Intergovernmental grants and local public finance: An empirical examination in Israel

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A B S T R A C T

What is the overall effect of intergovernmental grants on local public finance? While previous studies show an asymmetric effect of changes in intergovernmental grants on local taxation, other budgetary variables are often neglected. We take advantage of a 2011 Israeli reform in the context of a centralized country, which resulted in reduced intergovernmental grants for some local governments and increases for others, and analyse the overall effect on local spending, taxation, and deficits, using event study and difference-in-differences methodologies. Our results show that grant reductions led local governments to increase local tax rates and their annual deficits, but did not change local spending levels while revealing the mechanism behind rates adjustments. Local governments which experienced an increase in their grants increased their expenditures and lowered their tax rates and deficit levels. We find an asymmetric effect on tax rates: a grant reduction causes a tax hike which is twice as large as the tax reductions following a grant increase. This asymmetric effect can create tax hikes when grants decrease and then increase to their original level. Our results help establish the effect of intergovernmental grants on local taxation, and their effect on expenditure and fiscal balance in a centralized country.

1. Introduction

Fiscal federalism concerns how funding and administrative responsibilities are divided between different tiers of government. Fiscal decentralization entails a transfer of at least some responsibility for public finance to lower tiers, under the assumption that local governments (LGs) are best suited to provide services based on their residents' needs. Under these regimes, central and upper-tier governments usually control the level of taxes that lower tiers may impose, and compensate for the difference between local government expenditures and their own-source revenues (the "fiscal gap") through intergovernmental grants (IGGs). In this paper we focus on unconditional and non-matching IGGs. The optimal design of an intergovernmental transfer scheme needs to satisfy four conditions: it must finance the fiscal gap; equalize the horizontal level (i.e., compensate for differences in fiscal capacities between LGs); allow higher tiers to influence and supervise lower tiers; and compensate for spillovers between adjacent LGs (Boadway and Shah, 2007; Oates, 1972; Reingewertz, 2014; Romer and Rosenthal, 1980).

According to the classical theory, when LGs receive more grant funding, they decrease taxes, and when they receive fewer grants, they raise tax collection as long as the level of services coincides with median voter preferences (Bradford and Oates, 1971; Romer and

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Rosenthal, 1980). Therefore, LGs response should be symmetrical - increasing tax rates when grants decline and decreasing tax rates when grants increase.

However, empirical studies found that LGs responded to an increase in grants mainly by increasing their expenditure and only modestly, if any, by lowering local tax collection (Helm and Stuhler, 2021; Jia et al., 2020, 2021), as "money sticks where it hits" (Inman, 2008), known as the flypaper effect. It is less clear what happens when grant levels fall. Some argue that grant reductions lead to a decline in expenditure because legislators are reluctant to increase taxes (Hines and Thaler, 1995). Others suggest that LGs respond asymmetrically to grant reductions as they increase taxes and do not reduce expenditures (Deller and Maher, 2006; Marattin et al., 2022).

The flypaper effect requires some autonomy for LGs to set local tax rates and manage their budget. Such capabilities align with decentralized government structure, which usually characterizes democratic countries. Such capabilities may not be present in an authoritarian regime or a centralized country, where the central government controls the majority of decision-making powers. Because LGs do not have the authority to set tax rates in those countries, the flypaper effect is expected to be maximal. As a result, all the additional grants income will increase the expenditure level. In line with this assumption, Liu and Ma (2016) found that an increase in grants in China, which has an authoritarian regime but a highly decentralized sub-national government (Ivanyna and Shah, 2014), resulted in a one-to-one rise in spending. In contrast, Jia et al. (2020, 2021) found that increased grants relaxed LGs' tax collection efforts, indicating how LGs shared the additional resources with the taxpayers, as the classical theory describes.

When LGs do not have the authority to set tax rates, as in centralized countries, changes in tax rates are slow to implement, as they need to obtain permission to change local taxes. Therefore, LGs whose IGG declines and need to respond quickly, their most imminent action is increasing the deficit where a soft budget is allowed or increasing debt and loans in institutional settings that do not allow LGs to increase their deficit. The constraints that LGs face in a centralized country, where the central government delegates only limited

Table 1

Studies that analysed LGs' reaction to IGG changes.

Researchers	Country	When IGG decreases	When IGG increases
Allers and Vermeulen (2016)	Holland		Increase local housing prices Small reduction of taxes
Alpino et al. (2022)	Italy	Increased income tax on top earners	
Baekgaard and Kjaergaard (2016)	Denmark	Left-wing: raise taxation Right-wing: cut spending	Left-wing: boost spending Right-wing: cut taxation
Baskaran (2016)	Germany		Increase expenditure, did not reduce taxes
Benzarti et al. (2020)	Finland	VAT decrease - reduce prices	VAT increase - increase prices x2
Berset et al. (2022)	Switzerland	Local policymakers smooth transitory fiscal shocks	Local policymakers smooth transitory fiscal shocks Only 20% of increase was reflected in expenditure increase
Bracco et al. (2015)	Italy	Increase the chance of challenger elections	Increase the chance of incumbent elections, reduces taxes
Buettner (2006)	Germany	Increase of tax base/decline in IGG → increase tax rate more than LGs w/o IGG	
Christofzik and Schneider (2019)	Germany	Increase loans, not tax	
Dahan (2022)	Israel		Expenditure increased: education, pay debt, reduce deficit
Dahlberg et al. (2008)	Sweden		Expenditure increased, no change in taxation
Deller and Maher (2006)	US	Cut leisure-related expenditures, no change in essential services	
Egger et al. (2010)	Germany		IGG deter LGs from reducing tax rates, eliminating tax competition
Eyraud and Lusinyan (2013)	OECD		Large IGG may relax fiscal discipline High IGG softens the budget constraint
Gamkhar (2000)	US	Expenditure declined	No change in expenditure
Helm and Stuhler (2021)	Germany	Reduce expenditure	Increase in infrastructure investments, small decline in tax
Heyndels (2001)	Belgium	No change in expenditure, compensated by adding taxation	Expenditure increased
Jia et al. (2020)	China		Reduce local tax enforcement = collect less tax
Jia et al. (2021)	China		Relaxed collection efforts, reduction in tax revenue
Kalb (2010)	Germany	reduce cost efficiency	
Kjaergaard (2015)	Denmark	No change in expenditure	Expenditure increased
Lago-Peas (2008)	Spain	Left-wing: maintain spending, increase deficit	
Liu and Ma (2016)	China		Spending increased 1:1 No tax decline
Marattin et al. (2022)	Italy	Increased revenue from property tax	
Navon (2006)	Israel	Increase deficit in the short run, adjust expenditure in the long run	
Rattsø and Tovmo (2002)	Denmark	Increase taxation	No change in expenditure
Sobel and Crowley (2014)	US	Rachet effect: when federal funding ends for a program, states increase local tax	
Stine (1994)	US	Reduce own-source revenue	Limited fiscal relief

powers, may moderate their response to changes in IGG.

Broadly speaking, LGs may respond to a decline in their IGG in three ways. They can reduce spending either by reducing the level of services delivered or making service delivery more efficient (Berset et al., 2022; Deller and Maher, 2006; Gamkhar, 2000); they can try to raise the lost revenue in other ways, i.e., by re-evaluating properties value, enlarging the tax base or raising taxes (Alpino et al., 2022; Marattin et al., 2022; Rattsø and Tovmo, 2002; Sobel and Crowley, 2014); or they can increase their budget deficits (Christofzik and Schneider, 2019). The bulk of the literature focuses on the expenditure side, looking at different effects of changes in IGGs, but predominately their effect on total spending. Most studies have found a relationship, and a few even causal effects, between IGG levels and municipal spending, including an asymmetric response. However, the majority of studies do not explain how LGs compensate for the decline in IGGs, but simply assume that LGs increase their own-source income. Only a few studies have specifically researched the effects of changes in IGG (increases or declines) on local tax rates, or evaluated the full budgetary effects of such changes on all fiscal variables (spending, revenue, and deficits). Table 1 lists empirical studies that analysed LG's reaction to IGG changes. Most studies focus on decentralized countries. For example, Chu and Yang (2012) showed that a decentralized structure dominates a centralized one in terms of economic growth and that there is an optimal degree of tax competition. Tax competition in a centralized system is relatively low, and IGG may be an instrument a central government uses to reduce it (Egger et al., 2010).

Taking advantage of a reform to Israel's IGG unconditional equalization model introduced in 2011, using LG financial statements for the period 2006–2018, and the area-based property tax rates adjustment mechanism of a centralized country, we use a quasi-experimental design and difference-in-differences and event study methods to examine how changes in IGG levels (declines and increases) affect changes in tax rates, the composition of income, expenditure, and deficits among Israeli local governments. Focusing on business taxation, Egger et al. (2010) showed that IGG deters LGs from reducing tax rates, thereby eliminating tax competition. We add that modifying the IGG formula causes LGs to increase their tax rates, thereby softening tax competition, and that they also use other measures, including increasing deficit and loans.

Five arguments support our claim that the IGG reform was an exogenous event. To begin, we demonstrate a parallel trend across the treatment and control groups, which suggests that both groups exhibited similar time trends before the reform. Second, we show that the control and treatment groups were similar in their observable characteristics before the reform. Third, to make sure that other selection issues do not bias our estimates we apply DiD together with propensity score matching (Villa, 2016). Our fourth point is that actual IGG reductions were smoothed and reduced relative to their projected levels, which further detaches them from LG's characteristics, resulting in a random component (Dahan, 2022). The final argument is that the reform was imposed by the central government without any other events taking place at the time. Furthermore, due to the complexity and non-linearity of the IGG model, LGs only comprehended the reform's implications after executing the revised model, and only then could they begin making adjustments in both budget execution and tax rate modifications. Furthermore, the positive treatment is a positive externality resulting from the zero-sum nature of the funds available for grants, therefore LGs whose IGG increase learnt about it following the reform.

We show that a decline in IGG causes LGs to submit more tax rates adjustment requests, revealing the causal relations between grants and tax changes, which leads to an increase in tax rates. However, their deficits grew as compared to the control group, which is in-line with the theoretical expectation as in a centralized country it takes time to increase tax rates, but different from the findings of Helm and Stuhler (2021) and Heyndels (2001). An increase in IGG causes LGs to reduce their tax rates exhibiting a partial flypaper effect, and in-line with the classical theory. LGs use the IGG rise to reduce their deficit levels and increase their loan repayments. Our findings also demonstrate an asymmetric effect: a grant decrease causes a tax hike which is nearly twice as large as the tax reduction that follows a grant increase. The elasticity of the change is such that a 1% decrease in IGG causes a 6.5% increase in tax rates, whilst a 1% increase in IGG causes a 4% decrease in tax rates. The absolute value of the increase and decrease of the IGG is in the same order of magnitude.

We offer several contributions to the literature. First, our analysis is done for a centralized country, while most literature deals with decentralized nations. In a centralized country, LGs have limited capabilities, where the central government maintains most decision-making powers, especially in setting and modifying tax rates. In a decentralized regime, more often than not LGs can modify their tax rates, as evident from the literature. We show that even in centralized regimes LGs modify their tax rates; however, they also need to use loans or debt to bridge the time until the central government approves their requests, fully or partially. Second, we describe and provide evidence regarding the mechanism behind revenue changes, i.e., the reduction or increase in tax rates, specifically non-residential tax rates which are less salient. Previous studies show that LGs responded to IGG decline by increasing tax rates, yet most use an indirect measurement of collection of tax revenue or average rates. We offer a direct measurement of LGs' behaviour, showing a causal relation, where IGG changes caused LGs to submit significantly more rate change requests than those LGs which were unaffected. Third, we quantify the magnitude of the asymmetrical effect of IGGs on tax rates. The asymmetrical effect is important, as governments tend to reduce IGG levels when facing austerity, and when the market stabilizes increase IGG. This dynamic causes tax rates to increase, even though the IGG level stabilizes to the original level. We augment the study by Benzarti et al. (2020), who found such behaviour in the private sector, showing that the public sector behaves similarly. Finally, we provide an overall assessment of the way IGGs affect local public finance using their own-source revenues. While most previous studies focused on a specific budgetary item (e.g., taxes or spending) we assess the effect of IGGs on all budgetary components, namely taxes, spending and deficits. As for the latter we are one of a few studies to show that IGGs cause deficit to change. A few studies present the influence of IGG changes on specific budgetary components such as loans, deficit, and education (e.g., Dahan (2022) discussion of education, Christofzik and Schneider (2019) on smoothing deficit). However, those studies looked into different components without studying the entire budget composition.

