Who's Coming to the Rescue? Revenue-Sharing Slumps and Implicit Bailouts During the Great Recession

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Abstract

This paper analyzes the distribution of *discretionary transfers* from higher tiers of government in the process of fiscal adjustment in local jurisdictions which were hit by a negative revenue shock in *formula transfers*. Spanish local governments experienced a 30% fall in their revenue-sharing revenues at the beginning of the Great Recession. We use a 'difference-in-discontinuities' design to identify the causal effect of that shock on the amount of discretionary grants provided by three higher tiers of government (i.e., central, regional, and provincial) and on other budget items (i.e., spending and taxation). We identify these effects using an exogenous variation in formula transfers, as the losses during the crisis of municipalities above the 5,000 population threshold were greater than the losses of those below this threshold. We find that, on average, municipalities above and below the 5,000 inhabitant threshold did not differentially adjust their budgets during the crisis. Rather, we find that for the most indebted municipalities, a substantial share of the shock was absorbed by discretionary grants provided by regional and provincial governments.

Keywords: intergovernmental transfers; bailouts; fiscal consolidation

JEL Classification: E62, H72, R5

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1 Introduction

Local governments across the globe experienced high levels of fiscal stress during the last recession (Ter-Minassian and Fedelino, 2010). The causes of these fiscal imbalances were twofold. First, many local governments had to deal with a reduction in their own-source revenues, based as they were on taxes (most notably, property transactions, capital gains, and business taxes) that fell sharply during the crisis. However, much of the problem was caused by the reduction in transfers originating from the upper tiers of government (Martínez-Vázquez and Searle, 2007). While this state of affairs was not entirely surprising, it does run contrary to the stabilizing role that these transfers are in theory supposed to play (see Blöchliger and Petzold, 2009). Indeed, transfers should be used to reduce the procyclicality of tax revenues and local spending; that is, they should be less generous in good times and more generous in bad times, especially when local tax autonomy is limited, and local governments face borrowing constraints (von Hagen, 2008).

One of the reasons why this does not occur in practice is that, in many countries, the evolution of transfers is directly linked to the evolution of the central government's tax revenues (OECD, 2014).[1] As central tax revenues tend to move with the cycle, spending on transfers also becomes procyclical and can exacerbate local government own-revenue fluctuations. This, for instance, has been the case of the revenue-sharing transfer received by the Spanish municipalities, whose dramatic fall during the Great Recession is analyzed in this paper. On the other hand, note that some intergovernmental transfers might be counter-cyclical.[2] For instance, and of particular relevance to our purpose here, discretionary transfers might be used during a crisis to provide implicit bailouts to local governments in financial trouble (Rodden, Eskeland, and Litvack, 2003; Vigneault, 2007). Although these transfers might provide some insurance against shocks and, thus, help local governments stabilize their revenues and avoid procyclical outcomes, bailouts might also give rise to moral hazard problems. Expectations of a bailout might soften the local budget constraint (Kornai, 1979) and, so, provide strong incentives to increase debt and to wait until higher tiers of government come to the rescue (see, e.g., Wildasin, 1997; Goodspeed, 2002; Köthenbürger, 2004; Breuillé and Vigneault, 2010, or Bordignon and Turati, 2009).[3] Note that the evolution of these two types of transfer might be interconnected:

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[1]There are other reasons that account for the procylicality of transfers (see OECD, 2014, for a more detailed analysis). For example, in times of crisis, local governments might find it difficult to fulfill the matching requirements of some grants. Also, the procyclicality of transfers might be policy-driven, as the central government might have incentives to increase transfers during booms (Abbott and Jones, 2012 and Abbott and Jones, 2013) and to reduce them during a crisis (Ahrend, Curto-Grau, and Vammalle, 2013).

[2]Another factor contributing to the counter-cyclicality of transfers is that specific grants - those mostly earmarked for capital projects - tend to constitute an important ingredient of stimulus packages (see, e.g., Carlino and Inman, 2015, for a discussion of the US case).

[3]Some papers though consider that bailouts may have some positive effects. For instance, without bailouts sub-national governments might be reluctant to engage in risky but socially beneficial projects (see Besfamille and Lockwood, 2008). Some recent papers also suggest that conditional bailouts (i.e., bailouts that impose a tight adjustment plan in exchange for financial assistance) might actually help consolidate local budgets (Dietrichson and Ellegård, 2015).

that is, the procyclical behavior of revenue-sharing grants might have been responsible for the rise in the number of bailout episodes during the crisis. This is a disappointing outcome from a policy perspective, given that strengthening the link between local resources and tax collections is often advocated on the grounds of increasing fiscal responsibility (e.g., Weingast, 2009).

This paper analyzes the role of discretionary grants used as tools by higher tier governments to bailout local governments when the latter face a revenue-sharing slump. We focus on Spanish local governments, which experienced a fall in their revenue-sharing revenues of more than 30% at the beginning of the Great Recession. We look at the effect of this negative shock on the amount of discretionary grants received and on other budget outcomes (i.e., spending and taxes) during the Great Recession (2008-2012). The first contribution made by this paper is to provide evidence of implicit bailouts, that is, of higher tiers of government increasing grants to local governments in the wake of a negative shock. The literature abounds with anecdotal accounts of bailout episodes (see Rodden, Eskeland, and Litvack, 2003; Inman, 2001; Dahlberg and von Hagen, 2004) and various papers provide econometric evidence of the positive effects of debt on discretionary grant allocation (see Bordignon and Turati, 2009; Sorribas-Navarro, 2011; Fink and Stratmann, 2011).[4] Moreover, while these papers examine bailouts by federal governments of state administrations, we focus our study on the role played by all higher tiers of government (i.e., central, regional, provincial) in rescuing local governments that find themselves in trouble. Indeed, our results provide evidence of the differences in the bailout incentives of these three higher tiers of government. These differences would appear to be attributable to the role played by each tier in the design and implementation of revenue-sharing grants[5], to the overlap that exists between upper tiers and local governments in the funding of specific services[6], and to the political role played by local governments vis-à-vis each upper tier.[7] To the best of our knowledge, only a few papers take into account the possibility that more than one tier of government might be granting or receiving bailouts (see Breuillé and Vigneault, 2010, for one obvious exception).

Our second contribution is to use a quasi-experimental methodology that allows us to interpret our results as causal. We implement a 'difference-in-discontinuities' design (see Nannicini, Grembi, and Troiano, 2016), which specifically exploits the characteristics of a 2002 re-

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[4]Other papers have sought to identify the effect of bailout expectations on spending and deficit decisions, in an effort to provide evidence of a soft-budget constraint and, hence, of moral hazard problems (see Pettersson-Lidbom, 2010; Bordignon and Turati, 2009). Given the enormous difficulties in the measurement of expectations, we have opted not to pursue this approach and so we make no claims to be testing for the presence of a soft budget constraint. Rather, our study examines the causal effect of the shock on discretionary grants.

[5]For instance, in Spain the central government is responsible for the design of local revenue-sharing. Interestingly, a reform enacted by this tier of government in 2004 exposed this transfer revenue completely to the evolution of the business cycle. Recently, central government has been blamed for the poor outcomes, which might have affected its bailout incentives.

[6]Regional and provincial governments tend to co-fund many local services and projects, which means they might be especially concerned for these specific outcomes.

[7]There is evidence that regional and provincial governments - much more than is the case of central government - tend to favor co-partisan discrimination in the allocation of local transfers (see Solé-Ollé and Sorribas-Navarro, 2008).

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form of the local revenue-sharing transfer system that generated larger relative revenue losses during the 2008-2013 crisis for municipalities with a population threshold above that of 5,000 inhabitants. Various authors have already stressed the omitted-variable and endogeneity problems that plague the estimation of the effects of intergovernmental transfers (e.g., Knight, 2002) and, indeed, several studies employ quasi-experimental methods for precisely this purpose (see Gordon, 2004; Dahlberg et al., 2008; Lundqvist, Dahlberg, and Mörk, 2014; Litschig and Morrison, 2013). In some of these papers the identification strategy exploits the exogenous variation created by a reform in the transfer formula (see Gordon, 2004 and Cascio, Gordon, and Reber, 2013), others rely on a 'regression discontinuity design' that exploits jumps or kinks at specific population thresholds (e.g., Dahlberg et al., 2008; Lundqvist, Dahlberg, and Mörk, 2014; and Litschig and Morrison, 2013). Our identification strategy in this papers combines the advantages of these two approaches.

Similarly note that all the aforementioned studies examine the long-run effect of transfers on budget outcomes and not the response to a negative shock over time. Several papers have, however, analyzed the role that transfers play in the dynamics of local fiscal adjustment (Buettner and Wildasin, 2006; Buettner, 2009; and Solé-Ollé and Sorribas-Navarro, 2012). Buettner and Wildasin (2006) find that transfers have no impact on fiscal adjustment in the US, while Buettner (2009) and Solé-Ollé and Sorribas-Navarro (2012) find that formula transfers do have an effect after tax base shocks in Germany and that capital transfers are adjusted in the wake of an expenditure shock in Spain, respectively. Note, however, that these papers do not differentiate between positive and negative shocks and given that the response need not be symmetric, these findings might not actually reveal a great deal about the role of transfers during a crisis. Likewise, these papers rely on VAR methods to identify these effects, and while they provide a very rich description of the dynamic of the response to the shock, they have well-documented limitations in terms of identification. As such, our quasi-experimental approach constitutes an improvement on such methods.

We find that municipalities above and below the 5,000 inhabitant threshold did not differentially adjust their spending or taxation levels during the crisis. These results indicate either the complete failure to consolidate local budgets or the fact that higher tiers of government intervened to remedy the situation. Both scenarios are supported by our results. First, on average, municipalities simply allowed their debt levels to grow as they absorbed the shock. However, in the case of the most heavily indebted municipalities, a substantial share of the shock was absorbed by regional and provincial discretionary grants. Despite anecdotal evidence of the central government adopting specific measures in response to the revenue-sharing slump, our results suggest that it took no part in rescuing troubled municipalities. This would imply that the bailout measures enacted by the central government were mainly just rhetoric or simply ineffective. Indeed, our results indicate that most of the bailing out of local governments was undertaken by the regional governments and, to a lesser extent, the provincial governments.

