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ABSTRACT
Unconditional intergovernmental grants are popular with economists but increasingly rarely observed in practice. Conversely, earmarking grants became a common form of the centres' support to states in federalist countries, though they are seriously flawed by welfare loss induced by the intended reallocation of states' provision of goods and services. Conditional grants bring states' governments a dilemma: intergovernmental grants increase states' revenues and enhance welfare, but the revenue gain is paid with amendments on the expenditure side, which harms welfare. We introduce the notion of price-shifting fungibility. It describes the effect of grant-receiving states minimizing the distortionary impact of conditional grants by lowering the prices or quality of the targeted good. By reducing the expenditure for the subsidized good, states create financial leeway to promote goods and services other than the targeted interest. By doing so, they can compensate for the welfare loss caused by conditional grants. We provide a simple theoretical model and some empirical evidence.

INTRODUCTION

Transfers of resources between jurisdictions are a significant feature of federalism. We often observe grants-in-aid, mainly if the central government is the foremost collector of total tax revenues.

From a normative point of view, the principle of subsidiarity determines allocative decisions in a federal system (Tresch, 2015, ch. 26). Grants-in-aid are thus required to resolve the distribution issues since all but the lowest-level governments must organize taxes and transfer resources as lump-sum grants among the governments directly under them. These lump-sum grants should be unconditional and non-matching ('distributional grants-in-aid'). Such a view corresponds in its consequences to Oates's celebrated decentralization theorem (Oates, 1972).

In practice, however, most intergovernmental grants are categorial and closed-ended. Most of the non-matching grants represent categorical block grants, and most of the matching grants are closed-ended (cf. Huber & Runkel, 2006).[1]

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Examples for conditional grants include the Cohesion Funds of the European Union (cf. Dettmer & Sauer, 2018) and most intergovernmental grants such as in Canada (Baker et al., 1999) and Germany (Huber et al., 2002).

An extensive literature explains this observation. Alm (1983) emphasizes that matching grants are not solely justified by externalities but reflect allocative and distributional goals of the grantor. In an optimal setting, they are sensitive to the distorting effects of federal taxes. The role of asymmetric information concerning cost structures of local jurisdiction may also justify conditional grants, as Cornes and Silva (2002) argued. In this line, Huber and Runkel (2006) showed that in a setting with asymmetric information, a second-best optimum can be achieved with categorical block grants and closed-ended matching grants instead of unconditional and open-ended grants-in-aid. By extending asymmetric-information models by the possibility of migration, Breuillé and Gary-Bobo (2007) show how an optimal grant schedule may affect increasing regional disparities.

In an attempt to understand why grants are so often earmarked, some of the literature emphasizes political considerations. For the central, providing such grants instead of unconditional ones (or awarding a higher share of total tax revenue) may be more advantageous for several reasons:

- The central will forgo tax revenues only temporarily.
- It is much less expensive for the central to reach a particular aim by providing allocative grants, as we will illustrate in the next section.
- The central can claim political success.
- Central government incumbents may use grants-in-aid to enhance their re-election probability by granting financial aid to states in which they have or can gain the most supporters (Cox & McCubbins, 1986; Johansson, 2003). In this line, Borck and Owings (2003) argue that the grant distribution to subcentral entities is at least partly determined by lobbying activities of regional governments. In a recent contribution, Baskaran and da Fonseca (2021) provide evidence for *hometown favouritism*, that is, German municipalities that are the residence of a central government minister experience a higher annual growth rate in state government employment.

Another strand of the literature deals with *fungibility*.[2] It describes the shifting of earmarked grants to other purposes. Grants targeted to, say, investment in schools are used to enhance roads, as an example. An often-used assumption in economics is that conditional grants alter the grant receiver's budget constraint according to the de jure disposability (i.e., the nominal administrative requirements). The first to show that this assumption is tenuous was McGuire (1978), who provided an 'indirect statistical method' to describe the post-grant budget constraint of receiving states. McGuire applied his econometric method against US local government expenditure decisions on education. In an empirical investigation of upper-tier municipalities in Ontario, Canada (1977–1992), Islam (2005) found that roughly 30% of the conditional grants were converted into fungible resources.

Four strategies of a grants-receiving state have been emphasized to explain the fungibility of conditional grants (Zampelli, 1986). The state can do the following:

- Reduce its normal funding of the targeted output.
- Use a programme or project that was going to be undertaken anyway.
- Redefine budget categories.
- Reallocate overhead costs.

Facing these strategies, several attempts were made to develop optimal grant designs (e.g., Breuillé & Gary-Bobo, 2007; Huber & Runkel, 2006). An aspect worth considering is that a central government provides grants-in-aid if the legal competence to provide a particular good or service lies in the subcentral states' hands. Competencies are often in the hands of the states, whereas the centre has greater fiscal power. Consequently, the central government can only introduce an intergovernmental grant programme with the states' approval. Thus, the central government is limited in designing a grant. Often, even unanimity is required (e.g., for imposing some of the EU programmes). Such constraints are essential for assessing grant programmes in practice and for explaining why (aside from information asymmetries) it is often not feasible to provide optimal grants.

However, a consequence of the fungibility discussion has been that grant programmes' designs will not allow the receiving states to reduce their planned funding or redefine budget categories. This will be achieved by imposing an *on-top* condition. It describes that a subsidy is granted only for units beyond the provided amount at the time of launching the programme.

In this paper, we assess theoretically and empirically fungibility in grant programmes with an *on-top* condition. Thus, we show that, in practice, McGuire's case is still an issue. Therefore, we introduce the notion of *price-shifting fungibility*. It describes that receipting states minimize the distortionary impact of conditional grants by lowering the prices or quality of the targeted good. By reducing the expenditure for the subsidized good, states create financial leeway to promote goods and services other than the targeted interest. By doing so, they can compensate for the welfare loss caused by conditional grants.