Helm and Stuhler (2021) found that LGs use the increase in IGG to invest in local infrastructure but not in debt repayments or to reduce loans. Moreover, the cut may be in earmarked grants due to higher-tier policy, such as education or welfare income, causing LGs

to reduce that budget component expenditure. When a soft budget is not allowed, LGs need to balance their budget following a change in IGG. An interesting question is how LGs adjust their budget on all budget components, re-allocating their own-source revenue. Our research adds to existing knowledge through the understanding of central government IGG policy and its implications for local tax rates and fiscal conduct in the presence of balanced budget requirements. The limitation of our study is the relatively small size of our treated groups, which may impose a limitation on the statistical analysis.

The rest of the paper is organized as follows. Section 2 reviews the literature and the theoretical background of IGGs. Section 3 describes the quasi-experimental setting (including the institutional background of local governments and IGGs in Israel), and outlines our predictions. Section 4 presents our research method, and Section 5 the empirical results. Section 6 discusses the results, outlines some of their policy implications, and concludes.

2. Literature review

Central governments have a taxation advantage over LGs, which creates a vertical fiscal imbalance (Dahlberg et al., 2008). This is because the power to tax is concentrated in upper-tier governments, which generally control the level of taxes that LGs may levy. Furthermore, the tax base of LGs is not distributed evenly: some locations generate high tax revenues, whereas other locations have poor fiscal capacity. As such, central governments employ a fiscal equalization system to reduce the fiscal gap, compensate for differences between LGs, and finance spillovers between jurisdictions (Boadway and Shah, 2007; Bradford and Oates, 1971; Romer and Rosenthal, 1980). An unconditional IGG is equivalent to an increase in the LG's income (Bradford and Oates, 1971). Thus, according to the standard theory, LGs that receive IGGs should increase their expenditure to the same extent as if their own-source revenue had increased by the same amount.

How do LGs respond to changes in IGG levels? The welfare theory suggests that LGs should increase their spending when their income rises, and decrease their spending when it falls. Moreover, the theory is indifferent to the source of income, whether an increase in residents' income or an increase in IGGs. Yet empirical analyses have found that an increase in IGG induces a bigger increase in expenditures than a similar increase in residents' income, a phenomenon known as the flypaper effect (Hines and Thaler, 1995). Most empirical studies have found asymmetry between the effects of increases and decreases in income (see Table 1), while only two studies found symmetry (Gamkhar and Oates, 1996; Helm and Stuhler, 2021). Helm and Stuhler (2021) found that the response to IGG changes is asymmetrical in the short-term but becomes symmetrical in the long-term. LGs reduce their expenditure in response to a decline in IGG immediately while maintaining a balanced budget, whereas LGs which enjoy an increase in IGG increase their spending within five years.

There are a few explanations for the asymmetry of the flypaper effect in the literature. Gramlich (1987) indicates the political difficulty of cutting existing programs. Stine (1994) observes the fiscal illusion, in which an increase in IGGs goes unnoticed by the public, but program cuts are observed. According to Hines and Thaler (1995) and Heyndels (2001), people categorize grant revenues and personal income into separate mental boxes. Bracco et al. (2015) regard IGG changes as a signal from the central government to voters. An increase in IGG enhances the likelihood of re-election for incumbent mayors, whereas a reduction in IGG raises the odds of a challenger. We extend this direction by assuming that the central government uses IGG changes to signal LGs to adjust their tax rates, particularly in a centralized country, where the central government only approves tax changes, but cannot initiate them. Baskaran (2016) and Liu and Ma (2016) showed that expenditure increases at a similar magnitude when IGG increases. In contrast, Hines and Thaler (1995) and Sobel and Crowley (2014), on the other hand, found that the pass-through effect is lower, with a median of 45%. Our study explores if an increase in IGG causes a decline in tax rates, i.e., is there a full pass-through flypaper effect or only a partial effect? In a centralised country, politicians from both the central and local governments approve tax changes; thus, they may be inclined to share IGG increases with the tax base in lowering tax rates.

Overall, most studies which examine the influence of changes in IGGs consider the effects on total expenditure and revenue but not on deficits. A few studies have looked at the influence on tax rates indicating a fiscal replacement, but without explaining the mechanism of raising taxes. Moreover, the studies do not show how tax changes when IGG increases. Dahan (2022) shows that an increase in IGG results in a decrease in deficits and enables debt repayment. Our study augment Dahan (2022) by analysing LGs' deficits when IGG declines. In a somewhat analogous market, Benzarti et al. (2020) found an asymmetrical response of prices to VAT changes in the private sector. Prices respond twice as much to VAT increases as to VAT decreases. This indicates that firms are taking advantage of the change to improve their profit margins. We augment those findings in the public sector. When modifying the tax structure, Bracco et al. (2019) show that LGs prefer to raise less salience taxes from the range of tax instruments available to them. In a centralized country both the central government and LGs are involved in the decision making of increasing tax rates. Therefore, it further moderates the increase in salience taxes, augmenting Bracco et al. (2019).

Most, if not all of the surveyed countries rank quit high on the Decentralization Index (Ivanyna and Shah, 2014), with LGs having the authority to impose taxes. Israel, on the other hand, ranks low on the decentralization index (94th out of 182 surveyed countries), where LGs need to obtain central government approval for any tax change.

3. Institutional background

3.1. LGs in Israel

Israel is a unitary and centralized country (Ivanyna and Shah, 2014) having one layer of sub-national governments for cities and towns, and two layers in the rural space. In 2020, it had 257 local governments: 77 cities; 124 towns; 2 industrial councils; and 1013

villages clustered within 54 regional councils.[1] Thanks to this structure, local authorities in Israel have an average population size of 36,147, larger than in most European countries.[2] Slightly more than half (52%) of LGs' income comes from government grants, and the rest (48%) from own-source revenues, including property taxes (28%), levies, and user fees for specific services. There are two categories of government grants: unconditional grants, which LGs may use as they see fit (12%), and earmarked grants (40%), especially for education (26%) and welfare services (10%) (for more details see Ben-Bassat and Dahan, 2009).[3]

The Israeli government allocates unconditional IGGs to finance the fiscal gap. The IGG fiscal equalization model is based on a formula where for each LG the fiscal gap is calculated as the difference between the LG's expected average expenditure and its expected normative income (see section 3.2 and Appendix A for details). The IGG model output may be negative or positive. A negative outcome indicates that the LG's normative income is higher than its expected expenditure; these LGs are ineligible for IGGs. A positive outcome shows the amount that, under the model, should be allocated to the LG. The actual grant received by each eligible LG is then determined by two additional factors. First, to prevent fiscal shocks, an implementation schedule smooths upward or downward changes in the IGG relative to previous years. Second, the Ministry of Finance (MoF) allocates the total IGG budget according to national considerations (e.g., budget constraints and pressure from political and interest groups). The amount allocated to a given LG is always less than the output of the IGG model, typically around 85%.

As noted, the own-source income of a typical LG derives mainly from local area-based property taxes. LGs set these tax rates based on the property's classification, intended use and location.[4] The Ministry of the Interior (MoI) and the MoF mandate a yearly adjustment of tax rates based on price indices from the previous year; as a centralized country, LGs seeking to impose higher or lower rates need to, first, pass a resolution in the local council; then publish the resolution so that affected citizens and businesses have an opportunity to lodge objections; and finally, submit the request for approval from the MoI and the MoF. This process must be completed a year before the proposed modification. The top three property classifications, in terms of their contributions to local tax revenue, are residential housing, which is a highly salient tax, and commercial and industrial properties, which are less salient taxes, which together amount to 87% of the total tax charge.[5]

In 1934, the property tax (named "Arnona") began as a percentage of the property rateable value.[6] In 1967, the law was amended to allow local governments to impose an area-based property tax.[7] The value-based property tax was repealed in 1968,[8] but the law permitted LGs that levied it to continue doing so until 1975. In 1975, the government established a law that defined the reimbursement of LGs who utilized value-based property tax, and since then LGs employed area-based property tax.[9]

The high inflation rates in Israel during the mid-1980s eroded the value of the currency. LGs responded by raising property tax rates. Due to the extremely high inflation rate and the lack of mandatory tax rates adjustment, however, each LG adjusted rates as it saw fit. The government then passed a law to stabilize the economy in 1985, which prohibited all price increases and allowed only government-approved increases.[10] The government adjusted the area-based property tax setting in 1992, including the limiting of the annual rate change.[11] LGs could change rates up to the maximum allowable increase. In 2006, the government issued another law that specified the mandatory annual rates increase as an average of the consumer price and the public wages indices.[12]

3.2. Quasi-experiment: the IGG model reform

Prior to 2011, the government calculated the fiscal gap for each LG as the difference between the LG's average expenditure and a combination of (a) expected income from residential properties, reflecting normative residential tax rates set by the government based on the socioeconomic status of each LG; and (b) actual commercial and industrial taxes collected (See Appendix A for more details). As a result, the fiscal gap increased for some LGs whose commercial and industrial tax rates were lower than the regional average. The government then compensated those LGs for proceeds they could have collected from their tax base. In 2011 the Israeli government changed the fiscal equalization model.[13] Under the reform, income from industrial and commercial properties would henceforth also be based on defined normative regional tax rates, rather than taxes actually collected. The reform resulted in narrowing the fiscal gap for those LGs whose industrial and commercial tax rates were lower than the regional average. The outcome of the reform was thus a reduction in grant levels for those LGs (for other LGs, grant levels stayed the same or even rose; see below). The reform internalizes the

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[1] For a description of regional councils and their structural efficiency see Shani et al. (2023).

[2] When all small villages are counted separately, the average size of an LG drops considerably, to 7593 people. Therefore, the Israeli central government regulates only 257 LGs instead of 1214 (Razin, 2004 with figures updated to 2020).

[3] All percentage figures relate to total income, averaged over all LGs between 2013 and 2018.

[4] Many countries levy value-based property taxes as a percentage of property value. Property tax in Israel is area-based, and is calculated by multiplying the tax rate (in NIS per square meter) by the property area. This is the only tax that LGs can levy. LGs are not permitted to impose income, sales, or value-added taxes.

[5] Average of levied taxes by classification between 2006 and 2018. Data source: Israel Central Bureau of Statistics.

[6] The British High Commissioner for Palestine act, "The Municipal Corporations Ordinance" No 1 of 1934, §102.

[7] The Cities and Local Councils Order (amendment no 5) 1967, §274b. Cancelled by the Economic Arrangements Law 1992, §8–10.

[8] The Cities and Local Councils Order (amendment no 8) (Cancellation of property value-based tax), 1968.

[9] The Local Governments Law (Reimbursement of Arnona) 1975. Cancelled by the Economic Arrangements Law 1992, §17.

[10] Economic Stabilization Plan 1985, §10.

[11] Economic Arrangements Law 1992, §7-9.

[12] Economic Arrangements Law 2006, §17-19.

[13] Israeli government decision number 3378, June 26, 2011.

tax competition between neighbouring LGs. Tax competition exists where LGs set lower tax rates to attract enterprises to their jurisdiction, and the IGG compensates for the lower rates (Egger et al., 2010).

Implementation of the change began in 2011, with a gradual decline in grants to negatively affected LGs over the following two or three years. LGs wishing to increase their tax rates in order to compensate for the decreased IGG had to follow the procedure outlined in section 3.1. This event is exogenous at the LG level, thus enabling us to measure the effect of changes in IGG income on LGs' adjustment of tax rates and the composition of their income and expenditure. The gradual change of IGG generates an exogenous deviation from the modified grant formula, such that the size of IGG is partially unrelated to LG's characteristics (Dahan, 2022). We thus used an exogenous smooth decrease in IGGs as our identifying assumption.

Israel's MoI approves LGs budgets, which by law must be balanced; unbalanced (deficit) budgets are not approved. High deficits may be met with various responses under the law; in extreme circumstances, the Interior Minister may dissolve the local council and appoint a special commission to govern temporarily in its place. Hence, LGs whose grants declined could be expected to take measures to balance their budgets. The options that LGs may exercise when facing a deficit include, but are not limited to, the following: reducing their expenditure by either reducing the services provided or making them more efficient; increasing tax rates; developing industrial and commercial areas; reducing discounts; reclassifying properties to categories with higher tax rates; or reassessing the physical area of a property subject to tax. Of course, LGs may also choose to increase their deficits, though they are then potentially subject to measures by the MoI.