The rest of the paper is organized as follows. In Section 2 we describe the background to local public finances in Spain, outlining the revenue-sharing transfer systems and the effects of the 2002 reform, which plays a crucial role in our identification strategy. In Section 3 we devise a conceptual framework to aid us in the interpretation of our results and we describe the identification strategy used and the data. Section 4 presents the results. Section 5 concludes.

2 Institutional background

2.1 Spanish local public finances

Spain has four tiers of government. There are 17 regional governments (the so-called *Comunidades Autónomas*), responsible for major spending categories, including health and education. Below this, there are two tiers of local government: the provinces and the municipalities. Contrary to the situation in most federal countries, local government is regulated and funded by the central government (i.e., they are not the dependents of the regions). However, as the regional governments delegate some of their spending responsibilities to the municipalities, they do co-fund these services and so demonstrate a concern for their quality and for the financial situation of the municipal governments. The role of the provinces is restricted to the provision of administrative and financial assistance to small municipalities, which suggests that the provision of relief in times of crisis might be quite natural. Note also that, while regional and municipal politicians are elected directly, provincial politicians are chosen indirectly based on the results of the municipal elections. Spain has more than 8,000 municipalities, most of which are small. The municipalities are multi-purpose governments with similar spending responsibilities to those assigned to local governments elsewhere (i.e., environmental services, urban planning, transportation and urban infrastructure, welfare assistance). However, the size of Spanish local governments is comparatively modest (i.e., representing around 15% of public spending).

Municipal own revenues account for around two thirds of current revenues[8], and the remaining third are grants (see Solé-Ollé, 2010). The main grant is a revenue-sharing grant allocated by the central government (i.e., the PIE, or *Participaciòn en los Ingresos del Estado*), which normally accounts for two thirds of current grants. The remaining grants are earmarked for specific purposes. To receive such grants, municipalities must respond to calls convened by government agencies (belonging to one of the higher tiers of government, i.e., central, regional or provincial). The tax-sharing grant is an unconditional formula grant and cannot therefore be manipulated. Earmarked transfers are somewhat discretionary, and the rules applied for their concession are not always clear (see Solé-Ollé, 2010). Some of these grants might be com-

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[8]Two thirds of a municipality's own revenues are derived from taxes, while the remaining third come from user charges. The main taxes are the property tax, the local vehicle tax and the local business tax, which account for 50, 25 and 10%, respectively, of tax revenues. Spanish local governments can set the rates of these taxes, subject to minimum and maximum rates that are rarely binding.

pletely discretionary, given that their purpose is to address specific situations, such as catastrophes (e.g., floods, forest fires, etc.) or financial difficulties. During periods of crisis, regional and local governments tend to create new financial relief grants or to change the regulations applying to previous grants so that they might be used to fund deficits (i.e., by allowing capital transfers to be used for current spending).

2.2 The revenue-sharing transfer

Amount and evolution. The grant was introduced in the late 1980s[9] with the aim of providing a stable framework for financing the Spanish municipalities, which had been exposed to a period of severe funding problems at the beginning of that decade. The law extended municipal tax autonomy (e.g., by widening the difference between minimum and maximum tax rates) and converted the unconditional grant received by municipalities from the central government into a revenue-sharing transfer. The law specified that the formula and overall amount could be modified every fifth year, following negotiations between the municipalities and the central government. During the negotiations, the central government typically raised the amount to be distributed in the following period (to make the changes to the formula more palatable for the municipalities). The amount of funding in this base year was expressed as a percentage of the central government's tax revenues and modified in the following period in line with the growth in the tax revenue rate. Importantly, the law established both a floor and a ceiling for the evolution in the overall amount of the grant: the amount to be distributed was not permitted to grow more than the (nominal) growth rate of GDP and was to be kept constant in real terms. [10]

Allocation formula. The new law specified the variables to be included in the polynomial formula used for allocation.[11] These variables were weighted population (with weights jumping at the 5, 20, 50 and 100 thousand population thresholds), tax effort (computed as the ratio between the tax rates set by the municipality and the maximum tax rates allowed by law), and the number of school units (since municipalities have some responsibilities for maintaining state schools). Weighted population represented the variable with the greatest weight (between 70 and 75%). School units were subsequently withdrawn from the formula, on the grounds that school maintenance represented a small share of local spending, and the weight of tax effort was reduced after 1999, given that it did little to stimulate tax autonomy. Instead, an inverse fiscal capacity variable was introduced in the formula; note, that before

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[9]The main traits of the tax-sharing grant (PIE) are outlined in the legislation that continues to regulate local public finances in Spain, that is, Law 39/1988, *Reguladora de Haciendas Locales,*

[10]During the period 1990-1994 the floor was set by the growth rate of spending needs, quantified as the rate of growth of central government spending in categories similar to those for which local government has responsibility. The implementation of this rule gave too much discretionary power to central government and was abandoned following repeated complaints from the municipalities.

[11]See Solé-Ollé and Bosch (2005) and Solé-Ollé (2010), for a detailed description.

1999, the unconditional grant failed to equalize the differences in the local tax bases. The way in which this variable was computed during the period 1999-2003 was particularly blunt, to the extent that the equalizing power of the formula remained null (see Solé-Ollé and Bosch, 2005). It was not until the 2002 reform that the calculation of this variable was improved and the impact of this change is crucial for our identification strategy here (for more details see below).

Minimum guaranteed transfer. The central government employed two main tools to alleviate the distributional effects of the re-negotiation of the revenue-sharing grant. First, it increased the amount of money for distribution. Second, it guaranteed that, in each of the following five years, each municipality received at least the same amount of money (in nominal terms) that it would have received if the old system had been applied at the outset. This meant that, in practice, the new formula was never fully applied. The municipalities that under the new formula received an amount that was lower than the sum received under the old formula were granted a minimum guaranteed transfer equal to the amount of the old formula. The discrepancies between the formula and the minimum grant were then subtracted from the formula grant of those municipalities unaffected by the constraint (i.e., those for which the new formula amount was larger than the minimum guaranteed transfer). Since the minimum only applied to the first year of the period, the number of municipalities receiving the minimum transfer fell (and eventually disappeared completely) during periods when the total amount of the grant to be distributed grew. Of course, this share might increase over time as this amount shrank, and over a long period it might fluctuate in line with the business cycle. Third, an additional guarantee was provided for small municipalities (those below the 5,000 threshold), which meant that the application of the formula for municipalities with particularly low values of the variables was further limited.

Implementation. The purpose of the revenue-sharing grant is to provide a stable source of cash for all municipalities. Therefore, a system of 'cash-advances' was used: the central government disbursed an estimation of the yearly grant to each municipality in monthly installments. This estimate was based on the information in t-1 of the variables included in the formula and on a forecast made in t-1 of the evolution in central government's tax revenues (included in the budget law of year t). The grant was then rectified during the second semester of t+2, once the final data regarding the formula variables and tax revenue were known. A municipality received an additional grant in t+2 if the 'cash-advance' was lower than the final amount of the grant. If this final amount was higher than the 'cash-advance' then the municipality had to return the difference to the central government. Originally, it was established that municipalities had to refund these negative grants in monthly quotas over a two-year period.

2.3 The 2002 reform

The revenue-sharing grant was reformed in 2002, and the new system came into effect at the start of 2004.[12] The reform introduced two main changes:

- First, the evolution of the overall grant amount would be linked to the growth in the central government's tax revenues. Thus, the GDP ceiling and the price floor were abolished. Similarly, the scheduled reforms that occurred every fifth year were also abolished. As a result, the municipalities were able to benefit from the extraordinary growth in revenue during the boom years. However, they were at the same time completely exposed to the fluctuations of the economic cycle.[13] The main motivation for this reform was political: the central incumbent could not resist the rent-seeking pressures from local (and regional) governments in the face of the huge revenue windfalls of that period.[14]

- Second, changes were made to the formula and the minimum grant. The weight at the 5,000 inhabitant threshold was raised from 1.15 to 1.17, and the jump at the 10,000 threshold (i.e., from 1.15 to 1.17) was abolished.[15] The computation of the fiscal capacity variable was also changed. Between 1999 and 2003, fiscal capacity was computed as the average tax revenues per capita of the population bracket of the municipality. As of 2004 fiscal capacity was computed using the tax revenues per capita of each particular municipality relative to the average fiscal capacity of the population bracket.[16] Note, the additional minimum grant for small municipalities (those below the 5,000 inhabitant threshold) was abolished.

This reform had significant effects that we exploit for our identification strategy. First, the reform increased the exposure of the revenue-sharing transfer to the economic cycle. Figure 1 shows the actual evolution of the revenue-sharing transfer (in per capita terms) during the period 2002-2013 (blue line), and also the simulated evolution of the grant had the ceiling and floor limits not been abolished by the 2002 reform (red line). The Great Recession started in 2008, hitting Spain a year later and cutting its GDP by 3.6%. The GDP growth rate was to remain

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[12]Table A1 in the Appendix summarizes the changes implemented in the formula.

[13]Note that this reform needs to be seen as part of a wider one. Both the regions and the cities with a population threshold above 75,000 were given access to tax sharing in specific taxes collected in their jurisdiction (namely, personal income tax, VAT and excises).

[14]The incumbent's view regarding decentralization probably also influenced the reform. The aim was to increase fiscal responsibility by making sub-national revenues more sensitive to growth and by increasing sub-national tax powers (this last change only being made for the regions, see Solé-Ollé, 2013). The purpose was to rein in the supposed spending profligacy of sub-national governments and to harden budget constraints (see Sorribas-Navarro, 2011).

[15]The jump at the 100,000 threshold also disappeared as following the reform municipalities above the 75,000 threshold were moved to a different funding system.

