on public goods remains fixed at the centralized level T^* in moving to partial decentralization, private-good consumption remains at the centralized level e^*. As a result, the adjustment occurs only in the mix of public

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goods, with overall spending held fixed. This mix depends on the share of the x exponent β_i in the sum $1 - \alpha_i$ of the public-good exponents, a share that equals $\beta_1/(1 - \alpha_1)$ for the type-1's and $\beta_2/(1 - \alpha_2)$ for the type-2's. If the type-1 x-exponent share is the smaller of the two, then the public-good mix shifts toward z and away from x in type-1 cities in moving to partial decentralization while shifting away from z and toward x in type-2 cities. These changes are seen in the above inequalities.

Full decentralization vs. centralization. Combining the inequalities in (9) and (10) with those in (13) and (14), the following relationships hold when the condition in (12) is satisfied:

$$z^* \;<\; \widehat{z}_1 \;>\; z_1^*, \qquad x^* \;>\; \widehat{x}_1 \;>\; x_1^* \tag{15}$$

$$z^* \;>\; \widehat{z}_2 \;<\; z_2^*, \qquad x^* \;<\; \widehat{x}_2 \;<\; x_2^*. \tag{16}$$

These conditions in turn yield

$$x_1^* \;<\; x^* \;<\; x_2^*, \qquad z_1^* \;>\; (<) \; z_2^*. \tag{17}$$

Thus, x_1^* is lower, and x_2^* higher, than x^* (their weighted average), while the positioning of the two z_i^* values relative to one another and thus relative to z^* (their weighted average) is ambiguous. The z_i^* values could have either order, and the two values could in fact be equal if parameters have the right magnitudes. In the latter case, the z values in the two city types stay at the original common value of z^* in moving to full decentralization. Note that even when the z_i^* are not exactly equal, they may be nearly so despite what could be a substantial difference in the utility parameters. The results in (15)–(17) also can be seen directly from the solutions.[8]

If (12) is reversed, then the inequalities in (13) and (14) are reversed. Combining these new inequalities with (9) and (10) yields new versions of (14) and (15) in which the x's and the z's trade places. The ordering of the x_i^* values is now ambiguous, with equality (or near equality) being one possibility, while $z_1^* < z^* < z_2^*$ holds. These conclusions can again be seen directly from the solutions.[9]

The intuition for these results is as follows. Whereas the intermediate movement from centralization to partial decentralization causes the x's and z's to spread around the common centralized values, the second movement to full decentralization causes the levels of both goods to fall in type-1 cities (controlled by the high private-good demanders) and to rise in type-2 cities. If (12) holds, so that the partial-decentralization spread puts x below (above) the centralized value for the type-1 (type-2) cities, then this second movement further widens the x spread while narrowing the z spread (as seen in (15) and (16)). This pattern is shown in Figure 1, where $x^* > z^*$ is assumed. If, on the other hand, the reverse of (12) holds, so that the partial-decentralization spread puts z below (above) the centralized value for type-1 (type-2) cities, then this second movement further widens the z spread while narrowing the x spread.

The analysis thus shows that a movement from centralization to partial decentralization has a more clearcut effect on public-good provision than a movement to full decentralization. Partial decentralization generates dispersion in each public good around the centralized level for that good, while a movement to full decentralization generates dispersion for one public good but not necessarily for the other. In both cases, however, decentralization yields public-sector "heterogeneity" as the public goods no longer both assume common levels across cities. Summarizing yields

Proposition. *Fiscal decentralization leads to public-sector heterogeneity by allowing the provision of public goods to respond to inter-city demand differences. But partial decentralization tends to foster more heterogeneity than full decentralization by guaranteeing dispersion in the levels of both public goods, rather than just one.*

For expositional simplicity, the analysis so far has assumed the existence of only two types of consumers. With more than two types, the number of possible city types would increase, given that each consumer type is potentially in the majority in some city. However, the dispersion effect of partial decentralization continues to emerge. Letting θ_i denote the population share of consumer type i, the analog to (12) and (13) is

$$\widehat{z}_i \;>\; z^*, \quad \widehat{x}_i \;<\; x^* \qquad \text{if} \qquad \frac{\beta_i}{1 - \alpha_i} \;<\; \frac{\sum_{j \neq i} \theta_j \beta_j}{\sum_{j \neq i} \theta_j (1 - \alpha_j)}, \tag{18}$$

with the first set of inequalities reversed if the third inequality is reversed. Therefore, depending on the relationships among the α's and β's for the consumer types, partial decentralization will lead to increases in z and decreases in x in some cities and reverse changes in other cities, creating the kind of dispersion in the levels of public goods seen in the two-type case. A further generalization that increases the number of public goods beyond two also leaves the main predictions of the theory unaffected.

The preceding analysis makes no assumptions on the makeup of city populations in the two-type case aside from assuming that cities of both types exist. The movement to partial decentralization, however, would generate the usual kinds of Tiebout forces toward homogenization of the jurisdiction structure. With public goods no longer uniform across cities, minority residents of a city, whose tastes are not represented in its choices, would have an incentive to move to a city where their type is in the majority. So, in addition to generating dispersion in public-good levels, partial decentralization would create migration incentives leading to greater homogeneity.

As explained in the introduction, the 1986 reform in Norway led to partial rather than full decentralization. Relying on the Proposition's sharp predictions regarding the effects of partial decentralization, remainder of the paper carries out empirical work exploring the reform's effects.

3. Norwegian Institutional Setting

The public sector in Norway is large and decentralized, with the sector's local component accounting for about one-fifth of GDP. The major source of tax financing is the income tax paid by individuals. Income-tax revenue is shared between municipalities, counties and the central government, with revenue shares determined each year by the Parliament. Since the 1992 tax reform, income has been taxed at an overall flat rate of 28%, which decomposes into rates of about 13% for municipalities, 3% for counties and 12% for the central government. Municipalities and counties are allowed to set their own tax rate within a narrow band, but they all use the maximum rate.

While the income levels available for taxation are very different in urban and rural areas, a

comprehensive tax equalization system ensures that a locality is not penalized by a low income tax base. In addition, a comprehensive system of expenditure equalization grants is designed to neutralize the effect of variation in local cost conditions. Today, the tax and expenditure equalization grants are mostly distributed as block grants based on characteristics of the local jurisdictions, with relatively few restrictions on the use of funds.

