Interregional Redistribution and Regional Disparities: How Equalization Does (Not) Work*

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Abstract

Do inter-governmental transfers such as equalization grants reduce interregional disparities? This paper studies both theoretically and empirically the impact of interregional redistribution on interregional inequality. We set up a model with residential choice and equalization grants between regions, and show that interregional transfer payments prevent convergence promoting migration. We test our model in using cross-country data and panel data for 22 highly developed OECD countries. The evidence suggests a positive relationship between interregional transfers and regional disparities both across countries and over time from 1982 to 2000. In the cross-section data, we find that countries with higher levels of interregional redistribution in the past show a subsequent increase in interregional disparity, while countries with lower levels of grants and transfers show less divergence or even convergence. The panel reveals a similar picture: countries who have increased their sub-governmental transfers and grants have experienced more divergence (less convergence) over time than countries who have lowered their transfers.

JEL classification: R58; H71; H73
Keywords: Interregional Transfers, Regional Disparity, Redistribution Evidence

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1 Introduction

The majority of high-income countries are organized as federations, where sub-national jurisdictions are unified to a larger entity with a common market, each jurisdiction endowed with a certain level of autonomy. The main arguments for this organizational form are based on efficiency enhancing economic integration and Oates' *Decentralization Theorem* recommending a decentralized provision of local public goods [Oates (1972)]. In the last decades, this institutional arrangement has become so popular that several countries decided to incorporate in supra-national institutions with the European Union as the most prominent example. At the same time, though, politically autonomous jurisdictions are not necessarily financially autonomous: the linkage between local revenues and expenditures is frequently broken through governmental grants. Often, the aim of these payments is to help poorer regions to catch up with the richer ones.[1] Such redistributive transfer schemes can be found in most federations as e.g. Canada, Italy, Germany, or the EU. While these federations use unconditional grants in explicit equalization programs, other countries redistribute in a more indirect way as e.g. the U.S., where several formula grants consider a state's personal income in determining federal support. The extent of equalization grants is considerable. In Germany, for example, as a country with a cooperative federal style, more than 7 billion Euro were redistributed between German states (*Länderfinanzausgleich*) in 2007 accompanied by 10 billion Euro vertical transfers to the East German states (*Sonderbedarfsbundesergänzungs-zuweisungen*).[2] Altogether, the share of transfers in consolidated total government revenues is 6.3%. The explicit purpose of these transfers is the equalization of living standards across the nation.[3] Redistributive grants exist also in countries with a competitive federal structure such as Switzerland, where horizontal and vertical grants in 2008 are estimated to amount to CHF 1.26 billion and CHF 1.80 billion, respectively, representing 5.3% of consolidated total government revenues.[4] These payments are meant to strengthen the financial power of disadvantaged and poor cantons. A further example is the EU, which also has a strong redistribution policy. During the budgetary period 2007-2013 the investment made by the EU through cohesion instruments will be worth 308 billion Euro, which is roughly 36% of its entire budget (862 billion Euro).[5]

The aim of this paper is to investigate both theoretically and empirically the impact of interregional transfers on regional disparities within federations. We first present a basic model where people

[1] Aside from the equity goal, horizontal or vertical grants may also be used as an instrument to help jurisdictions internalize fiscal (or other) externalities [Wilson (1999), Wilson and Wildasin (2004)].

[2] Source: German Federal Ministry of Transport, Building and Urban Affairs, http://www.bmvbs.de/-,1663/knoten.htm.

[3] See article 72, 106, 107 Basic Constitutional Law of the Federal Republic of Germany.

[4] Source: Swiss Federal Department of Finance, www.nfa.ch. Fischer et al. (2003) give an overview on the reform of the Swiss equalization schemes.

[5] Source: European Commission, Financial Programming and Budget, http://ec.europa.eu/budget/.

migrate between regions in pursuit of higher wages and better public policies. Without federal equalization payments, people will emigrate from poor regions into richer ones, thereby promoting convergence of regions with respect to per capita GDP, wages, consumption, taxes and the level of public goods provided. This is the well-known phenomenon of 'the poor chasing the rich' and in line with the neo-classical growth theory [see Barro and Sala-i-Martin (1992)]. If the federal government redistributes between rich and poor regions via equalization payments, the individual migration decisions are distorted. In particular, because the grants help to increase public good provision and decrease the tax burden in poorer regions, those regions become relatively less unattractive: the convergence process gets paralyzed and existing disparities are cemented. We test our theoretical findings using cross-section as well as panel data for 22 OECD countries covering the period from 1982 to 2000. The evidence suggests a positive relationship between interregional transfers and regional output disparities, both across countries and over time. In the cross-section data, we find that countries with higher levels of interregional redistribution in the past show a subsequent increase in regional disparity, while countries with lower levels of grants and transfers show less divergence or even convergence. The panel reveals a similar picture: countries who have increased their sub-governmental transfers and grants have experienced more divergence (less convergence) over time than countries who have lowered their transfers.

The remainder of the paper is organized as follows. In Section 2 we present a theoretical model illustrating that interregional transfers do not necessarily promote convergence. We provide empirical evidence for these negative redistributional effects in Section 3. In Section 4 we discuss our theoretical and empirical findings in relation with the literature. In a concluding Section 5 we sum up our results and we give an outlook on future work.

2 Migration, Equalization Payments, and Convergence

Although most federations make use of equalization transfer schemes, it is not per se clear in how far such payments are appropriate to diminish regional disparities. We argue that intergovernmental transfers distort individual migration decisions, and can be therefore the reason for persisting regional inequalities. This section develops a basic analytical framework to study the channels through which regional disparities are affected by equalization transfers and population movements, and how these channels interact. The model is primarily meant to illustrate the main argument; rather than aiming for generality, we therefore confine ourselves to a simple general equilibrium economy, augmented by a public sector. The reader can easily convince himself, though, that the line of reasoning would remain qualitatively unchanged in a more intricate framework. Consider a

federation or a country consisting of $j = 1, 2$ regions, inhabited by a continuum of mobile households i who reside on the closed interval $[0, 1]$, where i represents their initial location. The border is located at $i = \bar{n}_1 = 1 - \bar{n}_2$ so that all households $i \in [0, \bar{n}_1]$ initially live in region 1 whereas households $i \in (\bar{n}_1, 1]$ are initial residents in of region 2. When emigrating from its home region, households incurs different migration cost m^i, which we assume to be proportional to their distance from the border, $m^i = \theta(\bar{n}_1 - i)$ for $i \leq \bar{n}_1$ and $m^i = \theta(i - \bar{n}_1)$ otherwise, where $\theta \geq 0$ measures the cost of mobility.[6] By definition, $\bar{n}_j$ is region j's share of the total population. Households supply one unit of labor inelastically wherever they live, and have identical preferences over a composite consumption good c and a local public good g represented by a strictly increasing, twice differentiable, and concave utility function $U(c, g)$. We also assume $U(\cdot)$ to be homothetic.[7]

In each region, competitive firms produce c according to a strictly increasing, concave, and constant returns to scale production function $Y_j = F(n_j, \bar{K}_j)$, where n_j is the equilibrium labor force of (the mass of households living in) region j, and $\bar{K}_j$ is a fixed, immobile factor of production such as infrastructure, natural resources, land, entrepreneurial input, or non-transferable know-how. We assume that K_j is owned (supplied) by absentee households for simplicity,[8] and that the cross-derivative of F are positive, i.e., additional use of one factor of production increases the marginal productivity of other factors. The first-order conditions of profit maximization imply that each factor is paid its marginal product and that profits are zero (subscripts denote derivatives)

$$\begin{aligned} w_j = F_n(\bar{K}_j, n_j) = f_n(k_j) \qquad \text{and} \quad r_j = F_K(\bar{K}_j, n_j) = f_k(k_j) \\ Y_j = F(\bar{K}_j, n_j) = r_j \bar{K}_j + w_j n_j \quad \Leftrightarrow \quad y_j = f(k_j) = w_j + r_j k_j \end{aligned} \tag{1}$$

where $k_j = \bar{K}_j / n_j$ and $y_j = Y_j / n_j = f(k_j)$. Note that the technology $F(\cdot)$ is identical across regions, i.e., any (initial) productivity differences can solely be attributed to differences in the regions' (initial) factor endowments.

