ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Wardenburg, Sven; Brenner, Thomas

Article — Published Version

How to improve the quality of life in peripheral and lagging regions by policy measures? Examining the effects of two different policies in Germany

Journal of Regional Science

Provided in Cooperation with:
John Wiley & Sons

Suggested Citation: Wardenburg, Sven; Brenner, Thomas (2020) : How to improve the quality of life in peripheral and lagging regions by policy measures? Examining the effects of two different policies in Germany, Journal of Regional Science, ISSN 1467-9787, Wiley, Hoboken, NJ, Vol. 60, Iss. 5, pp. 1047-1073,
https://doi.org/10.1111/jors.12500

This Version is available at:
https://hdl.handle.net/10419/230249

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

http://creativecommons.org/licenses/by/4.0/

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Check for updates

Received: 17 May 2019 | Revised: 20 February 2020 | Accepted: 11 May 2020

DOI: 10.1111/jors.12500

ORIGINAL ARTICLE

JOURNAL OF REGIONAL SCIENCE WILEY

How to improve the quality of life in peripheral and lagging regions by policy measures? Examining the effects of two different policies in Germany

Sven Wardenburg | Thomas Brenner

Department of Economic Geography and Location Research, Philipps-University Marburg, Marburg, Germany

Correspondence
Sven Wardenburg, Department of Economic Geography and Location Research, Philipps-University Marburg, Deutschhausstraße 10, 35032 Marburg, Germany.
Email: sven.wardenburg@geo.uni-marburg.de

Funding information
Volkswagen Foundation, Grant/Award Number: 89 472

Abstract

Peripheral regions commonly appear to be less attractive to live in and policymakers all over the world are applying various measures to make them more attractive. This paper analyzes the effects of two very different measures: The German municipal fiscal equalization scheme and the German structural funds for economically weak areas (GRW). It focusses on the impact on perceived quality of life, measured through interregional migration between German labor market regions. Using a spatial vector autoregressive panel model, we find evidence that equalization transfers have a significant positive impact on regional net migration and contribute to the aim of regional equity. These effects are especially found for regions with low endogenous fiscal capacities. GRW funding reveals no significant effects on net migration rates in total, but short-term effects in rural regions.

KEYWORDS

amenities, impulse-response functions, migration, quality of life, regional policy

JEL CLASSIFICATION

C33; O38; R23; R58

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.
© 2020 The Authors. Journal of Regional Science published by Wiley Periodicals LLC

1 | INTRODUCTION

Population and economic development in the world are highly polarized, with strong differences between countries as well as within countries. In most countries we find prosperous cities and peripheral regions falling short of this development. Especially rural and more peripheral regions have to deal with manifold challenges that affect regional quality of life, such as structural weakness, unemployment, smaller private incomes, demographic change, and insufficient public infrastructure, whereas most metropolitan areas experience population growth and appear highly attractive as a place to live. As a result, we observe rising inequalities between those well-performing regions and declining mostly peripheral regions. Governmental policy instruments, therefore, aim at reducing regional disparities by redistribution of financial funds or fiscal equalization transfers to underperforming or structural disadvantaged regions and firms, such as the European Cohesion Policies and manifold national policies. These kinds of policies can be denoted as place-based policies (Iammarino, Rodrguez-Pose & Storper, 2019). Germany is an adequate case to study the effects of place-based policies, as it is facing significant disparities, especially between the former separated West and East. Politics is tackling regional inequalities with very different policies that redistribute high amounts of money.

The economic efficiency of regional development policies has been frequently examined in the German case (Alecke, Mitze, & Untiedt, 2013; Brachert, Dettmann, & Titze, 2019; Eberle, Brenner, & Mitze, 2019 and others), as well as in the case of European Cohesion Policy. Pieńkowski and Berkowitz (2016) provide an extensive summary on this issue. However, referring to the insight that regional inequalities have manifold social and political implications for society instead of being solely economic, the evaluation of regional policies should not only consider economic efficiency, but also social and regional justice (Storper, 2011). Various recent studies find that the global phenomenon of rising populist votes is an outcome of regional inequalities and structurally weak regions getting more and more suspended from economic and social development (Dijkstra, Poelman & Rodríguez-Pose, 2019; Rodriguez-Pose, 2018).

This paper can make a substantial contribution to the discussion on regional inequalities within high-developed countries by investigating the effects of two regional equalization policies within Germany, the fiscal equalization scheme on the municipality level and the "Joint Task for the Improvement of the Regional Economic Structures" ("Gemeinschaftsaufgabe Verbesserung der regionalen Wirtschaftsstruktur," henceforth GRW). The central aim of this paper is to investigate whether both policies contribute to the reduction of regional inequalities and the perceived development of the regional quality of life. To reach this aim, we use a flexible spatial vector autoregressive (SpVAR) approach that is an emerging method in spatial policy evaluation (Eberle et al., 2019; Mitze, Schmidt, Rauhut, & Kangasharju, 2018). We use regional migration balances to measure the region's appeal and utilities to inhabitants and migrants, which gives a good impression on the development of regional quality of life in a region. This will be explained in Section 3.

To the best of our knowledge, our study is the first enhancing an econometric SpVAR process to investigate the complex interactions of economic and socioeconomic variables in a spatial context. This allows us to gain new knowledge about the mechanisms behind regional policies and the complex mutual dynamics of economic and spatial socioeconomic variables. Our results suggest that fiscal equalizations on municipality level have a positive impact on regional net migration rates especially in regions with low endogenous tax income, while GRW funding reveals no significant effects on net migration rates in total, but significant short-term effects in rural regions. We conclude that the former is able to reduce regional inequalities.

The remainder of the paper succeeds as follows. We start with a presentation of the examined policies and existing literature on their effects. In Section 3 we discuss the advantages and disadvantages of our measurement approach. In Section 4 hypothetical effects of all policies based on theoretical consideration are developed. Our data and econometric model are presented in Sections 5 and 6. Section 7 provides the empirical results and their discussion. Section 8 concludes.

2 | POLICY SETUPS AND LITERATURE EVALUATION

This paper investigates the impact of two German regional redistribution policies aiming at regional development and cohesion. They are of particular interest as both policies provide financial support for structurally lagging regions, but differ strongly in their funding strategy, thematic focus, and amount of payment. This might provide new knowledge on the instruments efficacy regarding socioeconomic regional development.

2.1 | Fiscal equalization scheme

Financial equalization schemes are used by many countries, redistributing tax revenues from regions and municipalities with high tax incomes to those with low fiscal capacities to reduce spatial disparities (see Blöchliger & Charbit, 2008 for an overview on OECD countries).