The current system is the legacy of public-sector decentralization during the 1980s, which occurred in Norway and several other Nordic countries (see Lotz (1998) for an overview). Our analysis concentrates on the major 1986 reform in the control and financing of the Norwegian local public sector. The historical background was a centralized system of sectoral control where national ministries controlled local spending within their own sector through mandating and the use of earmarked grants, usually arranged as matching grants. Ministries responsible for education and health care in particular exercised strong control over local spending, attempting to equalize service levels across jurisdictions. The reform was designed by a government commission with the broad goal of establishing local accountability and autonomy. The policy shift was intended to strengthen local democracy and improve efficiency by giving local governments more discretion in the allocation of resources. The sectoral influence through mandating and earmarking was reduced, and equalization was handled by consolidation of old earmarked grants into a new block grant system. About 50 earmarked grants were replaced by block grants based on objective criteria. The result was a simpler and more transparent grant system.

The reform represented a shift in the design of fiscal federalism similar to the shift from centralization to partial decentralization in the model of section 2. The centralized regime before 1986 attempted to control local government spending with sectoral mandating and earmarking. Although localities were required, under the system's matching arrangements, to supplement central transfers with their own funds, these required contributions (and the taxes supporting them) were effectively determined by the center. As a result, the system was roughly equivalent to the full-centralization regime in the model, where the center collects all taxes, dictates public-good levels, and fully funds the localities by transfers. However, it should be noted that, because of imperfect equalization, local revenues from electric power

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plants, and the existence of some regionally targeted grants, the levels of provision of public goods and services were not uniform prior to the reform, unlike in the model. Nevertheless, the reform greatly relaxed the central control over the use of transfers along with requirements on local contributions, thus mirroring the case of partial decentralization.

4. Data, Descriptive Statistics, and Kernel Densities

The dataset covers all 443 municipalities in Norway during the period 1980-1991. The analysis compares the 1980-1985 pre-reform period to the 1986-1991 post-reform period using data for three social-service sectors: child care, primary and secondary education, and parks and cultural services. The heterogeneity of the services across jurisdictions can be described and understood in various ways. The spread around the mean of a particular public-service measure such as child-care coverage can be shown by the standard deviation. An increase in the standard deviation indicates larger differences in coverage in absolute terms across jurisdictions. But as will be seen in Tables 1–4 below, the mean levels of some of the variables measuring public-good provision rose substantially over the 1980-1991 period.[10] While predicting an increase in dispersion, the model does not offer any prediction about the change in the mean level of the good. The model, however, is static in nature and does not capture forces such as the increase in Norwegian incomes that occurred over the decade during which the reform was implemented. This increase generated higher tax revenues at all levels of government and thus central transfers to local governments (they grew at 2.7% per year over the period, a bit faster than real GDP). In the model, this income-driven increase in transfers would have raised the common levels of the public goods x and z under centralization, with partial decentralization then generating dispersion around these higher levels. Since the mean levels of the public goods were rising, a better dispersion measure would be the coefficient of variation (CV), which equals the standard deviation divided by the mean. A further description of the change in heterogeneity comes from estimation of kernel density functions showing the distribution of public-service levels before and after the reform. Details of this approach and its results are presented below, following discussion of the descriptive statistics.

The provision of child care in a locality is captured by three different variables: child-care

coverage (the share of children in child care), child-care employment per child in child care, and employment per young child (1-6 years of age). For each of these variables, Table 1 shows the mean, standard deviation and CV among the 443 jurisdictions in each of the sample years. For each measure, the mean rose over the 1980-1990 period. Even though the standard deviations were higher after than before the reform for two of the three measures, these changes were not sufficient to offset the higher means, making the coefficient of variation lower in 1990 than in 1980 for all three service measures, a pattern that fails to match the predictions of the theory. However, it could be argued that in the case of child-care coverage, whose mean is bounded above at 100%, absolute differences as captured by the standard deviation are more meaningful than the CV at capturing dispersion. From this viewpoint, the rising standard deviation for child-care coverage might offer support for the theory.

As shown in Table 2, the provision of primary and lower (pre-high-school) secondary education is captured by three interrelated variables: class size, teachers per class (a class may have more than one teacher), and teachers per student.[11] Table 2 shows that all three measures improved over the period, with class size falling and the other two measures increasing. For teachers per class and per student, standard deviations rose over the period, and the increases were large enough to dominate the rising means, so that coefficients of variation rose. With only small changes in the mean and standard deviation for class size, its CV was also little changed over the period. Nevertheless, the patterns in Table 2 mostly support the theory's prediction of greater post-reform dispersion in the provision of education.

The last public-good category is cultural and park services, measured by separate per capita spending levels for general cultural services and park services, both adjusted for inflation. Table 3 shows that level of general cultural spending rose over the period, as did its standard deviation, while park spending fell and its standard deviation declined. The net effects were an increase cultural spending's CV over the period, matching the predictions of the theory, and a rise in the CV for park spending despite the decline in the standard deviation.

Estimation of kernel density functions provides another view of the change in the distribution of a public service between the pre- and post-reform periods. For each sample year, the public-service levels in the different jurisdictions are divided by the mean value for that

year, so that the estimated densities show differences relative to the mean (being centered at 1). The density estimates are calculated using a Gaussian kernel with bandwith set according to Silverman's rule of thumb.[12] The Kolmogorov-Smirnov (K-S) test is used to test for a difference between the pre- and post-reform distributions. The test statistic measures the maximum value of the absolute difference between two cumulative distribution functions. The statistic has a known distribution under the null hypothesis of equal distributions. In addition to providing an overall test, the K-S test can be used locally to test for differences in the left or right tails of the distributions.

The estimated kernel densities for child-care coverage before and after the reform are presented in Figure 2, which shows that the distribution narrowed following the reform, mirroring the decline in the CV. The K-S test shows that this change in the distribution is statistically significant, as seen in the test statistics D and the p-values reported in Table 4. These results, of course, do not support the predictions of the model.