Regions decide on their local public good provision g_j, which they finance by a proportional tax t_j on the income of their residents. To abstract from congestion effects, let the cost of providing a unit of the public good to one more resident be constant and without loss of generality equal to one (g_j is a publicly provided private good such as education or health care). Although local policies (t_j, g_j) are chosen independently in each region, regions may be linked financially through horizontal transfers $T_j \in \mathbb{R}$ to be received or paid by region j. The size of these interregional

[6] Equivalently, these migration costs can be interpreted as representing an 'attachment to home' (individuals have locational preferences for their home region due to cultural differences) by assuming that individual utility is given by consumption c^i, plus a non-pecuniary element m^i [see, e.g., Mansoorian and Myers (1993)].

[7] The homotheticity assumption is much stronger than is necessary but shortens the analysis and exposition considerably.

[8] Alternatively, the fixed factor could be publicly owned as in Boadway and Flatters (1982). However, the migration equilibrium in this case is generally inefficient, which complicate matters without changing the main result.

grants is determined by the federal government *prior* to local policies decisions in a manner that is made precise below. For the moment, we take T_j as an exogenously given lump sum transfer to (or from) region j and only require $\sum_j T_j = 0$ so that the federal budget is always balanced. The local budget constraint in per capita terms, which defines the set of feasible policies in region j, reads

$$g_j = t_j w_j + T_j/n_j, \qquad j = 1, 2. \tag{2}$$

Using (2), the indirect utility of a household residing in region j can be written as

$$U(c_j, g_j) = u(w_j - g_j + T_j/n_j, g_j). \tag{3}$$

Given the fiscal constitution, the sequence of events is as follows. In stage 1, households decide where to live so as to maximize their utility, taking regional factor incomes as given and anticipating the public policy in each region. In stage 2, regional governments choose g_j, households collect their after tax income, and consume.[9]

Solving the model backwards, the stage 2 decision on local public good provision in region j maximizes the indirect utility of a representative household (3) residing in that region. The corresponding first-order conditions equate the marginal rate of substitution between the private and the public good to the marginal rate of transformation,

$$\frac{u_g(c_j, g_j)}{u_c(c_j, g_j)} = 1 \qquad \text{or} \qquad \frac{u_g\left(\frac{c_j}{g_j}, 1\right)}{u_c\left(\frac{c_j}{g_j}, 1\right)} = 1, \qquad j = 1, 2 \tag{4}$$

where the second equality follows from our assumption that preferences are homothetic. Together with $c_j = w_j - g_j + T_j/n_j$, condition (4) defines the level of local public goods supplied in region j as a function of average income w_j, inter-regional transfers T_j, and population size n_j. Turning to stage 1 migration decisions, note first that they depend on individual mobility cost, as well as on the inter-regional differences in wages and public policies. Because the costs of moving are monotonic, a migration equilibrium can be characterized by a marginal household i^* who is indifferent between residing in either region, with all households $i \leq i^*$ (respectively, $i > i^*$) living in region 1 (respectively, region 2). Regional populations are

$$n_1 = \int_0^{i^*} di = i^* \quad \text{and} \quad n_2 = \int_{i^*}^1 di = 1 - i^*,$$

and the migration equilibrium condition can be written as

$$u(c_1, g_1) = u(c_2, g_2) - \theta(\bar{n}_1 - n_1) \tag{5}$$

[9] Assuming that policies are determined *after* residential choices have been made allows us to disregard tax competition effects (migration-induced fiscal externalities) between regions. The sequential model here is equivalent to the assumption that public policy is chosen simultaneously to households' migration, factor supply, and consumption decisions, but regional governments do not foresee migration responses to their political choices.

which, using (3) and $n_1 + n_2 = 1$, determines regions j's labor force (population size) as a function of w_j, $\bar{n}_j$ and g_j.

Equilibria without Equalization

As a benchmark, let us first study the case where households are immobile ($\theta \to \infty$) and the federal government imposes no equalization transfers ($T_1 = T_2 = 0$). Assume without loss of generality that $\bar{k}_1 = \bar{K}_1/\bar{n}_1 > \bar{K}_2/\bar{n}_2 = \bar{k}_2$, i.e., region 1 enjoys a higher per-capita endowment of the fixed factor. Using $y_j = f(k_j)$ and (1), this endowment difference will translates into higher regional per-capita GDP and higher wages in region 1, $y_1 > y_2$ and $w_1 > w_2$. At the same time, region 1 will be providing more public services at lower taxes. Substituting for $c_j = w_j - g_j$ in (4) and taking derivatives, we find

$$\frac{\partial g_j}{\partial w_j} = \frac{u_{cc} - u_{cg}}{u_{cc} - 2u_{cg} + u_{gg}} \in (0,1) \quad \text{and} \quad \frac{\partial t_j}{\partial w_j} < 0, \tag{6}$$

where the second inequality follows from $g_j = t_j w_j$ [see (2)] and the fact that $\partial g_j/\partial w_j < 1$. Regions where the wage rate is high supply more of the local public good at a lower tax rate than regions where the wage rate is low. As a result, net income (consumption) is higher in the former as well.

Observation 1. *Consider a federation with immobile households ($\theta \to \infty$) and no fiscal equalization ($T_1 = T_2 = 0$), and assume w.l.o.g. $\bar{k}_1 = \bar{K}_1/\bar{n}_1 > \bar{K}_2/\bar{n}_2 = \bar{k}_2$. An equilibrium in this economy is then characterized by*

$$\bar{y}_1 > \bar{y}_2,\ \bar{w}_1 > \bar{w}_2, \bar{c}_1 > \bar{c}_2, \quad \textit{and} \quad \bar{g}_1 > \bar{g}_2,\ \bar{t}_1 < \bar{t}_2. \tag{7}$$

We can thus conclude that in the absence of migration and inter-regional redistribution, regions with a higher initial per-capital endowment of the fixed factor (higher labor productivity) will display higher per-capita GDP and wages, provide more public services and impose lower taxes in equilibrium than regions with lower initial per-capita endowments of the fixed factor (lower labor productivity).

How does labor mobility affect this equilibrium? If we continue to assume that no equalization payments are made, the higher wages in region 1, coupled with lower taxes and higher public good supply, will induce low-migration cost households to emigrate from region 2 into region 1, increasing the size of the labor force in the latter region. The immigration will continue to the point where (5) is satisfied with equality. Analogous to our previous arguments, the influx of labor will depress wages, reduce public good provision and raise taxes in region 1, while the opposite happens in region 2. The result is regional convergence: disparities in wages, net incomes, per-capita GDP, and public policies are diminished. Moreover, the effect is stronger the lower the migration cost.