We focus on the German equalization scheme implemented on the municipality level including vertical fiscal transfers from federal states to local jurisdictions and de facto horizontal transfers across municipalities within federal states. These grants (In German: "Schlüsselzuweisungen") are institutionally separated from the horizontal equalization scheme on the federal state level ("Länderfinanzausgleich"), although distributed vertical means can result from this superordinate equalization level. The amount of support grants from the German equalization scheme is formula-based. The calculation design varies across the federal states, descriptions of the different calculation setups in the federal states are given by Lenk, Hesse, and Lück (2013). In general, calculation includes the imputed financial needs and population of a municipality minus its endogenous fiscal capacities. The common basic understanding allows us to assume that appropriate analysis across federal states is possible (Eberle, 2019; Lenk et al., 2013).

The granted funds are unconditional and not earmarked to a specific project. The main purpose is to enhance the public budget of economically weak regions and allow municipalities with low fiscal income to fulfill their municipal tasks and provide public services and public goods at an adequate level. Average annual grants to municipalities amounted to 23.8 billion euros in the period of 2000–2014.[1] Thus, it is the by far largest regional redistribution policy and the most important income source for regions with comparatively low tax income (Lehmann & Wrede, 2019). The majority of formula-based grants is paid to municipalities in the Eastern of Germany, but besides the city states of Berlin, Hamburg and Bremen every municipality received equalization payments in the investigated time period. See Figure 1 for the spatial distribution of grants.

The economic consequences of regional fiscal equalization schemes in general have been discussed over a long time period and for several countries (e.g., Albouy, 2012; Buchanan, 1950; Buchanan & Wagner, 1970; Feldstein, 1970; Oakland, 1994). The most common finding is that fiscal equalization toward less productive regions appears to be inefficient with respect to total national productivity, but promotes equity by providing necessary financial capabilities to regions with low tax capacities. As high economic productivity is linked to spatial concentration, redistribution of resources to structurally weak regions challenges the overall economic efficiency. Martin (1999) and Baldwin, Forslid, Martin, Ottaviano, and Robert-Nicoud (2005) refer to this as the inevitable trade-off between the equity and efficiency goals of public policies.

In contrast to its large volume and its economic and political relevance, scientific evidence on consequences of the German redistribution scheme is small. Henkel, Seidel, and Suedekum (2019) estimate an equilibrium model for a scenario of abolished total fiscal redistribution (federal state and municipality level, also including structural funds) and find evidence for increasing spatial disparities and the relocation of approximately 2.7 million people, mainly from rural former recipient regions to urban areas within Germany. In this scenario national labor

[1]Calculation based on Quarterly Cash Statistics of the German Federal Government and the Federal States.

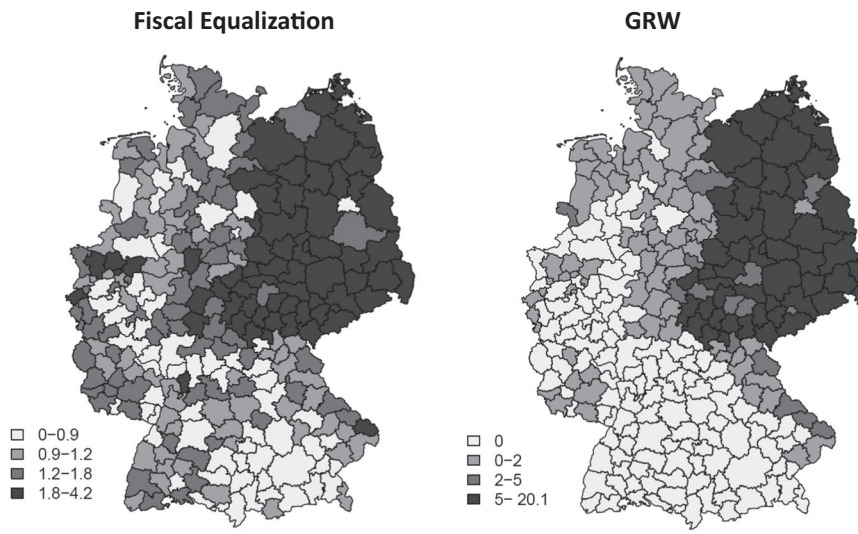

FIGURE 1 Spatial distribution of yearly average support grants from the fiscal equalization scheme and GRW funding intensity from 2000 to 2014 in € per GDP in %. GDP, gross domestic product

productivity would rise by 3.4% and real gross domestic product (GDP) per Capita by 1.8%, while negative growth effects in overcrowding cities inhibit total welfare gains. Eberle (2019) estimates a Panel VAR approach and finds that enhancing the fiscal equalization payments has significant effects on the regional employment rate, but not on other economic variables. Lehmann and Wrede (2019) confirm the common conclusions that the equity criterion of the equalization scheme is satisfied, while total efficiency is hampered by the Bavarian redistribution scheme, adapting the approach from Albouy (2012).

2.2 | GRW

The structural fund GRW, the largest German regional economic development policy, was implemented in 1969 referring directly to the aim of regional equivalent living conditions (Bundesregierung, 1969; Deutscher Bundestag, 2014). Its goals and functionality are closely related to the European Regional Development Fund including financial means from the European policy. In contrast to the fiscal equalization scheme, the program's main purpose is to explicitly procure primary and secondary effects on economic growth and employment by attracting mobile factors of production and stimulating private sector investments in regions as a kick-off for long-term local economic development.

Subsidies are split into two funding schemes. First, industrial investments of firms, especially labor costs and equipment capital, are subsidized. Second, municipalities are subsidized to improve economic relevant infrastructure, for instance traffic or communication infrastructure. The average annual grants amounted to 1.89 billion euros between 2000 and 2014, of which 1.32 billion were paid within the industrial scheme.[2] Both industry and infrastructure investments are earmarked to specific investment cases and limited to 35–60% of total investments to reduce windfall gains and stimulate further private investments (see Alecke et al., 2013 and Deutscher Bundestag, 2014 for more details on GRW functionality). Subsidies are solely given to regions with high rates of unemployment and low gross salary levels. A total of 122 of 258 labor market regions did not receive any GRW

[2]Calculation based on Funding Data from the Federal Office for Economic Affairs and Export Control (BAFA).

funds in the period considered, especially the economic stronger regions in the south. About 77.5% of the money was spent in East-German regions, which are inhabited by just 15% of German population[3] (see Figure 1 for spatial distribution of GRW funds).

Eberle et al. (2019) provide a detailed summary on the broad existing literature examining the economic effects of GRW funding. The majority of studies find some evidence that GRW grants support regional productivity, GDP growth, and/or employment. However, up until now no study focusses explicitly on socioeconomic effects of the GRW funding scheme. von Ehrlich and Seidel (2015) find positive effects on income and migration balances for historic equivalent funds for West German regions neighboring the Iron Curtain ("Zonenrandgebietförderung"), but also arising negative externalities of higher land rents and negative effects to neighboring regions. For the comparable EU structural funds, a small number of studies estimates effects on migration flows. Egger, Eggert, and Larch (2014) find in a theoretical model that structural funds reduce net migration from economic weak to strong countries in the EU-15 over the period of 1986–2004. Thomas (2013) finds analogous results for an econometric model of internal migration in Poland in the period of 2004–2009.