As seen in Figure 3, the estimated pre- and post-reform kernel densities for class size are quite similar. The figure indicates a slightly wider distribution after the reform, but the K-S test shows no significant difference between the two distributions. By contrast, the kernel densities for teachers per class in Figure 4 appear to show higher dispersion after the reform, particularly at the lower end. Although the K-S test shows no statistically significant overall difference between the two distributions, Table 4 shows that the the post-reform distribution is significantly wider in the left tail than the pre-reform distribution, confirming the impression given by Figure 4. The significance level is 10%. Note that the densities show that the reform had little effect on the frequencies of the highest values of teachers per class.

The estimated kernel densities for cultural spending per capita, shown in Figure 5, indicate somewhat higher dispersion after the reform. Although the K-S test in Table 4 shows that the overall difference between the distributions is not statistically significant, the right part of the post-reform distribution is significantly wider at the 10% level. In particular, the high end of cultural spending moves to the right after the reform.

The kernel density estimations thus tend to validate the previous conclusions based on coefficients of variation. They provide some evidence of greater post-reform dispersion in

the provision of education (teachers per class) and cultural services. Given the importance of educational services, which are the largest local spending category, these conclusions lend some credence to the theoretical predictions.

5. Demand Regressions

5.1. The setup

In a previous analysis of the reform, Borge and Rattsø (1993) estimate a demand system based on budget shares in order to investigate parameter stability across the pre- and post-reform periods. They find a shift in parameters from 1984-85 to 1986-87, indicating some change in behavior. But they do not find significant changes in short-run and long-run expenditure elasticities or changes in the effects of demographic variables that are consistent with the predicted effects of the reform. The present analysis, however, relies on the measures of local service provision used in Tables 1–3, which are more detailed than those in previous studies and thus better able to capture the quantitative and qualitative aspects of the services.

The estimated demand model follows the usual approaches in the literature while also mirroring previous demand studies for local governments in Norway, including Borge and Rattsø (1993, 1995). The key demand variable is per capita income for the municipality (denoted PINC and measured on an after-tax basis), which will reveal the income elasticities of demand for the various services. Since services are oriented toward specific age groups in the population, demographic factors will be important determinants of demand. The demographic variables are the child share of the population, measured by the fraction below 7 years of age (CH), the 'youth' share of the population, measured by the fraction between 7 and 15 years of age (YO), and the elderly share of the population, representing individuals aged 67 years and above (EL). In addition, population size (POP) is included to control for possible scale effects in service production, which may reduce unit costs and thus raise provision levels.

The demand model is estimated separately for the pre- and post-reform periods, 1980-85 and 1986-1990. The main prediction is that local demand determinants should play a more important role in determining public-good levels after the reform than before it, a consequence of the relaxation of central controls over local resource allocation. In other words, the estimated

coefficients of the local characteristics are expected to be higher in absolute value and more statistically significant after the reform.

Estimating of the pre- and post-reform demand coefficients is carried out within a single regression model, where interaction terms allow different coefficients for the two periods while the error variance is constrained to be the same across periods. The model, which facilitates inter-period hypothesis tests on the coefficients, is

$$S_{it} = \alpha_t + D_t^{pre}\{\eta_i^{pre} + \beta_1^{pre}\log(\text{PINC}_{it}) + \beta_2^{pre}\text{CH}_{it} + \beta_3^{pre}\text{YO}_{it} + \beta_4^{pre}\text{EL}_{it} + \beta_5^{pre}\log(\text{POP}_{it})\} +$$

$$(1 - D_t^{pre})\{\eta_i^{post} + \beta_1^{post}\log(\text{PINC}_{it}) + \beta_2^{post}\text{CH}_{it} + \beta_3^{post}\text{YO}_{it} + \beta_4^{post}\text{EL}_{it} + \beta_5^{post}\log(\text{POP}_{it})\} + \epsilon_{it}$$

$$(19)$$

In (19), i denotes the jurisdiction and t denotes the year, with the dummy variable D_t^{pre} taking the value one when t is a pre-reform year and zero otherwise. Year fixed effects are denoted by α_t, while η_i^{pre} and η_i^{post} give jurisdiction fixed effects that may vary between the periods. The other demand coefficients are also allowed to differ between the periods, and ϵ_{it} is the error term.

Possible endogeneity of the local characteristics determining public-good demand is a challenge for this type of study. In particular, the income and demographic characteristics of a jurisdiction may respond, via migration, to service levels. In addition, background unobservables represent a challenge since many unmeasured social and economic factors may influence demand. Jurisdiction and year fixed effects partly handle this problem, but the influence of jurisdiction-specific time-varying factors may still be present. These problems could in principle be addressed by instrumentation of the key local demand determinants.

5.2. Estimation results

The estimated demand models for the three child-care measures are presented in Table 5. The results show that child-care coverage was independent of income and the age composition of the population before the reform. For the post-reform period, the estimates show that income became a significant determinant of coverage, with the share of children in the

population becoming a marginally significant factor. This CH effect is consistent with recent evidence from Borge and Rattsø (2003), who conclude using data from Denmark that being part of a large cohort is a disadvantage in terms of child-care service levels.[13] The third column of Table 5 shows the t-statistic for testing equality of individual coefficients between the periods. Equality is rejected only for the CH coefficients, with the test being marginally significant for income. Note that the equality tests and the individual coefficient significance tests may provide different verdicts. As in the case of income and child-care coverage, the significance tests may show one coefficient significantly different from zero and the other not, while the equality test may fail to reject equality of coefficients. In this case, we believe that the individual significance tests deserve more credence. The table also shows the F statistic for testing the null hypothesis that all the demand coefficients are equal. This statistic, reported as F_1 at the bottom of the table, is significant at the 10% level, while the statistic for testing equality of all but the population coefficients (F_2) is almost significant at the 5% level.

Turning to the remainder of Table 5, employment per child in child care and employment per young child have mostly insignificant coefficients prior to the reform. But they both respond positively to income in the post-reform period, although one income coefficient is only marginally significant and neither of the t-statistics allows rejection of coefficient equality. Moreover, both F statistics lie well outside the significant range. Nevertheless, the results in Table 5, especially those for coverage, suggest that local characteristics may have gained some influence as determinants of child-care services following the reform.