[16]Clearly, both approaches are erroneous. The first only redistributes between population brackets, such that the equalization power remains null. The second redistributes within brackets, creating unusual effects at the thresholds. The reasons for this peculiar design are the political difficulties encountered in attempting to equalize fiscal capacity. The solution adopted in 1998 was entirely cynical: fiscal capacity was included in the formula, but the eventual design rendered it impracticable. The situation began to change with the 2002 reform and the availability of funds to compensate losers.

negative throughout the rest of this period. Figure 1 clearly illustrates the immense size of the shock to revenue-sharing in 2008 and 2009. The drop represented a fall of around 30% on the 2007 level, with reductions of a similar size in both fiscal years. The average per capita amount that was distributed shrank from more than 180 euros to less than 130. Note, however, that the grant would not have fallen so much had the old evolution rule (based on price growth, which was positive during the crisis years) been retained. Of course, similarly, the grant would not have grown so much during the boom, given that central government's tax revenues grew more than national GDP during those years. Yet, even in the old system, the tax-sharing grant was procyclical, with revenues growing at a higher rate than the trend GDP (dotted line).

[Figure 1 about here]

Second, the reform increased the difference between the amount of transfers assigned by the formula to municipalities below and above the 5,000 threshold. Per capita grants had already jumped at this threshold before the reform, because of the jump in the population weight applied. However, the aforementioned modifications in the formula heightened the effect. Figure 2 shows the percentage increase in per capita transfers around this threshold (which stands at about 10%).[17]

[Figure 2 about here]

2.4 Fiscal consolidation and bailouts

During the years of the Great Recession, Spanish public finances went through deeply troubled times. The revenue shocks described above affected all tiers of government, leading to generalized debt increases (see Lago Peñas and Solé-Ollé, 2016, for a detailed description). Moreover, the process of fiscal consolidation following these shocks was slow, it not being until 2013 or 2014 that substantial cuts were made in sub-national public spending. However, some regional and local government were ousted from credit markets much earlier (see again Lago Peñas and Solé-Ollé, 2016). This suggests that during these years the central government and regional and provincial governments (at least those that faced fewest financial problems) played an important role in helping consolidate local budgets.

First, following the complaints made by the municipalities regarding the possible impact of their having to pay a refund (i.e., negative grants that had to be paid back to the central government), and which arose after the clearing of the revenue-sharing grants of 2008 and 2009 (as well as those of 2010 and 2011), the central government extended the number of years over which the refund could be paid. First, the period was extended from two to five years, an option made available to all municipalities, irrespective of their financial situation. Second, the period

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[17]Table A1 in the Appendix shows the pre and post reform jumps in the per capita amount at the 5 thousand population threshold (and the difference between them), both for the total grant and for the different formula variables.

was extended to ten years for municipalities in financial trouble (although informal contacts with local managers suggest that, in practice, this facility was available to all municipalities). Given these characteristics, we believe this loan can be qualified as a form of implicit bailout. Note, first, that no interest has to be paid, which is quite remarkable if we take into consideration that by this time many municipalities had been excluded from the credit markets. While there is no legal provision stating that these loans are not going to be repaid, the refund has been delayed considerably, and so just what might happen to this debt when payment falls due is unclear. Second, regional and provincial governments used funds from earmarked programs for tax relief purposes and even created new grant programs for the same purpose. Likewise, this constitutes yet another type of implicit bailout used to help local governments in financial difficulties. These types of implicit bailout measures can be aggregated into a single measure. Figure 3 below shows the evolution of revenue-sharing vs. implicit bailouts over the whole period, indicating that implicit bailouts through grants increased following the slump in revenue-sharing.[18]

[Figure 3 about here]

While the revenue-sharing grant (in blue) fell as the crisis unfolded, the overall amount remained stable, as other grants (in red) were used to top them up. In the next section, we explain how a causal relationship can be established between these two elements.

3 Empirical analysis

3.1 Conceptual framework

The purpose of this paper is to analyze how Spanish municipalities adjusted their budgets during the Great Depression (2008-2012) in response to the shock that hit the tax-sharing grant. In particular, we are interested in comparing the respective roles of local adjustment, on the one hand, and implicit bailouts provided by higher tiers of government, on the other.

We define ∇G_i as the revenue-sharing shock experienced by municipality i, that is, the drop in revenue-sharing transfers between the peak of the boom years (i.e., 2006 and 2007) and the average transfers during the crisis (i.e., 2008-2012). As explained in Section 2, the way in which the revenue-sharing grant is implemented means that the timing of the shock in terms of entitlement differs from the timing of the shock in terms of outlays. The shock to entitlements occurred during 2008-09, while the shock to outlays was delayed until 2010-11. These effects are illustrated in Figure 4 below. The graph shows how entitlements began to drop in 2008 and continued to fall in 2009, while outlays did not fall until 2010. By the end of the period, both entitlements and outlays had returned to their previous levels.

[Figure 4 about here]

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[18]Please refer to Section 3.3 for a detailed description of how these variables are calculated.

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We define spending cuts (∇E_i) and tax increases (ΔT_i) in the same way, and ΔL_i ($= \nabla E_i + \Delta T_i$) is the local (own) adjustment to the shock. Finally, we define ΔB_i as the average amount of bailout-funds received. In the empirical specifications, we decompose B into the different parts originating from the different tiers of government, $B^{central}$, $B^{regional}$ and $B^{provincial}$. The first of these includes other grants from the central government (defined as total grants received less G) and implicit bail-outs through delayed repayments in the case of a negative difference between 'cash-advance' and the final amount of the grant. For the other two tiers of government, we measure the discretionary grants provided to the municipalities. As the residual, ΔDEF_i is the average increase in the primary deficit.

By the budget identity, we have:

$$\nabla G_i = \Delta L_i + \Delta B_i + \Delta DEF_i \tag{1}$$

and the average response to the tax-sharing shock can be estimated as:

$$\Delta L_i = \alpha^L + \beta^L \cdot \nabla G_i + u_i^L \tag{2a}$$

$$\Delta B_i = \alpha^B + \beta^B \cdot \nabla G_i + u_i^B \tag{2b}$$

$$\Delta DEF_i = \alpha^{DEF} + \beta^{DEF} \cdot \nabla G_i + u_i^{DEF} \tag{2c}$$

Effect on the average municipality. Note that the shock, although certainly massive, was of a transitory nature. Therefore, the optimal response of a municipality should have been to generate a primary deficit and to let the debt level rise, thus smoothing the shock over a long period (Jappelli and Pistaferri, 2010). If a municipality had responded in this way, we would expect β^{DEF}=1 and β^L=0. However, for some local governments such a response might have been impossible due to credit constraints (see, e.g., Borge and Tovmo, 2007). Although the debt level of Spanish municipalities was not especially high on suffering the revenue-sharing shock, the scarcity of credit that characterized the crisis period limited their ability to resort to using this instrument.[19] This being the case, we should find some degree of adjustment even on average, i.e., we would expect 1> β^{DEF} >0 and β^L and β^B >0.

High v. low debt municipalities. In line with the preceding discussion, it is also reasonable to expect some heterogeneous effects depending on the starting level of debt. For any of the outcomes above, represented by Γ, we have:

$$\Delta \Gamma_i = \alpha^\Gamma + \beta^\Gamma \cdot \nabla G_i + \gamma^\Gamma \cdot \nabla G_i \cdot D_i^0 + \delta^\Gamma \cdot D_i^0 + v_i^\Gamma \tag{3}$$

where D_i^0 is the level of debt before the shock. A higher level of starting debt increased the probability that the revenue-sharing shock would worsen the financial situation, making

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[19]See Bentolila et al. (2013) for a general discussion of the effect of the credit drought in Spain during the Great Recession.

it difficult for the municipality to obtain more credit and increasing the likelihood of fiscal adjustment (either local or external). This, the marginal effect of the shock on spending cuts, tax increases, and bailouts should be increasing in initial debt.

Who is coming to the rescue? We differentiate between the implicit bailout responses provided by each of the three tiers of government (i.e., central, regional, and provincial). The literature differentiates between bailouts made to avoid spillover effects (see Wildasin, 1997, and Crivelli and Staal, 2006) and those issued to safeguard the basic equality of public services across localities (see Breuillé and Vigneault, 2010, Köthenbürger, 2004 and Goodspeed, 2002).

3.2 Identification

A threat to the estimation of the above equations is the possible endogeneity of the revenue-sharing shock. There are various sources of omitted or unobservable variables that may bias the OLS estimates. For example, there might be some local characteristics (e.g., income shocks and political traits) that have an influence on local budgets (i.e., spending cuts, tax or debt increases) and that are also correlated with the variables used in the revenue-sharing formula (e.g., the tax rates and tax bases used to compute the tax effort and fiscal capacity variables). It might be feasible to control for these influences by adding a vector of covariates to the equations, but it is not clear that this will completely eliminate any potential bias.

For this reason, we use a source of exogenous variation in the revenue-sharing shock. We exploit the fact that the revenue-sharing shock was stronger to the left of the 5,000-population threshold than it was to the right. Municipalities above this threshold benefited from the 2002 reform, which increased the size of the jump at the 5,000-inhabitant threshold. This means that, when the crisis hit, the amount of the grant received by these municipalities was further from the minimum guaranteed grant. Hence, the size of the drop was greater.