As noted above, some LGs benefited from the reform. This is because every year, the central government allocates the total amount distributed to LGs based on the IGG model as a zero-sum game. Following the implementation of the reform, the overall fiscal gap declined, and the amount that was saved from those whose grants fell was allocated to other LGs. The IGG model favours LGs whose residents are of a lower socio-economic status and those with low per-resident normative income. For those LGs, this increase is thus a positive externality of the reform.

3.2.1. General predictions

Given all the foregoing, the setting of the IGG fiscal equalization reform in Israel enables us to observe the response of LGs whose IGGs declined or increased (the treated groups) in comparison with those which were unaffected (the control group) in the context of a centralized country. We predict the following. First, we expect to find that LGs whose IGGs declined maintained a balanced budget by requesting an increase of their non-residential tax rates relative to the control group, while not altering residential tax rates due to its high salience (Bracco et al., 2019). We further expect to find that the actual tax rates increased. We also expect to observe asymmetric behaviour among LGs whose IGGs increased, due to the flypaper effect. Specifically, we expect to find that those LGs reduce tax rates due to the increase in their grants relative to the control group (Benzarti et al., 2020). We further expect them to take advantage of their higher grants by increasing their spending on local services.

4. Method

4.1. Identifying the treated groups

In 2011, Israel had 256 LGs comprising 75 cities, 126 towns, and 53 regional councils as well as 2 industrial councils.[14] We used the modified model (described in section 3.2) to calculate the normative income of each LG for which we had data during the period 2006–2018, adjusting all financial figures according to the price index. We then examined post-reform IGG calculations relative to those preceding the reform to identify our two treated groups. LGs to which the reformed model added normative income, such that the addition resulted in a consistently lower per-resident IGG (i.e., between 2012 and 2018) relative to its pre-reform level, were defined as the negative-treated group. The positive-treated group was defined as those LGs for which the reform resulted in a consistently higher per-resident IGG relative to its pre-reform level. Fig. 1 shows the average per-resident IGG of the treated and control groups. We note parallel trends prior to the reform, and different slopes after. See Appendix B for more details on the LGs groups.

The control group was defined as all LGs that did not fall into either the negative-treated or positive-treated groups. Two LGs were eliminated from the control group: the capital (Jerusalem), which receives a special grant; and one outlier (the Tamar regional council, which has about 1200 residents, but a very high per-resident income: more than 12 times the other LGs average). The final analysis was based on 31 LGs which fit the criteria for the negative-treated group, 28 LGs which fell into the positive-treated group, and 194 in the control group. A detailed analysis of the IGG data is presented in Appendix C.

4.2. Calculating actual tax rates

The only tax that LGs can impose in Israel is an area-based property tax. The property tax disbursement is calculated by multiplying the specific property tax rate by the physical area of the property. LGs classify different tax rates based on location and usage, and they must obtain the MoI and MoF approval. The MoI establishes the major classifications, where each LG is allowed to define sub-classifications as it sees fit.

The Israel Central Bureau of Statistics (ICBS) annually publishes the total levied tax and total accumulated property areas for the

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[14] As noted in section 3.1, in 2020 Israel had 257 LGs. Between 2011 and 2020 two towns (Kfar Yona and Arabe) were reclassified as cities, and one regional council (Abu Basma) was split into two (El Kasum and Neve Midbar).
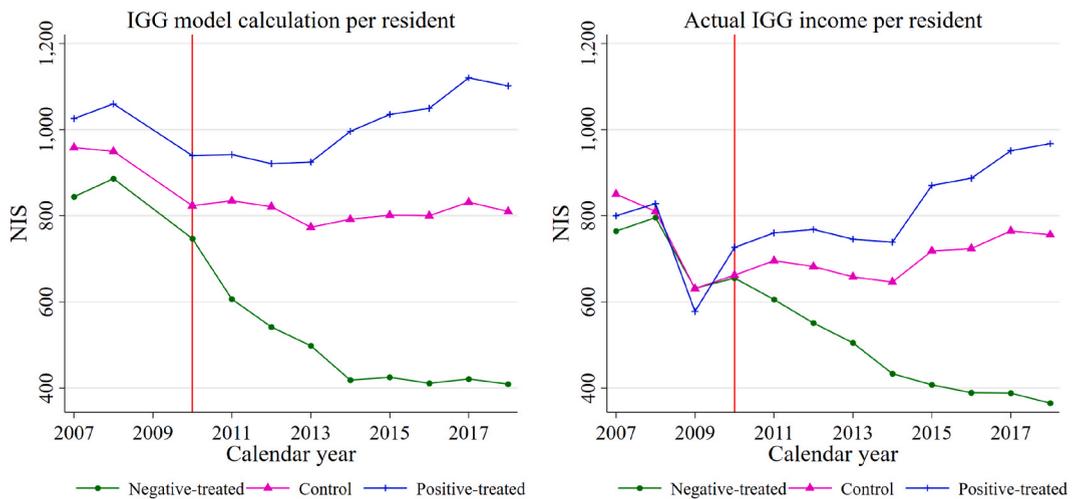
Fig. 1. Per-resident average IGG model outcome and actual IGG income.

major classifications. We calculated the average tax rates for the three major classifications - residential, commercial, and industrial - by dividing the total levied amount by the total accumulated area. The resulting rates are an average of all subclassifications for each classification. The rates were adjusted in accordance with the annual increase mandated by the MoI. As tax rates vary in magnitude across LGs and classifications, we used the average tax rates as our dependent variable in two ways: (a) in a fixed-effects analysis, which uses the difference of each yearly rate from the average rate (natural log), and (b) as a robustness check we use an alternative specification which includes the adjusted rates increase relative to 2006.[15]

4.3. Difference-in-differences (DiD) analysis

The treatment event took place by mid-2011, effective immediately, but with an implementation schedule of a few years, with a gradual decrease in IGG levels for the negative-treated group. LGs were aware of the coming change in the IGG calculation formula as of the beginning of 2011. As such, those who potentially faced reductions in their grants could not began preparing for the change in 2011. Due to the complexity of the fiscal equalization model, LGs in the positive-treated group learned about the increase in their IGG only after receiving the model output.

4.3.1. Treated LGs' behaviour

Having access to LGs' financial statements between 2006 and 2018 enables us to monitor how the treated LGs behaved before and following the treatment. We examined two main variables: changes in LGs' (a) tax rates and (b) spending for different services. For the latter, we used a method called "own-source balance" (OSB), defined as per-service expenditure minus any income earmarked for that service category. We use equations (1) and (2) to calculate the DiD for each service category, obtaining the behaviour of the treated groups following the change in their IGG.

4.3.2. Two-way fixed effects DiD analysis (TWFE)

The classic difference-in-differences method (Angrist and Pischke, 2009; Reingewertz, 2020) compares changes in outcomes (in our research, tax rates and other fiscal aggregates) for a treated group to the parallel changes for a control group. The DiD method assumes that the behaviour of the treated group, absent the treatment, should have been similar to that of the control group. This is called the parallel trend assumption. The control group acts as the counterfactual group - what would have happened to the treated group without the treatment.

The classic DiD framework assumes that there are only two groups: one which received some kind of treatment, and another which did not receive the treatment. It also assumes two time periods: before and after the treatment. Finally, the DiD framework assumes that there are no unobserved variables that are correlated with both the outcome (in this case, tax rates or OSB) and the treatment (here, a downward or upward change in IGG levels). The DiD method provides an unbiased treatment effect.

The following equation shows the specifications for the DiD analysis:

$$X_{m,t} = \alpha_{m,t} + \beta_1 Y_T + \beta_2 d_m + \beta_3 Y_T d_m + \beta_4 T_{m,t} + \varepsilon_{m,t} \tag{1}$$

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[15] Since 2007, the MoI sets a mandatory tax rates yearly increase. Prior to that year, each LG could increase its tax rates up to a limit specified by the MoI. Therefore, we were able to adjust rates only since 2006. The results of the alternative specification are available from the authors upon request.

where $X_{m,t}$ is the explained variable, either $ln(\tau_{m,t})$, where $\tau_{m,t}$ is the average tax rate of LG_m in year t, or $OSB_{m,t}$, the own-source balance (expenditure minus income) for each service category. We also used the increase in tax rates relative to the year 2006 as an alternative specifications, where $X_{m,t} = \tau_{m,t}/\tau_{m,2006}$. Y_T is a dummy variable representing the year of the treatment (2011) and onward, d_m is a dummy variable indicating that the IGG in LG_m either increased (for the positive-treated group) or decreased (for the negative-treated group), and $T_{m,t}$ is a vector of LG characteristics which includes population and socioeconomic status. β_i are parameters to be estimated, and $\varepsilon_{m,t}$ is the residual.

Having access to yearly data both before and following the treatment enables us to use DiD in a panel model. Although the treatment event took place in a single year, we can test multiple periods ex-post. TWFE uses both year and LG fixed effects according to the following specifications:

$$X_{m,t} = \alpha_{m,t} + \beta_3 Y_T d_m + \beta_4 T_{m,t} + H_t + M_m + \varepsilon_{m,t} \qquad (2)$$

where $X_{m,t}$ is either $ln(\tau_{m,t})$ or $OSB_{m,t}$, H_t and M_m are year and municipality fixed effects, and are composed of dummy variables for each year *(t)* and each municipality *(m)*. The treatment group dummy (d_m) is omitted as it does not change over time.

For the tax rate outcome variable, we expect to obtain $\beta_3 > 0$ for the negative-treated group and $\beta_3 < 0$ for the positive-treated group, indicating that LGs whose IGG decreased raised their tax rates more than the control group, and that LGs whose IGG increased raised their rates less than the control group. For the OSB outcome variables, we expect to find an increase in the positive-treated LGs, as they receive additional grants, but no major change in the negative-treated LGs, as they should have compensated for the decline in IGG with an increase in tax collection.

In addition we used DiD with kernel propensity-score matching (PSM), and with a repeated cross-section option (Villa, 2016). As the control groups vary by their population size, socioeconomic and periphery indices, propensity-score matching creates matching between the treatment and control groups, lowering the likelihood of selection bias.

4.3.3. Ex-ante parallel trend verification

As we have data from a few years before the treatment, we can verify the ex-ante parallel trend assumption. We first created timeline charts, allowing us to see the ex-ante trends. We then used event study analysis (Callaway and Sant'Anna, 2021) to confirm that all pre-treatment effects are equal to zero. In addition, we tested the difference in pre-treatment trends between the treatment and control groups using the triple interaction per the following specifications:

$$X_{m,t} = \alpha_{m,t} + \beta_3 Y_T d_m + \beta_4 T_{m,t} + \beta_5 d_m (1 - Y_T) t + \beta_6 d_m Y_T t + H_t + M_m + \varepsilon_{m,t} \qquad (3)$$

where β_5 captures the difference in slope in the pre-treatment years, and β_6 in the post-treatment years. For a parallel trend, we expect that $\beta_5 = 0$. We used the Wald test to statistically verify this for both the negative-treated and positive-treated groups.

The analysis confirmed the ex-ante parallel trend, validating the assumption that absent the treatment, the ex-post trend would have been similar for both the treatment and control groups. For details on the trend analysis for the change in tax rates, see section 5.1.

4.3.4. Continuous treated group

The IGG model reform is an exogenous event for each LG. Moreover, the IGG model calculates the grant for each LG based on past performance. As such, we conducted an additional analysis in which instead of defining the negative-treated and positive-treated groups, we used the per-resident yearly IGG model (adjusted to the price index) as an exogenous treatment variable according to the following specification:

$$ln(\tau_{m,t}) = \alpha_{m,t} + \beta_3 Y_T \, ln(IGG_{m,t}) + \beta_4 T_{m,t} + H_t + M_m + \varepsilon_{m,t} \qquad (4)$$

where $IGG_{m,t}$ is the per-resident intergovernmental grant for LG_m in year t adjusted to the price index. β_3 indicates the rate of change of the tax rates when the IGG is increased by a one percent point.

4.4. Data

The data for this study were compiled from three databases. The first is the set of annual reports of the ICBS for 2006 through 2018, which include financial as well as descriptive data for each LG. The second is the IGG model data published yearly by the MoI; this includes the IGG model output and the actual IGG allotted to each LG. Finally, the third database is the set of LG tax rate change requests compiled by the MoI and examined by Kimhi et al. (2022). Data from all three sources were compiled into a one-panel database, sorted by year and LG.