Table 6 shows the regression results for the three education measures. The results for the class-size measure are not particularly supportive of the model, with some coefficients gaining significance and others losing it in the post-reform period. However, the regressions for teachers per class and per student more closely match the theoretical predictions. Higher income, which has no pre-reform effect, raises teachers per student in the post-reform period. A large youth share reduces both measures in the post-reform period, with the effect changing from insignificant to significant in the case of teachers per class. In addition, for each service measure, the YO coefficient magnitude is much larger in the post-reform period. Although only one of the pairwise coefficient-equality tests allows rejection, all four of the F statistics

are in the significant range, indicating that the reform significantly affected the link between the teachers per student and per class and the determinants of demand.[14]

The culture and parks regressions are shown in Table 7. Income becomes a significant determinant of cultural spending in the post-reform period, with its effect much larger than the marginally significant pre-reform impact (despite these differences, coefficient equality cannot be rejected). In addition, an increase in the elderly share reduces cultural spending in the post-reform period, whereas no pre-reform effect exists (again, coefficient inequality cannot be rejected). This negative effect might seem counterintuitive, but it likely reflects competition for funds between cultural services and services for the elderly in the local budget. POP has significantly negative effects on cultural spending both before and after the reform. In the park-spending regressions, POP has a significantly negative post-reform effect, with equality of coefficients also rejected by the t-test. Although both effects are only marginally significant, a higher youth share raises park spending before and after the reform, a natural outcome. Finally, none of the F statistics lies in the significant range.

Overall, the regression results in Tables 5–7 offer some support for the model's prediction that variables measuring local demand should matter more in the determination of public-good levels after the reform than before it. Most importantly, the key income variable, which never has an effect on public-service provision prior to the reform, emerges after the reform as a determinant of child-care coverage, child-care employment per young child, teachers per student, and cultural spending. In addition, larger cohort sizes (for children, youth, and elderly) lead to reductions in post-reform levels for some services, when effects were absent prior to the reform. This pattern is seen for CH in child-care coverage (being marginally significant), YO in class size and teachers per class, and EL in cultural spending.

The results thus suggest that local discretion granted under partial decentralization allows public-service levels to respond to local demand.

6. Conclusion

This paper provides an empirical test of a principal tenet of fiscal federalism: that spending discretion, when granted to localities, leads to public-sector heterogeneity, with public-good

levels adjusting to suit local demands. The test is based on a simple model of partial fiscal decentralization, under which earmarking of central transfers for particular uses is eliminated, allowing funds to be spent according to local tastes. The model predicts that partial decentralization generates dispersion in the levels of public services as spending adjusts to local preferences. But the model also yields the more-general prediction that the characteristics of local jurisdictions should play a bigger role in determining the levels of public goods after a decentralization reform than before. Both predictions receive some support from the paper's empirical results, which show the effects of the 1986 Norwegian reform. Dispersion in the provision of primary/secondary education and cultural services increases following the reform, and the paper's regression results suggest that local characteristics matter more in the determination of public services after the reform than before. These findings are important because they represent an affirmation of a central, but seldom-tested, principle of public economics.

Table 1: Child care

Year	Coverage (share of children in child care)			Child-care employment per child			Employment per young child (1-6 years)		
	Mean	St. dev.	CV	Mean	St. dev.	CV	Mean	St. dev.	CV
1980	0.209	0.134	0.640	0.193	0.072	0.372	0.039	0.028	0.723
1981	0.230	0.132	0.572	0.199	0.076	0.384	0.043	0.027	0.623
1982	0.252	0.128	0.508	0.198	0.069	0.349	0.049	0.028	0.580
1983	0.270	0.134	0.495	0.202	0.070	0.349	0.053	0.031	0.580
1984	0.289	0.137	0.474	0.206	0.085	0.411	0.057	0.031	0.542
1985	0.315	0.132	0.420	0.208	0.063	0.305	0.063	0.031	0.490
1986	0.346	0.138	0.398	0.216	0.078	0.360	0.074	0.040	0.544
1987	0.376	0.140	0.373	0.223	0.062	0.279	0.083	0.039	0.473
1988	0.408	0.147	0.362	0.234	0.063	0.268	0.096	0.046	0.485
1989	0.438	0.151	0.346	0.238	0.060	0.254	0.105	0.049	0.462
1990	0.472	0.155	0.329	0.242	0.056	0.231	0.116	0.053	0.459

Table 2: Primary and lower secondary education

Year	Class size			Teachers per class			Teachers per student		
	Mean	St. dev.	CV	Mean	St. dev.	CV	Mean	St. dev.	CV
1980	18.6	3.41	0.183						
1981	18.6	3.42	0.184	1.73	0.169	0.098	0.097	0.023	0.233
1982	18.4	3.44	0.186	1.76	0.178	0.101	0.099	0.025	0.250
1983	18.3	3.44	0.187	1.78	0.174	0.098	0.101	0.024	0.236
1984	18.1	3.54	0.195	1.83	0.207	0.113	0.105	0.025	0.237
1985	18.1	3.55	0.197	1.89	0.283	0.149	0.109	0.026	0.238
1986	17.6	3.39	0.193	1.97	0.235	0.119	0.117	0.030	0.254
1987	17.3	3.39	0.196	2.05	0.239	0.117	0.124	0.032	0.262
1988	17.1	3.35	0.196	2.10	0.253	0.121	0.128	0.033	0.261
1989	17.1	3.35	0.196	2.12	0.265	0.125	0.130	0.035	0.267
1990	16.9	3.34	0.198	2.16	0.290	0.134	0.134	0.038	0.281

Table 3: Culture and parks

	Cultural spending per capita			Parks spending per capita		
	Mean	St.dev.	CV	Mean	St.dev.	CV
1980	331	136	0.410	33.8	63.9	1.89
1981	356	151	0.424	31.5	57.6	1.83
1982	377	156	0.415	34.1	66.3	1.94
1983	404	178	0.440	33.6	56.8	1.69
1984	419	184	0.439	30.6	54.5	1.78
1985	454	218	0.481	30.1	54.0	1.79
1986	483	246	0.510	29.1	52.7	1.81
1987	499	245	0.492	30.4	57.7	1.90
1988	514	273	0.531	27.8	52.8	1.90
1989	525	276	0.526	27.9	54.4	1.95