[Figure 5 about here]

This is illustrated in Figure 5. The figure shows how the log of per capita revenue-sharing transfers evolved for two hypothetical municipalities, one with more than 5,000 inhabitants (in blue) and one with less than 5,000 inhabitants (in red) at the time of the reform. These two municipalities are assumed to be identical in all other respects. Note how before the reform the municipality with more than 5,000 inhabitants already received more transfers than its counterpart with a population below that threshold. Although the absolute difference between the two municipalities increased during the period (thanks to the increase in the overall amount of resources distributed by the revenue-sharing transfer), the log-difference stayed constant. The reform increased the difference between the two municipalities: note how the blue line climbs and the red line falls. The green and pink lines are the minimum guaranteed grants of each of the two municipalities. Note that following the reform the minimum guaranteed grant is never

binding for the larger of the two municipalities (after 2004 the red line is always above the pink). In contrast, the minimum guaranteed grant is binding for the smaller municipality during the first year of the implementation of the reform: note that the solid blue line (which indicates the actual grant allocated) is above the dashed line (representing the formula amount, which is not implemented in those years because it is lower than the minimum). Note also that the formula amount falls between 2008 and 2009 by exactly the same amount in both cases; however, the fall in the actual amount received is much greater for the larger of the two municipalities, because the formula never drops below the minimum. In contrast, the smaller of the two municipalities obtains the minimum grant over three consecutive years (2008-2010), which means the drop in the amount of the grant from the peak recorded in 2007 is much smaller.

In line with these trends, we can write the revenue-sharing shock as a function of a dummy variable coded one if the population of the municipality at the time of the reform had more than 5,000 inhabitants:

$$\nabla G_i = \mu^G + \eta^G \cdot d(pop_i \geq 5000) + \varepsilon_i \tag{4}$$

This is used as the first-stage equation, and we can find the reduced form by substituting this equation in those above (which is the one we estimate here) to obtain:

$$\Delta \Gamma_i = \pi^\Gamma + \rho^\Gamma \cdot d(pop_i \geq 5000) + \varsigma_i \tag{5}$$

Note that by comparing the results of Equations (5) and (4) we obtain an idea of the composition of the adjustment process. For instance, the effect of a cut of 100 euros in the revenue-sharing transfer on the amount of bailouts is simply the ratio of the two estimated coefficients, which alternatively can be obtained by estimating equation (5) by 2SLS using the $d(pop_i \geq 5000)$ as an instrument. The identifying assumption behind this strategy is that both treated and control municipalities where on parallel trends before the treatment. The treatment is defined as having a population greater than 5,000 inhabitants at the time of the reform. Unfortunately, good quality data for the outcomes of interest are only available after 2002, so we cannot formally test this assumption. For this reason we have opted to follow Nannicini, Grembi, and Troiano (2016) and estimate a 'difference-in-discontinuities' model instead of using first differences directly. With this aim, we add a polynomial of population to the above equation. We apply a local linear regression function, as suggested by Gelman and Imbens (2014), to estimate the boundary points of four different functions of our outcome variable on P_{it} to the left and the right of the 5,000- inhabitant threshold and before and after the onset of the Great Recession: [20]

$$\Gamma_{i,t} = \delta_0 + \delta_1 P_{it}^* + S_i(\gamma_0 + \gamma_1 P_{it}^*) + C_t[\alpha_1 P_{it}^* + S_i(\beta_0 + \beta_1 P_{it}^*)] + t_t + \varepsilon_{it} \tag{6}$$

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[20]For reasons of clarity, we omit the superscript Γ when indicating the outcome variable from hereon.

As in [Nannicini, Grembi, and Troiano (2016)](#), $S_i = d(pop_i \geq 5000)$ is a dummy for municipalities above the 5,000 population threshold (the defining treatment) and C_t is an indicator of the crisis period. P_{it}^* is the normalized population size, i.e., $P_{it} - 5000$. Our model includes a full set of time fixed effects. Therefore, we can omit the baseline effect of C_t as this is a linear combination of the year effects. We cluster standard errors at the observational level. The identifying assumption in this case is that municipalities just below and just above the threshold were on parallel trends prior to the treatment. We are also unable to test this assumption. However, we are confident that the evolution of municipalities of roughly the same size is more similar than that of municipalities in population brackets below and above the 5,000 threshold (which range from zero to 4,999 inhabitants and from 5,000 to 20,000). The 'difference-in-discontinuities' strategy is especially helpful when other policies also change at this same threshold. In our case, we know that Spanish municipalities above the 5,000-inhabitant threshold have more spending responsibilities, higher maximum tax rates, and larger council sizes, than municipalities below this threshold (see [Foremny, Solé-Ollé, and Jofre-Monseny, 2015](#)). We also know that they always obtain more revenue-sharing resources. Note, however, that all these influences were already present before the 2002 reform, which means that in practice they will be captured by the base-period coefficient γ_0. This coefficient does not have any causal interpretation (being a mixture of all the effects of all the aforementioned policies). The parameter of interest is β_0 which captures the effect of the municipalities subject to treatment in the crisis period.

To estimate heterogeneous responses across municipalities we allow for interactions with the starting level of debt D_i^0. In this case the model becomes

$$\Gamma_i = \delta_0 + \delta_1 P_{it}^* + S_i(\gamma_0 + \gamma_1 P_{it}^*) + C_t[\alpha_1 P_{it}^* + S_i(\beta_0 + \beta_1 P_{it}^*)] \tag{7}$$
$$+ D_i^0[\pi_1 + \beta_0^D(C_t \cdot S_i) + t_t + \varepsilon_{it}$$

and the two coefficients of interest are β_0 as the baseline effect and β_0^D for the interacted term.

3.3 Data and sample

We use data for the entire period 2006-2012 to study the effects of the shock to the formula grant on various budget categories: current spending, tax revenues (including revenues from taxes and user charges), as well as formula and discretionary grants.[21] The data are provided by the Ministry of Finance (*Ministerio de Hacienda y Administraciones Públicas*). Data on resident population and other demographic controls are provided by the National Institute of Statistics and several other sources.[22] All budget variables are expressed in per capita terms and in logs.

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[21]We focus on the period until 2012, because the constitutional reform of that year changed the regulations regarding access to credit, deficits, and introduced a spending rule. This however, should be analyzed once sufficient post-reform years are available to provide reliable estimations.

[22]The data on public spending and revenues presented missing values for about 2% of the sample. To keep the panel balanced, we linearly interpolated these observations and dummified them in all specifications. Our results

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We logged the variables so that the negative revenue-shock did not just reflect the mechanical effect of municipalities with higher per capita grants at the peak of the boom recording greater losses in absolute terms simply because the total amount of funds dropped. The variation in our instrument is not just attributable to this effect (recall Figure 5): it also derives from the fact that the municipalities that benefited most from the 2002 reform were the ones that received the largest minimum guaranteed grant, thus they had more to lose in the event of a crisis. The use of logs, however, has an associated cost: the interpretation of the size of the coefficients is less intuitive. For this reason, when interpreting the results we transform the coefficients into euros by evaluating the effect on the median value of the budget variables involved.

We use a sample of all the municipalities with a population between 3,000 and 9,000 in 2004. The reason we restrict the sample in this way is because of the existence of other policy-changing thresholds at populations of 2,000 and 10,000. Table 1 provides summary statistics for this sample. The table provides information for the entire period in panel A, but also for the boom and bust period separately in panels B and C. Data on taxes (T) and current expenditures (E) are directly taken from the the budgets. As for B, we use data on the grants provided by each level of government. For the central level, we subtract the formula based transfer from this value. We adjust the amount of the formula transfer in period t for the delayed repayments of already paid 'cash-advance' in t-2 to capture the effect of implicit bail-outs.[23]

[Table 1 about here]

Moreover, we further restrict our sample for two additional reasons. First, we remove all the municipalities that jumped in either direction across the threshold between 2004 and 2007 (50 observations). We do so to adhere to our philosophy of the 'difference-in-discontinuities' strategy, which uses the exogenous variation generated by the interaction between the effect of the reform at the threshold and the cyclical evolution of tax collections. Note that municipalities jumping across the threshold receive a permanently higher or lower grant, independently of the effects of the reform or the cycle. Moreover, when a municipality jumps, other policies (besides the transfer) also change. This means that keeping these municipalities in our sample would contaminate our instrument with influences that cannot be considered as being uncorrelated to local budgetary policies. After excluding these municipalities, our sample comprises 1,147 annual observations. Second, we conduct a 'donut' estimation and eliminate observations in a small range of the threshold (see Barreca et al., 2011, for a justification, and Sanz, 2015, for an application to Spanish municipalities).[24] After applying the 'donut' we fit a local regression to each side of the 5,000 threshold on the optimal bandwidth, which is estimated using the bandwidth selector proposed by Calonico, Cattaneo, and Titiunik (2014).

[Figure 6 about here]

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are, however, robust to excluding these observations.

[23]i.e., $B^{central}$ is defined as total grants less formula grants corrected by the difference $(G_f - cash\ advance)_{t-2}$.

[24]We are able to demonstrate that our results are robust to the size of the 'donut'.

There are two reasons for doing this. First, we need to deal with the possibility that some municipalities might have deliberately manipulated their population figures in order to be eligible for higher grants. According to the McCrary (2008) test shown in the left-hand graph in Figure 6, there does not appear to be a statistically significant discontinuity in the density at the threshold. However, the fact that earlier studies report clear evidence of manipulation during earlier periods (Foremny, Solé-Ollé, and Jofre-Monseny, 2015) points to the need to use the 'donut' estimator. Second, we need to deal with the possible effects of excluding the municipalities that jumped across the threshold, since this generates a marked discontinuity and a density hole close to the left of the threshold. This is clearly not the effect of any manipulation, but the mechanical result of the application of our definition of treated and control municipalities. However, if 'jumpers' differ from 'non-jumpers', the characteristics of the treated and control municipalities might not be balanced at the threshold and, more importantly for our purposes, they might not be on parallel paths. As mentioned above, we are not able to test this assumption, so the use of the 'donut' estimation is also a prudent safeguard in this case. Intuitively, what our estimation approach does by combining the 'difference-in-discontinuities' method with the 'donut' estimation is to define the treated and control municipalities as those that are closest to the 'donut' (i.e., if the 'donut' is 200, those with 5,200 and 4,800 inhabitants). While this estimator requires our making an extrapolation (after all, it is not the same as estimating the effect only at the 5,000 threshold), we are confident that this procedure is more reliable than that of 'difference-in-differences': the municipalities close to the 'donut' are more likely to be on parallel trends than the municipalities across the whole sample.