Observation 2. *Consider an equilibrium in a federation with mobile households ($\theta < \infty$) and no fiscal equalization ($T_1 = T_2 = 0$) satisfying (7). As individual mobility cost decline to $\theta' < \theta$, the new equilibrium is characterized by*

$$y_1' < y_1,\ w_1' < w_1,\ c_1' < c_1 \quad \textit{and} \quad g_1' < g_1, t_1' > t_1$$

and

$$y_2' > y_2,\ w_2' > w_2,\ c_2' > c_2 \quad \textit{and} \quad g_2' > g_2, t_2' > t_2.$$

As households become perfectly mobile, $\theta \to 0$, all regional disparities vanish and we have $y_1 = y_2$, $c_1 = c_2$, $w_1 = w_2$ and $g_1 = g_2$.

As the argument behind this result is straightforward but tedious, we omit a full-fledged formal proof here and only sketch the line of reasoning.[10] To show for instance that public and private consumption must fall in region 1, suppose to the contrary that $c_1' > c_1$. But then $g_1' > g_1$ by (4), which in turn implies $n_1' > n_1$ from (5). Hence, $w_1' < w_1$ contradicting our assumption that $c_1' = w_1' - g_1' > w_1 - g_1 = c_1$. Thus, we must have $c_1' < c_1$.

Equilibria with Equalization

Let us now turn to the case where $T_1 = -T_2 \neq 0$. In many federations, such transfers play the role of explicit 'equalization payments' from the federal government to state or provincial governments with the objective of offsetting differences in available revenue or in the cost of providing services.[11] As mentioned above, we will assume the T_j's are set by a federal government prior to regional policies. In other words, local governments treat T_j as exogenously given, while the federal government correctly anticipates how local policies (t_j, g_j) vary with T_j.[12] A system of full fiscal equalization providing the average level of public goods in each region. In a system of partial equalization, only a fraction β of revenues are equalized. Define $R \equiv t_1 n_1 w_1 + t_2 n_2 w_2$ as the average tax revenue in the federation. A transfer scheme

$$T_j/n_j = \beta(R - t_j w_j) \quad \Rightarrow \quad g_j = \beta R + (1-\beta) t_j w_j, \qquad j = 1, 2. \tag{8}$$

pays each region a fraction of the difference between average public revenues and regional public revenues in per-capita terms, and will result in full (partial) equalization if $\beta = 1$ ($\beta < 1$). Note from (4) that full equalization in terms of public expenditures, $g_1 = g_2$, also implies full equalization in terms of private consumption. Intuitively, since the (politically decisive) households in each region

[10] See Appendix A for formal proofs of Observation 2 and 3.

[11] Examples of federal systems with explicit equalization payments include Australia, Belgium, Canada, Germany, and Switzerland.

[12] If regions foresee the effect of regional policies on grants, regional governments in the recipient (respectively, donor) region would have an incentive to strategically manipulate (t_j, g_j) in order to increase (respectively, decrease) the net transfer [see, e.g., Smart (2007).]

share the same marginal rate of substitution between private and public goods, they would want to consume the same amount of private goods whenever they also consume the same amount of local public goods under the equalization system. As a result, the local political process in stage 2 yields to adjusted regional tax rates ensuring $c_1 = (1 - t_1)w_1 = (1 - t_2)w_2 = c_2$. Importantly, however, transfer payments cannot do more than that. In particular, they cannot serve to equate regional differences in GDP or wages: those variables are still determined by the market, and since the regional factor endowments remain unchanged, so do regional output and factor prices. In summary,

Observation 3. *Consider an equilibrium in a federation with immobile households ($\theta \to \infty$) that satisfies* (7)*. If the federation puts a system of transfers* (8) *in place, the new equilibrium for $\beta = 1$ (full equalization) will be characterized by*

$$y_j = \bar{y}_j,\ w_j = \bar{w}_j, \bar{c}_1 > c_1 = c_2 > \bar{c}_2, \quad \textit{and} \quad \bar{g}_1 > g_1 = g_2 > \bar{g}_2,\ t_1 > \bar{t}_1, t_2 < \bar{t}_2.$$

For $\beta < 1$ (partial equalization), we have y_j and w_j unchanged, and partial convergence in public and private consumption, $g_1 - g_2 < \bar{g}_1 - \bar{g}_2$ and $c_1 - c_2 < \bar{c}_1 - \bar{c}_2$.

A comparison of Observation 2 and 3 reveals that the channels of domestic migration and fiscal equalization are substitutes in driving inter-regional convergence, albeit imperfect ones. While inter-regional migration leads to convergence of both regional consumption *and* factor prices/regional output, inter-regional transfers only affect the former and are not suitable to reduce regional disparities in factor prices and output.

It remains to study how the two channels interact, i.e, how equalization and migration work together. At first glance, one may be tempted to conclude that the qualitative implications of either effect remain intact, implying for instance that perfect mobility still serves to effectively eliminate any existing disparities. This is no longer the case, however, as can be seen from (5). If fiscal equalization equates public and private consumption, we have $c_1 = c_2$ and $w_1 = w_2$, implying nobody would want to move. We can conclude:

Observation 4. *Consider an equilibrium in a federation with mobile households ($\theta < \infty$) and a system of transfers* (8) *in place, there is a new equilibrium for $\beta = 1$ (full equalization) characterized by*

$$y_j = \bar{y}_j,\ w_j = \bar{w}_j, \bar{c}_1 > c_1 = c_2 > \bar{c}_2, \quad \textit{and} \quad \bar{g}_1 > g_1 = g_2 > \bar{g}_2,\ t_1 > \bar{t}_1, t_2 < \bar{t}_2.$$

Thus, while equalization payments equate public and private consumption, they at the same time eliminate all incentives to migrate, thereby cementing the regional differences in factor prices and

GDP.[13] To summarize, the main implication of analysis above is that equalization payments may not be suitable instruments to help poor regions to catch up with the richer ones. Of course, our simple model did not include indirect channels such as local investments in public infrastructure or other local government expenditures that can be boosted with inter-governmental grants and could help to diminish regional inequalities. But anecdotal evidence suggests that this effect of transfers may be limited as well.[14] A case in point is the Italian Mezzogiorno and parts of East Germany, where even the trillions of Euro spend over decades for the structural change in those backward regions where not able to promote regional growth and convergence. In either case, the question whether or not the effect of transfers is the desired one is largely an empirical matter. The following section therefore provides a direct test of the impact of interregional transfers on regional disparity.

3 Empirical analysis

Our theoretical model suggests that interregional transfers are no feasible instrument to promote regional convergence. Referring to our *Observations 3* and *Observation 4*, we can state the main hypotheses for our empirical analysis: Interregional transfers have a negative impact on regional disparity. We test these hypotheses using cross-section as well as panel data for 22 OECD countries covering the period 1982-2000. As the measurement of regional disparities and interregional transfers is a challenging topic, we discuss our data in the following section in details before we subsequently present our estimation results.

3.1 Data description

Measures of regional disparity

To test our hypotheses derived from the theoretical model, we need adequate measures for regional disparities and interregional transfers. Let us first refer to the first issue, the measurement of regional disparities. Three different decisions arise when measuring regional inequality: the choice of an appropriate economic indicator as the basis for the calculation, the territorial level to be applied, and an applicable concentration measure [see e.g., Spieza (2003) and Lessmann (2006), for details].

[13] Note that we do not claim that all equilibria under full equalization have the same properties as the equilibrium in Observation 4. Indeed, there is always a 'trivial' equilibrium in which migration yields to full convergence and thus reduces equilibrium transfers to zero. However, it should be obvious that any equilibrium in which positive equalization payments are paid and received must necessarily be characterized by less than full convergence.

[14] See Section 4 for further discussion of this point.