Table 4
Kolomogorov-Smirnov tests for equality of distribution functions

Variable	Side of distribution	D	p-value
Child-care coverage	Left	0.104	0.008
	Right	-0.095	0.019
	Combined	0.104	0.017
Class size	Left	0.034	0.602
	Right	-0.023	0.798
	Combined	0.034	0.961
Teachers per class	Left	0.072	0.099
	Right	-0.054	0.272
	Combined	0.072	0.198
Cultural expenditures	Left	0.018	0.865
	Right	-0.072	0.099
	Combined	0.072	0.198

Table 5
Child Care Regressions

	Coverage (share of children in child care)			Child-care employment per child			Employment per young child (1-6 years)		
	1980-85	1986-90	equality t-stat	1980-85	1986-90	equality t-stat	1980-85	1986-90	equality t-stat
Log(PINC)	0.043 (0.68)	0.178 (3.02)	1.68	0.003 (0.06)	0.100 (1.77)	1.44	0.004 (0.26)	0.069 (2.43)	1.91
CH	0.855 (1.25)	-1.153 (-1.74)	2.10	-0.299 (-0.90)	-0.159 (-0.38)	0.27	-0.042 (-0.31)	-0.317 (-1.21)	0.94
YO	0.034 (0.08)	-0.645 (-1.09)	0.94	0.232 (0.81)	0.427 (1.14)	0.39	-0.150 (-1.22)	-0.065 (-0.27)	0.31
EL	0.286 (0.28)	-0.182 (-0.33)	0.39	0.304 (0.87)	0.482 (0.90)	0.26	0.178 (0.80)	0.273 (0.79)	0.22
Log(POP)	-0.396 (-2.31)	-0.288 (-2.23)	0.50	0.004 (0.07)	0.081 (0.61)	0.49	-0.080 (-1.96)	-0.074 (-1.36)	0.09
N	443	443		412	412		443	443	
F_1	1.90 (0.094)			0.52 (0.759			1.55 (0.174)		
F_2	2.23 (0.065)			0.57 (0.688)			1.78 (0.131)		

t-statistics in parentheses; F_1 (F_2) *is* F *statistic for equality of all coefficients* (*all coefficients except that of* Log(POP)) *between periods*

Table 6
Primary and Lower Secondary Education Regresssions

	Class size			Teachers per class			Teachers per student		
	1980-85	1986-90	*equality t-stat*	1981-85	1986-90	*equality t-stat*	1981-85	1986-90	*equality t-stat*
Log(PINC)	-0.971 (-0.84)	-0.945 (-0.99)	0.02	-0.063 (-0.24)	0.281 (1.42)	1.01	0.015 (1.15)	0.038 (2.83)	1.21
CH	7.38 (0.78)	-2.51 (-0.28)	0.68	0.394 (0.14)	-0.873 (-0.47)	0.33	0.001 (0.01)	0.087 (0.87)	0.68
YO	19.6 (1.76)	20.2 (2.85)	0.04	-1.33 (-0.58)	-5.31 (-3.74)	1.45	-0.108 (-2.09)	-0.556 (-5.61)	4.15
EL	3.73 (0.35)	-2.13 (-0.27)	0.44	2.26 (1.43)	-0.230 (-0.14)	1.07	0.164 (1.98)	0.025 (0.23)	0.99
Log(POP)	4.85 (2.66)	0.137 (0.08)	1.81	0.650 (1.99)	-0.075 (-0.18)	1.76	-0.017 (-0.85)	-0.072 (-2.54)	1.51
N	443	443		443	443		443	443	
F_1	1.07 (0.379)			3.01 (0.011)			7.41 (0.000)		
F_2	0.19 (0.944)			2.49 (0.042)			8.73 (0.000)		

t-statistics in parentheses; F_1 (F_2) *is* F *statistic for equality of all coefficients* (*all coefficients except that of* Log(POP)) *between periods*

Table 7
Culture and Parks Regressions

	Cultural spending per capita			Parks spending per capita		
	1980-85	1986-89	equality t-stat	1980-85	1986-89	equality t-stat
Log(PINC)	199.7 (1.70)	363.1 (3.58)	1.10	-9.34 (-0.32)	-4.21 (-0.17)	0.12
CH	-806.1 (-1.20)	-1466.0 (-1.04)	0.41	106.4 (0.47)	-67.3 (-0.32)	0.50
YO	-374.8 (-0.55)	420.6 (0.35)	0.59	445.3 (1.91)	411.4 (1.84)	0.10
EL	-775.9 (-0.65)	-3273.3 (-2.44)	1.21	107.9 (0.37)	-282.6 (-1.46)	1.00
Log(POP)	-575.8 (-2.57)	-707.2 (-2.94)	0.42	30.9 (0.72)	-116.4 (-2.62)	2.08
N	443	443		443	443	
F_1	0.85 (0.518)			1.92 (0.089)		
F_2	1.04 (0.388)			0.40 (0.812)		

t-statistics in parentheses; F_1 (F_2) *is* F *statistic for equality of all coefficients* (*all coefficients except that of* Log(POP)) *between periods*