3 | QUALITY OF LIFE, APPEALING REGIONS, AND INTERREGIONAL MIGRATION

Regional equalization implies the reduction of regional inequalities. Therefore, policies should contribute to compensate the disadvantages that peripheral and less economic developed regions face in terms of economic perspectives such as availability of jobs and wage level as well as noneconomic factors that contribute to the quality of life in those regions. Thus, such policies should strengthen the regions' attractiveness for its current population and possible immigrants from other regions.

According to the utility maximization framework, places offer specific individual and subjective perceived utilities for its residents that depend on the fit of the places' values and the residents' individual goals and values plus their individual local social integration such as family and social contacts (Biagi, Faggian, & McCann, 2011; Wolpert, 1965). Residential choices rest upon expectations toward beneficial place utilities of alternative residences and perceived likelihoods to improve the personal well-being and achieve individual goals in those alternative places. Individual utility maximization behavior results in substantial migration flows, if place utilities are not evenly distributed in space and additional expected place values are larger than the total migration frictions and costs.

Cebula and Vedder (1973) found first that net benefits of individual migration behavior are not necessarily economic and get influenced by further residential amenities that determine the individual perception of living conditions in many ways. Gottlieb (1995, p. 1413) defines these amenities as "(…) place specific goods or services that enter the utility function of residents directly", such as regional advantages in natural or cultural conditions. Thus, migration decisions are reactions to perceived unequal distributions of regional economic strength as well as individual weighted further amenities.

It follows that regional net migration balances provide worthwhile information on the attractiveness of regions as a place to live (Faggian, Olfert, & Partridge, 2012). Faggian et al. (2012) refer to this as people "voting by their feet" for the best quality of life. Their study uses net migration as an indicator for the regional quality of life respectively well-being. This indicator has several advantages against other measurements by taking into account individual demands, preferences and subjective perception of living conditions and ensuring independency from researcher's preferences on objective indicators. Effective regional policies that improve the quality of life in regions by increasing its economic or noneconomic utilities should have a direct impact on regional migration rates.

[3]Calculations based on Funding Data from Federal Office for Economic Affairs and Export Control (BAFA) and Population data from Federal Statistic Office, Status 30.12.2017.

Hence variations in the regional net migration rates become an appropriate indicator to measure the effects from regional redistribution and development policies on the perceived quality of life in a region.

Mobility frictions in the spatial behavior hamper migration flows, due to migration costs, insecurities in the relocation process, local social commitments or immobile possessions that create a long-term relationship between regions and their residents and alleviate the disposition of moving to another region. Hence, migration numbers are rather small compared to the dimension of spatial inequalities. Heise and Porzio (2019) describe this as the "home-bias" of migration, which makes migration decisions inertial and less rational than stated above and supports the persistence of spatial inequalities. Therefore, individual migration decisions have to be provoked by changes in the personal environment that raise the perceived inequalities above a subjective threshold level. These can be either linked to specific individual chances in the destination area such as job offers, earnings, higher education opportunities and relationships, or are reactions to constraints in the current residence, such as the regional unemployment and income level, availability and quality of social infrastructure, public goods and public services. Individual weightings of amenities depend on life-cycle aspects as well as personal circumstances, such as employment status, income, education, marital status, sex, or health (Greenwood, 1985).

Weaknesses from using net migration as an indicator for quality of life arises from various sources. Mobility friction and costs may bias the "voting with your feet" behavior toward the more educated and wealthy parts of the population as their mobility is higher than those who cannot afford costs and risks of migration. Thus, preferences of the former have higher impact on migration rates (Faggian et al., 2012). In addition, interregional migration patterns are also determined by developments in common preference, such as changes in attitudes toward cities or the development of fashionable locations that trigger interregional migration. Life-cycle aspects can alter the individual weighting of amenities and change place utilities without altering the regional conditions. At the same time, this aspect of using migration as an indicator provides a chance for a more detailed analysis, since migration behavior of specific demographic groups allows to draw further conclusions on which amenities triggered variations in the regional net migration.

In addition, all regional policies pursuing regional equity should aim at influencing migration streams, since they can determine future economic potentials and inequalities. A constant negative local migration balance affects, in particular, the presence of skilled workforce, which are crucial for local innovative activities and endogenous regional growth potentials (Lucas, 1988; Romer, 1990). Out-migration causes further problems, such as real estate vacancies, investment backlogs, and declining supply of public infrastructure, while workforce inflow and growth are self-enforcing in prosperous regions, which amplifies the polarization of regional development. This brings further interest to our analysis and migration rates become a reliable and comparable indicator stabilizing endogenous regional potentials and monitoring policy success.

4 | THEORETICAL CONSIDERATIONS AND RESEARCH HYPOTHESIS

A broad literature focusses on explaining interregional migration dynamics. Since we are interested in variations in the migration balances of individual regions, we focus on its local determinants and ignore more detailed approaches explaining complex migration patterns and interactions between regions. Internal net migration for a specific region can be modelled within the utility maximization framework as the regions' place specific average household utilities minus the national average utilities for the average household and monetary and nonmonetary mobility costs and frictions. (Faggian et al., 2012; Rappaport, 2004). The utility function of the individual depends on the personal weighting of locational utilities and disutilities that affect the individual quality of life. These utilities can be categorized into economic incentives, natural amenities, and cultural (man-made) residential amenities (Rodriguez-Pose & Ketterer, 2012). They will be explained in more detail in Section 4.1. Migration risks and costs are assumed to be constant over time and homogenous across regions, reducing the net migration of regions by the same unknown factor.

Place-based redistribution and development policies are set to affect its residents' quality of life by changing the composition of dynamic location utilities in a direct or indirect way. Approaches that model net migration as the outcome from more or less static regional differences in productivity and noneconomic regional characteristics, such as Partridge, Rickmann, Ali, and Olfert (2008), Biagi et al. (2011), and Rodriguez-Pose and Ketterer (2012), are good starting points to identify relevant amenities. However, these approaches are disadvantageous to investigate dynamic changes in migration flows as they consider mainly time-invariant amenities, such as environmental conditions (climate, landscape) or distance to urban agglomerations. These factors cannot explain variations in migration rates over time and are not plausibly affected by regional policies. Investigating the impact of regional redistribution policy on the appeal of regions to migrants, we concentrate on dynamic local characteristics that are potentially affected by policy implementations and determine changes in the migration dynamics of regions by working as time-variant push and pull factors.