Economic indicator: Existing cross-country studies on the determinants of regional disparity use regional per capita income, regional GDP per employee, or regional GDP per capita as a starting point for calculating disparity measures [see e.g., Shankar and Shar (2003), Gil Canaleta et al. (2004), and Ezcurra and Pascual (2008)]. Despite the pros and cons of the different approaches, it is straightforward to use the regional GDP per capita in our investigtaion, since our theoretical model explains disparities between regional outputs. Nevertheless, it should be mentioned that a disparity measure based on the GDP per capita (GDP p.c.) may be distorted by commuting between jurisdictions, so that the choice of an appropriate territorial level becomes important.

Territorial level: A further problem arises from the different sizes of the regions considered. In countries with large economic differences and an unequally distributed population, a disparity measure might be biased up- or downward. Therefore, it is necessary to use a territorial classification that creates relatively homogeneous regions. We address this problem by using the Eurostat Nomenclature of Territorial Units for Statistics (NUTS) classification level 2 within Europe and state level data for countries outside Europe. Moreover, our empirical model considers different control variables for agglomeration effects.

Concentration measures: The last question is which statistical concentration measures are applicable. Different measures of inequality do not always provide the same country disparity ranking. Especially in cross-country analyses, the concentration measure should be independent of the number of regions considered, should not be sensitive to shifts in average GDP levels, and should satisfy the Pigou-Dalton transfer principle. This principle says that an arithmetical transfer from rich to poor regions reduces inequality [see Dalton (1920) and Pigou (1912)]. The coefficient of variation (cov) and the adjusted Gini coefficient ($adgini$) satisfy these requirements:

$$cov := \frac{1}{\bar{y}} \left[1/n \sum_{i=1}^{n} (\bar{y} - y_i)^2 \right]^{1/2}, \tag{9}$$

$$adgini := \frac{2 \sum_{i=1}^{n} i y_i}{n \sum_{i=1} y_i} - \frac{n}{n-1}. \tag{10}$$

Here $\bar{y}$ is the country's average GDP p.c., y_i is the GDP p.c. of region i, p_i is the share of the country's total population in region i, and n is the number of sub-national units. We calculate both disparity measures for 22 OECD countries using data from national statistical offices and Cambridge Econometrics. Table 1 shows the results for two different 5-year averaged periods.

The coefficient of variation indicates a disparity far below average for the Scandinavian countries and Switzerland. In contrast, Slovakia, Mexico, and Belgium have a very high level of regional

Table 1: Regional disparity in OECD countries

	Disparity measures			
	Coefficient of variation		Adjusted Gini coefficient	
Countries	1982-1986	1996-2000	1982-1986	1996-2000
Austria	22.5	20.1	14.6	12.6
Belgium	39.8	37.3	18.8	18.9
Canada	25.6	22.0	15.6	13.8
Czech Republic		38.2		16.4
Denmark	10.9	10.9	8.8	8.5
Finland	13.5	18.4	7.3	11.1
France	16.9	18.8	7.6	7.5
Germany	17.9	19.3	9.5	10.2
Hungary		28.9		18.3
Ireland	11.5	19.3	11.0	19.0
Italy	24.3	25.1	14.9	15.4
Japan		19.4		9.1
Mexico		45.5		26.1
Netherlands[a]	25.4	16.5	13.6	10.0
Norway	15.4	25.8	10.2	14.4
Portugal	26.2	19.6	14.2	12.0
Poland		18.9		10.5
Slovakia		53.2		27.2
Spain	21.1	19.9	12.6	12.1
Sweden	7.5	13.5	4.2	6.5
Switzerland	10.7	13.9	6.9	7.8
UK	25.4	29.0	10.4	12.9
USA	38.6	32.0	14.7	12.5
Average	20.8	21.3	11.5	12.1

Note: a) The disparity measures for the Netherlands refer to 1986 because of an reorganization in the NUTS classification. Source: Own calculations from data of national statistical offices.

inequality. These results also hold for the adjusted Gini coefficient.[15] Focusing on development over the two periods, the overall average degree of regional disparity was quite stable. However, disparities within countries developed differently – in some countries, regions converged, while they diverged in others.[16]

Measures of interregional transfers

In addition to measures for regional disparity, we also need adequate measures for interregional transfers within countries. For this purpose we revert to data of the IMF *Government Finance Statistics* and the OECD *Revenue Statistics*. Our main explanatory variable of interest is $trans1$, which are grants received by sub-national governments from other levels of government (without grants from abroad or supra-national institutions) as share of total government revenues. As this measure covers all grants from other levels of government, it reflects the extent of vertical as well as horizontal equalization. To check for the robustness of our results, we also consider an alternative measure, $trans2$, which denotes sub-national non-autonomous revenues as share

[15]The correlation coefficient between COV and ADGINI is 0.87.

[16]Our disparity measures reflect the distribution of per capita GDP within countries. This is in accordance with the concept of *sigma*-convergence first mentioned by Easterlin (1960). See e.g. Barro and Sala-i-Martin (1991), Barro and Sala-i-Martin (1992), Barro and Sala-i-Martin (1995), or Quah (1993) for details. *Sigma*-convergence means that the dispersion of income (or in our case GDP per capita) between regions declines. This is not necessarily a consequence of *beta*-convergence meaning that poor regions catch up with richer ones.

of total government revenues (adjusted for sub-national transfers to other government levels). The calculation of this measure is more sophisticated as we need to know which sub-national revenues are determined autonomously. The OECD has developed an internationally comparable framework to assess the degree of control sub-central governments have over their revenues [see OECD (1999)]. This study classifies all tax revenues in respect to the control different government levels have over their revenue sources. Using this framework, we calculate the share of non-autonomous revenues of sub-national governments in total government revenues. In contrast to $trans1$ the $trans2$ measure covers sub-national revenues from centrally-determined composite (or shared) taxes as well as horizontal and vertical transfers.[17] This more comprehensive measure of transfers accommodates the fact that in some countries the apportionment of revenues from shared taxes on sub-national jurisdictions incorporates redistributive elements. In Germany, for example, the states (*Bundesländer*) receive 45% of the revenues from the national value-added tax. Up to 25% of this amount is given to those states whose per capita revenues from the income tax, the corporate tax and local state taxes is below the average of all states. Since our measure $trans2$ considers all non-autonomous revenues of sub-national governments it accounts for such horizontal tax redistributions.

Other determinants of regional disparities

In order to minimize possible omitted variable bias on the coefficient of our transfer measure, we include in our regressions a number of controls that have been shown in the literature to impact regional disparity. One control is national wealth as reflected by GDP per capita (*gdppc*). A wealthier country has a larger scope for redistributive politics through transmission channels besides inter-regional grants and transfers. Moreover, we control for the unemployment level (*unempl*), since unemployment is often locally concentrated and might thus affect our disparity measure.

Following the suggestions of Kuznets (1955), we consider the population size (*pop*), the population distribution within a federation (*popgini*), and the degree of urbanisation (*urban*) as controls for agglomeration. We control for country size effects using the logarithm of the total population. The Gini coefficient of the population concentration reflects the extent of agglomeration within a country. The degree of urbanisation is also a control for agglomeration effects, although it reflects a different kind of agglomeration compared to the *popgini* variable. While the degree of urbanisation can be high within a country, meaning that the majority of people live in urban areas, that does not necessarily imply that urbanisation varies across sub-national jurisdictions. In the latter case, we would not expect a large effect on our disparity measure.

[17] See Appendix C for details of these calculations.

We control for the size of the welfare state (*social*) using government expenditures on public welfare as a share of GDP. If, for example, regions were heterogeneous with respect to productivity, unemployment etc., then we would expect that people in richer regions would be net contributors to social security funds, while people in poorer regions would receive net transfers. Thus, one can expect that countries with big welfare states have strong indirect inter-jurisdictional redistribution systems.