By using a new data set on a billion-Euro programme to enhance study places, we will assess whether conditional grants-in-aid has led to a remarkable increase in the number of study places and if this has occurred more in the less costly sectors in higher education.

Though the model we will present is quite simple, to our best knowledge we analyse the just-described behaviour of states for the first time. We conclude that fungibility effects should be considered both theoretically and empirically by evaluating intergovernmental grants programmes.

The remainder of the paper is structured as follows. The next section presents the welfare effects of both conditional and unconditional grants in a simple model. The third section further illustrates price-shifting fungibility. Before we present some empirical evidence, we provide some institutional background on fiscal federalism in Germany. The final section concludes.

MODEL

Federalist system and preferences

Consider a central government ('centre') as the grantor, providing grants to a (single) state. The latter consists of one representative individual. Its preferences determine the state's social welfare and are represented by a Cobb–Douglas utility function, $u(\cdot)$, with the constant return-to-scale property. The state's government can provide two private goods, x and q.[3] The preferences of the representative individual can be represented according to the just-mentioned properties by:

$$u(x, q) = x^{\alpha} \cdot q^{\beta}. \tag{1}$$

where $q \in \mathbb{R}_+$ denotes the number of university places; and $x \in \mathbb{R}_+$ indicates a publicly provided composite good. For simplicity, we set x as a numéraire good (to be interpreted as the set of all other goods and services).

With α we denote the partial elasticity of the marginal utility from x; and with $\beta = 1 - \alpha$ the partial elasticity of the marginal utility from q. The partial elasticities measure how utility changes with consumption.

As the representative individual knows that she or he gains from universities, science and better educated people, s/he has preferences over the provision of university places even if s/he does not attend higher education. Thus, both x and q are *consumed* by all individuals. We neglect any form of redistribution in order to eliminate the effects of social welfare optimization. Social welfare coincides with the utility level of the representative individual.

Both x and q are financed by an exogenously given tax revenue $T \in \mathbb{R}_+$, which is raised without any allocative distortion (such as a lump-sum tax). This feature allows neglecting 'price effects' from grants (Dahlby, 2011). The public budget constraint for any government providing the goods x and q depends on their prices and is given by $T = p_x \cdot x + p_q \cdot q$. The state's optimization problem is, therefore:

$$\max_{x,q} u(x, q) \quad \text{s.t.} \quad T = p_x \cdot x + p_q \cdot q. \tag{2}$$

The optimal allocation results from the condition that the marginal rate of substitution corresponds to the price ratio.[4]

In practice, a feasible option is to increase the overall tax revenue. We fix revenues to focus on the welfare effects deriving from the receipts' adjustments (substitution effects). Allowing for higher tax rates would require explicitly modelling the revenue system and then distinguishing the effects deriving from the tax increase to the effects deriving from states' responses to federal grants.

A simple model of intergovernmental grants

Consider that both sides (the centre and the state) acknowledge the need for more university study places, q. They mutually agree that a financial contribution from the centre is required to cover the higher financial needs. Note that allocative decisions are still on the regional level, but influenced by federal grants-in-aid. For the moment we consider only variations in the supplied quantities of the goods. In the following subsection we relax this restriction and consider provision by lower level quality.

The central government provides the grants conditionally.[5] Promoting q will be achieved by offering a (fixed) amount for each additional study place, that is, for each study place above the number of places that already have existed at the time the programme was launched, q_0 (on-top condition, as mentioned in the Introduction). Designing a programme in such a way has become a common feature in practice because it corresponds to the centre's goal to minimize windfall gains, as mentioned in the Introduction. The grants-in-aid are denoted by $\tau(q) \in \mathbb{R}_+$, where $\tau' \in (0, p_q]$ is constant (the same grant amount for each additional study place).

With conditional grants, the budget constraint becomes:

$$T + \tau(q, q_0) = p_x \cdot x + p_q \cdot q. \tag{3}$$

Further, we restrict that the grant does not succeed the price of the target good (otherwise, we would not have an interior solution as a state provides infinitely the subsidized good). Thus, we have $\tau' < p_q$, $\tau'' = 0$. We can now specify the grant programme $\tau(q, q_0)$ by $\tau' \cdot (q - q_0)$. Recall that the grant is awarded to each unit above that amount of q, provided in the absence of any grants, q_0.

The receiving state is facing a trade-off. It can attract additional revenues by providing more study places. Since the grant covers only part of the costs, the states must invest

more resources in expanding university study places than they receive in financial aid. Due to budget restrictions, this is only possible by reducing the quantity of the composite good, x.

Two effects influence the welfare level in opposite directions. On the one hand, the total amount of goods consumed rises; and, on the other, the composition of the goods changes, harming the welfare level.[6]

In formal terms, the amount of the subsidies good, q is given by:

$$\tilde{q}(\tau) = q_0 + \frac{p_q}{\tau'}\tau. \tag{4}$$

which indicates that a state has to provide $\partial\tilde{q}/\partial\tau = p_q/\tau'$ more university places to pocket a unit of grants. A state's incumbent acting rationally thus chooses the utility-maximizing level of $\tilde{q}$, which yields:

$$q^* = \beta\,\frac{T - \tau' \cdot q_0}{p_q - \tau'}. \tag{5}$$

The impact of conditional grants on welfare can be described as follows. Consider that in the initial (i.e., pre-grant) situation the allocation of goods is such that welfare is maximized. Grants-in-aid, conditional or unconditional, increase the resources available for the state and thus enhance welfare. However, the way of providing federal grants makes a great deal of difference. Unconditional grants operate similarly to an increase in overall revenue and do not affect the pre-given price ratio. The allocation of goods still complies with the optimality condition (marginal rate of substitution = price ratio) after being granted unconditionally. Conversely, conditional grants alter the price ratio. After-grant, the targeted good has a more favourable price. For instance, let the grant cover half of the cost of provision, then the initial price is bisected. Furthermore, the state needs financial leeway in order to co-finance the subsidized goods. This leeway is created by providing less of the unsubsidized good. As a result, the state allocates the goods distinct from the optimality condition mentioned above. The latter effect must be concerned with a loss of welfare, measured in terms of the difference to the welfare level gained without efficiency losses.