4.1 | Factors of regional utilities

Economic incentives and potential economic returns based on employment opportunities and regional wage differences are well-known as key determinants of internal migration in high-developed countries, especially in Europe (Greenwood, 1975; Hunt & Mueller, 2004; Rodriguez-Pose & Ketterer, 2012). Economically growing labor markets will increase the probability to find a job in a region. In addition, human capital incentives in growing markets offer additional monetary returns to skills. Thus, regional economic growth can enhance the personal utility function of less and high-skilled workers in a direct way (Arntz, 2010). Vice versa, shrinking local economies with high unemployment rates lose high and less skilled population to thriving markets due to income maximizing behavior. Especially the high educated labor force is more sensitive to income inequalities and benefits from knowledge spillovers (Arntz, 2010; Borjas, Bronars, & Trejo, 1992; Hunt & Mueller, 2004). These mobility patterns manifest long-term inequalities and labor market imbalances (Granato, Haas, Hamann, & Niebuhr, 2015; Kanbur & Rapoport, 2005). Hence, we use regional productivity, employment and household income growth as direct economic utilities contributing to the utility function in a specific region.

In contrast, it has to be considered that regional income benefits are potentially offset by higher prices in high-income regions that likely compensate for additional amenities (Glaeser & Gottlieb, 2008). Especially housing prices should be added to the utility function as they can displace people from attractive cities, while shrinking regions in many cases cannot offer adequate housing supply due to lower returns of investments for owner and developer, resulting in investment backlogs.

In addition, migration can be affected by multiple residential socioeconomic or cultural amenities such as the public infrastructure (public transport, traffic infrastructure, education infrastructure), public services (medical care, child care) or leisure opportunities (recreational areas, public libraries, museums, public pools, sport facilities) that may enter the individual's utility function. They possibly arise as major pull-factor, in particular for urban areas if the supply of these amenities becomes insufficient in rural areas. Maintenance of public infrastructure is a serious problem in many regions that are challenged by demographic change and outward migration. In line with the strong impact of the "home-bias" (Heise & Porzio, 2019), it seems reasonable that additional supply of local amenities and public infrastructure increases the number of "stayers" especially in those regions and offsets lower income opportunities to a certain point. Moreover, education infrastructure is a key settlement factor for families and high-potentials determining future earning potentials, offering individual development potentials and creating freedom to pursue individual life-goals.

In contrast to the time constant natural environment, public or industrial construction projects might have positive or negative impacts on the constructed environment. Especially additional land sealing by industry investments can have negative effects on perceived quality of life in a region.

Converting the considered aspects into a reliable model is limited by three aspects. First, the literature provides limited knowledge about the actual importance of socioeconomic and cultural amenities as migration

determining factors. Second, it is practically impossible to display the specific heterogeneity of individual migration decisions into an universal migration utility function on a regional level. Thus, omission of variables from the individual's function is unavoidable. Third, variable selection is limited to data availability. Available regional data is especially limited concerning the quality and dynamic development of regional infrastructure, public services, cultural amenities as well as the constructed environment. Variable selection will be explained in Section 5.

4.2 | Research hypothesis on policy impacts

Overall, policy funding should enhance local factors and generate variations in the regional migration flows toward recipient regions provoked by adjustments in regional amenities. One basic assumption of this study is that the policies are not the actual key factor for individual migration decisions, but single structural improvements in the personal environment initiated by policy interventions can become decisive in both directions by altering the individual's regional utility function. The different strategic orientations and intended goals of policies result in different funding specifications and cause distinct research hypotheses. Summarized expectations toward policy effects are displayed in Figure 2. Discussed regional factors are based on the literature on internal migration, concentrating on dynamic economic incentives and further time-variant residential amenities as presented in Section 4.1. To derive detailed hypotheses on policy effects, we match the identified utilities with their expected reaction to both policies.

Structural funds, such as GRW, are designed to reduce the productivity gap between economically prosperous and lagging regions and provide incentives for firms and their employees to locate in regions with lower productivity (Kline & Moretti, 2014). The majority of studies confirm economic efficiency of GRW with regard to per capita output and employment development (Eberle et al., 2019; Dettmann et al., 2017; Rhoden, 2016 and others). Productivity growth should enable firms to raise wages. Considering that unemployment and income opportunities are the main reasons for labor migration, GRW funding should create economic incentives to stay, respectively, move to funded regions. The growth effects should in particular affect the high skilled and educated workforce, but less often those who already started a family, since families make migration decisions more rigid and economic returns to migration decrease over time (Hunt & Mueller, 2004). Hence, we should observe clear positive effects of GRW funding for the age groups 18–30 years, lower effects on groups above 30 years and no effects on retired persons.

Predictions on specific economic consequences of the equalization scheme are difficult, due to the lack of respective studies in the literature. The findings from Eberle (2019) suggest that regional employment effects are

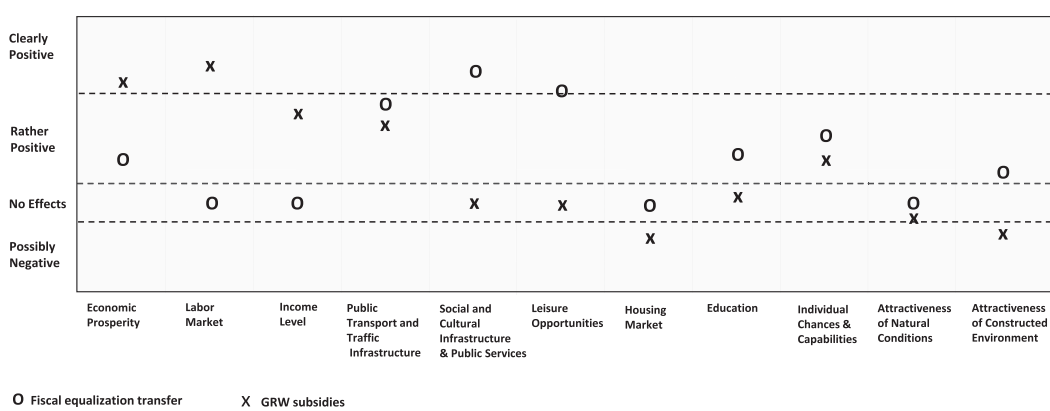

FIGURE 2 Expected reaction of important push and pull factors for interregional migration in Germany to the considered regional policies

existent, which should have slightly positive effects on migration balances. As the policy is not designed for triggering economic growth, direct effects on prosperity cannot be expected to be large.

Forming hypothesis on policy effects on noneconomic amenities is more heterogeneous and less profound by existing literature. Fiscal equalization transfers should enable local governments to ensure long-term affordability and maintenance of public sourced social and socioeconomic infrastructure, regardless of their local economic situation and possible tax income crises (Kline & Moretti, 2014). German municipality task and expenditure structure is split into obligatory public tasks (e.g., fire protection, waste disposal, energy, water supply and school authority) and optional tasks (e.g., public transport, traffic infrastructure, public social infrastructure, and cultural infrastructure). Local governments can decide about the amount of expenditures for the latter and, in theory, abolish their supply if financial capacities are exhausted, so that financial capabilities should make a difference on the quality and quantity of optional tasks. Moreover, we assume that an increased municipality budget from equalization transfer potentially improves local school infrastructure. Although the educational system is basically comparable within Germany, spatial inequalities arise from the federalistic organization and local availability of certain types of schools. While federal states bear the costs for the teaching staff, municipalities are school authorities paying for public school infrastructure. Accordingly, local financial capabilities become important (Brückner & Böhm-Kasper, 2010). The local quality, reputation and distance to primary and secondary schools can be a large settlement factor for couples and young families. Concurrently, it is feasible that higher levels of education result in increasing out-migration from recipient regions in the long-term, due to higher skill-returns in donor regions (Zukowska-Gagelmann, 2017).