Another determinant of regional disparity is the degree of fiscal decentralization. On the one hand it is argued that decentralization might soften central governments power to redistribute between regions [Prud'homme (1995)], while on the other hand decentralization gives poor regions the scope they need to compete with richer ones [McKinnon (1995), Qian and Weingast (1997)]. We use the degree of expenditure decentralization (*dec*) as control, which can be calculated from the IMF *Government Finance Statistics*. See Table C1 in the appendix for data sources and definitions and Table C2 for summary statistics of the relevant variables.

3.2 Cross-section results

A major challenge for our empirical analysis is the availability of regional data, which is necessary for the computation of disparity measures. We need information for a long time period because we are interested in the dynamics of convergence or divergence within federations, not just disparity levels.[18] This restricts our cross-section analysis to a sample of 22 countries.[19] In the panel analysis data problems are less eminent, because we can revert to annual data for 17 countries.

Our basic regression for the test of our hypothesis of a negative impact of transfers on regional disparity has the following form:

$$disparity_i = \alpha + \sum_{j=1}^{k} \beta_j \cdot control_{j,i} + \gamma \cdot transfers_i + \varepsilon_i. \tag{11}$$

Here $disparity_i$ represents the level of our disparity measures (*cov* and *adgini*) in country i, $control_i$ are k exogenous control variables affecting regional disparity, $transfers_i$ represents our measures of interregional transfers, and ε_i is a random error term.

Since our sample size of 22 observations does not allow us to consider our entire set of control variables, we decided to control for national wealth (*gdppc*), and unemployment (*unempl*). We

[18] Our observation period ends in the year 2000 since there was a change in the classifications of the IMF government finance statistics (GFS) in 2001. Government finance data based on the new classifications are available since 1995. Since we are interested in long time-series data, we revert to data based on the standards for the compilation of statistics required for fiscal analysis that were established by the 1986 GFS Manual.

[19] The considered countries are: Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany (West), Hungary, Ireland, Italy, Japan, Mexico, the Netherlands, Norway, Poland, Portugal, Spain, Slovakia, Sweden, Switzerland, the United Kingdom, and the USA.

are primarily interested in γ, the coefficient of our transfer measure ($trans1$). To reduce potential problems caused by reverse causality [Wooldridge (2002)], the timing of independent variables is chosen so that they are long averages for a period (1982-1996) prior to the period of the disparity measures (1996-2000), giving us a lag structure.[20] Moreover, we consider a modification of equation 11, where our dependent variable is the difference of the disparity level between 1996-2000 and 1982-1986. This allows us to estimate the dynamic relationship between transfers and regional inequality. In those regressions, we also control for the initial disparity level at the beginnig of our observation period. White's test for heteroskedasticity in the residuals rejects the null hypothesis of no heteroskedasticity, so all the standard errors of the coefficients are calculated using White (1980) correction. Table 2 presents the cross-section results for different specifications of equation 11.

Table 2: Cross-section estimations

	Dependent variable:			
	cov	Δ cov	adgini	Δ adgini
	(1)	(2)	(3)	(4)
initial disparity[a]	-	-.208***	-	-.182*
		(-2.66)		(-1.85)
gdppc	-.001	-.012***	-.001**	-.007***
	(-1.42)	(-2.99)	(-.2.29)	(-3.81)
unempl	-.408	-.625	-.156	-.164
	(.56)	(-1.55)	(-.26)	(-1.22)
transfers	-.149	.460*	0.137	.278***
	(-.40)	(2.04)	(0.77)	(2.64)
constant	.437***	1.249***	.250***	.120***
	(3.58)	(2.81)	(4.16)	(3.09)
Obs.	22	22	22	22
Adj.-R^2	.25	.26	.38	.47
F-Test (p-value)	.219	.002	.135	.004

Note: t-values in parenthesis; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.
a) initial disparity reflects cov_{1982} and $adgini_{1982}$, respectively.

The results reportet in colum (1) and (3) show that there is no significant impact of transfers on the level of regional disparity. In fact we are not able to explain much of our empirical model in those regressions since the F-test on joint significance fails. This may be due to unobserved heterogeneity we can not consider in the cross-section estimations as we have a very limited number ob observations. Column (2) and (4) report the estimation results we obtain, if we consider the change of our disparity measures within the observation period. In both specifications our measure of transfers enters the regressions with a positive sign and is significant at conventional confidence levels (10% and 1% respectively). This indicates that countries with a high level of equalization payments have diverged, while countries with a lower transfer level experienced convergence. In both specifications, the initial level of regional disparities has a negative impact on the change

[20] Averages of our transfer measure for the whole observation period lead to similar results. The results are available on request.

in disparities implying that countries with a high level of disparity have converged. The GDP p.c. as measure for national wealth shows that richer countries experienced convergence, while the unemployment ratio has a negative but insignificant impact. The estimations explain up to 50% of the variation in the change in our disparity measures.

All in all, our cross-section results support our theoretical model, but we are aware of the problems coming from the small sample size and the potential endogeneity bias. Therefore, we repeat our estimations with a larger panel data set.

3.3 Panel evidence

Using panel data has several advantages compared to pure cross-section data as used in the former section. A major advantage is that we can capture all unobserved time-invariant country-specific factors, such as geographic area or traditions, by including country fixed effects [Baltagi (1995), Wooldridge (2002)]. In addition, considering country dummies allows us to focus on within-country variations as opposed to between-country differences in the cross-section analysis. Another benefit from panel data is the larger number of observations that allows us to consider all of the important control variables. With panel data, we are able to apply more sophisticated estimation procedures to determine the direction of causality between the dependent and independent variables, and thus we eliminate a possible endogeneity bias.

We estimate several panel data models for 17 OECD countries. To get rid of business cycle effects, we build three-year period averages of all variables from 1982 to 1999. Due to the unavailability of fiscal and especially regional data for certain periods and countries, the panel dataset is unbalanced. Moreover, we must drop the Eastern European countries, Japan, and Mexico from the data set due to missing long time series data. Our baseline estimation equation looks similar to those of the cross-country analysis and has the following form:

$$disparity_{i,t} = \alpha_i + \sum_{j=1}^{k} \beta_j \cdot control_{j,i,t} + \gamma \cdot transfers_{i,t} + \delta_t + \varepsilon_{i,t}, \tag{12}$$

where α_i captures the country specific fixed effects and δ_t represents period fixed effects. In our panel regressions we control for the per capita GDP (*gdppc*), the unemployment level (*unempl*), the population distribution (*popgini*), the degree of urbanization (*urban*), the size of the welfare state (*social*), and the degree of fiscal decentralization (*dec*).

Several unit root tests as the Levin, Lin and Chu test, the Im, Pesaran and Shin W-statistics, the augmented Dickey-Fuller test statistic, and the Phillips-Perron Fisher unit root test negate the hypothesis of the existence of non-stationary time-series, individual or common unit roots.

Furthermore, the Hausman (1978) specification test rejects models using random effects; hence, we choose the country fixed effects model as econometric specification. Table 3 reports the estimation results for the coefficient of variation (*cov*) as dependent variable.