Table 1 illustrates the considerations as mentioned above. In the initial situation, we set the state's tax revenue to 100, both prices equal to 1, $\alpha = 0.6$ and $\tau' = 1/2$. Providing 20 units as unconditional grants increases the provision of both goods according to the optimality condition since the price ratio remains unaffected. Therefore, 12 units out of the 20 are used to provide more in x. The resulting welfare level, denoted by $u(\cdot)$, is calculated by setting the numbers into equation (1). Unconditional grants enhance the welfare level proportional to the increase in revenues. Conversely, if the same amount is provided conditionally (and assuming that the state will draw down the funds), the state has to decrease the provision of x remarkably. Part of the resources used in the initial situation for the provision of x is now redirected to co-finance the conditional grants to increase the q provision. However, it is important to emphasize that the numbers do not represent

Table 1. Numerical example.

Scenario	Conditional grant	Unconditional grant	x	q	$u(\cdot)$
Initial	0	0	60	40	51.01
A	0	20	72	48	61.22
B	20	0	40	80	52.78
C	4	0	56	48	52.65

optimal provisions as predicted by the model. They are used to illustrate the opposing effects on welfare. The actual provision of q are given by equation (5).[7]

Table 1 (scenario C) also shows why a grantor resorts to conditional grants, despite its distorting effect: the centre needs significantly less financial resources to achieve a certain level of q compared with the resources required when unconditional grants are given.

VARIATIONS IN THE QUALITY LEVEL

Consider next the possibility that states decide not only their provided quality but also the quality level. In the literature, often fixed price and given quality levels are assumed. However, grant recipients often can vary the costs for the goods to be promoted. Furthermore, due to restrictions such as information asymmetries and bargaining, the grantor cannot adjust the grants to such a price or quality change. In higher education, for example, a study place can be created in medicine or the humanities. Alternatively, as a further example, a recipient of earmarked grants for higher education may increase professors' teaching obligations instead of hiring more instructors.

Moreover, most countries have a differentiated higher education system with institutions that cause different costs. Germany, for instance, has (at least) two types of universities. *Traditional* universities, where half the professors' working time (and a vast share of total resources) are assigned to research activities; and the so-called universities of applied science (UAS), where professors should more or less focus on advising and teaching students instead of investing resources in research. The teaching load at UAS is often twice as high as that at traditional universities.

Denote study places at traditional universities with q_1 and those in UAS with q_2, the total number of study places are then $q = q_1 + q_2$, with prices p_1 and p_2, respectively, and with $p_2 < p_1$. As can readily be seen, a state seeks to increase the share q_2/q to minimize p_q and reduce the gap between p_q and τ', respectively. Consider the extreme case that a state faces no restriction on choosing q_1 or q_2, then there is no equilibrium with both, increasing q_1 and increasing q_2.

We can incorporate these considerations into the model. The possibility of complying with federal grant programme conditions works in the same way as an increase in τ': the overall costs of provision diminish by reducing the quality. Leaving the unit grant untouched, it covers a higher portion of the provision costs. Less of the composite good has to be waived to co-finance the grants, which drives the welfare effect of quality reduction.

However, assuming no restriction on states' choice over the quality level does not fit well with actually existing political conditions. Rather, the assumptions themselves question why the federal government imposes such a grant programme. Instead, states may have different degrees of freedom to choose between q_1 and q_2, respectively. By substituting τ' by the resulting average effective per unit grant, $\hat{\tau}'$ in equation (5) yields the state's response to conditional grants given its degree of freedom. In the next section we will argue that such different degrees of freedom, more accurately, different pressure to expand universities, indeed have been the starting point for a billion-worth programme in Germany.

Consider that two states L_1, L_2; $L_1 \cap L_2 = \emptyset$ constitute a federal country. Let L_1 be a high-pressured state, meaning that it faces high demand for more study places in traditional universities. L_1, therefore, is under pressure to gain a financial envelope to comply with their citizens' demand. Contrastingly, L_2 does not face such pressure and can provide study places in lower cost sectors without further restrictions. In many federal systems, the centre can impose a grant programme only with the consent of all states,[8] and let this rule hold for our case, too. Given, further, that the central government cannot impose different programmes for the states, the centre has three options, all widely discussed in connection with Oates's decentralization theorem (Oates, 1977, 1972, 1999):

- The federal government abstains from providing intergovernmental grants due to different regional preferences.
- The centre establishes a programme that complies well with the requirements in L_1.
- The grants-in-aid are suitable to the circumstances found in L_2.

The first option would be the political consequence of taking the decentralization theorem seriously. The second option gives L_2 an incentive to comply with the federal government's grant conditions by providing more study places of lower quality. In this case, we expect to find different responses to grants-in-aid such that the UAS sector increases asymmetrically. Finally, the third option leaves the high-pressured state L_1 primarily empty handed.