z *levels*   *x levels*

*x**

*z**

FD   PD   C   C   PD   FD

C = centralization; PD = partial decentralization; FD = full decentralization

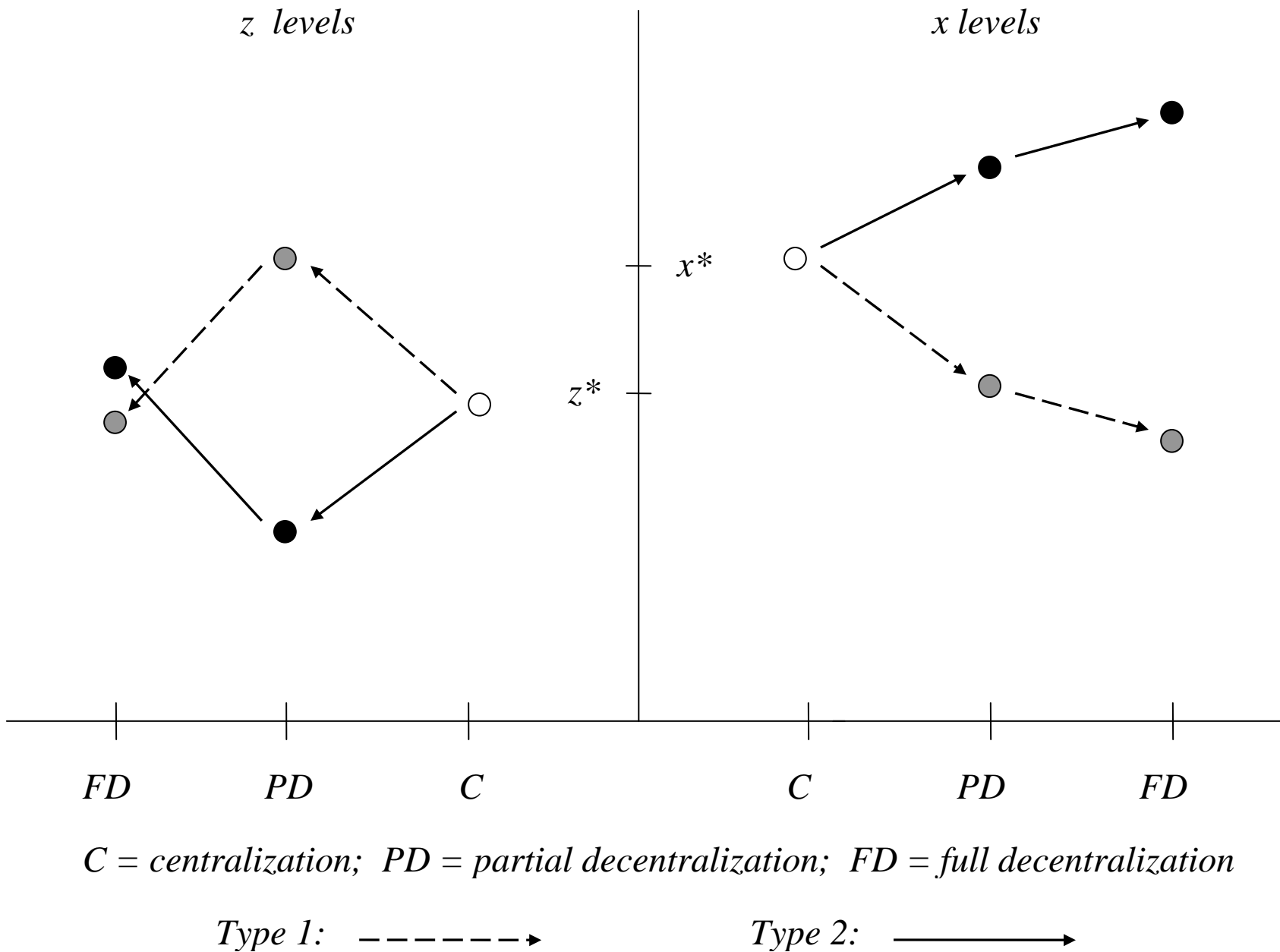*Type 1:* - - - - - →   *Type 2:* ——————→
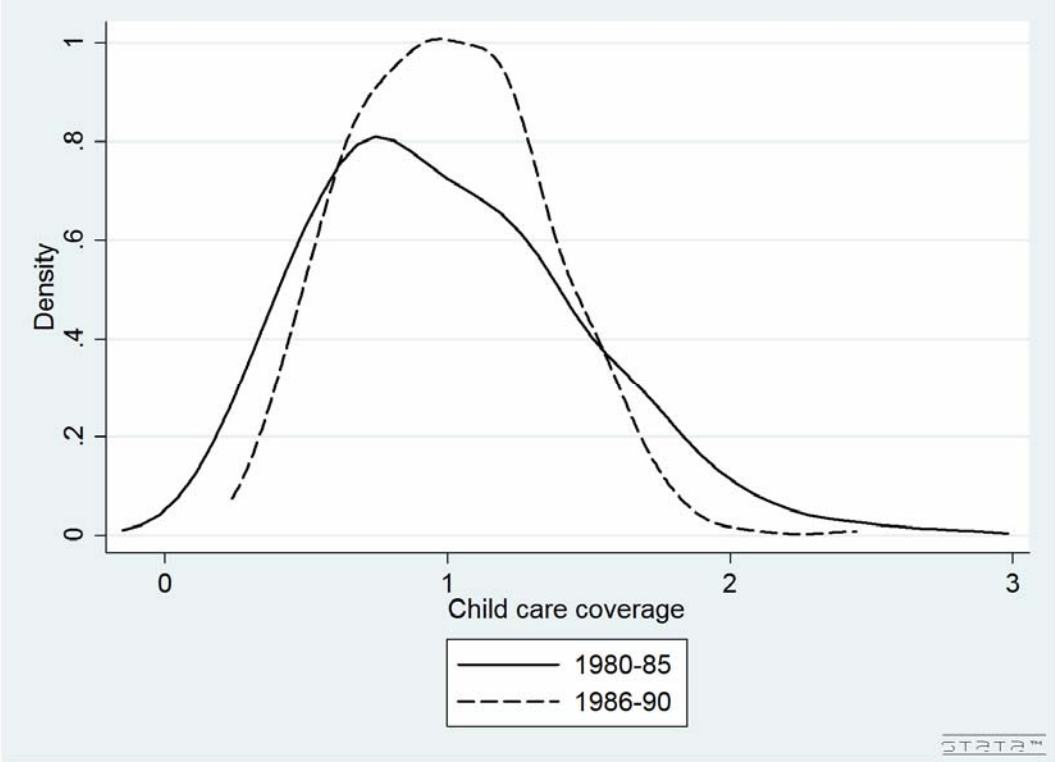
Figure 1: Effects of Decentralization