In total, equalization transfers should affect the individual's utility function in favor of regions with less financial resources. GRW is bound to funding economic activities, so that it does not plausibly affect cultural amenities, but can work negative on the perceived quality of life by additional land sealing.

H1: *Fiscal equalization transfers do not affect economic disparities in a significant way, but improve regional quality of life by enabling regions to maintain an adequate quality and supply of public infrastructure and public services. Especially regions with low fiscal income capacities are expected to profit from this. Effects are not limited to certain age groups.*

H2: *GRW subsidies reduce the economic gap between regions. Potential labor market and income effects cause significant effects on the net migration balance in the age groups* 18–30, *lower effects on* 30–50 *years old and no effects on retired persons.*

5 | DATA AND DESCRIPTIVE STATISTICS

We test the identified research hypotheses in an econometric analysis using a balanced panel dataset on the spatial level of 258 German labor market regions.[4] In this structural unit administrative districts are bundled due to economic ties and commuting flows. Their main advantage is that short-distance movements driven by life-cycle phenomena, such as suburbanism, are excluded from the analysis. To enhance the informative value, based on the theoretical considerations, it is adequate to include only migration acts that involve extensive personal relocations. Concurrently, the chosen regional units are small enough to expect measurable effects from local policy input.

Our main outcome variable is the annual regional net migration rate from the official German migration statistics. This includes all registered interregional inflow and outflow of persons moving within Germany. We exclude abroad movements, as immigrant location decisions are known to be driven by different factors, such as chain migration and ethnic

[4]Official Classification of labor market regions of the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR; Status 31.12.2015).

networks in the host country (Barthel, 1989; Haug, 1998). The net migration rate at different age groups is used in comparative analysis to additionally explore the relationship of the policies and internal migration at different stages of the life cycle. While 18–24 years old are expected to move in majority by educational reasons, labor market is decisive for many 25–29 years old. Reasons for middle-aged are heterogeneous, persons between 50 and 64 can be expected to move in preparation to retirement. Registration behavior brings some weakness to the dataset. The census of 2011 revealed mismatches and time lags between registered and real movements. Assuming that the occurring error is equally distributed over years, this produces negligible errors on the annual variation. Administrative second-residences registrations cause bias, if they are actually used as first-residence.[5] Finally, we had to omit the Göttingen region due to a major data bias. As the administration for their matters is located in this area, ethnic German late resettlers from former soviet states get registered near Göttingen first. Their distribution all over Germany afterwards causes constant implausible statistical within-German out-migration from the region. The time period from 2000 to 2014 is chosen, because the first strong wave of relocations from east to west after German reunification was abated in 2000 and from 2015 onwards the increasing refugee migration would cause problems.[6]

The two considered policies are investigated in separate estimations and normalized by the regional GDP. Furthermore, we incorporate variables that are expected to influence interregional migration decisions based on the considerations in Section 4. We include three economic variables: (a) the regional employment rate to account for increasing/decreasing numbers of jobs, (b) the disposable household income to consider individual profit maximizing behavior, (c) the GDP to consider the general local economic dynamics. In addition, we include the prices of land that is ready for development to control for the regional level of housing prices. As variables that represent the development of further local amenities, we include (a) the number of elementary and secondary schools to take into account changes in the local education infrastructure, and (b) the number of overnight stays as a proxy for the development of cultural amenities and environmental quality. All indicators and data sources are displayed in Table 1. The selection especially of the noneconomic variables is limited by the availability of reliable data within the whole research period and the lack of adequate indicators. Time invariant variables, such as natural amenities, are not integrated into the model, but controlled for in the use of fixed effects.

All variables are set to the natural logarithm (ln), except for the net migration balance, due to the occurring negative numbers. The presence of nonstationarity in the time-series (unit roots) can become a serious problem for panel data with long time periods (Im, Pesaran, & Shin, 2003). The corresponding test detected unit roots for the variable LEMPL and the spatial lags of LINC and LMIG (see Section 6 for computing and use of spatial lags). For this reason, we created stationarity in these variables by eliminating linear time-trends in the variables LEMPL, LINC, and LMIG and their spatial lag variables. Summary statistics of all variables are given in Table 2.

6 | ECONOMETRIC APPROACH

The variety of considered regional policy effects represents the complex mutual interactions between economic and socioeconomic variables in time and space. This impedes model building and is reflected in the variety of methodological approaches in regional policy evaluation. We follow a flexible VAR approach, first proposed by Sims (1980), that has become a standard part in econometric modeling of time series forecasting and recently drew some attention in related spatial policy analysis, used by Eberle et al. (2019) and Mitze et al. (2018). Our model basically follows their recent SpVAR approaches, including two main advancements that adapt the VAR for panel data analysis and account for the explicit spatial dimension by correcting for spatial autocorrelation (Beenstock & Felsenstein, 2007; Di Giacinto, 2010;

[5]The amount of this bias is in particular visible in regions with high student rates. The first-residence registration in Münster and Gießen significantly increased after they implemented a taxation on second-residence registrations.

[6]Similar to the problem with Göttingen, refugee-registration stations for refugee migration (e.g., Fürth region) are problematic. However, these effects bring only minor limitations to our dataset as they are marginal until 2014.

TABLE 1 Variable description and data sources of variables

Acronym	Variable description	Data source
LFT	Unconditional financial assignments to municipalities as part of the municipal fiscal equalization scheme ("Schlüsselzuweisungen) in relation to regional GDP [Fiscal assignments in €/GDP in €]	Fiscal Transfer: Quarterly Cash Statistics of the Federal Government and the Federal States GDP: Working Group "National Accounts of the Federal States — Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder"
LGRW	Total GRW funding intensity [(GRW Industry funding + GRW infrastructure funding in €)/GDP in €]	GRW: Federal Office for Economic Affairs and Export Control (BAFA) GDP: Working Group "National Accounts of the Federal States — Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder"
LOVN	Overnight stays in tourism businesses [Overnight stays in tourism businesses/population]	Monthly Tourism Survey of Federal Government and Federal States
LSCO	General education schools per 10,000 inhabitants [Sum of general education schools (elementary +secondary schools)/population × 10,000]	Statistical Office of Federal Government and Federal States
LEMPL	Employment rate at workplace [Employees total/population aged 15–64 years] 15–64 years	Employees: Institute for Employment Research (IAB) Population (15–64): Statistical Office of Federal Government and Federal states
LINC	Mean disposable household income [Disposable income of private households/population]	National Accounts of the Federal States ("Arbeitskreis Volkswirtschaftliche Gesamtrechnung der Länder")
LLAPR	Prices of sold land plots ready for development per m^2 [Total purchase value of sold land ready for development in €/sold land ready for development in m^2]	Statistical Office of Federal Government and Federal States
LGDP	Nominal gross domestic product per capita [GDP in €/population]	GDP: Working Group "National Accounts of the Federal States—Arbeitskreis Volkswirtschaftliche Gesamtrechnungen der Länder"
LMIG	Internal net migration balance [(In-movers—out-movers from/to German regions)/population]	Migration Statistic of the Federal Government and the Federal States
LMIG18–24; LMIG25–29; LMIG30–49; LMIG50–64; LMIG65	Internal net migration balance of 18–24 (25–29; 30–49; 50–64; >65) years old [(In-movers—out-movers in age group from/to German regions)/population in age group]	Migration Statistic of the Federal Government and the Federal States

Note: LMIG 30–49 also includes underaged.