PRICE-SHIFTING FUNGIBILITY

Henceforth, we refer to the behaviour described in the preceding section as *price-shifting fungibility*. It describes the effect that grant-receiving states minimize the distortionary impact of conditional grants by lowering the prices or quality of the targeted good. By reducing the expenditure for the subsidized good, states create financial leeway to promote goods and services other than the targeted interest. By doing so, they can compensate for the welfare loss caused by conditional grants. States provide the targeted good to lower costs/qualities in order to gain financial leeway. This strategy opens the opportunity to improve the provision of the composite good evenly. Analogously, the states can fulfil the objectives of the granting incumbents but generate undesirable side-effects from the grantor's point of view. An example from the university sector is the supervising ratio (advising relationship), a transparent and comparable measure. It allows citizens to compare the performance of their government with that of their neighbour's. Since other goals are often hard to quantify (e.g., scientific output, teaching quality, etc.), adjustments in the advising relationship can be easily compared. Therefore, voters can judge whether the ratio of the advising relationship in their state improves more during a federal programme period than in a neighbouring state. Hence, the public may shed light on this variable and use it to judge whether an incumbent is of the 'good' or 'bad' type, to put it like Besley and Case (1995).
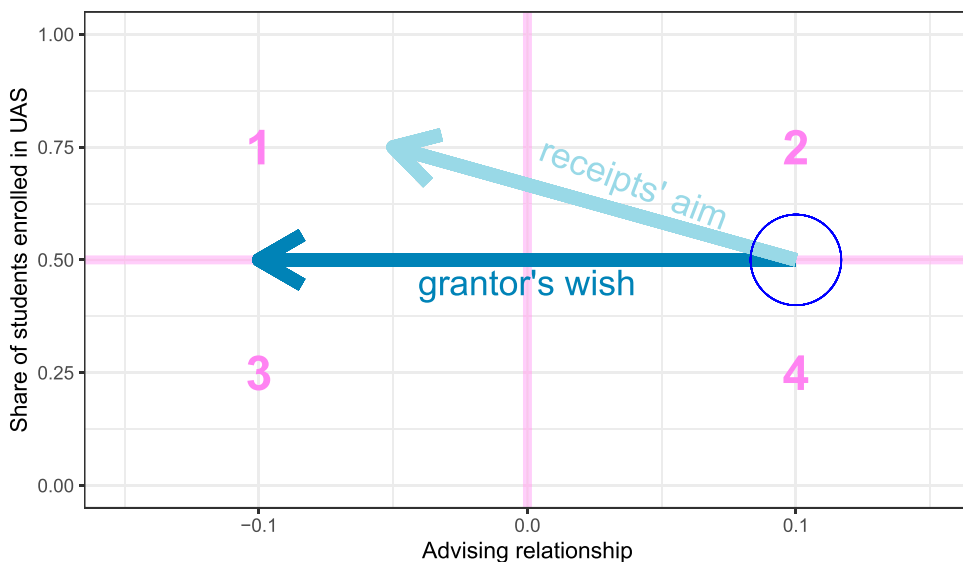

Figure 1. A simple illustration of the receipts' aim and the grantor's wish.

Figure 1 illustrates the difference between what the central government wants and what the states aim for. Half of the students are enrolled in UAS; the other half are in traditional universities. We set the value for the initial advising relationship equal to 0.1. The central government now imposes a conditional grant programme to enhance the advising relationship. Let the circle indicate the pre-grant situation and the dark blue-coloured arrow indicate the grantor's goal. The states comply with the grantor's aim. However, limiting adverse welfare effects, the states seek to increase the UAS share to cut the average price for the targeted good. From the centre's point of view, a shift to field 1 in Figure 1 indicates that its goal could have been reached with fewer resources. However, the states' gain is limiting the programme-induced welfare loss.

In the empirical part of this paper, we evaluate the phenomenon of price-shifting fungibility. Based on the theoretical framework and the just-described reflections, we assess whether the conditional grants-in-aid has led to a remarkable increase in the number of study places and if this has occurred, especially in the less-costly UAS. We are particularly interested in whether the enhancement of the advising relationship is linked to an expansion in the UAS sector. We use an amended version of Figure 1 to assess the states' behaviour. To put it differently, we will evaluate whether we can observe a movement toward quadrant 1. We will provide the results in the empirical section.

INSTITUTIONAL BACKGROUND

Fiscal federalism in Germany

In 1949, eleven states (*Länder*) in West Germany constituted the Federal Republic of Germany. With Reunification in 1990, the reunited city of Berlin and the five states on the territory of the former German Democratic Republic (GDR) joined the Federal Republic as new states
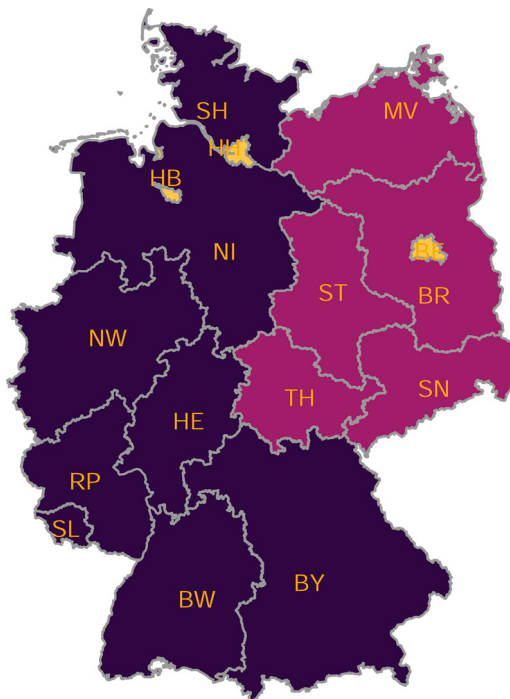

Figure 2. German states (*Länder*) coloured by state groups.
Note: Labels are abbreviations of states' names.