4.5. Descriptive statistics

Table 2 presents descriptive statistics for the three groups for the year 2010. Note that the control and positive-treated groups have similar population sizes, whereas the negative-treated LGs are smaller. The residents of negative-treated LGs also tend to be of higher socio-economic status, whereas those in the positive-treated LGs are of lower status.

While residential tax rates are similar for all groups, industrial tax rates are lower in the negative-treated group relative to the other

groups, which may indicate that the modified IGG model adds normative income to these LGs.

Table 2 also shows the dynamics of per-resident IGG in the years 2007 and 2018. While changes in the control group are small, IGG levels decline sharply in the negative-treated group, and increase in the positive-treated group.

5. Results

5.1. Treated and control groups: pre- and post-treatment trends

As noted above (section 4.1), we identified 31 LGs in the negative-treated group, 28 in the positive-treated group, and 194 which formed the control group. Appendix C details the results of DiD analyses verifying that IGG changes in the positive-treated and negative-treated groups are in line with the groups' definitions.

The timeline charts in Fig. 2 show changes in tax rates for the three groups by the tax classifications (industrial and residential). As can be seen, the most striking image is that for industrial tax rates, where the three groups show somewhat similar trends before the treatment but large differences following the treatment year. In particular, we can observe a sharp increase in the negative-treated group's industrial tax rates following the year 2011 relative to the control group, and a decline for the positive-treated group. By contrast, residential tax rates show parallel trends for all three groups throughout the period examined, with no marked difference between the pre- and post-treatment years.

One of the basic assumptions of the DiD analysis is that the treated and control groups exhibit parallel pre-treatment trends. We tested the parallel pre-treatment trend assumption with Equation (3). We then used the Wald test with the null hypothesis that the linear trends are parallel, and obtained high p-values, which means that we cannot reject the null hypothesis of parallel trends. We performed this test for the negative and positive-treated groups for industrial tax rates. Fig. 4 shows a linear trend model for the change in industrial rates both in the natural log of the rates and in rates relative change from 2006.

Moreover, LGs could start preparing for a decline in their IGG even before the reform was implemented. We used the Granger causality test with the null hypothesis that anticipation of the treatment had no effect on the outcomes (Wing et al., 2018). This test is relevant only to LGs that were likely to be negatively affected, as positive treatment is a positive externality resulting from the zero-sum nature of the funds available for grants (see section 3.2). The test for the negative-treated group resulted in a high p-value, indicating that we cannot reject the null hypothesis (results available upon request).

5.2. Tax rates: first differences and DiD analysis

For each group, we looked at average tax rates for the residential and industrial classifications before and following the treatment. Table 3 shows the average change in rates, the difference between the pre- and post-treatment rates for each group and class (the first difference), and the difference between the treated and control groups. The difference-in-differences results confirm our expectations. LGs in the negative-treated group increased their industrial tax rates following the reform relative to the control group, while not altering their residential rates. LGs in the positive-treated group increased their industrial tax rates less than the control group.

5.2.1. Asymmetry in tax rate changes

Thus far, we have shown that LGs adjust their tax rates to either compensate for a decline in their IGG or to ease residents' tax burden when their IGG increases. We further predict that the response of LGs will be asymmetric: the increase in tax rates for LGs in the negative-treated group should be higher than the decline in tax rates for LGs in the positive-treated group. The timeline charts in Fig. 2

Table 2
Descriptive statistics.

Year = 2010	Control group				Negative-treated group				Positive-treated group			
	N	Median	Mean	S.D.	N	Median	Mean	S.D.	N	Median	Mean	S.D.
Population (000)	194	12	29	50	31	13	15*	10	28	13	30	38
Socio-economic index	194	5	4.9	2.3	31	6	6.1*	1.6	28	3	4.0*	1.7
Periphery index	194	5	5.1	1.9	31	6	6.2*	1.4	28	5	5.3	1.7
Loans (percentage of income)	186	32%	32%	17%	31	28%	29%	17%	26	29%	31%	16%
Residential tax rates	189	31	34	7	31	32	34	5	26	30	34	7
Industrial tax rates	173	49	60	36	29	39	53	33	24	56	64	32
Commercial tax rates	184	68	92	50	31	71	83	26	26	70	96	56
Per-resident IGG model 2007 (NIS)	186	1001	958	803	31	538	844	841	28	1027	1026	606
Per-resident IGG model 2018 (NIS)	193	880	810	698	31	9	409*	594	28	1006	1102*	646
Per-resident IGG income 2007 (NIS)	186	813	850	730	31	563	764	638	28	757	800	525
per-resident IGG income 2018 (NIS)	194	790	756	648	31	153	365*	498	28	844	968	549

Notes: The socioeconomic index is a measure of the socio-economic standing of the residents of each LG, and the periphery index captures the LG's relative weighted geographical proximity to a significant metropolis. Both indices are published periodically by the ICBS. Both indices span from 1 through 10, where 1 means the lowest socioeconomic standing or the most peripheral location. See Appendix A for more details. Loans present the percentage of the total loan load of current income. Tax rates are in NIS per square meter of property. IGG is allocated in two steps. The first gives the model calculations, which then are subject to various conditions, resulting in the actual sum that the LG receives. * indicates that the average of the treated group is significantly different than the average of the control group.
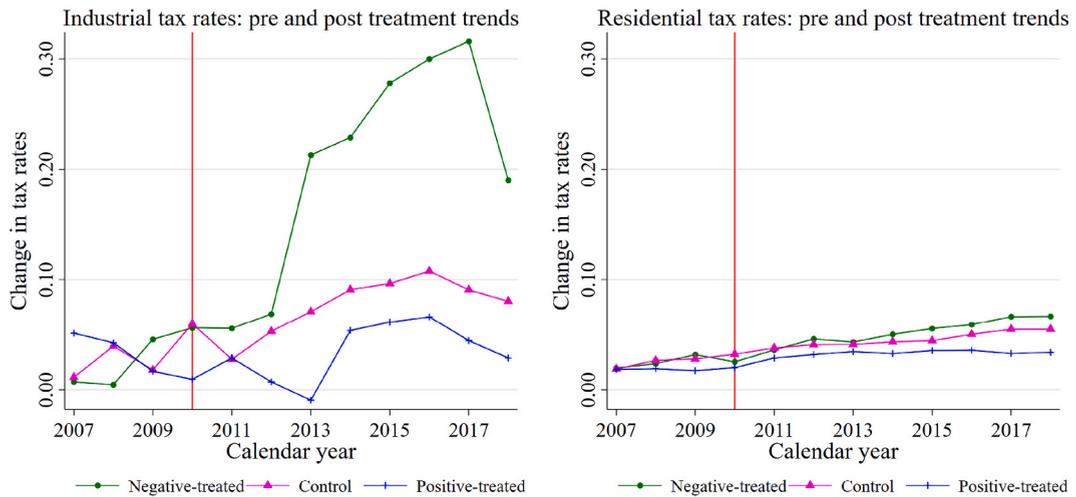
Fig. 2. Timeline charts showing changes in tax rates relative to the year 2006. Note: the vertical red line indicates the year prior to the treatment. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Table 3
Tax rates of treated and non-treated groups for each property class before and after the treatment.

	Group	Ex-ante	Ex-post	First difference	Diff-in-diffs
Industrial rates	Negative-treated	48	53	5.010***	3.704**
		(2.531)	(1.974)		
	Control	54	56	1.306**	
		(1.061)	(0.782)		
	Positive-treated	59	60	0.682	−0.624
		(2.647)	(2.131)		
Residential rates	Negative-treated	31	32	0.950***	0.215*
		(0.384)	(0.310)		
	Control	31	32	0.736***	
		(0.208)	(0.167)		
	Positive-treated	31	32	0.534***	−0.202
		(0.564)	(0.452)		

Notes: Rates are in NIS per square meter; Standard deviations are in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

present an indication of such behaviour, and the following analysis adds econometric verification.

Columns (1)–(2) of Table 4 show the treatment effect on the negative-treated group, and columns (3)–(4) present the treatment effect on the positive-treated group. The positive sign of ATE in column (1) indicates an increase in the industrial tax rates of negative-treated LGs relative to the control group. The negative sign in column (2) also indicates an increase in industrial tax rates, as the treatment variable is ln*(IGG model)*, which declined for the negative-treated group. The industrial tax rate increases by 6.5% relative to the control group.

The negative sign of ATE in columns (3)–(4) indicates a decrease in the industrial tax rates of the positive-treated LGs relative to the control group. The absolute magnitude of the positive ATE is about half that of the negative ATE, indicating an asymmetric response of LGs.

Fig. 3 presents an event study plot showing the change in industrial tax rates of the negative-treated group relative to the control group following the reform, using the method of Callaway and Sant'Anna (2021). Note that almost no changes in the industrial rate are seen in the years before the event and the first two years after the event, after which the rate change of the negative-treated LGs increased sharply. For the positive-treated LGs we note only a small increase, but we rely on the regression analysis where the results are statistically significant.

Previous studies found an asymmetric behaviour whereby when IGGs declined expenditures did not change, and when IGGs increased expenditures increased. We found another asymmetric behaviour — namely, the absolute value of the magnitude of the negative ATE is more than twice that of the positive ATE. Specification (4) calculates the elasticity of change: by how much tax rates change with a change of 1% of IGG. Our results indicate that a 1% reduction in IGG causes an increase of 6.5% in tax rates, whereas a 1% increase in IGG causes a 4% reduction in tax rates. The absolute value of the change is similar: IGG declined by 208 NIS for the negative-treated group while increasing by 154 NIS in the positive-treated group.

We also conducted similar analyses for the commercial and residential tax rates. The results show no significant treatment effects. See Appendix C.

Table 4
DiD results for the change in industrial tax rates of the negative-and positive-treated groups.

Treatment variable	(1) Group dummy	(2) ln (IGG model)	(3) Group dummy	(4) ln (IGG model)
Group	Negative-treated		Positive-treated	
Negative ATE	0.065***	−0.064**		
	(0.0201)	(0.0257)		
Positive ATE			−0.0319**	−0.041*
			(0.0146)	(0.0211)
Population	0.0007		0.0006	
	(0.0009)		(0.0008)	
Socioeconomic index	0.013		−0.008	
	(0.0089)		(0.0093)	
Periphery index	−0.0258*		−0.0321**	
	(0.0147)		(0.0152)	
Constant	3.891***	3.375***	4.059***	3.712***
	(0.096)	(0.189)	(0.094)	(0.134)
Observations	2626	1616	2554	1665
R^2	0.902	0.044	0.907	0.027
Year and LG FE	Yes	Yes	Yes	Yes

Notes: The table presents the TWFE results for a DiD analysis; columns (1) and (3) present TWFE where the treatment variable is the negative and positive groups using Equation (2); columns (2) and (4) present TWFE results with continuous treatment variable using Equation (4); ATE = interaction between treatment year and treatment variable; Population in thousands of residents; Yearly dummy variables omitted; Robust standard errors with clustering at the LG level in parenthesis; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
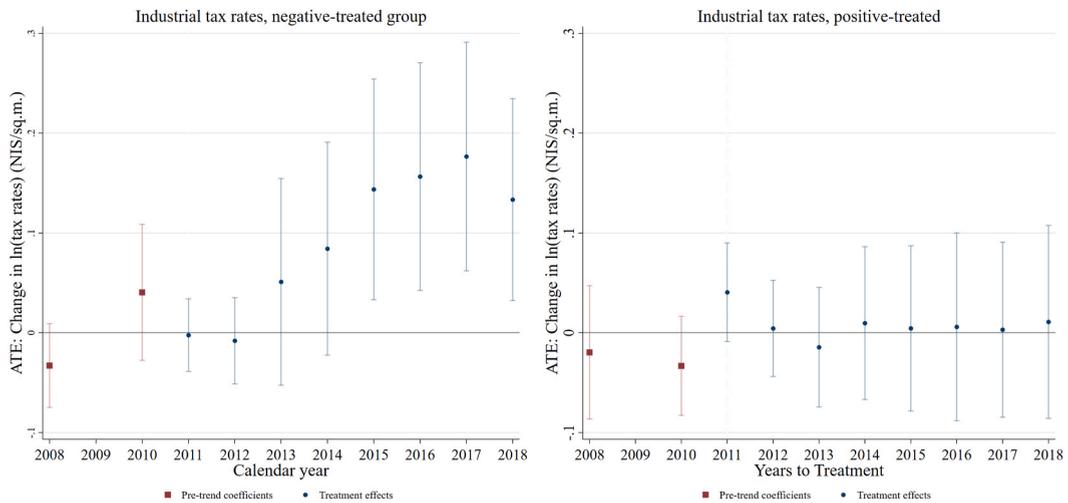

Fig. 3. Event study plot of the change in industrial rates of the negative-treated group. Note: The treatment event occurred in 2011.