Figure 2: Kernel densities for child-care coverage
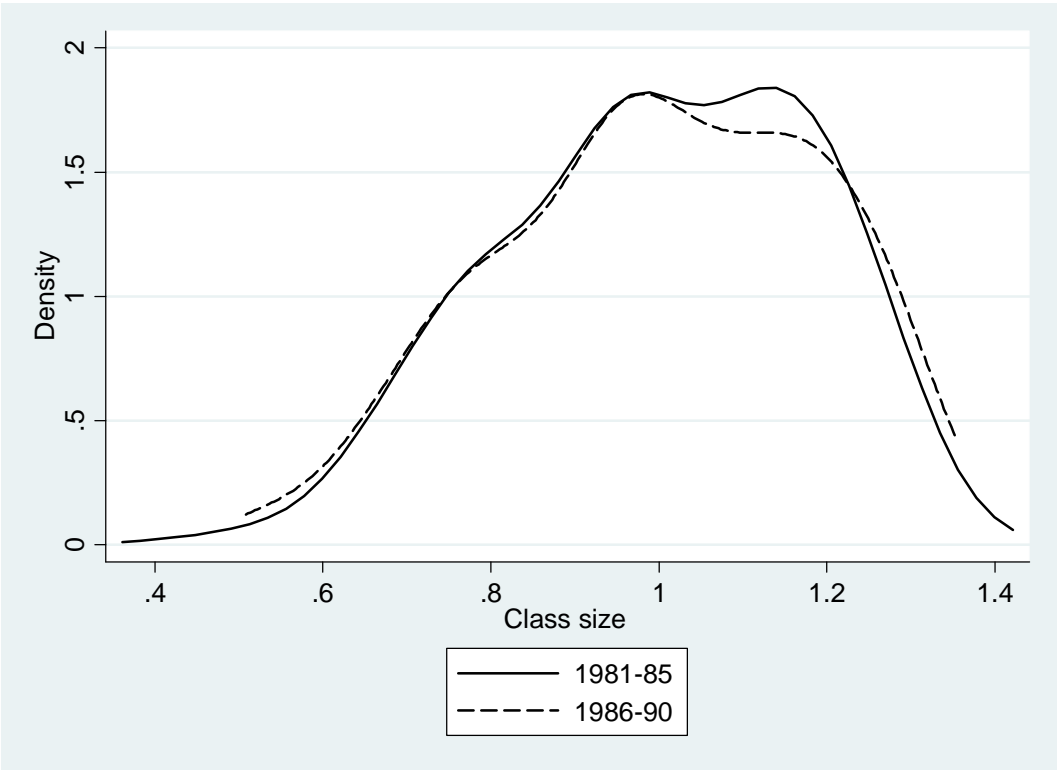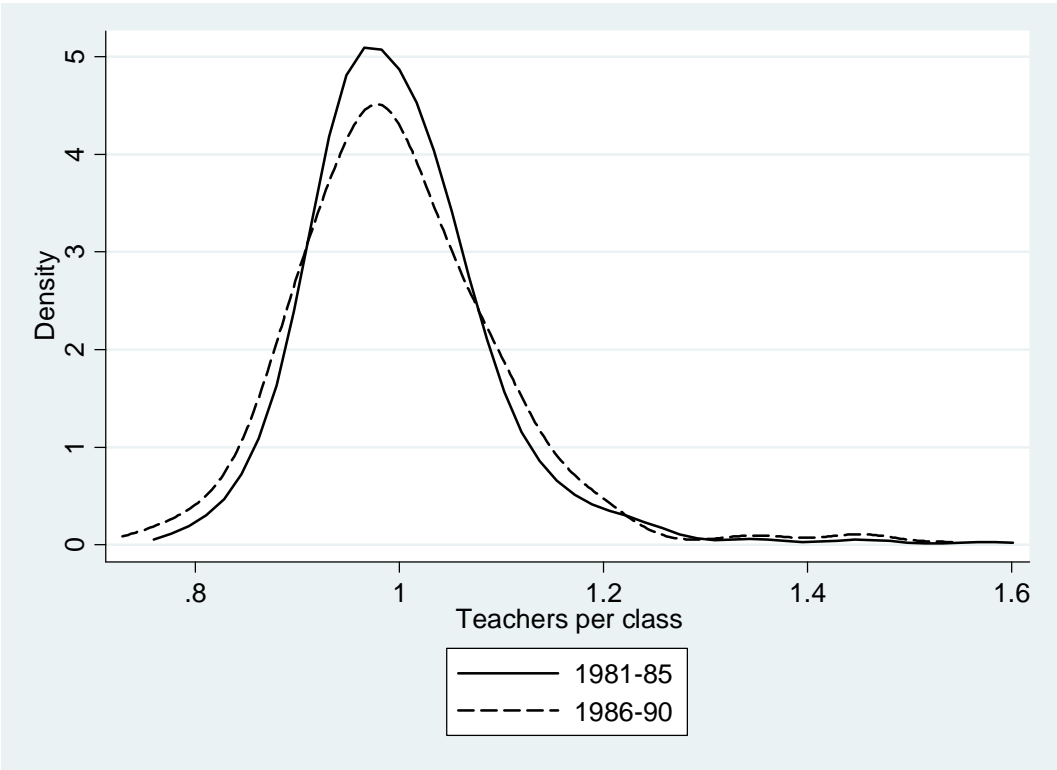
Figure 3: Kernel densities for class size
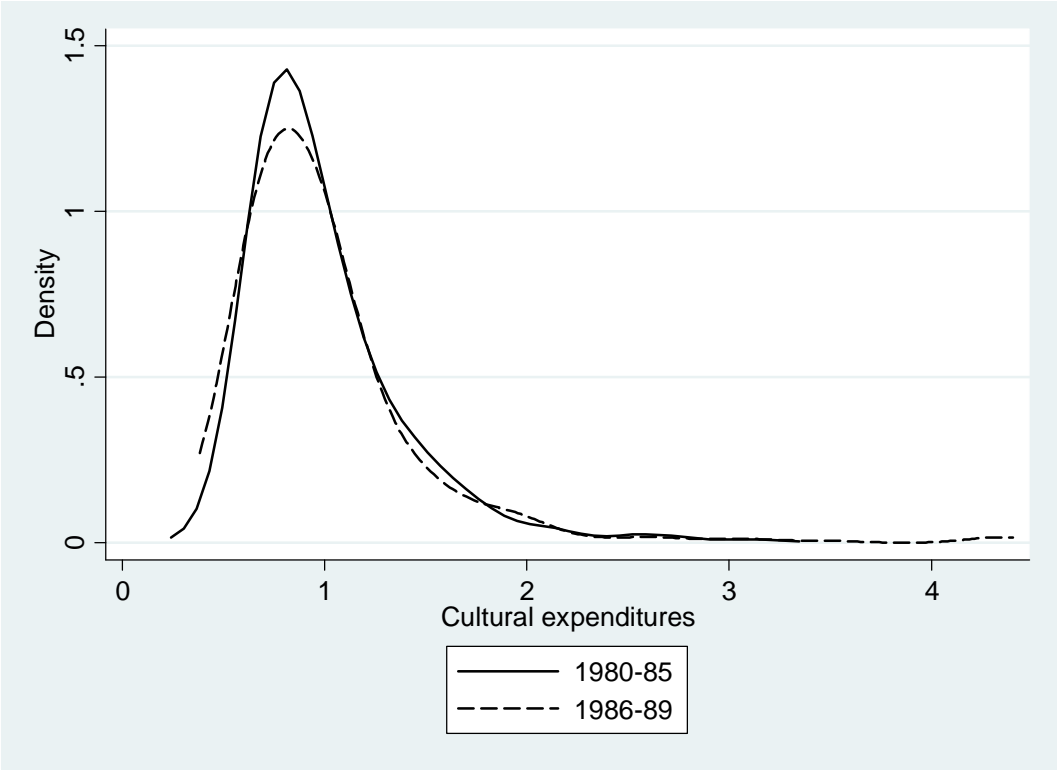
Figure 4: Kernel densities for teachers per class