(Figure 2). Three out of the 16 states are city-states (Hamburg, Berlin and Bremen); the rest are territorial states. Germany's constitution, the *Grundgesetz* (Basic Law),[9] holds that as long as a legislative competency has not been assigned to the federal government, the legislative power lies with the states (Article 30).

The federal government has exclusive legislative power in foreign affairs and defence, citizenship and immigration, rail and air transport, and foreign trade. The states are responsible, inter alia, for educational policy issues ranging from early childhood education to public schools, higher education and vocational training.

Some policy fields are not exclusively assigned to either governmental level, but the competencies are well defined nevertheless. These fields are called *concurrent legislative jurisdiction*. An extensive list of concurrent legislative jurisdiction areas includes civil and criminal law, the regulation of nuclear energy, labour relations, environmental protection, road transport, and science.

A significant feature of the German Federation is that the states are more directly involved in decision-making at the federal level than the states or provinces in most other federal countries. The political power is achieved in the second chamber, the *Bundesrat*, where the states possess a right of veto over all federal legislation affecting them.

Despite the states' political power, their abilities to affect revenues from taxes are limited. The legislative tax power is in the federal government's hands with few exemptions not worth considering for this paper's purpose.

The primary feature of revenue-raising arrangements is the constitutionally mandated sharing of tax revenues. All significant tax revenues are divided between the federal and state governments. Despite value added tax (VAT) revenues, the shares assigned to the central state and the states are enshrined in the constitution. Thus, the revenue shares could not be amended with a simple majority in both chambers of parliament.

According to the constitution, the share of VAT revenues will be distributed according to financial requirements of the central legislative and the states that might change over time. Article 106 of the constitution states that the federation and the *Länder* shall have an equal claim to funds from current revenue to cover their necessary expenditures. The level of expenditures should be predictable based on multi-annual financial planning.

This so-called *hinge of fiscal federalism* ensures that as financial needs change, each legislative level can finance the expenditures to which it is competent under the Basic Law. For instance, if a higher amount has to be allocated to NATO, the central government shall receive a higher share of VAT revenues. On the other hand, if more young people want to enrol at universities, the states will be able to finance this need through higher revenues from VAT. For an excellent overview of other vertical and horizontal equalization schemes and grants programmes, see Hepp and von Hagen (2012).

Summing up, the mothers and fathers of German Basic Law – as the group of persons who worked out the draft for a new constitution after the Second World War were dubbed – attached much importance to a clear assignment of responsibilities. Common tasks should be an exception rather than a rule. Some decades later, economists emphasized the economic advantages of such a clear-responsibility system by developing the theory of yardstick competition as a key feature of fiscal federalism (e.g., Belleflamme & Hindriks, 2005; Besley & Case, 1995; Shleifer, 1985). Also, the revenue-sharing system has gained more attention after researchers emphasized the role of vertical externalities (e.g., Keen & Kotsogiannis, 2002).

It is, therefore, all the more astonishing that the system of competence division has become increasingly diluted. More than 15 constitutional amendments have taken place throughout the last 20 years, and the direction of the measures is not always clear.[10] The possibilities of allocating matching grants instead of making adjustments to VAT revenues have increased in recent years, in particular in the field of (higher) education.

Financing of higher education institutions

Public higher education institutions are, with a few exceptions, maintained and financed by the states (*Länder*). They are in particular responsible for providing financial resources to universities and UAS, and their tasks in the field of training and supervision of students from the time of enrolment to the doctorate. The funds are intended to cover personnel and material costs as well as investments in buildings and equipment.

According to the official financing statistics, in 2017, the public sector expended €30.5 billion on higher education institutions. The states provided roughly 80%, and the central government contributed the remaining 20%.

As already mentioned, this dichotomy of responsibilities has recently been increasingly blurred due to several constitutional amendments. One crucial legal reorganization was imposed in 2005 and concerned the new Article 91b. In cases of supra-regional or nationwide importance, it permits cooperation between the states and the central to promote science, research, and higher education teaching. Even open-ended grants from the central government to the states have been feasible since then. Higher education institutions can now also be permanently supported by federal funds. Agreements between the federation and the states, which primarily concern higher education institutions, require unanimity and hence the consent of all states.

The higher education pact

In 2007, the states faced an expected rising number of entrants. High birth rates and some other causes triggered this expectation. Accordingly, a quality deterioration (usually measured by a decline in the student–faculty ratio) was feared. A forecast of the conference of education ministers based on the federal statistical office data from 2004 indicates an increase of entrants, particularly in 2010–15. In both higher education sectors, traditional universities and so-called UAS, the number of entrants was expected to increase, though with no significant difference between both. The coloured areas in Figure 3 depict the prospected number of entrants.

The federal government and the states' governments agreed on an intergovernmental grant programme instead of adjusting VAT revenues as provided by the constitution. Conditional grants-in-aid in exchange for an increasing number of entrants was the main feature of this programme,[11] dubbed the higher education pact.

The central government faced 16 states with very different starting positions and needs. The western territorial states and the city-states expected a considerable increase in the number of new entrants. The eastern states, on the contrary, were shaken by the emigration of young people to the West and expected a correspondingly decreasing enrolment rate. In this respect, the western territorial states and the city-states had a great interest in finding an agreement.[12]

The higher education pact lasted four years (2007–10, completing funding by 2013). The term was extended twice to 2020 (financed until 2023) with some amendments.