4 Results

Effects on the revenue-sharing grant, ∇G. The first stage of our identification approach involves an estimation of the evolution of grants ∇G around the threshold. Table 2 presents the results of β_0 for two different grant indicators: G_o (outlays), in Panel A, and G_f (entitlements), in Panel B.

[Table 2 about here]

This table confirms the correct application of our identification approach as β_0 proves to be highly significant independent of the bandwidth chosen and the donut applied. The point estimate for $\ln(G_o)$ is about -7% (i.e., -0.066) and confirms the expected exogenous cut in formula transfers in this period. The effect of $\ln(G_f)$ is similar in magnitude and significance. We have chosen Model 4 as our preferred estimation and we use the selected bandwidth of 992 with a donut of 100 in all further estimations.[25] This estimate represents a reduction of about 10

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[25]Note that the selection of the donut does not change our results. We gradually increase the excluded observations from 0 to 200 (i.e., between 4,800 and 5,200) inhabitants and the results remain stable. Furthermore, we apply the bandwidth selected for G_o to the estimation of G_f and vice versa. Again, our results are robust to both of these modifications.

euros in per capita values, given that the average local grant prior to the crisis was 160 euros per capita. Indeed, using per-capita grants in levels as the dependent variable gives a point estimate of β_0=-12.24 (std. err. 3.78).

[Figures 7 and 8 about here]

Figures 7 and 8 illustrate our estimates. In Figure 8(a), we depict all our results and show the pre-crisis (boom) periods in blue and the crisis period in red. The way in which the grant functioned is made evident in this graph, as the huge positive windfall during the boom years diminishes during the crisis until, due to the minimum guaranteed transfer, the effect is almost the same. The parameter of interest β_0 is, however, the difference between the two discontinuities in the two periods. This is illustrated in Figure 8(b). The point estimate corresponds to the jump in the lines at the threshold in this figure and represents our difference-in-discontinuities estimate of -.066. Figure 8 proceeds analogously for G_f.

Local adjustment to the shock, ΔL. As pointed out above, there are two possible policy responses to this exogenous shock. First, local governments can react themselves by adjusting their expenditure and/or revenue. Table 3 shows the results for ΔL and its components.

[Table 3 about here]

These results basically indicate that local budgets do not react. In the first two columns, we first examine the effects on ΔL and then on expenditure, in Models (3) and (4), and on revenue in Models (5) and (6) as its sub-components. Models (2), (4), and (6) include the interaction term β_0^D to test whether or not the effects depend on the pre-existing level of debt. However, all coefficients on L and its components are close to zero and statistically not significant, indicating no reaction of the local budgets. The same is true for the interaction term in all specifications. From this exercise we can conclude that local governments did not respond and that they made no adjustments to their budgets on either the revenue or on the expenditure sides. Similarly, note that we record no effects even in the case of the heavily indebted municipalities.

Effects on bail-outs, ΔB. The failure of local current budgets to respond suggests that other policies must have affected municipal public finances during the crisis. In other words, if no own-adjustments were implemented, bail-outs in the form of additional funds can be expected to have played a role. We investigate this in Table 4.

[Table 4 about here]

In Models (1) and (2) we re-estimate the baseline first stage but interact it with the debt level, as in the analysis of local adjustments above. First, we observe unchanged coefficients of β_0, confirming the baseline effect found previously. In the last row, we report the coefficients of the

interacted terms β_0^D. The interaction terms for both variables prove to be insignificant. This is a relevant finding as it indicates that the cut in grants is independent of the financial situation of the local governments. Any significant effect here would have implied that the formula could not have been implemented in a stringent way.

In Models (3) to (10) we examine additional funds given by the variation in B. Overall, we do not observe any increases in bail-out funds for those municipalities hit by the negative shock, as β_0 is insignificant in all models. Even when we split B into its sub-components, based on the tier of government that provides them, the average effect does not differ statistically from zero.

However, our findings are quite distinct for the interaction term β_0^D. The estimations of Model (4) provide evidence that indebted municipalities actually received bailouts as the interaction term for funds received from regional and provincial grants gains in significance. This indicates that, although no funds were distributed in a regular fashion to the municipalities affected by the cut in the revenue-sharing grant, those with substantial budgetary problems received additional help. However, this funding did not originate from central government, as a breakdown into the different sub-components originating from the central, regional, and provincial tiers reveals that no extra funds were distributed by the central government (c.f. Model (6) in Table 4). The results presented in columns 7-10 suggest that other sub-national governments were offsetting the loss of money from the revenue-sharing arrangement.[26]

To estimate the magnitude of these effects, we compute the average additional funds for a value of D equal to its 75th percentile (corresponding to about half a standard deviation, which is relatively large for this variable). Note that the reduction in revenue-sharing grants does not vary with the level of debt, as indicated by the interaction terms in Models (1) and (2), and that the reduction corresponds to a loss of 10.8 euros. Regional governments, however, seem to be the tier of government absorbing the shock. They provide an additional 9.5 euros per capita at that debt level. In addition, the provinces provide a further 2.5 euros per capita at that level of debt. Thus, it seems that at high levels of debt, regional and provincial bailouts are able to absorb the whole shock. These results imply that a shock of 100 euros triggers 127 euros in bailouts, however, it is true that the effect is imprecisely estimated, with 95% confidence bands being equal to 28 and 226 euros. Note, however, that the effect could be even greater for very high levels of debt due to potential non-linearities.[27] In any case, our results suggest that other sub-national sectors assumed responsibility for those local governments that found themselves in trouble, and partially used this opportunity to offset their existing debt levels. However, this effect can only be confirmed for relatively high values of outstanding debt at the beginning of the crisis, meaning that this was a policy targeted at particularly troubled local jurisdictions.

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[26]The interaction is implemented using the difference in debt in 2008 from the average debt of all the municipalities in our sample. The mean of this variable in the bandwidth selected for estimation is .016 with a standard error of .27.

[27]We do not present these numbers as it is difficult to extrapolate the predictions at some distance from the middle of the distribution, given also that we do not allow for the possibility of non-linearities in the response.

5 Conclusion

This paper reports new evidence as to how federations react to a negative revenue shock at the local level. The novelty of this paper lies in the fact that we analyze the reaction of all the actors involved, i.e., central government as well as the sub-national tiers of the administration. Indeed, our results point to the particular relevance of the latter, since both regional and provincial tiers are found to play a crucial role.

We identify an exogenous shock resulting from a drop in the revenue-sharing grants at the central level, but we show that the municipalities did not adjust their spending or taxation levels accordingly. This points either to the complete absence of consolidation of local budgets or to the fact that higher tiers of government stepped in to address the situation. Both scenarios are supported by our results. First, on average, municipalities simply allowed their debt levels to grow and absorbed the shock. However, in the case of the most indebted municipalities, a substantial share of the shock was absorbed by regional and provincial discretionary grants.

Our results suggest that the central government played no part whatsoever in the rescue of troubled municipalities. The lack of involvement might be due to the fact that indeed wanted to show commitment to a no bail-out policy and to impose hard-budget constraints. Anecdotal evidence shows that specific measures adopted by the central government rather relied on loans to avoid the use of transfers. On the contrary, we show that it was the other sub-national tiers of government that bailed out the local governments using transfers for which the shock was especially burdensome (i.e., those that already suffered from high debt levels). This finding is relevant for several reasons. First, even though central government might enact a policy characterized by hard budget constraints and expose local jurisdictions to the cyclical fluctuations of tax revenues, other players appear to soften these budget constraints. Thus, any revenue-sharing system implemented from the central level needs to take into account the fact that other channels exist for mitigating negative shocks in order to reduce poor ex-ante fiscal behavior.

However, various steps are still required to complete our analysis of this transitory shock. Further research will analyze whether or not the bailouts were driven by political motives (see Goodspeed, 2002; Piolatto and Sas, 2016). To do so, in the next step in our research we propose analyzing the political constellation between local and higher tier governments. In particular, alignment between local and regional governments might play a role as some regional governments received loans and transfers themselves during the same period. In addition, it might be interesting to analyze specific loan programs undertaken by the central government.

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Graphs and tables

Figure 1: Evolution of the Tax-sharing grant: real and simulated
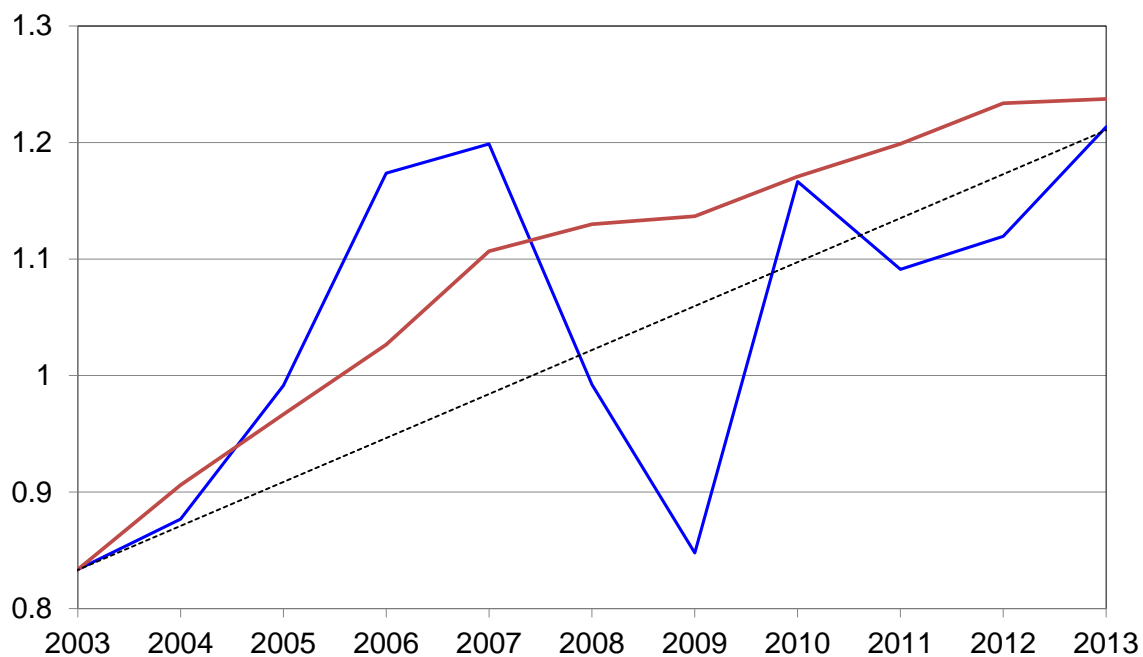
Notes: blue = actual tax-sharing grant (in nominal terms). Red = simulated tax-sharing grant (= Total grant keeping the pre-2002 evolution rules: maximum growth rate is GDP and minimum is price growth). Dotted = trend line. Source: Ministerio de Hacienda (several years): "*Liquidación de la Participaciòn de los Municipios en los Tributos del Estado*" and own calculations.