Table 3: Panel estimations

	Dependent variable: cov			
	OLS	OLS	TSLS	TSLS
	(1)	(2)	(3)	(4)
gdppc	.011***	.009***	.013***	.012***
	(3.86)	(2.78)	(6.11)	(6.25)
unempl	.466***	.423***	.406***	.315**
	(3.81)	(3.54)	(4.19)	(2.48)
pop	-.436***	-.457***	-.388***	-.518***
	(-6.41)	(-6.82)	(-3.37)	(-7.00
popgini	1.607***	1.507***	1.728	2.530***
	(2.67)	(2.99)	(1.19)	(3.25)
urban	-.300*	-.299*	-.307	-.129*
	(-1.80)	(-1.92)	(-1.55)	(-1.82)
social	-.001	-.001	-.001	-.002
	(-.92)	(-1.23)	(-0.78)	(-1.64)
dec	-.354***	-.347***	-.181*	-.179*
	(-2.70)	(-2.63)	(1.71)	(-1.94)
trans1	.232**		.129	
	(2.37)		(.36)	
trans2		.235***		.186**
		(3.47)		(2.55)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
Obs	17 (92)	17 (91)	17 (77)	17 (74)
Adj.-R^2	.45	.48	.53	.61
F-Test (p-value)	.000	.000	.000	.000
Sargan-Hansen statistic (p-value)	–	–	.000	.000

Note: *t*-values in parenthesis; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

We do not report coefficients of the country and time dummies due to space limitations. The first two specifications are two-way fixed effects OLS estimations with our alternative transfer measures *trans*1 and *trans*2. In specification (3) and (4) we present results from the TSLS estimation procedure using a one period (3-year) lagged value of the transfer measure as instrument. An endogeneity bias may occure since interregional trsnafers might react to shifts in regional disparity. The Sargan-Hansen statistic implies that our instruments are valid. Note that in contrast to some of the cross-section estimations we now use levels of the disparity measure in combination with country fixed effects focusing on the within country variation. In the OLS estimations of column (1) and (2) both transfer measures have a positive and significant impact on regional disparities indicating that a high level of interregional redistribution is associated with high regional disparities. Turning to the two-stage results of column (3) and (4), we find no significant effect of transfer measure *trans*1, but a significant positive effect of *trans*2. Table C3 in the appendix presents similar results using *adgini* as dependent variable. We therefore conlude, that our results are robust.

We now turn to the interpretation of our control variables, providing deeper insights about the

determinants of regional disparity. Our variable for national wealth, *gdppc*, has a positive and highly significant impact on regional disparities. Moreover, countries with a high unemployment ratio (*unempl*) also have high inequalities. Larger countries in terms of population size (*pop*) exhibit smaller disparities, whereas an unequal population distribution (*popgini*) is associated with a high level of regional disparities. In contrast, the degree of urbanization (*urban*) has a negative and weakly significant impact on our disparity measure. The size of the welfare state (*social*) shows no significant effects, while fiscal decentralization (*dec*) has a significant negative impact on regional disparity supporting the results of earlier studies [see e.g. Rodríguez-Pose and Gill (2004), Gil Canaleta et al. (2004) or Lessmann (2009)]. All in all, our estimation results support our hypothesis derived from the theoretical model: Interregional transfers hamper the natural convergence process and have, thus, a negative impact on regional disparity.

At this point some additional remarks are necessary. The transmission channel in our theoretical model is the following: transfers affect migration and migration affects regional convergence. The empirical test we provide is not able to prove that migration is the channel through which transfers affect regional inequality. We are only able to provide evidence for the quintessence of our model. A direct test of our model would require to solve a simulatneous equation model, which estimates the impact of migration on disparity, while migration is determined by the level of transfers. In the attempt to do this, we have collected internal migration data from the European System of Social Indicators and matched them with our data set [see ZSi (2009)]. The problem which occurs is the poor range of data. For several countries, internal migration rates are available for the first time in the 1990s, and in two cases, Canada and Great Britain, we have no data at all. Thus, we end up with a highly unbalanced panel of 15 countries and a total number of 57 observations, which is not enough to do reliable panel data econometrics. The only credible information we can provide is the following: internal migration is negatively correlated with both measures of regional disparity (*cov*, *adgini*). Also the correlation of first differences is negative as well as the coefficient of internal migration, if we enter it in a first-differenced two-way fixed effects panel regression on our disparity measures (without other controls). This is in line with the predictions of our theoretical model. However, we cannot find any significant relationship between our measures of transfers, $trans1$ as well as $trans2$, and internal migration. One reason for this is certainly the shortness of our data set. Another reason may be the fact that migration decisions are driven by so many individual factors that a cross-country study is not able to explain them. In this case it is necessary to analyze micro-data, which we can not match on the other hand with our macro-data for regional inequality.

4 Discussion

The growth literature has long recognized that the speed of convergence can be quickened by migration. In a standard neo-classical growth framework, regions with higher capital–labor ratios are predicted to grow faster in per capita terms than regions with lower capital–labor ratios. This process should be accelerated by migration as people move from areas of low productivity to areas of high-productivity in order to enjoy higher wage rates [Barro and Sala-i-Martin (1992).] Thus, we would expect a positive relationship between net migration and the speed of convergence. Our theoretical model shows that if moving was costless, migration alone is sufficient to equalize per capita incomes instantaneously according to the neo-classical theory under some straightforward conditions (see *Observation 2*). In practice, of course, moving entails costs. In such a situation, migration does not generally result in full convergence.

Although wages, unemployment rates, and migration cost are undoubtedly important, there are other factors that influence an individual's decision to move. In particular, a natural determinant of migration are regional variations in the public policy sphere that manifest themselves as differences in fiscal capacity, pubic expenditures, unemployment subsidies and tax rates.[21] If migration is in part a response to those differences, its positive effect on allocative efficiency can no longer be taken for granted because movement of labor may be triggered by differences in fiscal policies which do not necessarily reflect underlying differences in the marginal product of labor. This perspective is often taken in the public finance literature.[22] In such a situation interregional transfers can serve as an instrument to control migration, as noted by Boadway and Flatters (1982), Wildasin (1994) and Fernandez and Rogerson (1996). The basic idea here is that the federal government can use these transfer payments in a way similar to Pigouvian taxes and subsidies, i.e., in order to induce regions to internalize migration-induced (fiscal) externalities. This view is limited, however, in the sense that the notion of transfers as an instrument for horizontal equity is entirely absent. To understand whether or not they might be appropriate for that purpose, one also has to bring the relationship between migration and convergence into the picture. This is what we do in our model. We find that equalization payments inhibit migration and thus inhibit regional convergence (see *Observation 4*).

[21] While there is strong empirical evidence that internal migration depends on relative incomes and unemployment rates [Barro and Sala-i-Martin (1991), Barro and Sala-i-Martin (1992)], the evidence on the relative importance of other factors such as tax rates and income support programs is more scattered. Using Canadian data, Day (1992) and Shaw (1986) find evidence that internal migration in Canada is influenced by provincial differences in income tax rates, transfer payments to persons, unemployment insurance programs, and natural resource revenues.

[22] One prominent example is the literature on tax competition, which shows that the competition for a mobile common tax base leads countries to implement tax rates below the cooperatively chosen level [see Wilson (1999) for a survey]. An alternative interpretation of this inefficiency is that countries do not internalize a migration-induced fiscal externality they exert on their neighbors by changing domestic taxes.

The paradoxical situation that interregional transfer payments sustain interregional inequalities is also discussed by other authors and it is dating back to the well-known transfer paradox by Leontief (1936). Leontief showed that untied transfers can be donor-enriching and recipient-immiserizing through improved terms of trade of donor regions [see Yano and Nugent (1999) for a modern application]. While this class of models is more applicable in an international economics context, Desmet and Ortuño Ortin (2007) and Desmet (2002) have developed a theoretical framework which is more appropriate for federal countries.[23] The authors propose a two-region model of uneven development, where technological change benefits either the lagging or the leading region. It turns out that interregional transfers raise wages in the backward region, thus reducing its chance to adopt the new technology and take off. Moreover, Desmet and Ortuño Ortin (2007) show that transfers which condemn the backward region to underdevelopment my Pareto dominate (lower) transfers that give the backward region a chance to catch up. This argument rationalizes persistent transfers which do not contribute to convergence, as we have shown in our empirical analysis.