The federal state and the states agreed that the financial requirement per additional entrant amounts to €22,000. The centre was to bear half of these costs. By expanding the programme term, the just-mentioned amount increased to €26,000.

It is important to note that decisions on study-place provision were primarily made by the universities and not by the states. The universities decided to introduce new bachelor's or master's programmes. The states usually ensure the financing according to the number of students enrolled. The funds from the higher education pact were allocated the same way. The states received grants according to the number of entrants, and the states forwarded the funds to their universities. The incentive derived from the uniform grant, thus, was much in favour of those higher education institutions with lower cost courses. The incentive to expand study places in traditional universities, and especially in particularly expensive faculties, was very low.
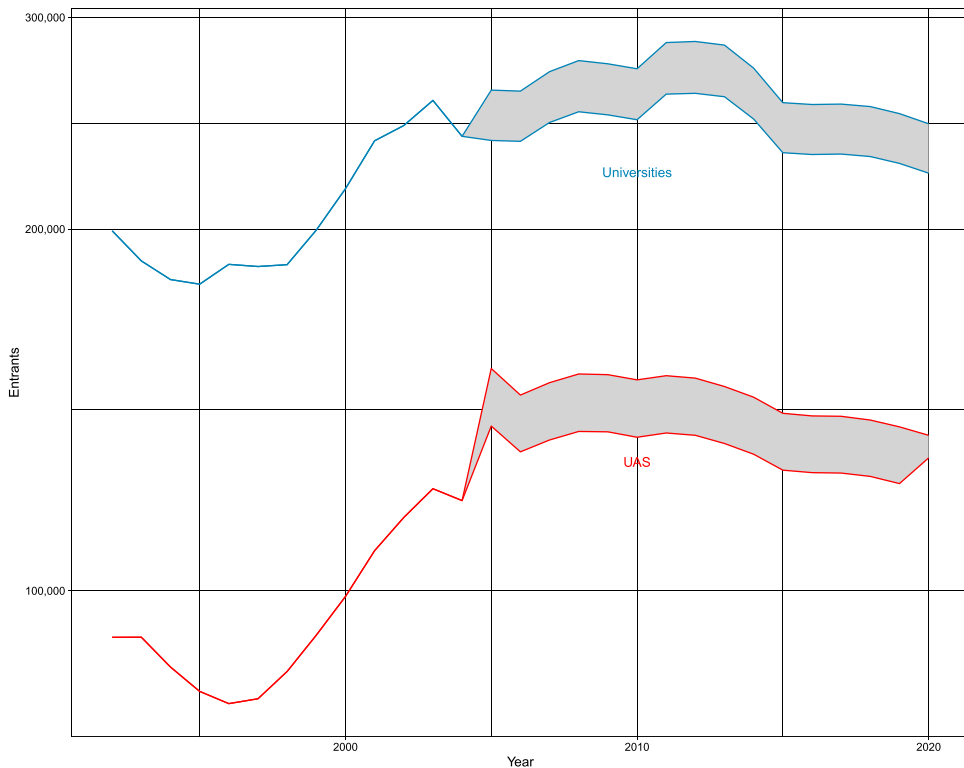
Figure 3. Entrants forecast by the conference of education ministers, 2004.
Note: Straight lines indicate the actual data at the forecast date.

The centre's main problem was that it could not check the 'additional' conditions since only the states knew how they would have financed their universities otherwise, that is, without the funds from the pact.

Between the start of the higher education pact in 2007 and a decade later, more than 1 million prospective students were able to enrol in higher education, still measured in terms of *additional entrants*. In this period, a total of roughly €18 billion flowed to the states' universities. A new treaty with fundamentally different rules replaced the higher education pact in 2019 and is now permanent (open ended).

DATA SET AND EMPIRICAL EVIDENCE

Data set

We took data from the federal statistical office and the joint conference of the ministers of finance and the ministers of science. The latter provides data on the financial transfers from the central government to states' governments; the first-mentioned source provides information on study places, the number of instructors, etc.

Further, we used prospect data by the conference of the ministers of science and education. Since demographic developments and other development in the dependent variables might differ between the three state groups for reasons unrelated to the higher education pact, we use their prospect data from the programme's beginning to compare the prospected developments, which consider demographic trends, with the actual data.

Table 2. Students enrolled at university level and universities of applied science (UAS) level, respectively.

Year	2005	2018	Δ (%)	Share 2005 (%)	Share 2018 (%)
Universities	1386	1781	28.5%	72.15%	64.04%
UAS	535	1000	86.9%	27.85%	35.95%
Σ	1921	2781	44.7%		

Note: Numbers are per 1000 persons.

Empirical evidence

As indicated in Table 2, the expansion in the higher education sector has taken place more strongly in UAS than in the traditional university sector. The number of students in UAS grew by roughly 87%, whereas the traditional universities experienced an increase in students by 28.5%.