Figure 5: Kernel densities for cultural expenditures

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Footnotes

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[1] For example, figures presented by Shah and Shah (2006) show that, in a sample of ten lower-income countries, local governments relied on intergovernmental transfers for 51% of their revenue, in contrast to a smaller transfer share of 34% for OECD countries. In a larger sample of developing countries analyzed by Shah (2004), 42% of subnational revenue (local and provincial) came from transfers.

[2] Although the Shah studies cited in footnote 1 do not present evidence on tax autonomy for the sample countries, a separate OECD study (1999) shows that, for one sample country (Mexico), subnational governments had effective control over only 14% of their tax revenue, with this limited control enjoyed only at the state rather than local level.

[3] Sigman (2007) offers a test for the effects of decentralization that does not rely on a natural experiment. Her empirical results show that variation in environmental quality is higher within federalist countries than within non-federal states, evidently reflecting variation in the restrictiveness of local environmental policies within the former set of countries.

[4] With full decentralization, jurisdictions in his model choose both the investment level in individual public projects and the number of projects to implement, in a setting with inter-jurisdictional spillovers. The central government can improve the outcome by specifying the level of project investment while still allowing localities to choose the number of projects undertaken, a partial-decentralization outcome that shares the spirit of the current approach.

[5] It does so because spending is then fixed at the level of the central transfer regardless of whether the uncertain unit cost of the public good turns out to be high or low (rather than adjusting to reflect this cost). As a result, rent-seeking politicians who wish to masquerade as benevolent can more easily extract rents under partial decentralization without revealing their type. While this conclusion affirms the superiority of full decentralization, Brueckner (2009) (in a variant of his basic model) offers a different result by showing that partial decentralization instead limits the options of rent-seekers, making it potentially superior to full decentralization.

[6] While local governments use nonredistributive and nondistortionary head taxes in a desire to avoid tax competition, a redistributive capital tax, which also distorts the economy by depressing capital supply, funds central provision of public goods. Facing a tradeoff between

efficiency and redistribution in the choice of local versus central provision, voters choose the optimal share of public goods to be provided locally, thus determining the extent of partial fiscal decentralization. Panizza (1999) and Jametti and Joanis (2011) use similar models in empirically oriented papers.

[7]For example, Rodden, Eskeland and Litvack (2003) offer a set of country studies addressing various issues of fiscal discipline in centralized systems. In the Norwegian context, Borge and Rattsø (2002) and Rattsø (2004) analyze fiscal adjustment within that country's centralized fiscal structure. Barankay and Lockwood (2007) analyze the impact of decentralization on governmental productive efficiency, using data for Swiss cantons with different degrees of decentralization. Zhuravskaya (2000) studies private business formation across Russian cities with different degrees of fiscal discretion.

[8]Eq. (12) and the condition $\alpha_1 > \alpha_2$ imply that $\beta_1 < \beta_2$ must hold. This inequality in turn implies $x_1^* < x_2^*$ using (2). However, since (12) and $\alpha_1 > \alpha_2$ carry no implication for the relative magnitudes of $1 - \alpha_i - \beta_i$ in (2), $i = 1, 2$, the relationship between the z_i^*'s is unclear.

[9]With (12) reversed, the inequality $1 - \beta_1/(1 - \alpha_1) < 1 - \beta_2/(1 - \alpha_2)$ holds, and given $1 - \alpha_1 < 1 - \alpha_2$, the direction of the first inequality is preserved after multiplying the left and right sides, respectively, by these expressions. The result is the inequality $1 - \alpha_1 - \beta_1 < 1 - \alpha_2 - \beta_2$, which implies $z_1^* < z_2^*$ using (2). There is no implication, however for the relative magnitudes of β_1 and β_2 and hence those of x_1^* and x_2^*.

[10]As can be seen from the tables, the length of time series varies slightly, reflecting the availability of data.

[11]Although class size is equal to teachers per class divided by teachers per student at the level of individual observations, the same relationship does not hold for the mean values shown in the table.

[12]The bandwidth is $1.06\sigma B^{-0.2}$, where σ is the standard deviation of the data and B is the number of observations.

[13]Note that a larger population reduces child-care coverage both before and after the reform.

[14]A positive elderly-share effect, which is hard to interpret, exists in the pre-reform period for teachers per student, but it disappears following the reform. Similarly, a significantly positive population effect exists prior to the reform for teachers per class, disappearing after it. These changes, which unfortunately run counter to the predictions, contribute to the significance of the F statistics.