Another argument implying that transfers are no feasible instrument to promote growth in recipient regions is the 'flypaper effect' [Hines and Thaler (1995)]. Hines and Thaler argue that 'money sticks where it hits': the higher the level of grants, the faster the growth of sub-national governments. The reason for this is that sub-national governments act as Leviathans and consume grants instead of using them for tax cuts or other growth stimulating factors. Rodden (2003) provides empirical evidence on this issue.

Closely related to our work is the study by Hansen and Kessler (2006) who analyze the effects and the determinants of interregional redistribution in a model of residential and political choice. In a much more sophisticated framework than ours, they find that with inter-jurisdictional redistributive transfers, regions not only differ in their local equilibrium policies, but also diverge with respect to per capita incomes: high-income households live in one region and low-income households in the other. Thus, interregional redistribution may not only cement existing disparities, but can explicitly promote divergence of regions.

As mentioned above the whole public policy sphere influences individuals decision to move. Sinn and Ochel (2003) analyze the impact of harmonization of social standards on convergence within the European Union. If the EU forces all member states to implement minimum social standards, as e.g. replacement incomes, than rich and poor regions are affected differently. While rich regions will have less problems with a certain economically justifiable level of replacement incomes, harmonization at a level appropriate for the rich that is binding for the poor regions is likely to result in mass unemployment in the latter. Moreover, people do not emigrate to the rich regions since the

[23] The underlying leapfrogging model is based on Brezis et al. (1993).

replacement incomes act as stay-put premia and prevent convergence promoting migration. The effect of such social transfers – be they paid by other jurisdictions as interregional transfers or are all jurisdictions forced by law to pay them on their own – has comparable negative redistributive effects as equalization grants in our analysis.

Although our the panel data evidence we provide is unique in respect to the underlying data set and estimation procedures, there are some studies in the literature supporting our findings. Most of them are case studies for single countries, whereas the Canadian provinces have been one focal point. Coulombe and Day (1999) compare the evolution of regional disparities in Canada to those of the 12 U.S. states along the Canadian southern border. Although this reference group has extensive similarities in terms of history, geography, institutions, economic structure, and the development stage, regional disparities – measured by the coefficient of variation – have turned out to be 50% higher in Canada compared to the U.S. regions. The reason for this is the systematically lower participation rate and higher unemployment rate in Canadian provinces, leading the authors to the conclusion that '[government policies are] the most likely factor responsible for the apparent differences, [in particular] the unemployment insurance system, in which benefits are tied to regional unemployment rates, and the intergovernmental transfer payments, which allow poorer provinces to offer a more attractive package of taxes and expenditures than would otherwise be the case' [Coulombe and Day (1999), p. 170-171]. This result is supported by the findings of Kaufman et al. (2003) who also analyze the impact of interregional transfers and the employment insurance on convergence of Canadian provinces. In different panel estimations, they find a weak positive effect of equalization transfers on regional GDP growth per capita, while transfers from the employment insurance always have a negative and highly significant impact on output convergence. The most recent study on convergence determinants of Canadian provinces provides Rodriguez (2006). On the basis of a time-series analysis he concludes '[...] that the interprovincial transfers were not determinant or decisive to the attainment of deterministic convergence in the Canadian provinces'[Rodriguez (2006), p. 26].

From a more international perspective there is a literature evaluating the effects of the European structural policy on growth and convergence of member states. In contrast to our analysis, these studies focus on transfers from supra-national institutions – not national equalization programs – on regional growth. Boldrin and Canova (2001) find no strong divergence or convergence in the EU leading the authors to a double headed conclusion: '*if*, on the one hand, the objective of the EU regional policies is to maximize aggregate economic growth [...], *then* [...] current policies are not appropriate and should be reversed, that is subsidies should be directed to foster agglomeration and divergence. On the other hand, *if* the true objective of regional economic

policies is to foster economic growth in the poorer regions and promote convergence, *then* the policies adopted by the Community are not justifiable in the light of current economic knowledge and hard statistical evidence '[Boldrin and Canova (2001), p. 242]. This results are contrasted by Cappelen et al. (2003) who estimate a Solow-type model with panel data and regional support as additional explaining variable. They find a significant positive impact of EU transfers on regional growth and conclude that 'EU regional support through structural funds [...] contributes to greater equality [...]'[Cappelen et al. (2003), p. 640]. In contrast, Ederveen et al. (2006) as well as Dall'erba and Gallo (2008) find no significant impact of EU transfers on growth and convergence applying spatial econometrics models.

Empirical findings on the impact of interregional transfers on regional disparities for the United States are rare. For example Sala-i-Martin (1996) analyzes regional growth and convergence of a wide range of countries. Concerning the dispersion of personal income in the U.S. states, he concludes that '[..] it seems as if transfers help reduce cross-state dispersion of per capita income. However, interstate transfers are not responsible for the long run decline in income dispersion'[Sala-i-Martin (1996), p. 1335]. To sum up, the seemingly paradoxical result that interregional transfers are harmful for the convergence of regions is supported by several theoretical as well as empirical authors.

5 Conclusions and Outlook

In this paper, we have analyzed the relationship between interregional redistribution and regional disparity both theoretically as well as empirically. For this purpose, we have constructed a theoretical model showing that equalization payments inhibit migration from poor to rich regions, and, thus, hamper the convergence process. We have subsequently tested our model empirically. The evidence suggests a positive relationship between interregional transfers and regional disparities, as measured by the coefficient of variation as well as the adjusted Gini coefficient of regional GDP, both across countries and over time from 1982 to 2000. In the cross-section data, we find that countries with higher levels of interregional redistribution in the past show a subsequent increase in interregional disparity, while countries with lower levels of grants and transfers show less divergence or even convergence. The panel reveals a similar picture: countries who have increased their sub-governmental transfers and grants have experienced more divergence (less convergence) over time than countries who have lowered their transfers. This association is robust for a wide range of potential sources of omitted variable bias as well as endogeneity bias. The policy implication we derive from our study is that grants are not an appropriate instrument to achieve output con-

vergence. In light of this, all federations – single nations as well as supra-national institutions as the European Union – should carefully asses their redistributive instruments in how far they really contribute to the convergence of regions.

Although data availability – especially concerning the required regional data – limits the conclusiveness of our results, the evidence in the paper raises a number of interesting issues for further investigation, including whether particular types of interregional transfers are more debilitating for the convergence process. Data availability will be the bottleneck for future studies.