Next, we argue that this unequal development has occurred precisely because of the grant programme (and would not have occurred without the federal grants). We depict our argument by expanding the forecast from 2004 (Figure 3) by the actual numbers of entrants (Figure 4). The dashed lines depict the actual development. The actual number of students enrolled in traditional universities comply more or less with the forecast. Quite differently, the actual number of students enrolled in UAS differs remarkably from the prospected one. Thus, Figure 4 indicates that the programme was responsible for the observed differences in the development of numbers between the two university types.
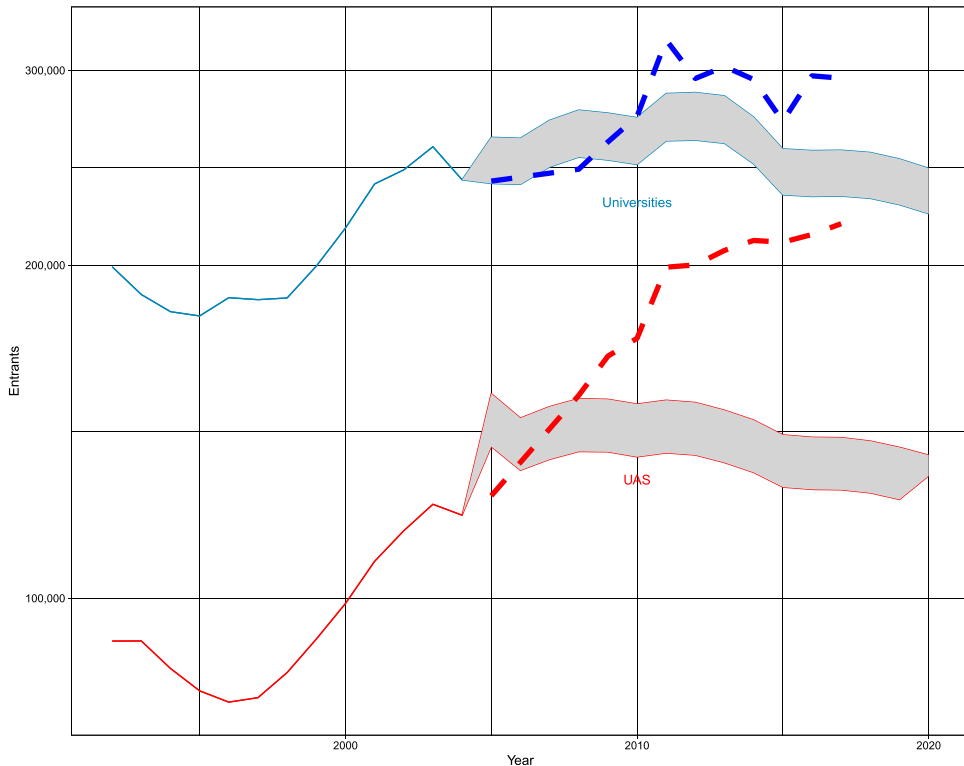

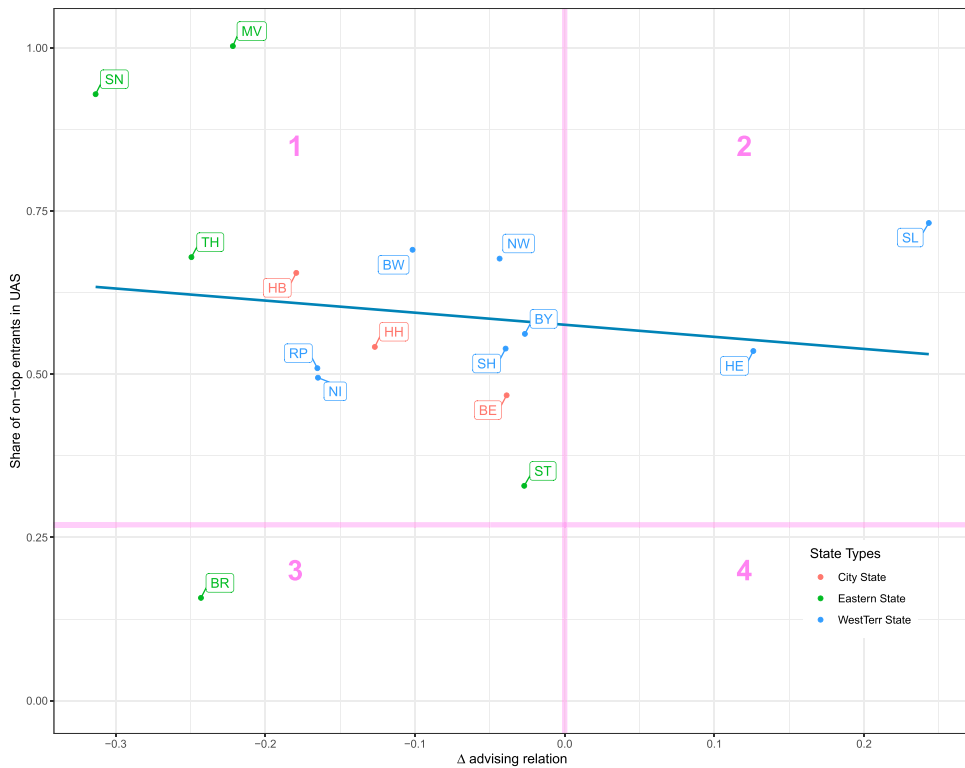**Figure 4.** Student prospect versus actual data, 2005–18.

Figure 5. Expansion in the universities of applied science (UAS) sector (measured as the share of additional entrants in UAS) and advising-relationship adjustments (comparing advising relationships in the period 2017–2005).

Recall Figure 1, where we analysed the relationship between price-reducing activities through higher investments in UAS and the adjustments of the advising relationship. Figure 5 shows the share of on-top entrants at UAS on the ordinate. On the abscissa we depict the changes in the advising relationship between 2018 and 2005. In this respect, quadrant 1 includes all states that enhanced their advising relationship and experienced an above-average expansion in the UAS sector. The pre-grant UAS share was roughly $535/1986 \approx 27\%$. A state that enrolled a higher share of on-top entrants into UAS contributed to an overall increase in the UAS share (quadrants 1 and 2).