5.3. Effects on deficit, income and spending budget components (OSB results)

LGs revenues stem from two primary sources: own-source and grants. Grants are further divided into two types: earmarked for a specific service (imposed by the grant source, e.g., education or welfare) or unconditional, where LGs may use as they see fit. Changes in revenue may be in earmarked or in unconditional grants. Changes in earmarked grants usually impose changes in that service expenditure, yet changes in unconditional grants may be in any budget component. Previous studies found differences in LGs' response to changes in IGG, which is expected due to the differences in culture, legal, political, and other environmental conditions, as Table 1 lists.

As we study the response of LGs to changes in unconditional IGG revenues, we further study how LGs reallocated their revenues following the change. Most of the previous studies found that when IGG declined, LGs did not reduce expenditure, and when IGG increased, LGs either boosted spending or reduced taxes. We expect to obtain similar behaviour, yet with further details on the specific budget components.

To study LGs budget reallocation decisions, we analysed the net allocation of their own-source revenues. We call this method "own source balance" (OSB) and performed TWFE analysis using Equation (2).

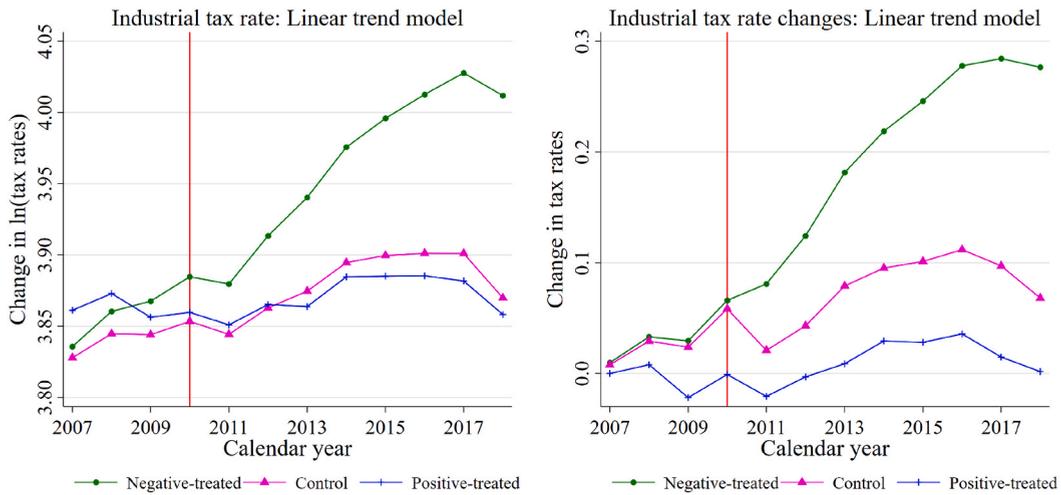$$OSB_{m,t,s} = Expenditure_{m,t,s} - Income_{m,t,s} \tag{5}$$

Fig. 4. Parallel trend diagnostics for industrial tax rates. Notes: The left-hand figure shows the results of a linear-trend model according to Equation (3) of the natural log of the changes in industrial tax rates. The right-hand figure similarly shows the results of the change of industrial tax rates relative to 2006. Wald tests indicate that we cannot reject the null hypothesis of a parallel trend. The vertical red line indicates the year prior to treatment. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

where $OSB_{m,t,s}$ is the net expenditure of LG m in year t for service s; $Income_{m,t,s}$ and $Expenditure_{m,t,s}$ are the earmarked revenue and expenditure for LG m in year t for service s respectively.

As we have seen, negative-treated LGs compensated for the decline in their IGG income by increasing their industrial tax rates, presumably translating into an increase in tax income. Positive-treated LGs received additional income in the form of higher IGG disbursements. We used LGs' income statements to examine the effects of these developments on the spending behaviour of all three groups.

We employed two methods to analyse the LGs' income statements: accounting-based analysis (Table B-1) and TWFE DiD (Table 5). The accounting-based analysis shows the first difference, where we compare LGs' income, expenditure, and OSB for different services

Table 5
DiD analysis of the major components of income and spending for the negative and positive-treated groups.

	(1)	(2)
	Negative-treated	Positive-treated
	TWFE	TWFE
Tax and grant income	−195*	150**
	(103)	(68)
Income from property taxes	92	−69**
	(57)	(35)
IGG revenue	−208***	154***
	(45)	(29)
Loan repayment expenditure	17	102***
Admin and management expenditure	9	147***
	(32)	(30)
Local services OSB	11	29
	(33)	(30)
State services OSB	−44	22
	(71)	(92)
Plants OSB	−26	−11
	(86)	(45)
Incidental activities OSB	−72	−64
	(55)	(72)
Total	−71***	28
	(14)	(14)
Accrued surplus/deficit	−308***	−62
	(75)	(179)

Notes: Columns (1) and (2) present the results of TWFE regression for the negative-treated LGs and for the positive-treated LGs respectively, showing the ATE for each category; All figures are per-resident indexed NIS; OSB = own-source balance: the difference between expenditure and income for each service. Robust standard errors clustered at the LG level are in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1.

before and after the treatment. Each group of LGs is compared to itself, showing how those LGs organized their spending in the presence of the treatment, yet without deducing causal effects.

The accounting analysis results show that by increasing their tax rates, the negative-treated LGs nominally regained the revenues that were cut by the treatment. To balance their budgets, they also cut administrative expenditure (mainly in relation to loan repayments). See Appendix B for more details. When comparing the negative-treated group to the control group through TWFE DiD analysis (Table 5), however, we notice that the relative income of the former significantly declined, due to the increased tax revenues of the control group. Furthermore, the control group LGs reduced their deficits. Thus, although the negative-treated LGs managed to maintain balanced budget execution, relative to the control group their deficits increased. Table 5 shows TWFE DiD analysis results for the budget components of the treated groups using Equation (2).

On the other hand, the positive-treated LGs enjoyed an increase in IGG income, which enabled them to increase their loan repayments and reduce their deficits (Fig. 6). The comparison to the control group reveals another important point: relatively speaking they reduced their tax income, replacing tax with IGG income.

Table 5 summarizes the treatment's relative effects on LGs' income and spending, showing the major budget components' net income statement (OSB). Administration and management are the overhead expenditures; Local services show the net (OSB) expenditure for services that the LGs provide, including sanitation, security, urban planning, public assets, celebrations and events, economic development, supervision, and agricultural services; State services show the net expenditure for services that LGs provide on behalf of the central government, including education, cultural services, public health, welfare, religious services, immigration, and sustainability; Plants include services which are self-sustained, and Incidental activities include financial transactions among municipal funds and discounts. (See Appendix B in Shani et al. (2023) for more details).

Table B-1 in Appendix B displays the results of a first-difference analysis showing that all LGs increased their spending on local and state services. The positive-treated LGs increased their spending nominally more than the rest of the LGs. Yet the magnitude of the increase is small and not statistically significant, as shown by the difference-in-differences analysis in Table 5. Fig. 5 shows the observed means of the own-source expenditure (OSB) for both local and state services, which exhibit similar trends irrespective of the treatment event.

We conclude that the negative-treated group, increase their deficit as the theory predicts. The positive-treated LGs use the additional revenue to increase their overhead expenditure, repay their loans, and reduce tax collection. Both treated groups did not reduce their spending on local and state services relative to the control group.

5.4. Tax rates change requests

LGs that want to change their property tax rates to more or less than the decreed increase must seek approval from the MoI and MoF. Kimhi et al. (2022) study the mechanism of the Permission to Override mandated tax changes and discovered that LGs with lower socioeconomic standing and fewer political connections are less likely to submit tax rate change requests. Using the tax rates change requests database (Kimhi et al., 2022) we asked whether LGs in the negative-treated group requested more rates changes than LGs in the control group in the years prior to and following the reform. As stated earlier in section 3.2, LGs in the positive-treated group benefited from a positive externality of the reform and were aware of the event later than LGs in the negative-treated group. Fig. 7
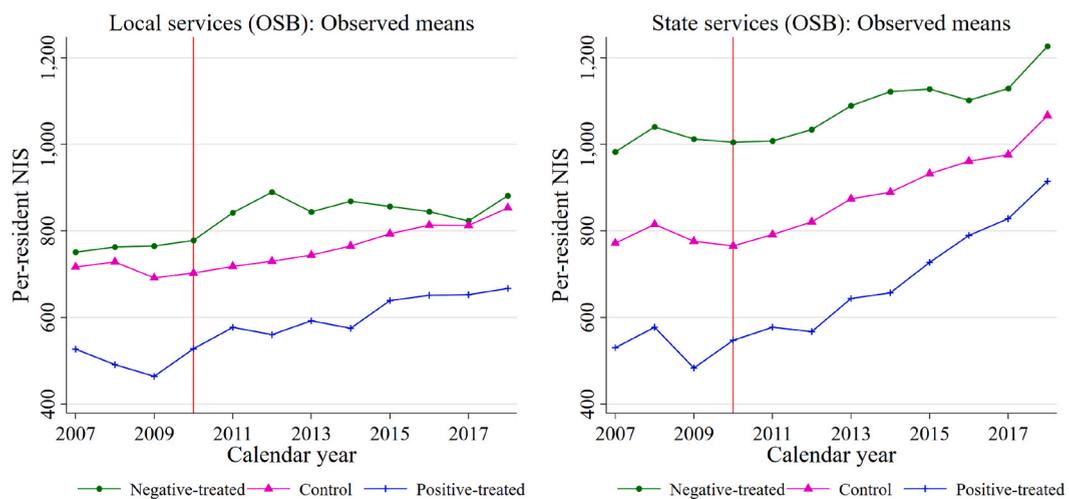
Fig. 5. Timeline charts showing OSB for local and state services for the three groups. Notes: The left-hand figure shows the timeline for the observed means of own-source expenditure on local services. The right-hand figure shows the same for state services. The figures show a similar trend for all groups, indifferent to the treatment event. Wald tests indicate that we cannot reject the null hypothesis of a parallel trend. The vertical red line indicates the year prior to treatment. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

Fig. 6. Timeline charts showing loan repayments and accrued deficits for the three groups. Notes: The left-hand figure shows the observed means of loan repayment expenditures for the three groups. The right-hand figure shows the same for the accrued deficits. The figures show that the positive-treated LGs increased their spending on loan repayments and reduced their accrued deficits. The vertical red line indicates the year prior to treatment. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
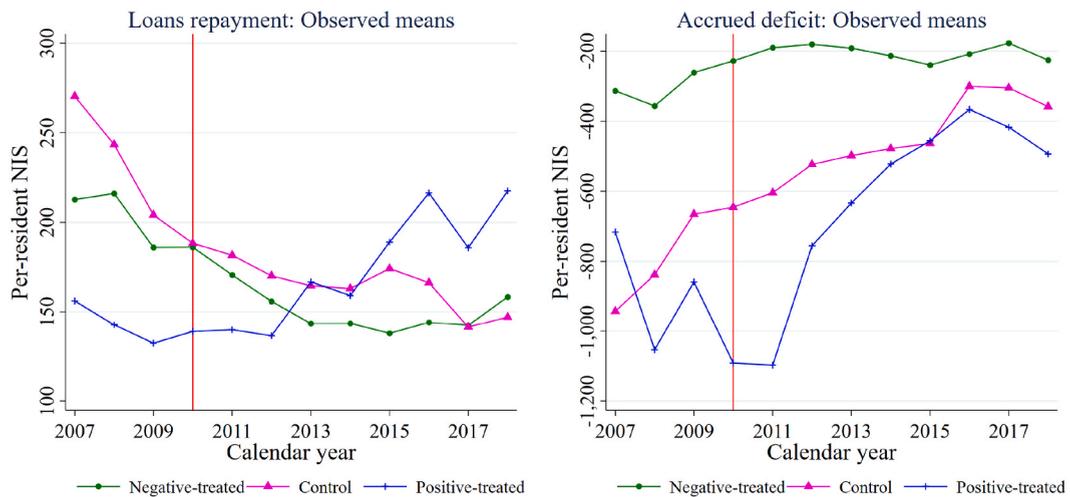
shows the percentage of LGs requesting tax rates changes for the negative-treated and control groups.