TABLE 2 Summary statistics of variables 2000–2000

Acronym	Observations	Min	1. Quarter	Mean	3. Quarter	Max	Standard deviation
LMIG	3855	−0.370	−0.023	0.003	0.039	0.263	0.058
LMIG18–24	3855	−1.009	−0.194	−0.080	0.049	1.340	0.241
LMIG25–29	3855	−0.665	−0.156	−0.070	0.037	1.062	0.172
LMIG30–49	3855	−0.424	−0.020	0.013	0.051	0.269	0.060
LMIG50–64	3855	−0.178	−0.005	0.015	0.032	0.173	0.031
LMIG65	3855	−0.238	−0.000	0.021	0.039	0.183	0.035
LFT	3855	−6.908	−4.668	−4.339	−3.960	−2.681	0.599
GRW	3855	−18.421	−18.421	−13.232	−6.690	−2.576	5.941
LOVN	3855	−0.693	0.693	1.278	1.825	3.764	0.850
LSCO	3855	0.793	1.250	1.410	1.562	2.296	0.234
LEMPL	3855	−0.949	−0.630	−0.532	−0.423	−0.202	0.145
LINC	3855	6.875	7.073	7.145	7.224	7.547	0.114
LLAPR	3855	0.793	3.800	4.327	4.845	6.847	0.748
LGDP	3855	9.393	9.962	10.139	10.309	11.115	0.266

Note: To overcome problems with zeros in the datasets, zeros in the policy input variables are replaced by very small numbers prior to the calculation of the ln.

Holtz-Eakin, Newey, & Rosen, 1988). The main advantages of the model are its ability to analyze dynamic direct and indirect relationships among variables while having marginal a priori model restrictions and the visualization of relationships between variables in impulse-response functions (IRF). Moreover, the approach is able to consider that actual migrations are time lagged to changes in the push and pull factors of migration.

VAR estimations are based on the assumption that every variable depends on its own past and the past values of every other variable in the system. Variables are given in Table 1, LFT and LGRW as well as LMIG and its subvariations define alternative models and are not used in the same equation models. Migration and inflation dynamics, trade cycle effects, especially the economic crisis beginning in 2008, and cross-sectional heterogeneity in the dataset require to control for regional and time fixed effects (μ and τ). Hence, we specify a reduced form panel VAR equation system with M (= 8) equations that can be aggregated to the following form by matrix notation (Mitze et al., 2018; Rickman, 2010):

$$y_{it} = \mu_i + \tau_t + Ay_{it-1} + \varepsilon_{it}, \tag{1}$$

where A is a M × M matrix of regression coefficients that describes the relationship between past values and current values, ε is a vector of error terms with the covariance matrix Σ_e and i and t represent region and time. We account for the spatial dimension to overcome problems with spatial dependency and regional spillovers as proposed by Beenstock and Felsenstein (2007) and Di Giacinto (2010). Applying a Morans-I test we found evidence for spatial autocorrelation in every variable except LEMPL. To calculate unbiased coefficients, we apply a Spatial Durbin Model and include spatial lag variables as additional independent variables to the M equations of (1):

$$y_{it} = \mu_i + \tau_t + Ay_{it-1} + HWy_{it-1} + \varepsilon_{it}, \tag{2}$$

where H is a M × M matrix of regression coefficients equivalent to A and W is a region-specific identity spatial weight matrix representing neighboring regions that is constant overall M equations and over time. Hence, lagged

spatial lag variables represent average values of neighboring regions in the previous period. The considered lag length is 1 year as the Akaike information criterion (AIC) proves that further lags have no additional explanatory power.

However, the lack of theoretical assumptions treats all variables as completely endogenous. This is not appropriate for policy analysis since real reciprocal relations are ignored and overparametrization results in biased IRF (Rickman, 2010). The structural VAR model uses a priori theoretical assumptions to the endogeneity of variables to account for the economic structure of variables and gain orthogonal shocks for calculating IRF (Bernanke, 1986). In line with the mentioned papers, we use a recursive causal ordering on ascending endogeneity of variables to impose a correct specification and perform a triangular Choleski identification scheme to the covariance matrix of the residuals from the reduced form VAR. The variable ordering is used as in Table 1, based on theoretical assumptions on ascending endogeneity and indications from Granger causality test for panel data (proposed by Dumitrescu & Hurlin, 2012; results reported in Table A1). Results confirm that, in particular, GRW is exogenous, while the exogeneity of fiscal transfers is limited. The other variables in the VAR show mutual Granger causality.

6.1 | Impulse-response functions

Based on the results of Equation (2), we calculate IRFs of every variable *m* in the VAR to uncorrelated exogenous changes (shocks) in other variables by transforming them to the moving-average (MA) form (Lütkepohl, 2005).

The commonly used IRFs are nonspatial responses to uncorrelated shocks in region i based on the coefficients from Ay_{it-1}, as done, that is, by Eberle et al. (2019). This means that spatial dependencies are included in the statistical estimation to avoid biases due to ignored spatial effects, but the effects of changes in one variable on other variables are only examined within regions (nonspatial IRF). We enhance these approaches by calculating additional spatially indirect IRFs based on the coefficients of HWy_{it-1}.[7]

In principle, the estimated model would allow to follow all responses through space. However, the responses lead to further responses that finally disperse overall variables and regions. As a consequence, the calculation of all spatially indirect responses would lead to different results for each region in which the original change occurs, resulting in 258 different IRFs for each pair of variables. Therefore, we restrict the calculation of spatial IRFs by considering spatial effects only from the original shock to all variables in the neighboring region, but no later spatial effects (while the further intraregional dynamics are considered). The results represent responses within a region to orthogonal shocks in neighboring regions, which allows us to calculate one-time spatial-spillover effects (inward-responses). Initial shocks are equivalent to shocks for intraregional IRFs and constant in space assuming spatial homogeneity. Responses to shocks in neighboring regions are time-lagged as they need time to diffuse into the region and have an equivalent autoregressive impact over time in the region. Hence, spatially indirect responses are vectors representing the coefficients of HWy_{it-1} in the first year after the shock and the MA representation from Ay_{it-1} equivalent to direct IRFs in the following years.