Figure 2: Effect of the 2002 reform on the tax-sharing formula around the 5,000 population threshold
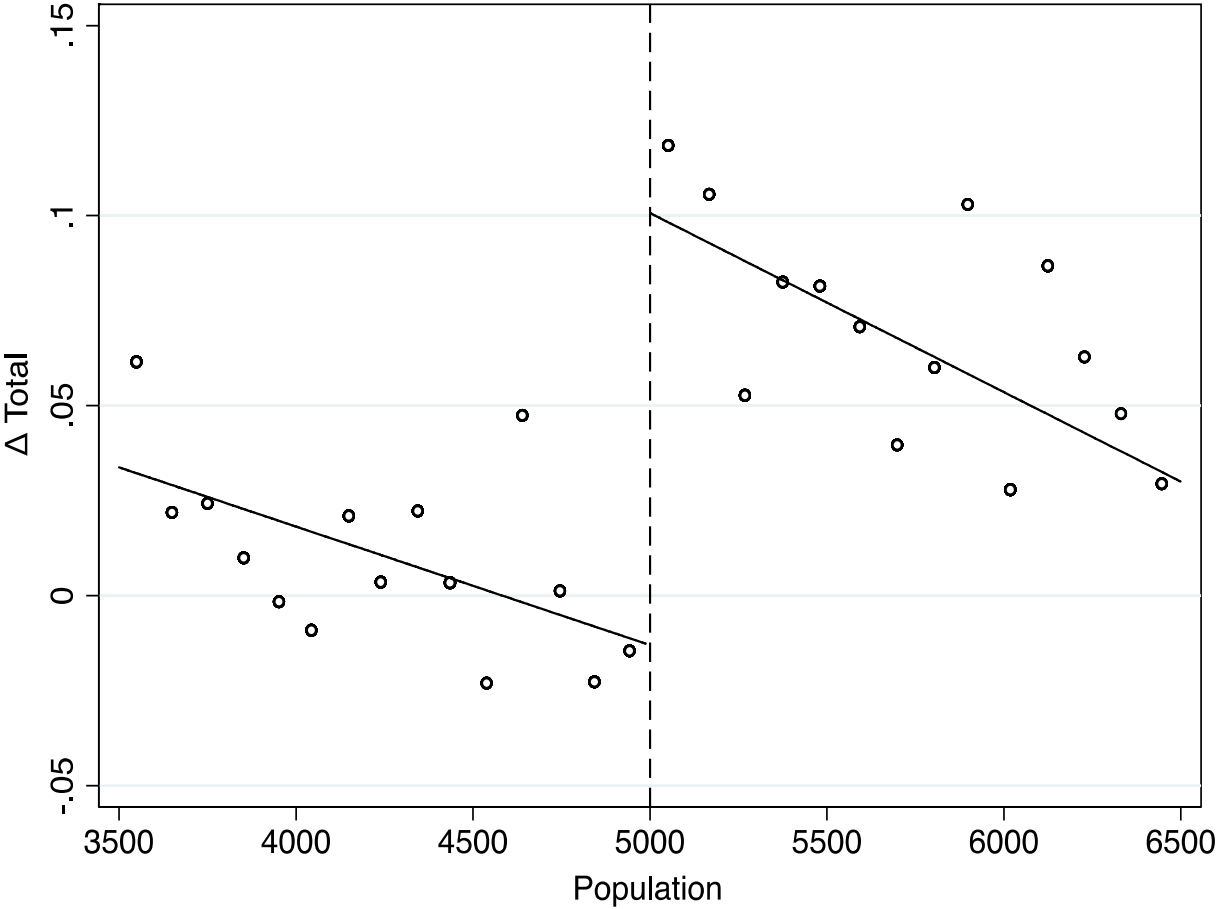

Notes: Difference between the total amount of the grant received by a municipality before and after the 2002 reform. Expressed relative to the value at the left of the threshold (=1). Dots are bin averages. Lines are local linear polynomials. Graphs for the pre and post-reform and for each of the variables included in the formula (weighted population, fiscal effort, and inverse of fiscal capacity) are presented in Figure A.1. Source: Ministerio de Hacienda (several years): "*Liquidación de la Participaciòn de los Municipios en los Tributos del Estado*" and own calculations.

Figure 3: Evolution of grants
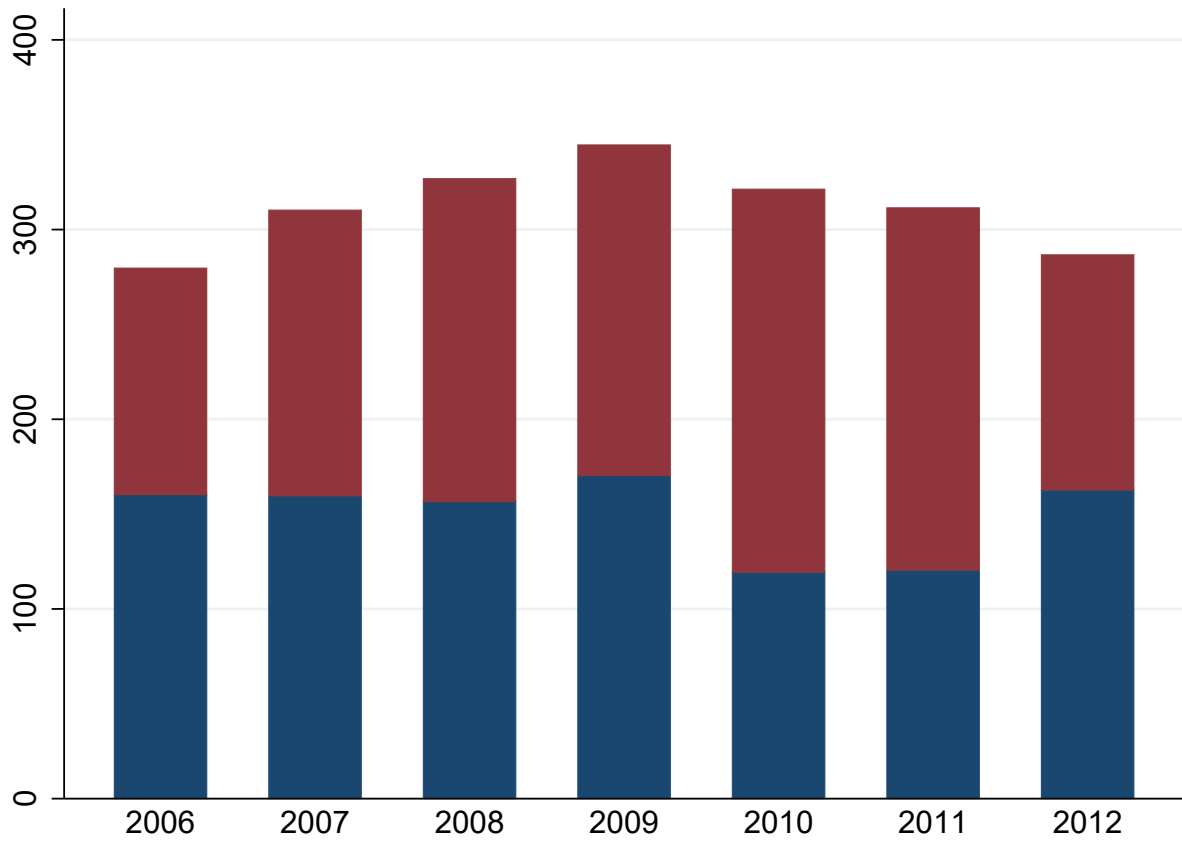
Notes: Evolution of the revenue sharing grant (in blue) and other funds (in red: discretionary grants from all governmental levels). Source: Ministerio de Hacienda (several years): "*Liquidación de la Participaciòn de los Municipios en los Tributos del Estado*" and own calculations.