Fig. 7 shows the difference in requests to change local tax rates between the negative-treated and control groups. LGs might have requested rates changes after they learned of the reform in 2011. Fig. 7 shows that negatively treated LGs requested changes in a substantially larger percentage following the reform. Table 6 displays the mean difference in the proportion of rate change requests previous and following the treatment year, and the difference-in-differences. According to our estimates, LGs in the treatment group sought 13.3% more rate modifications than LGs in the control group. The modification requests were then subjected to logit DiD analysis. Table 7 shows that the odds ratio between LGs in the negative-treated group requesting tax rates changes following the reform and LGs in the control group is 1.9.

The data the MoI provided marks only if an LG submitted change requests yearly. The data do not reveal whether tax change requests refer to residential or non-residential taxation. However, our analysis shows that there no changes in residential tax rates, and the only rate change was in non-residential rates. Therefore, we can conclude that the change requests referred to non-residential taxation. Overall, this analysis reveals the causal relations between grants and tax changes, showing that a decline in IGG revenue caused LGs to submit significantly more rate change requests.

6. Discussion and summary

6.1. Discussion

When facing an IGG shock, LGs need to respond to avoid going into the red. LGs have several possible options, including increasing tax rates; developing and enlarging the tax base; reassessing properties' physical area or their value; becoming more efficient and/or cutting services; or increasing budget deficits. Previous studies have shown that LGs which faced a decline in IGG levels responded by increasing their tax income, but did not explain how they did this (Baekgaard and Kjaergaard, 2016; Heyndels, 2001; Kjaergaard, 2015; Marattin et al., 2022). The quasi-experimental setting of the present study, based on a reform to Israel's fiscal equalization model introduced in 2011, and that Israel is a centralized country, where LGs need to obtain permission to adjust their tax rates, enables us to look at both negative-treated and positive-treated LGs, and compare their behaviour to that of a control group.

How will LGs respond to IGG changes in a centralized county without the autonomy to change tax rates? The most apparent response to an increase in grants will be to increase expenditure (Liu and Ma, 2016), whereas the response to grant reductions would be to either reduce expenditure (Gamkhar, 2000; Helm and Stuhler, 2021) or to increase loans or deficits (Christofzik and Schneider, 2019; Lago-Peas, 2008). However, where LGs can request approval for tax rate modification from the central government, we may expect a different response. When grants increase, LGs will use a portion of the added revenue to increase their spending and another to reduce taxes. A possible explanation may be that politicians from both the central and local governments will be inclined to reduce taxes, increasing their chance of reelection (Bracco et al., 2015). When grant revenue falls, LGs may request permission to increase tax rates and, until then, increase their deficit or loan level. We expect an asymmetrical response - when grants rise LGs will mainly increase expenditures and modestly reduce tax rates, but when the grants level fall, LGs will mainly increase taxes while only modestly reduce expenditures. Therefore, the magnitude of the change in tax rate when IGG falls will be higher than when the grants level increase, but in the opposite sign.

Based on several DiD estimates, we can say that the IGG decline caused LGs to request significantly more tax rate adjustments and
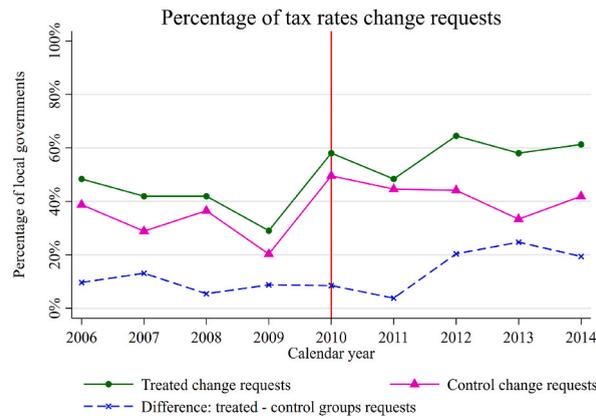
Fig. 7. Percentage of tax rates change requests of the treated and control LG groups. Notes: The dashed line presents the difference between the treated and the control groups' change requests; the vertical line shows the year prior to the treatment year.

Table 6
Tax rates change requests: the difference between the treated and the control groups.

Variable	Observations	Mean	S.E.
The difference before treatment year	6	8.2%	1.3%
The difference after treatment year	3	21.5%	1.6%
Difference in differences		13.3%	2.2%

Notes: S.E = standard error; *t*-test results show that all means differences are statistically significant at 95% confidence interval, where we reject H_0 that the means are equal.

Table 7
Panel DiD logit analysis of tax rates requests.

Variables	(1) Rates change requests	(2) Rates change requests
ATE	2.064**	1.917**
	(0.645)	(0.548)
Socioeconomic index	1.079	1.519***
	(0.160)	(0.0765)
Population	1.041*	1.016***
	(0.0216)	(0.00354)
Periphery index	0.692*	0.995
	(0.131)	(0.0685)
Constant		0.0437***
		(0.0158)
Observations	1710	2277
Number of LGs	190	253
LG FE	Yes	Yes
Model	FE	RE cluster

Notes: The table presents a panel DiD logit analysis; column (1) presents the fixed-effects model, whereas column (2) shows random effects with LGs clustering; ATE = interaction between treatment year and treatment variable; Population in thousands of residents; ***p < 0.01, **p < 0.05, *p < 0.1.

increase their industrial tax rates, while not increasing their residential tax rates which are more salient. Moreover, we showed that the negative-treated LGs reduce their administrative expenditure and managed to keep their budget execution balanced. Yet when compared to the control group, their deficits increased. All results are statistically significant when compared to the control group.

Our analysis also shows that when the IGG income increase, LGs respond by reducing their industrial tax rates, yet at a smaller percentage compared to those LG whose IGG declined, indicating an asymmetric effect. They use the additional income to reduce their deficits and increase their loan repayments while relatively reducing their tax income. Table 8 summarizes the results for the behaviour of the positive and negative-treated LGs when compared to the control group.

Our results also show an asymmetric effect: a grant reduction causes a tax hike which is twice as large as the tax reductions following a grant increase. Central governments should be aware of the pass-through effect when reducing grants, and then increasing back to the pre-reduction level, as tax rates will be higher than the original level.

6.2. Policy implications and conclusion

The central government's motivation in reforming the fiscal equalization model was to signal that the government will not transfer grants if LGs can collect taxes at competitive rates in a yardstick competition.

The 2011 IGG reform had a considerable effect on the public finance of local government in Israel. Specifically, LGs which saw a decline in their grants increased local tax rates and their deficits, while those that saw an increase in their grants decreased local tax rates and deficits. Both groups did not change their spending level. Our research shows the mechanism of tax rates adjustments and the impact of both rises and declines in IGG on local tax rates.

Bracco et al. (2015) regard IGG changes as a signal from the central government to voters. We add that IGG changes also signal LGs to initiate their tax rates adjustment mechanism and to collect more tax income as a substitute for the diminished IGG. When implementing such a policy, care should be taken to ensure that the affected LGs do have the potential to increase their tax rates and collection levels. Otherwise, they will be forced to cut services or enter the red zone. Moreso, governments should be aware of the asymmetry in the tax adjustments due to IGG changes, and refrain, as much as possible, from reducing IGG levels and then increasing them, as tax levels will increase.

Another contribution of our paper is that we explore the effect of IGG in a highly centralized country. We show that IGGs have a considerable effect on local taxation even when the local level does not have autonomy in tax rate setting. However, since changes in grants also affect deficits, it seems that the modifications in tax rates were not sufficient. This calls for more autonomy or otherwise for more discretion in implementing changes to grants given to the local level.

Our study suggests how LGs in a centralized country will respond to grant changes. Although many countries decentralize their sub-national governments, many other countries do not, and our study may assist them in setting policies. Furthermore, as central governments may keep the tax-setting powers even in a decentralized state, our findings may direct them in setting grants reforms and policies.

Finally, it should be noted that the relatively small size of our treated groups may impose limitations on the statistical analysis. In particular, the data we have do not distinguish between requests to increase and requests to decrease tax rates during the period under evaluation. Therefore, we leave the study of the detailed increase and decrease requests to future research.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data is publicly available from Israel CBS

Appendix A. Israel's IGG formula and socioeconomic and periphery indices

A-1. IGG equalization grant model

The sources of revenue for LGs in Israel are similar to those of many other local governments around the world. They are made up of local taxes, user fees, levies, fines, and local economic activities, as well as intergovernmental transfers that are divided into earmarked and free grants. The earmarked grants pay for a portion of the public services provided by local governments on behalf of the state, primarily education and welfare.

The unconditional equalization grant is intended to bridge the fiscal gap between the revenue of the local government and its normative expenditure. Until the mid-1990s, the equalization grant was determined through political bargaining between each LG and the MoI, with no predefined criteria. The first equalization formula, established by the central government in 1994, defined how to calculate the equalization grant for each local government based on its characteristics and past performance. Following the lessons learned from implementing that formula and recognizing its shortcomings, the government adopted a second model in 2004, which is still in use today with minor modifications (Dahan, 2022).

Based on a regression model, the current equalization grant model first calculates the normative expenditure for each LG. Based on

Table 8
LGs' conduct following treatment compared to the control group.

IGG	Positive-treated	Negative-treated
	Increased	Declined
Tax rates adjustment requests		Increased
Industrial tax rates	Decreased moderately	Increased significantly
Tax income	Decreased moderately	Increased
Loan repayments	Increased	
Deficit	Declined	Increased

the number of residents and the regression coefficients, the model calculates the normative per-resident expenditure: $Y = (\alpha + \sum p_i \beta_i)/p$, where Y is the per-resident normative expenditure; $p = \sum p_i$ is the number of residents; and α and β_i are regression coefficients, which vary based on the LG type and size.

Following the calculation, the model adjusts the normative expenditure based on a few LG characteristics: $Y' = Y \prod (1 + \gamma_i)$, where $\gamma_1 \in [-0.15 : 0.1]$ adjusts for the socioeconomic status of the residents of that LG; γ_2 adjusts for the socioeconomic variance; γ_3 adjusts for the number of students (residents in the age range of 0–18); γ_4 adjusts for welfare expenditure based on the number of senior residents; γ_5 adjusts for the percentage of new immigrants; and γ_6 adjusts for the number of villages and their distance in regional councils. The model sets limits to the adjustment: up to 10%, and also sets limits to the normative expenditure based on the socio-economic (*s*) status and LG type (*t*: city or regional council), such that $Y' \leq min(1.1Y, Y_{max}^{s,t})$.

The model computes normative revenue based on normative residential property tax rates and expected collection rates, which are adjusted based on the socioeconomic index. Before the 2011 reform, tax income from non-residential properties was added using the actual levied tax times the normative collection rate. The 2011 reform altered the calculation of tax income from commercial and industrial properties so that instead of using actual levied tax, the model establishes a normative regional tax rate and assumes that the LG will levy and collect accordingly.

The model then adds normative earmarked intergovernmental grants, which are adjusted based on the socioeconomic index, to the normative tax collection to arrive at the total normative revenue (*I*). The normative revenue is limited by a floor value: $I' = max(I, I_{min}^{s,t})$.

The unconditional equalization grant is $Y' - I'$. The model then accounts for two additional variables: pension expenditure and loan repayments.

The model smooths the increase or decrease in the unconditional grant further, resulting in relatively small variations. Dahan (2022) notes that "the gradual change generates exogenous deviation from the equalization grants formula, implying that the size of the equalization grant is partially unrelated to local government's characteristics, creating a random component".

A-2. The socioeconomic index

The ICBS developed a socioeconomic index and periodically publishes a new index every 2–3 years for all local governments.[16] The socioeconomic index ranges from 1 to 10, with 1 being the lowest status and 10 being the highest. The socioeconomic index is a weighted average of 14 variables that assess residents' financial resources, housing, home appliances, level of motorization, education, employment and unemployment, distress, and demographic characteristics. The ICBS makes use of data from formal administrative databases. Following data collection, the ICBS conducts factor analysis, grouping residents' data into the LG in which they live. Each LG receives a standardized index value as a result of the analysis. The ICBS then uses cluster analysis to divide all LGs into ten clusters, minimizing variance within clusters while maximizing variance between clusters.

The variables that compose the socioeconomic index include demography (median age, dependency ratio, percentage of families with four or more children); education (average years of schooling, % of people with a college diploma); employment (% of wage and income earners, % of women with no income from work, % of wage and income earners earning more than twice the average wage, % of sub-minimum wage earners, % of recipients of income support); standard of living (average monthly income per capita, number of owned vehicles per 100 residents, vehicle valuation, average number of days abroad).