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A Appendix: Proofs of Observation 2 and 3

Proof of Observation 2. Consider an equilibrium in a federation with mobile households ($\theta < \infty$) and no fiscal equalization ($T_1 = T_2 = 0$) satisfying (7). In the text, we already argued that $\theta' < \theta$ implies $c_1' < c_1$. From (4),

$$\frac{u_g\left(\frac{c_j'}{g_j'},1\right)}{u_c\left(\frac{c_j'}{g_j'},1\right)} = \frac{u_g\left(\frac{c_j}{g_j},1\right)}{u_c\left(\frac{c_j}{g_j},1\right)} = 1$$

and we thus must have $g_1' < g_1$. Furthermore, $c_1' < c_1$ and $g_1' < g_1$ imply $w_1' = c_1' + g_1' < c_1 + g_1$. $t_1' > t_1$ then follows from (6). It remains to establish that per capita GDP in region 1 falls as well, $y_1' < y_1$. Using $y_j = f(k_j)$, $k_j = \bar{K}_j/n_j$, this amounts to showing that $n_1' > n_1$, i.e., a reduction in the mobility cost θ always triggers higher equilibrium migration. To this end, note first that

$$u_n^i \equiv \frac{\partial u(c_j, g_j)}{\partial n_j} = u_c\left(\frac{\partial w_j}{\partial n_j} - \frac{\partial g_j}{\partial n_j}\right) + u_g\frac{\partial g_j}{\partial n_j} = u_c\frac{\partial w_j}{\partial n_j} < 0,$$

where we have used $c_j = w_j - g_j$ and (4). As expected, an influx of labor into the home region leads to a reduction in the representative household's equilibrium utility due to the fact labor productivity (wages) fall. Recalling that $n_1 + n_2 = 1$, totally differentiating (5) yields

$$\frac{\partial n_1}{\partial \theta} = -\frac{\bar{n}_1 - n_1}{u_n^1 + u_n^2 - \theta},$$

implying

$$\operatorname{sign}\frac{\partial n_1}{\partial \theta} = \operatorname{sign}(\bar{n}_1 - n_1). \tag{13}$$

In the initial equilibrium, $c_1 > c_2$ and $g_1 > g_2$ [see (7)] and thus $\bar{n}_1 < n_1$ from (5). Using (13), we can thus conclude $\theta' < \theta \Rightarrow n_1' > n_1$: a decrease in mobility cost causes an increase in n_1 as was to be shown. Finally, that $\theta \to 0$ implies full convergence is directly implied by (5) in conjunction with (4), which completes the proof. □

Proof of Observation 3. Consider an equilibrium in a federation with immobile households ($\theta \to \infty$) that satisfies (7). Now suppose the federal government, anticipating the local tax rates (t_1, t_2) chosen in stage 2 initiates a transfer scheme (8) with full equalization, $T_j/n_j = R - t_j w_j$, implying $g_j = R$, $j = 1, 2$, where $R = n_1 t_1 w_1 + n_2 t_2 w_2$ is the mean per capita public revenue in the federation. From (4), the chosen tax rates (given T_j) will be such that local private consumption is equalized as well: $c_1 = c_2$. Since both public and private consumption are equalized across the federation, there is no incentive to migrate and we therefore must have $n_j = \bar{n}_j$, $j = 1, 2$. But then, $y_1 = \bar{y}_1 > \bar{y}_2 = y_2$ and $w_1 = \bar{w}_1 > \bar{w}_2 = w_2$. Finally, $t_1 > t_2$ follows from $c_1 = c_2$ and, hence, $(1 - t_1)\bar{w}_1 = (1 - t_2)\bar{w}_2$. The proof for partial equalization ($\beta < 1$) is analogous and therefore omitted. □

B Appendix: Calculation of transfer measure $trans2$

The OECD (1999) has developed an internationally comparable framework to assess the degree of control sub-central governments have over their revenues. Table B1 presents the OECD tax classification framework.

Table B1: OECD framework of tax classification

Classification of taxes in decreasing order of control over revenue sources		
(a)		SCG determines tax rate and tax base.
(b)		SCG determines tax rate only
(c)		SCG determines tax base only
(d)		tax sharing:
	(d.1)	SCG determines revenue-split
	(d.2)	revenue-split only changed with consent of SCG
	(d.3)	revenue-split unilaterally changed by central government (CG)
	(d.4)	revenue-split unilaterally changed by CG (in annual budgetary process)
(e)		CG determines tax rate and tax base

CG: central government; SCG: sub-central government; Source: OECD (1999).

While the first three rows (a, b, and c) in Table B1 could be interpreted as taxes over which sub-national governments can decide autonomically, (d.1) and (d.2) represent shared (or composite) taxes which are influenced by both central and sub-central governments. In the cases (d.3), (d.4), and (e) the taxes are completely controlled by the central government. All kinds of taxes covered by the OECD Government Revenue Statistics are classified in this respect.

Using this classification we can separate sub-national autonomous (a, b, and c) and non-autonomous (d.1, d.2, d.3, d.4, and e) revenues. The TRANS2 measure is then calculated as:

$$trans2 = \frac{\text{total sub-national revenues} - [(\text{a+b+c}) + \text{non-tax} + \text{capital revenues}]}{\text{total government revenues}}. \qquad (14)$$

C Appendix: Variable definitions and data sources

Table C1: Variable definitions and sources

Variable	Definition	Source
cov	Coefficient of variation of regional GDP per capita (NUTS2 level in member countries of the European Union, state level otherwise)	National statistics, own calculations
adgini	Adjusted Gini coefficient of regional GDP per capita (NUTS2 level in member countries of the European Union, state level otherwise)	National statistics, own calculations
trans1	Grants received by national and sub-national governments from other levels of government (without grants from abroad or supranational institutions) as share of total government revenues	IMF Government Finance Statistics
trans2	Sub-national non autonomous revenues as share of total government revenues adjusted for sub-national transfers to other government levels	OECD Revenue Statistics
gdppc	Gross domestic product per capita	World Bank (WDI)
unempl	Unemployment rate	World Bank (WDI)
pop	Total population	World Bank (WDI)
popgini	Gini coefficient of regional population size	National statistics, own calculations
urban	Share of urban living population	World Bank (WDI)
social	Total government social expenditures as share of GDP	World Bank (WDI)
dec	Sub-national expenditures as share of total government expenditures	IMF Government Finance Statistics

Table C2: Summary statistics, panel data

Variable	Mean	Std. Dev	Min	Max
cov	.207	.081	.071	.420
adgini	.119	.037	.040	.194
trans1	.132	.052	.016	.245
trans2	.155	.100	-.077	.461
gdppc (1.000 $)	17.596	5.119	6.810	30.913
unempl	.086	.044	.008	.229
pop (Mill.)	36.848	61.470	3.504	275.168
popgini	.375	.127	.173	.635
urban	.745	.123	.389	.972
social	15.833	3.581	9.833	26.333
dec	.383	.146	.091	.700

Table C3: Robustness check: panel estimations

	Dependent variable: adgini			
	OLS	OLS	TSLS	TSLS
	(1)	(2)	(3)	(4)
gdppc	.007***	.007***	.008***	.008***
	(4.13)	(3.94)	(4.35)	(4.24)
unempl	.203***	.223***	.185*	.186
	(3.49)	(3.55)	(1.69)	(1.64)
pop	-.280***	-.252***	-.281***	-.362***
	(-7.83)	(-7.93)	(-3.18)	(-7.67)
popgini	.951***	.974**	.890	1.096*
	(3.07)	(2.60)	(.95)	(1.77)
urban	-.117*	-.076	-.128*	-.073
	(-1.88)	(-1.26)	(-1.86)	(-1.22)
social	-.001	-.001	-.001	-.001*
	(-1.30)	(-1.52)	(-1.07)	(-1.87)
dec	-.223***	-.225***	-.163*	-.130**
	(-3.62)	(-4.32)	(-1.71)	(2.21)
trans1	.127**		.135	
	(2.64)		(.61)	
trans2		.101**		.072
		(2.65)		(1.39)
Country Dummies	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
Obs	17 (92)	17 (92)	17 (77)	17 (74)
Adj.-R^2	.52	.52	.58	.60
F-Test (p-value)	.000	.000	.000	.000
Sargan-Hansen statistic	–	–	.000	.000

Note: t-values in parenthesis; ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.