First, we observe that a major aim of the grants programme, the enhancement of the advising relationship, has been achieved. A leftward shift on the abscissae indicates such an enhancement (the lower the relationship, the better). A total of 14 out of 16 states enhanced this measure over the term of the grant programme.

Second, in almost all states, the higher education expansion took place in particular at the UAS. The upward shift on the ordinate depicts this.

We find 13 out of 16 states located in quadrant 1. These have improved their advising relationship and invested above-average in the UAS sector. Only one (eastern) state, Brandenburg (BR), improved its advising relationship by expanding primarily traditional universities.

Summing up, the observed enhancement in the advising relationship occurred mainly by a price-shifting behaviour rather than by switching resources from other areas to higher education.

CONCLUSIONS

Intergovernmental grants in federal systems, and conditional ones, in particular, tend to harm welfare. We showed theoretically as well as empirically the states' responses to conditional federal funds.

We introduced the notion of price-shifting fungibility. It describes a legal complaint strategy to avoid adverse effects on welfare triggered by conditional grants. Grants-receiving states reduce the price or quality of a targeted good to provide other goods and services. Hence, they achieve a common objective with minimal financial effort. In the analysis of the higher education pact, we found strong indications of such price-shifting behaviour. We conclude that the degree of accuracy of conditional grants hinges on the recipients' abilities to vary the subsidized good(s) concerning price level and quality.

We identified some undesirable effects using a financially extensive programme of intergovernmental grants: the German higher education pact. We found unintended effects from the perspective of the grantor. However, from the point of view of welfare economics, we find that price-shifting activities as a response to conditional grants can moderate the welfare loss induced by conditional grants-in-aid.

We claim that conditional grants caused the remarkable UAS expansion. We justify this argument by comparing the student prospect with actual data. However, due to missing data, we cannot exclude that other reasons, such as a general trend in demand toward UAS, may have caused this unexpected shift, too. The data, however, do not indicate such a general trend. In Figure 4 we contrasted the prospect with actual data. The massive increase in UAS started some years after the introduction of the grant programme. In the first years, the actual data on entrants were below the prospect. Though this is not sufficient proof, it indicates that the observed development occurs due to the incentives caused by federal grants.

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DATA AVAILABILITY

The data that support the findings of this study are openly available at https://doi.org/10.5281/zenodo.5783562.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author.

NOTES

[1] Overall, central governmental grants to states and local entities have slowly grown over the penultimate decade within Organisation for Economic Co-operation and Development (OECD) countries (OECD, 2016, p. 23). In 2010, earmarked and non-earmarked grants were nearly in balance. Ten years later, earmarked grants grew by 5.4% at the expense of non-earmarked ones. Moreover, mandatory grants significantly replace discretionary ones. Focusing on mandatory grants, those being matching grew by roughly 10% (p. 25). The OECD's findings confirm previously reported observations (Baker et al., 1999; Huber et al.,

2002; Huber & Runkel, 2006) and are in line with recent ones (López-Santana & Rocco, 2021; Tillin, 2021).

2   The empirical literature on fungibility is more concerned with foreign aid. In an early study, Pack and Pack (1993) provide empirical results for the Dominican Republic and show that fungibility has undermined donor interests. In a more recent study, de Sijpe (2013) noted that when considering the on- and off-budget effects of foreign aid that was earmarked for education and health, there was hardly any empirical evidence for the fungibility hypothesis.

3   Thus, we assume that the consumer model of utility maximization can properly be applied to describing a grant-receiving state's response. Given the model as it stands, it makes no difference whether the federal government or the regional incumbents provides university study places (and the composite good). Oates's (1972) well-known decentralization theorem states that it is always more efficient for regional governments to provide the Pareto-efficient levels of output for the respective jurisdiction than for the central government if the central government has any additional binding constraint. If the additional constraint is not binding, the provision by the central level is as efficient as the outcome of the regional level. Note that we do not deal with variations in the quality of governments but assume welfare-maximizing governments instead.

4   By considering a production function, the price ratio would coincide with the marginal rate of transformation. For the sake of simplicity, we abstain from modelling the provisioning technology. We are grateful to an anonymous referee who pointed out a related flaw in a previous version of the paper.

5   The case of unconditional grants is similar to granting the states a larger share of total tax revenue, thus increasing T. In that case, the fraction β of the grants (additional revenues) is assigned to q.

6   For example, to pocket ψ units of grants, a state has to spend $\psi \cdot p_q$ and receives back $\tau' \cdot p_q$ from the centre. Consequently, the state has to spend $\psi(p_q - \tau')$ less for the composite good.

7   The optimal amount of x is given by $x^* = \alpha(T - \tau' \cdot q_0)$. Thus, even if the centre offers 20 units of conditional grants, the state will not draw down all the offered resources.

8   We emphasized this aspect in the introductory section. The unanimity requirement is enshrined in Germany's constitutional law, as we will highlight in the next institutional-background section.

9   It was dubbed Basic Law, as the states in 1949 feared that a constitution written as the foundation document of a new country could deepen the division of Germany into East and West. The Basic Law was to be provisional. It would only be valid during the division until unity had been restored.

10   For an excellent overview, see Lenk et al. (2019).

11   The states were entitled to a uniform grant for every on-top entrant. The number of entrants in 2005 served as the basis for the 'on-top' requirement.

12   As the treaty assignment required the Eastern states' approval for this, they successfully negotiated an earmarking-free amount from the total funds, which were to be granted even without additional first-year students but rather for maintaining the status quo. Furthermore, the Eastern states successfully claimed additional resources in the event that the number of entrants increased. The three city-states were only prepared to agree on unconditional grants for the Eastern states if they too were to receive unconditional financial aid.

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