A-3. The periphery index

The ICBS developed and publishes a periphery index once every 3–5 years. The periphery index classifies all LGs based on their geographic location in relation to economic activity centres. The periphery index ranges from 1 to 10, with 1 being the most peripheral LG and 10 being the most central LG. The periphery index is the weighted average of two factors: potential accessibility ($^2/_3$) and the distance to the Tel Aviv region ($-^1/_3$). Potential accessibility is the distance between each LG and other LGs, weighted by the population size: $\sum_j p_j / d_{ij}^{1.19}$.[17]

Appendix B. Financial Data for the Three Groups of Israeli Local Governments

Table B-1 presents income, expenditure, and OSB data for each group of LGs (negative-treated, positive-treated, and control), based on the average for each category in two periods: before and after the treatment year. The table also presents the first difference between the post- and pre-treatment events, and the total and the surplus/deficit for each group.

Schedule A of Table B-2 presents the breakdown of tax and grant income into their main elements, and Schedule B presents the breakdown of administrative and management expenditure into their main elements.

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[16] The description of the socio-economic index is taken from an ICBS publication, which can be found at www.cbs.gov.il.

[17] The description of the periphery index is taken from an ICBS publication, which can be found at www.cbs.gov.il.

Table B-1

Income statement of major categories for each group, pre-and post-treatment

	Ex-ante			Ex-post			First Difference
	Income	Expenditure	OSB	Income	Expenditure	OSB	
Negative-treated group:							
Tax and grant income	2974			2935			−39
	(72)			(43)			
Admin and management		792			683		−109***
		(23)			(14)		
Local services	383	1154	771	360	1216	856	85**
	(21)	(40)	(30)	(14)	(28)	(24)	
State services	2049	3053	1004	2414	3518	1105	101***
	(86)	(104)	(29)	(71)	(84)	(24)	
Plants	613	614	1	474	422	−52	−53
	(81)	(69)	(22)	(54)	(34)	(24)	
Incidental activities	295	707	412	195	545	350	−62**
	(43)	(52)	(29)	(18)	(20)	(17)	
Total	6313	6319	−6	6377	6385	−8	−2
	(215)	(213)	(11)	(137)	(136)	(9)	
Accrued surplus/deficit	−324			−203			121**
	(40)			(28)			
Control group:							
Tax and grant income	2862			2980			118*
	(53)			(44)			
Admin and management		850			726		−125***
		(16)			(11)		
Local services	247	963	716	283	1062	779	63***
	(12)	(25)	(17)	(9)	(20)	(14)	
State services	1712	2499	788	2179	3093	914	127***
	(31)	(43)	(18)	(38)	(44)	(15)	
Plants	459	507	49	308	333	25	−23***
	(11)	(13)	(8)	(11)	(12)	(5)	
Incidental activities	337	908	571	222	802	580	9
	(18)	(24)	(16)	(9)	(15)	(11)	
Total	5616	5728	−112	5972	6017	−45	67***
	(92)	(92)	(0)	(77)	(76)	(1)	
Accrued surplus/deficit	−848			−441			407***
	(36)			(20)			
Positive-treated group:							
Tax and grant income	2179			2488			309***
	(70)			(63)			
Admin and management		633			662		29
		(23)			(20)		
Local services	160	671	511	204	818	614	103***
	(12)	(31)	(23)	(11)	(28)	(20)	
State services	1436	1981	545	1954	2667	713	168***
	(53)	(74)	(29)	(56)	(76)	(26)	
Plants	449	500	51	350	361	11	−40***
	(24)	(28)	(13)	(29)	(27)	(9)	
Incidental activities	237	849	612	246	805	559	−53
	(28)	(73)	(62)	(29)	(33)	(18)	
Total	4461	4634	−173	5242	5313	−71	102*
	(140)	(159)	-(19)	(131)	(142)	-(11)	
Accrued surplus/deficit	−975			−593			382**
	(151)			(84)			

Notes: All figures are in per-resident NIS adjusted to the price index. OSB = Own-source balance: the difference between expenditure and income for each category. Standard deviations are in parentheses.

Table B-2

Composition of tax and grant income and administrative expenditure

	Negative-treated group			Control group:			Positive-treated group:		
	Ex-ante	Ex-post	First Difference	Ex-ante	Ex-post	First Difference	Ex-ante	Ex-post	First Difference
Schedule A: Tax and grant income:									
Property tax income	1810	2106	297***	1596	1761	164***	959	1098	138
	(50)	(48)		(49)	(39)		(63)	(55)	
IGG revenue	741	456	−285***	775	706	−70***	762	836	74

Table B-2 (*continued*)

	Negative-treated group			Control group:			Positive-treated group:		
	Ex-ante	Ex-post	First Difference	Ex-ante	Ex-post	First Difference	Ex-ante	Ex-post	First Difference
	(52)	(34)		(22)	(16)		(44)	(35)	
Other tax and grant income	424	373	−50	490	514	23	458	554	96**
	33	(22)		(21)	(21)		(26)	(34)	
Schedule B: Admin and management expenditure:									
G&A expenditure	325	313	−12	329	322	−7	261	277	17
	(13)	(9)		(7)	(6)		(13)	(11)	
Accounting management expenditure	213	184	−29***	211	198	−13**	167	172	4
	(6)	(4)		(4)	(3)		(7)	(6)	
Financing expenditure	46	36	−10***	70	43	−27***	56	36	−19***
	(4)	(1)		(3)	(1)		(5)	(2)	
Loan repayment expenditure	207	149	−58***	241	164	−77***	149	176	27*
	(12)	(7)		(7)	(4)		(9)	(10)	

Notes: All figures are in per-resident NIS adjusted to the price index. Standard deviations are in parentheses.

Appendix C. Detailed DiD Analyses

Appendix C provides further details on our DiD analyses, including results and methods used.

Group definitions

We used DiD analyses to verify that IGG changes in the positive-treated and negative-treated groups following the reform were in line with the groups' definitions. There is a difference between the IGG model outcome and the actual transfer. The allocated IGG typically covers only 85% of the model calculation. In addition, once the actual allocation is determined, the government activates an implementation schedule that smooths declines and increases over several years to prevent IGG shocks. Therefore, we looked at both the model-calculated outcomes and the actual IGG income of the three groups.

Table C-1 and Fig. 1 show trends, first differences, and DiD results for IGG model calculations and actual IGG income allotted to each group. The results show that IGG levels (both as calculated by the model and in actual disbursed income) declined for the negative-treated group and increased for the positive-treated group, as per the groups' definitions.

Table C-1
Classified tax rates and IGG model outcomes for the negative-treated (N = 31), positive-treated (N = 28), and control (N = 194) groups, before and after the reform

Dependent variable	Group	Ex-ante	Ex-post	First difference	Diff-in-diffs
IGG model calculation (per-resident NIS)	Negative-treated	826 (82)	466 (41)	−359***	−257***
	Control	910 (33)	808 (18)	−102***	
	Positive-treated	1008 (67)	1011 (38)	2.860	105
IGG actual income (per-resident NIS)	Negative-treated	741 (52)	456 (34)	−285***	−215***
	Control	775 (22)	706 (16)	−70***	
	Positive-treated	762 (44)	836 (36)	74	144**

Note: The table shows the observed means of the IGG model outcome and actual IGG income for the three groups before and after the IGG model reform. The diff-in-diffs column shows results for the classic DiD analysis. Table C-2 shows a panel DiD analysis. Standard deviations are in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Event study analysis

The IGG model reform resulted in an average decline of 52% in per-resident actual IGG income in the negative-treated group, and an average increase of 21% in the positive-treated group (2007–2018).

To statistically verify the changes in both the model outcomes and actual income revealed by the classic DiD analysis, we performed a two-way fixed effects regression and an event study analysis based on the method of Callaway and Sant'Anna (2021). Fig. C-1 shows that the per-resident IGG calculation declined sharply for the negative-treated group, but their actual income declined gradually, following the IGG implementation schedule described above. For the positive-treated group, per-resident IGG income increased gradually over the years. Both the negative-treated and positive-treated groups exhibit parallel trends before the reform. Table C-2

shows the TWFE analysis results for the negative- and positive-treated groups, in both the model calculations and actual income.
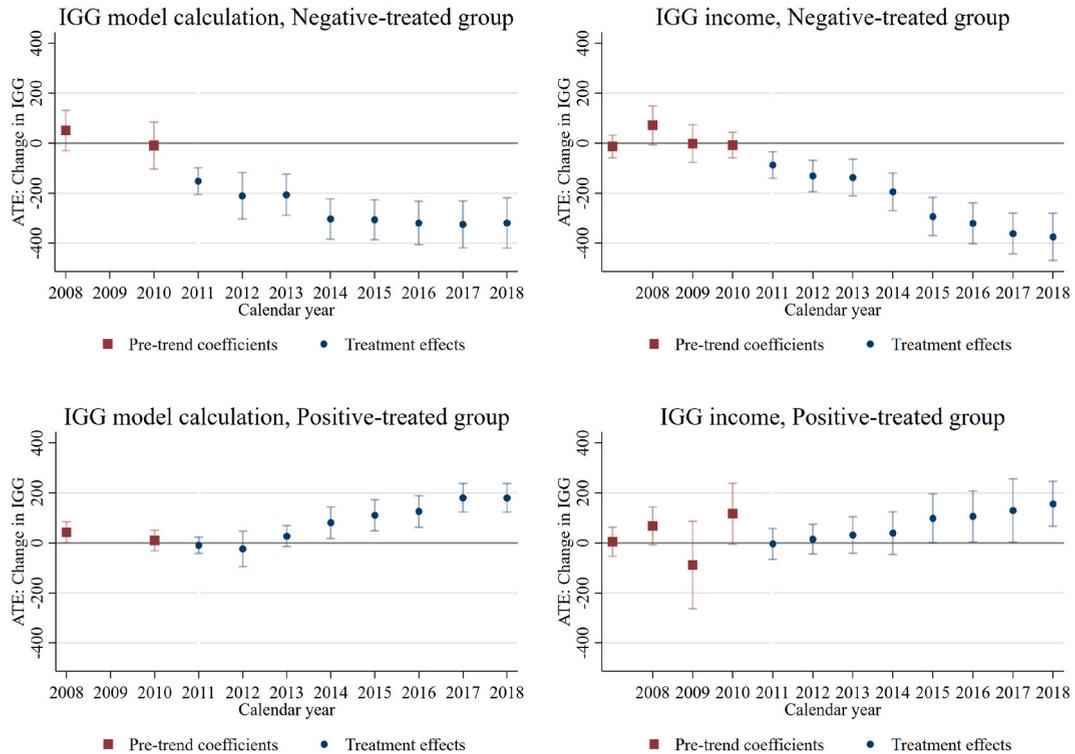

Fig. ure C-1. Event study analysis of the IGG model outcome and actual IGG income for the negative-treated and positive-treated groups. The treatment event occurred in 2011.

Table C-2
IGG TWFE analysis

Dependent variable	(1)	(2)	(3)	(4)
	IGG model outcome:	Actual IGG income:	IGG model outcome:	Actual IGG income:
Group	Negative-treated	Negative-treated	Positive-treated	Positive-treated
Treatment year	−155***	−197***	−135***	−167***
	(24)	(36)	(24)	(36)
Negative-treated ATE	−256***	−208***		
	(61)	(47)		
Positive-treated ATE			106***	152***
			(26)	(29)
Constant	944***	924***	969***	927***
	(18)	(24)	(15)	(24)
Observations	2445	2893	2412	2854
R^2	0.929	0.877	0.931	0.870
Year and LG FE	Yes	Yes	Yes	Yes

Notes: Robust clustered standard errors in parentheses. ATE: interaction between treatment year and positive or negative groups. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

As a robustness check, we also performed a kernel propensity-score matching DiD analysis with population size, socioeconomic and periphery indices as covariates (Villa, 2016). Table C-3 shows similar results to the TWFE analysis presented in Table C-2. Table 5 presents the results of the kernel propensity-score matching DiD for the service components.