Figure 4: Evolution of entitlements and outlays
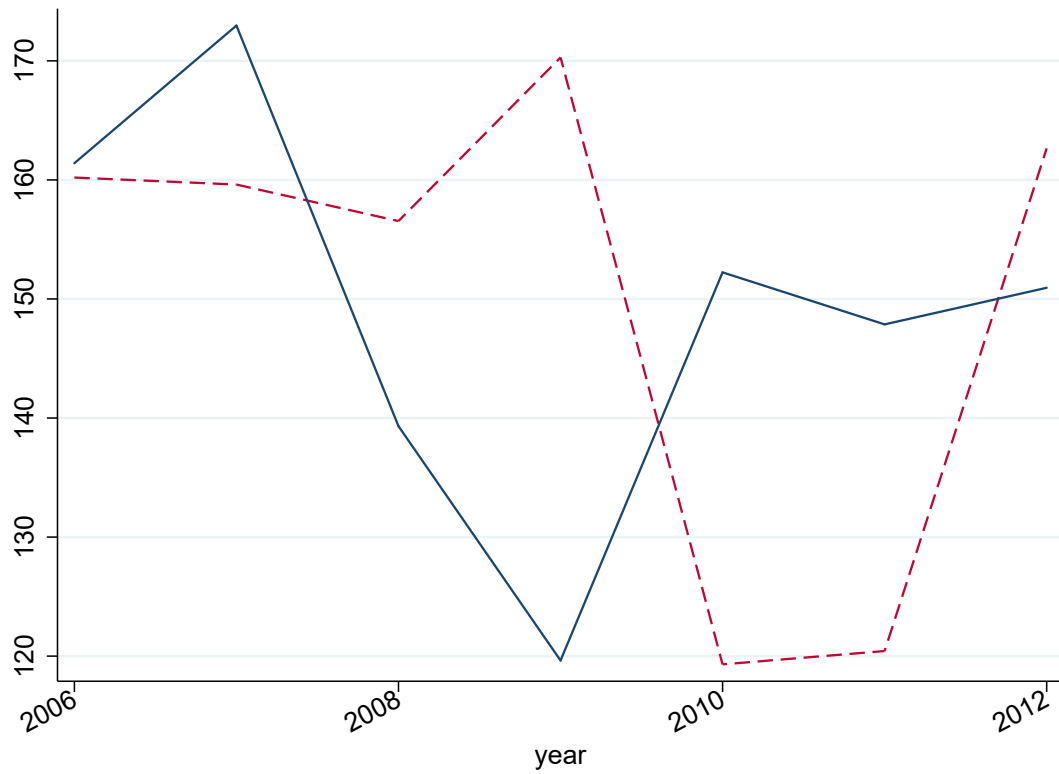
Notes: Evolution of the final amount of the grant (blue, solid line) (*entitlements*, labeled G_f) and amount of revenues obtained from this concept during each fiscal year (red, dashed line) (*outlays*, labeled G_o). Source: Ministerio de Hacienda (several years): "*Liquidación de la Participaciòn de los Municipios en los Tributos del Estado*" and own calculations.

Figure 5: Mechanism at the threshold
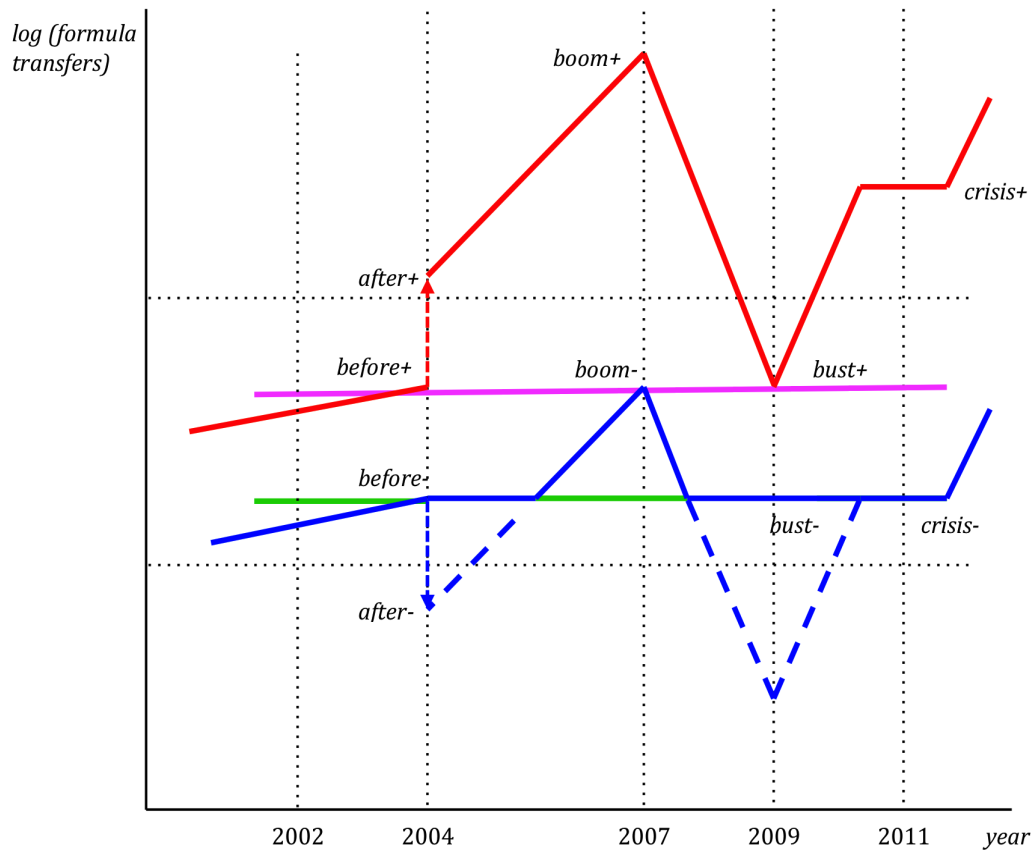
Notes: The figure shows how the log of per capita revenue-sharing transfers evolves for two hypothetical municipalities with more than 5,000 inhabitants at the time of the reform (indicated by +, in blue) and with less than 5,000 inhabitants (-, in red) at the moment of the reform. The green and pink lines are the minimum guaranteed grants of each of the two municipalities.

Figure 6: McCrary (2008)-density test at the 5,000 threshold
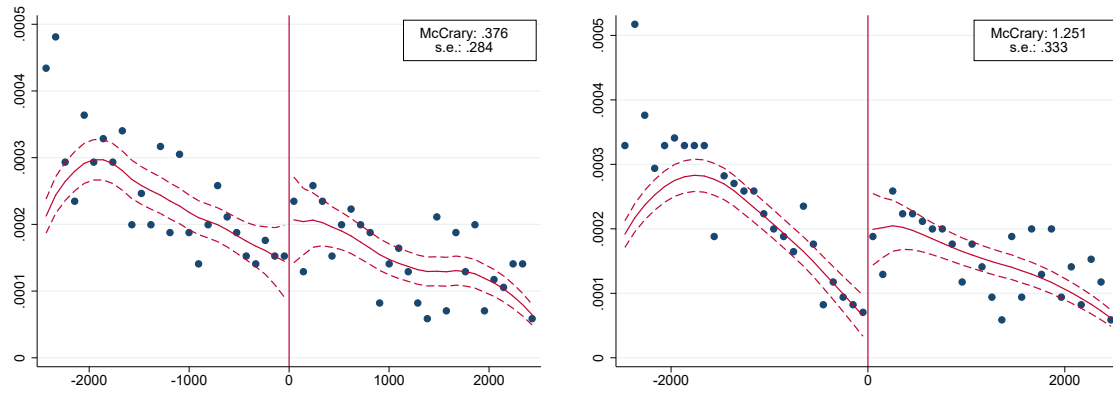
(a) all observations

(b) excluding movers across the threshold

Notes: Panel a) shows the McCrary2008-density test around 2004 population at 5,000 inhabitants before removing those observations which passed the threshold throughout our period; Panel b) after excluding them. Dashed lines are 95% confidence intervals.

Figure 7: Difference-in-discontinuities G_o
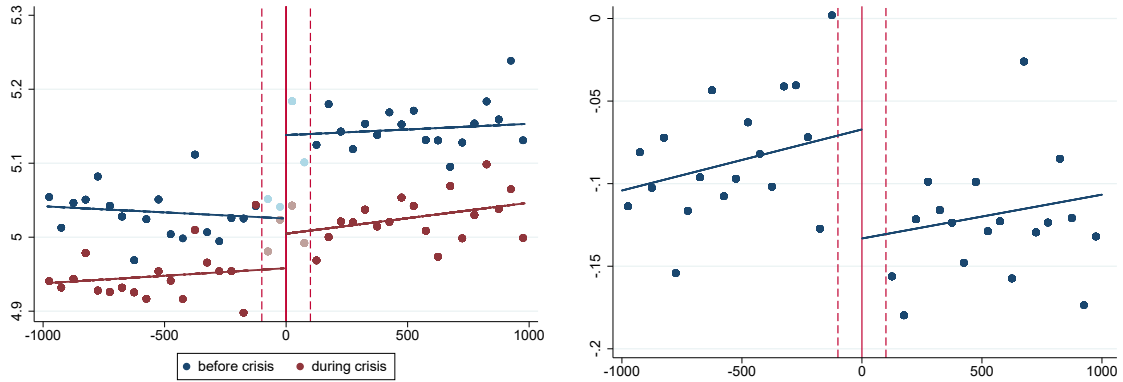
(a) all parameters

(b) dif-in-disc

Notes: Estimates according to Model (4a) of Table 2. Dashed lines indicate the limits of the applied donut estimator of 100 inhabitants. Dots show 50-inhabitants bins. Panel a) shows estimates for both periods, Panel b) represents the estimated coefficient for the dif-in-disc result.

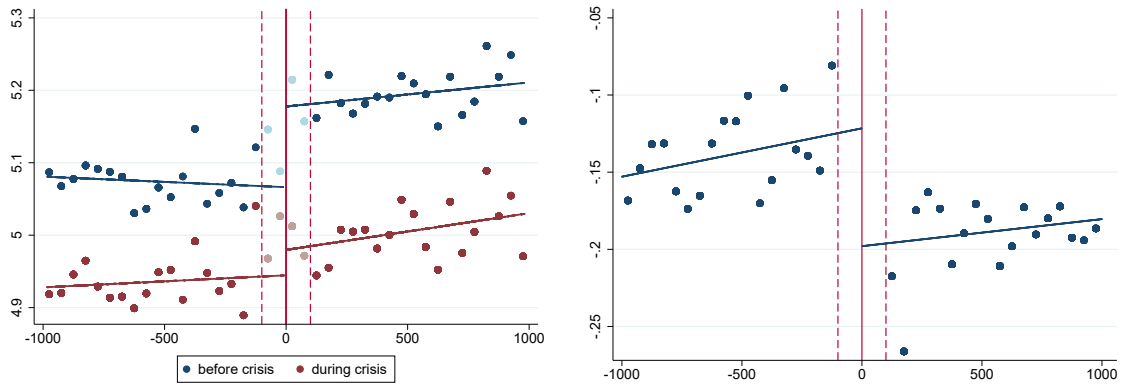Figure 8: Difference-in-discontinuities G_f .