To assess the statistical significance of the resulting IRFs, we calculate confidence intervals by performing Monte Carlo simulations and apply the approach to randomly generated datasets of same size that result from a redraw (with reclines) of random regions from the original dataset with all their attributes over time, while the isolated initial shocks are hold constant.

Since regions are heterogeneous in their economic strength and quality of life, we examine conditional effects and different regional or structural transmission paths by running the presented SpVAR model separately for different subsamples of our dataset. Subsamples represent the former Western and Eastern

[7]We thank an anonymous referee for the hint to conduct this additional analysis.

regions (**SWEST**; **SEAST**)[8], structural types of labor market regions (urban regions [**SURBAN**], rural regions with areas of concentrated population [**SRUCO**], and rural regions [**SRURAL**])[9] and different levels of municipal tax income per capita (**STAXLOW**; **STAXMED**; **STAXTOP**; separated according to quantiles). Visualizations of subsamples are given in Figure A1. It might be considered that the average fiscal equalization transfers and GRW funding are larger in the subsamples with lower fiscal capabilities. Thus, latter sample building is not completely exogeneous. However, there is no indicator that allows to account for economic strength or regional living conditions and proves complete exogeneity from the used variables. Again, shocks are constant for all subsamples.

6.2 | Robustness checks

We test the robustness of our results by applying the following checks. First, we tested the effects of fiscal equalization policy by calculating the equalization grants in euro per capita to control for possible correlation of transfer grants with regional GDP development. Second, we tested the robustness of GRW effects by estimating a SpVAR that includes only regions that received any GRW funds. Finally, we added the regional endogenous tax revenues and policy grants from the Federal Urban Development Program, the fiscal equalization scheme, and GRW program as additional exogenous variables to the underlying estimation to make further controls on additional income sources. All results reported in Section 7 are verified by these tests.

7 | EMPIRICAL RESULTS

As we will show in this section, results from both policies differ strongly. However, all impulse responses that do not involve policy inputs remain remarkably robust in comparison of both SpVAR-models, which confirms adequate choice of the model and included variables. The results suggest that direct regional shocks in schools, GDP, and, in particular, in the household income have significant positive effects on the regional net migration rate, while an increased number of jobs and land prices have no significant effects on the migration balance (Figure A4). In the following, we present and discuss the effects of the two policy measures on the other variables, with a more detailed look on the effects on migration. The intraregional and interregional spillover effects of the fiscal equalization payments are analyzed separately (Sections 7.1 and 7.2). In the case of the GRW funds, no interregional spillover effects on migration are found, so that all results on the GRW funds are examined in one Section (7.3).

7.1 | Intraregional fiscal equalization effects

The results for direct impulse responses to fiscal equalization payments within a region prove that the reaction of regional migration balances to fiscal equalization is positive from 1 year after funding up to 4 years after, whereas fiscal transfers have no significant positive effects on other variables except schools (Figures 3 and A2). The response of per capita GDP on fiscal transfers is found to be significantly negative. This may be explained by the increasing population due to the positive migration effect. The fiscal transfer seems to make the region more attractive, so that more people stay without implying more jobs, at least in the short run. As a consequence, the economic activity per inhabitant decreases. Overall, we do not observe any fiscal transfer induced economic growth effects.

[8]Berlin is excluded due to its history in both subdivisions.

[9]Official Classification of labor market region types according to settlement structure by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR, Status 31.12.2015).

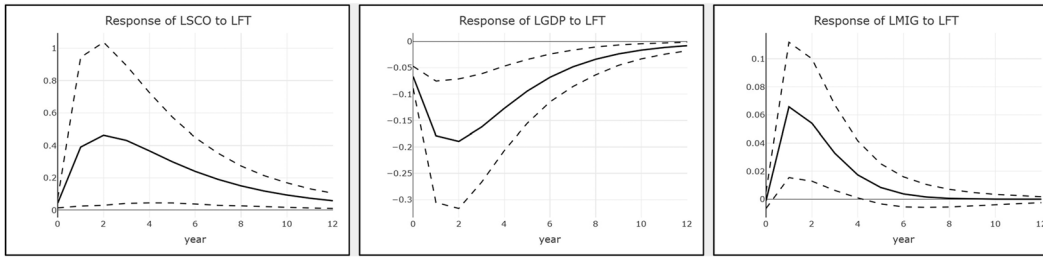

FIGURE 3 Selected impulse responses to isolated fiscal transfer shocks based on SpVar estimation with fiscal transfer inputs. Estimated impulse response functions are solid lines. Dashed lines represent 95% coefficient intervals from Monte Carlo simulations with 500 repetitions. IRFs display responses to orthogonal shocks in the amount of the standard deviations of the impulse variables. Responses are given in %. IRF, impulse-response functions; SpVAR, spatial vector autoregressive

Comparing the subsamples explained in Section 6, net migration responses to direct fiscal equalization are especially high in the eastern regions (**SEAST**), which have on average lower population density, are weaker in terms of regional economic situation and predominantly experience out-migration. The response is significant positive up to 9 years after the initial funding, while it is not significant in the West (**SWEST**; Figure 4).

In line with this, net-migration responds in particular positive in regions with low tax income (**STAXLOW**), which supports the hypothesis that especially regions with low tax income are able to improve their place utilities