Table C-3
DiD with kernel propensity-score matching

Model	(1)	(2)	(3)	(4)
	DiD with kernel propensity score weighting			
Dependent variable	IGG model outcome:	Actual IGG income:	IGG model outcome:	Actual IGG income:

Table C-3 (*continued*)

Model	(1)	(2)	(3)	(4)
	DiD with kernel propensity score weighting			
Group	Negative-treated	Negative-treated	Positive-treated	Positive-treated
Negative-treated ATE	−205**	−122*		
	(88)	(63)		
Positive-treated ATE			103*	128***
			(57)	(43)

Notes: ATE: Interaction between treatment year and group; DiD with kernel propensity score weighting and population size, socioeconomic and periphery indices as covariates (Villa, 2016). ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Residential and commercial tax rates

Table C-4 shows the DiD results for changes in commercial and residential tax rates. The commercial analysis shows a positive but insignificant ATE for the negative-treated group and a negative and insignificant ATE for the positive-treated group. The magnitude is small, however, suggesting the findings may be attributed to ordinary fluctuations in rates. See the timeline plot for changes in commercial rates in Fig. 2. The DiD results for changes in residential rates show a significant but very small ATE effect ($<1\%$), which we also observe in the residential timeline plot in Fig. 2.

Table C-4
DiD results for changes in commercial and residential tax rates for both treated groups

Treatment variable	(1)	(2)	(3)	(4)
	Group dummy	ln (IGG model)	Group dummy	ln (IGG model)
Group	Commercial	Commercial	Residential	Residential
Negative ATE	0.0099	0.0191	0.0087**	−0.0007
	(0.0171)	(0.0192)	(0.0041)	(0.0041)
Positive ATE	−0.0253	0.0363*	−0.008**	0.0009
	(0.000696)	(0.0197)	(0.000155)	(0.00415)
Population	−0.0014*		0.0001	
	(0.0007)		(0.0002)	
Socioeconomic index	0.0035		−0.0053***	
	(0.007)		(0.002)	
Periphery index	−0.0198*		0.0011	
	(0.0113)		(0.0023)	
Constant	4.412***	4.321***	3.423***	3.366***
	(0.071)	(0.13)	(0.015)	(0.026)
Observations	3154	1992	3154	1992
R^2	0.972	0.501	0.972	0.501
Year and LG FE	Yes	Yes	Yes	Yes

Notes: The table presents the TWFE results for a DiD analysis; columns (1) and (3) present TWFE where the treatment variable is the negative and positive groups using Equation (2); columns (2) and (4) present TWFE results with continuous treatment variable using Equation (4); ATE = interaction between treatment year and treatment variable; Population in thousands of residents; Yearly dummy variables omitted; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

References

Allers, M.A., Vermeulen, W., 2016. Capitalization of equalizing grants and the flypaper effect. Reg. Sci. Urban Econ. 58, 115–129. https://doi.org/10.1016/j.regsciurbeco.2016.03.005.

Alpino, M., Asatryan, Z., Blesse, S., Wehrhöfer, N., 2022. Austerity and distributional policy. J. Monetary Econ. https://doi.org/10.2139/ssrn.3720401.

Angrist, J.D., Pischke, J.-S., 2009. Mostly harmless econometrics. In: Mostly Harmless Econometrics. Princeton University Press. https://doi.org/10.2307/j.ctvcm4j72.

Baekgaard, M., Kjaergaard, M., 2016. Intergovernmental grants and public expenditures: evidence from a survey experiment. Local Govern. Stud. 42 (2), 189–207. https://doi.org/10.1080/03003930.2015.1110521.

Baskaran, T., 2016. Intergovernmental transfers, local fiscal policy, and the flypaper effect: evidence from a German state. Finanzarchiv 72 (1), 1–40. https://doi.org/10.1628/001522116x14462054864882.

Ben-Bassat, A., Dahan, M., 2009. The Political Economics of the Municipalities. The Israel Democracy Institute, Jerusalem, Israel.

Benzarti, Y., Carloni, D., Harju, J., Kosonen, T., 2020. What goes up may not come down : asymmetric incidence of value-added taxes. J. Polit. Econ. 128 (12), 4438–4474. https://doi.org/10.1086/710558.

Berset, S., Huber, M., Schelker, M., 2022. The fiscal response to revenue shocks. International Tax and Public Finance, January 1–35. https://doi.org/10.1007/s10797-022-09727-z.

Boadway, R., Shah, A., 2007. Intergovernmental fiscal transfers, principles and practice. In: Boadway, R., Shah, A. (Eds.), The World Bank. The World Bank. https://doi.org/10.1596/978-0-8213-6492-5.

Bracco, E., Lockwood, B., Porcelli, F., Redoano, M., 2015. Intergovernmental grants as signals and the alignment effect: theory and evidence. J. Publ. Econ. 123, 78–91. https://doi.org/10.1016/j.jpubeco.2014.11.007.

Bracco, E., Porcelli, F., Redoano, M., 2019. Political competition, tax salience and accountability. Theory and evidence from Italy. Eur. J. Polit. Econ. 58 (October 2018), 138–163. https://doi.org/10.1016/j.ejpoleco.2018.11.001.

Bradford, D.F., Oates, W.E., 1971. Towards a predictive theory of intergovernmental grants. Am. Econ. Rev. 61 (2), 440–448.

Buettner, T., 2006. The incentive effect of fiscal equalization transfers on tax policy. J. Publ. Econ. 90 (3), 477–497. https://doi.org/10.1016/j.jpubeco.2005.09.004.

Callaway, B., Sant'Anna, P.H.C., 2021. Difference-in-Differences with multiple time periods. J. Econom. 225 (2), 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001.

Christofzik, D., Schneider, B., 2019. Fiscal Policy Adjustments to Budget Shocks: Evidence from German Municipalities. German Council of Economic Experts, pp. 10–2019. https://www.dchristofzik.de/publication/adjustment/.

Chu, A.C., Yang, C.C., 2012. Fiscal centralization versus decentralization: growth and welfare effects of spillovers, Leviathan taxation, and capital mobility. J. Urban Econ. 71 (2), 177–188. https://doi.org/10.1016/j.jue.2011.10.003.

Dahan, M., 2022. The effects of intergovernmental transfers on municipalities' budgets. Isr. Econ. Rev. 20 (1), 1–25.

Dahlberg, M., Mörk, E., Rattsø, J., Ågren, H., 2008. Using a discontinuous grant rule to identify the effect of grants on local taxes and spending. J. Publ. Econ. 92 (12), 2320–2335. https://doi.org/10.1016/j.jpubeco.2007.05.004.

Deller, S.C., Maher, C.S., 2006. A model of asymmetries in the flypaper effect. Publius 36 (2), 213–229. https://doi.org/10.1093/publius/pjj005.

Egger, P., Koethenbuerger, M., Smart, M., 2010. Do fiscal transfers alleviate business tax competition? Evidence from Germany. J. Publ. Econ. 94 (3–4), 235–246. https://doi.org/10.1016/j.jpubeco.2009.10.002.

Eyraud, L., Lusinyan, L., 2013. Vertical fiscal imbalances and fiscal performance in advanced economies. J. Monetary Econ. 60 (5), 571–587. https://doi.org/10.1016/j.jmoneco.2013.04.012.

Gamkhar, S., 2000. Is the response of state and local highway spending symmetric to increases and decreases in federal highway grants? Publ. Finance Rev. 28 (1), 3–25. https://doi.org/10.1177/109114210002800101.

Gamkhar, S., Oates, W.E., 1996. Asymmetries in the response to increases and decreases in intergovernmental grants: some empirical findings. Natl. Tax J. 49 (4), 501–511.

Gramlich, E.M., 1987. Federalism and federal deficit reduction. Natl. Tax J. 40 (3), 299–313.

Helm, I., Stuhler, J., 2021. The dynamic response of municipal budgets to revenue shocks. SSRN Electron. J. https://doi.org/10.2139/ssrn.3851044. May.

Heyndels, B., 2001. Asymmetries in the flypaper effect: empirical evidence for the Flemish municipalities. Appl. Econ. 33 (10), 1329–1334. https://doi.org/10.1080/00036840010004536.

Hines, J.R., Thaler, R.H., 1995. Anomalies: the flypaper effect. J. Econ. Perspect. 9 (4), 217–226. https://doi.org/10.1257/jep.9.4.217.

Inman, R.P., 2008. The Flypaper Effect. National Bureau of Economic. https://doi.org/10.3386/w14579. *Research No. w14579* (No. 14579).

Ivanyna, M., Shah, A., 2014. How close is your government to its people? Worldwide indicators on localization and decentralization. Economics 8 (2014–3), 1–61. https://doi.org/10.5018/economics-ejournal.ja.2014-3.

Jia, J., Ding, S., Liu, Y., 2020. Decentralization, incentives, and local tax enforcement. J. Urban Econ. 115 https://doi.org/10.1016/j.jue.2019.103225.

Jia, J., Liu, Y., Martinez-Vazquez, J., Zhang, K., 2021. Vertical fiscal imbalance and local fiscal indiscipline: empirical evidence from China. Eur. J. Polit. Econ. 68 (17) https://doi.org/10.1016/j.ejpoleco.2020.101992.

Kalb, A., 2010. The impact of intergovernmental grants on cost efficiency: theory and evidence from German municipalities. Econ. Anal. Pol. 40 (1), 23–48. https://doi.org/10.1016/S0313-5926(10)50002-X.

Kimhi, O., Beeri, I., Reingewertz, Y., 2022. The political economy of local governments' requests for permission to Override central fiscal limitations: insights from Israel. Publius:TheJournal of Federalism 1–27. https://doi.org/10.1093/publius/pjac021.

Kjaergaard, M., 2015. The flypaper effect: do political institutions affect Danish local governments' response to intergovernmental grants? Local Govern. Stud. 41 (4), 534–552. https://doi.org/10.1080/03003930.2014.968708.

Lago-Peas, S., 2008. Local governments' asymmetric reactions to grants: causes and consequences. Publ. Finance Rev. 36 (2), 219–242. https://doi.org/10.1177/1091142107299596.

Liu, C., Ma, G., 2016. Taxation without representation: local fiscal response to intergovernmental transfers in China. Int. Tax Publ. Finance 23 (5), 854–874. https://doi.org/10.1007/s10797-015-9383-y.

Marattin, L., Nannicini, T., Porcelli, F., 2022. Revenue vs expenditure based fiscal consolidation: the pass-through from federal cuts to local taxes. Int. Tax Publ. Finance 29 (4), 834–872. https://doi.org/10.1007/s10797-021-09682-1.

Navon, G., 2006. Budgetary dynamics in the local authorities in Israel. Isr. Econ. Rev. 4 (2), 19–52.

Oates, W.E., 1972. Fiscal Federalism. Harcourt Brace Jovanovich.

Rattsø, J., Tovmo, P., 2002. Fiscal discipline and asymmetric adjustment of revenues and expenditures: local government responses to shocks in Denmark. Publ. Finance Rev. 30 (3), 208–234. https://doi.org/10.1177/109114210203000303.

Razin, E., 2004. Needs and impediments for local government reform: lessons from Israel. J. Urban Aff. 26 (5), 623–640.

Reingewertz, Y., 2014. Fiscal decentralization - a survey of the empirical literature. SSRN Electron. J. https://doi.org/10.2139/ssrn.2523335.

Reingewertz, Y., 2020. The use of difference-in-differences (DiD) in public administration research. In: Vigoda-Gadot, E., Vashdi, D.R. (Eds.), *Handbook of Research Methods in Public Administration, Management and Policy* (Issue DiD. Edward Elgar Publishing, pp. 127–137. https://doi.org/10.4337/9781789903485.00013.

Romer, T., Rosenthal, H., 1980. An institutional theory of the effect of intergovernmental grants. Natl. Tax J. 33 (4), 451–458.

Shani, R., Reingewertz, Y., Vigoda-gadot, E., 2023. Regional governments in the rural space : the effectiveness of dual-tier regional councils Regional governments in the rural space : the effectiveness of dual-tier regional councils. Reg. Stud. 0 (0), 1–16. https://doi.org/10.1080/00343404.2022.2153825.

Sobel, R.S., Crowley, G.R., 2014. Do intergovernmental grants create ratchets in state and local taxes? Publ. Choice 158 (1–2), 167–187. https://doi.org/10.1007/s11127-012-9957-5.

Stine, W.F., 1994. Is local government revenue response to federal aid symmetrical? Evidence from Pennsylvania county governments in an Era of retrenchment. Natl. Tax J. 47 (4), 799–816. https://doi.org/10.1086/ntj41789109.

Villa, J.M., 2016. diff: simplifying the estimation of difference-in-differences treatment effects. STATA J. 16 (1), 52–71. https://doi.org/10.1177/1536867x1601600108.

Wing, C., Simon, K., Bello-Gomez, R.A., 2018. Designing difference in difference studies: best practices for public health policy research. Annu. Rev. Publ. Health 39, 453–469. https://doi.org/10.1146/annurev-publhealth-040617-013507.