(a) all parameters

(b) dif-in-disc

Notes: Estimates according to Model (4b) of Table 2. Dashed lines indicate the limits of the applied donut estimator of 100 inhabitants. Dots show 50-inhabitants bins. Panel a) shows estimates for both periods, Panel b) represents the estimated coefficient for the dif-in-disc result.

Table 1: Summary statistics

Panel A: 2006-2012					
Variables	obs	mean	std. dev.	min	max
G_o	8,028	149.7	25.8	41.7	259.5
G_f	8,029	149.1	21.4	43.1	250.9
E	8,019	708.1	259.4	178.2	3318.1
T	8,019	301.7	209.6	2.5	3592.1
$B^{central}$	7,862	18.7	27.5	0	368.1
$B^{regional}$	7,908	99.5	88.9	0	1241.4
$B^{provincial}$	7,908	21.8	38.1	0	651.0

Panel B: 2006-2007					
Variables	obs	mean	std. dev.	min	max
G_o	2,293	159.8	17.2	41.7	247.9
G_f	2,294	166.9	17.4	106.8	250.9
E	2,294	663.2	269.9	178.2	3174.3
T	2,294	294.2	221.7	2.5	3592.1
$B^{central}$	2,221	6.6	18.0	0	368.1
$B^{regional}$	2,261	83.2	80.4	0	825.4
$B^{provincial}$	2,261	17.7	36.2	0	515.8

Panel C: 2008-2012					
Variables	obs	mean	std. dev.	min	max
G_o	4,588	141.5	28.2	52.8	259.5
G_f	4,588	139.8	19.0	43.1	215.3
E	4,583	735.4	255.1	208.5	3318.1
T	4,583	297.7	201.8	14.3	3446.4
$B^{central}$	4,542	27.9	29.6	0	315.6
$B^{regional}$	4,548	107.8	92.8	0	1241.4
$B^{provincial}$	4,548	23.2	39.0	0	651.0

Notes: All variables are expressed in Euros per capita. G_o: outlays; G_f: entitlements; E: current expenditures; T: tax revenues; B: bail out variable at the central, regional, and provincial level.

Table 2: Effects on formula grants (∇G_i)

Dependent Variables	Panel A: $\ln(G_o)$					
	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)
β_0	-0.071***	-0.062***	-0.079***	-0.066***	-0.044**	-0.076***
	(0.018)	(0.022)	(0.027)	(0.022)	(0.019)	(0.025)
observations	1,883	1,701	1,463	1,756	2,421	1,505
R^2	0.631	0.659	0.660	0.656	0.675	0.653
bandwidth h	975.4	861.4	796.8	989.6	1319	840.3
donut	0	25	50	100	200	100
	Panel B: $\ln(G_f)$					
	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)
β_0	-0.079***	-0.066***	-0.062***	-0.085***	-0.051***	-0.076***
	(0.020)	(0.019)	(0.022)	(0.020)	(0.015)	(0.018)
observations	1,603	1,540	1,316	1,505	2,149	1,757
R^2	0.638	0.644	0.642	0.639	0.651	0.642
bandwidth h	822.5	808.5	725.2	840.3	1179	796.8
donut	0	25	50	100	200	100

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. G_o are outlays, G_f entitlements of the formula transfer.

Table 3: Local adjustments

Dependent Variables	$\ln(L)$		$\ln(E)$		$\ln(T)$	
	(1)	(2)	(3)	(4)	(5)	(6)
β_0	-0.020	-0.022	-0.039	-0.027	-0.059	-0.048
	(0.078)	(0.079)	(0.048)	(0.048)	(0.076)	(0.078)
β_0^D		-0.028		0.048		0.020
		(0.103)		(0.060)		(0.104)
observations	1,756	1,756	1,756	1,756	1,756	1,756
R^2	0.050	0.100	0.084	0.199	0.047	0.183

Notes: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Bandwidth (990) and donut (100) according to Model (4a) of Table 2.

Table 4: Bail-outs

Dependent Variables	$\ln(G_o)$ (1)	$\ln(G_f)$ (2)	$\ln(B)$ (3)	(4)	$\ln(B^{central})$ (5)	(6)	$\ln(B^{regional})$ (7)	(8)	$\ln(B^{provincial})$ (9)	(10)
β_0	-0.068***	-0.081***	-0.008	0.096	-0.039	0.067	0.015	0.125	-0.176	-0.018
	(0.022)	(0.018)	(0.215)	(0.196)	(0.335)	(0.342)	(0.188)	(0.180)	(0.337)	(0.334)
β_0^D	0.012	-0.025		0.594*		0.099		0.869**		0.765*
	(0.031)	(0.024)		(0.304)		(0.500)		(0.351)		(0.460)
observations	1,756	1,757	1,719	1,719	1,719	1,719	1,701	1,701	1,566	1,566
R^2	0.664	0.657	0.108	0.118	0.495	0.501	0.039	0.047	0.013	0.059

Notes: Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All models use the continuous value of outstanding debt in thousands of Euros per capita in 2008 for the interaction term D. Bandwidth (990) and donut (100) according to Model (4a) of Table 2.

Appendix

Table A1: Tax-sharing formula (PIE) during several periods

	1990-1999	2000-2003	2004 onwards
weighted population share (1)	70%	75%	75%
- weight < 5,000 inh.	1	1	1
- weight 5,000 a 10,000 inh.	1.15	1.15	1.17
- weight 10,000 a 20,000 inh.	1.15	1.15	1.17
- weight 20,000 a 50,000 inh.	1.3	1.3	1.3
- weight 50,000 a 100,000 inh.	1.4	1.4	1.4
- weight 100,000 a 500,000 inh.	1.5	1.5	–.–
- weigh >500,000 inh.	2.85	2.8	–.–
fiscal effort share (2)	25%	14%	12.5%
inverse fiscal capacity share (3)	–.–	–.–	12.5%
school units share (4)	5%	–.–	–.–
eligible municipalities (5)	all	all	all, less > 75.000 inh. + tourism

Notes: (1) Resident population x Weight. Weight increasing according to population size. (2) Ratio between Local Tax Revenues from the three main taxes (Property. Vehicle and Business) and Potential Local Tax Revenues (those obtained if applying the maximum tax rates allowed by the law). (3) Inverse of Local Tax Revenues per capita of the corresponding population bracket (before 2004) or Inverse of the ratio of Local Tax revenues per capita on Average Local Tax revenues per capita of the corresponding population size bracket (after 2003). (4) Number of public school classrooms. (5) Since 2003 municipalities >75.000 inh. and Tourism municipalities are funded with a share of revenues from the Income Tax. VAT and Excises on Tobacco and Alcohol + a lump sum fund (*Fondo Complementario de Financiación*, FCF). computed as the difference between PTE and tax sharing revenues in a base year. Source: *Ley Reguladora de Haciendas Locales* (1988 and 2002) and own elaboration.

Figure A1: Effect of the 2002 reform of the Tax-sharing grant around the 5,000 threshold
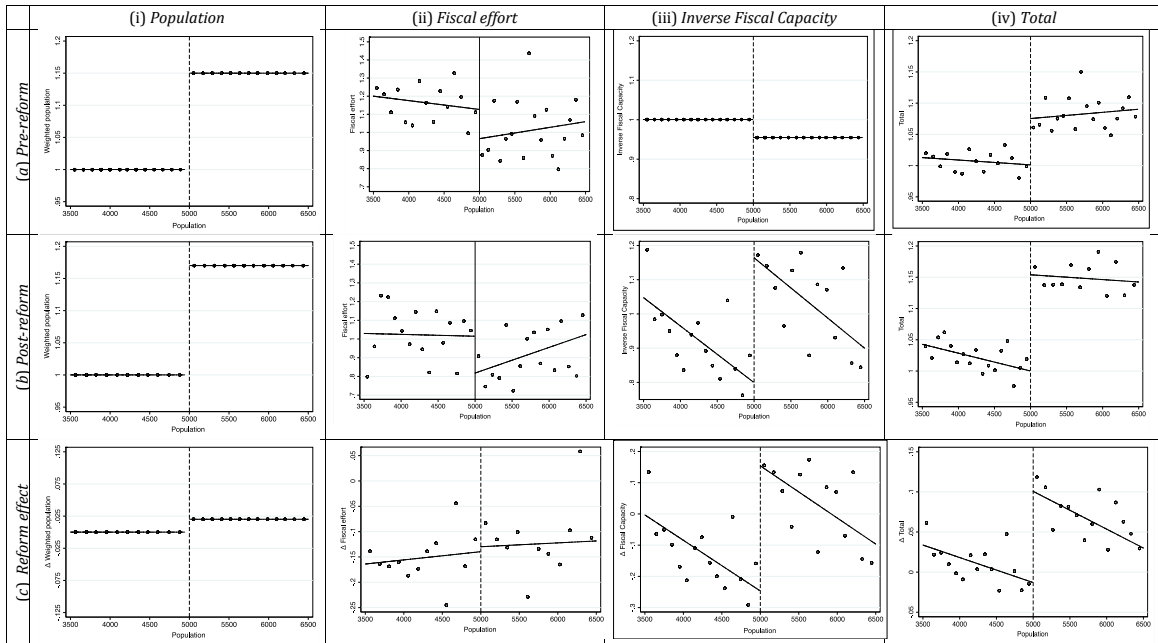
Notes: All variables are expressed in per capita terms and relative to the value at the left of the threshold (=1). Dots are bin averages. Lines are local linear polynomials. (b) Post-reform=grant per capita according to the new formula; (a) Pre-reform=grant per capita that each municipality would have obtained with the old formula; (c) Reform=(a)-(b). Source: Ministerio de Hacienda (several years): *Liquidación de la Participación de los Municipios en los Tributos del Estado*