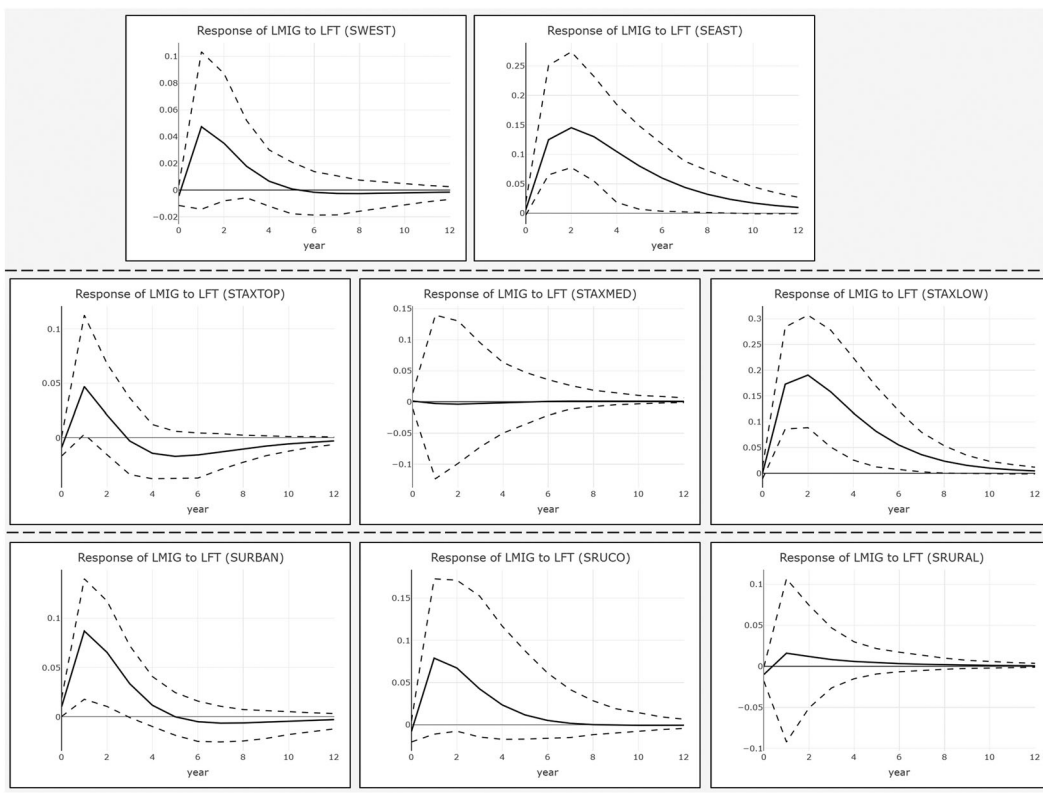

FIGURE 4 Response of net migration to fiscal transfers shocks in the defined subsamples. Specifications equal Figure 3. Estimated policy shocks are hold constant over subsamples

due to enhanced fiscal capacities. Considering settlement structures, significant positive effects of fiscal transfers on migration are only found for urban regions (**SURBAN**). Combining these findings, especially urban regions with low tax income can improve their attractiveness through fiscal transfers.

We conclude that these findings primarily result from decreasing out-migration from structurally weak regions due to reductions of local push factors. Equalization grants seem to encourage regions with below-average residential utilities to improve the quality of life and stabilize migration dynamics. As we found no evidence for labor market or income effects, improvements in the supply and quality of noneconomic local amenities seem to cause this effect. These results confirm the home-bias to be an important mechanism. Personal income opportunities are offset as long as local amenities do not fall below an individual threshold level.

Applying the SpVAR to the migration rates across age groups provides evidence that significant positive responses in the net migration rate persist for the groups LMIG25–29 and LMIG30–49. Responses of 18–24 years old are visible, but not significant in the total sample (Figure 5). Migration decisions of above 50 years old show no reaction to additional amenities created by equalization grants. Thus, H1, stating effects for all age groups is not confirmed. However, it might also be the case that effects for older people are not observed, because they rarely migrate anyhow. Detailed information for significant results in all subsamples and age subgroups are given in Table 3.

The results indicate that equalization grants are an adequate instrument to reduce disparities in perceived regional quality of life. The rate of young and middle-age persons that decide to stay in underperforming regions instead of searching for better conditions elsewhere can be increased by shifting financial resources to regions with low endogenous income. The above findings suggest that equalization transfers are able to stabilize the demographic balance of the affected regions to a certain point, although they do not appear to reduce economic inequalities. The reduced out-migration should result in increasing regional labor-supply and endogenous economic growth effects in the long run, if the additional population is linked to increasing human capital.

7.2 | Spatially indirect fiscal equalization effects

The results from the spatially indirect IRF estimation show that there is an explicit spatial aspect in the findings as we observe average negative responses of net migration to fiscal equalization shocks in neighboring regions.

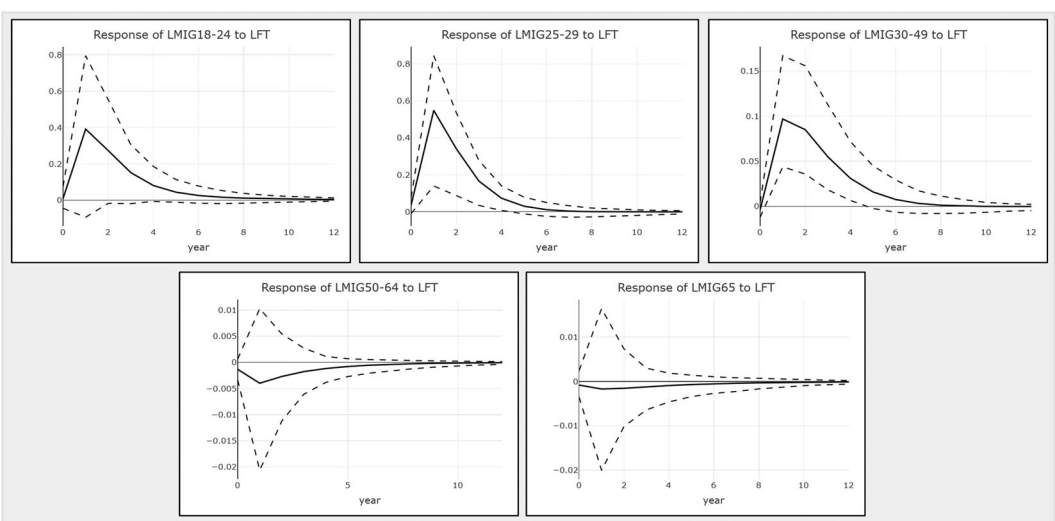

FIGURE 5 Responses of net migration in different age groups to fiscal transfer shock. Specifications equal Figure 3

TABLE 3 Summary of estimated responses of LMIG and its variations to policy input in the defined subsamples

Effect strength	Significant positive response (at least one-time point)	
Policy	**LFT**	**GRW**
Total sample	Total 25–29 30–49	–
SWEST	30–49	65+
SEAST	Total **18–24** **25–29** 30–49	50–64
STAXTOP	–	25–29
STAXMED	–	
STAXLOW	Total 18–24 **25–29** **30–49**	–
SURBAN	Total 25–29 30–49	–
SRUCO	30–49	25–29
SRURAL	–	Total 25–29 50–64

Notes: Numbers represent age groups. The displayed results are verified by robustness checks. Bold variations respond significant positive within the whole time period.

These responses are not significant for the complete sample but significant for West and East-German regions (Figure 6) as well as for rural and medium condensed areas and in particular for the age groups 18–24 and 25–29 overall regions. This shows that some of the migration bonus, especially concerning the age groups between 18 and 29, is rather short-distance migration at the expense of neighboring labor market regions. Interestingly, this is more the case for regions with a medium or strong economy. Economically weak regions that profit significantly from fiscal equalization, do not show spatial-spillover population losses to neighboring regions.

7.3 | GRW effects

In line with the respective Granger causality test (Table A1), we do not find significant effects of GRW funding on regional net migration rates (Figure 7). The impulse responses depicting the reactions of the various variables to direct GRW inputs are shown in Figures 7 and A3. The results indicate that GRW has a negative impact on regional tourism. This might be provoked by additional industry infrastructure that possibly affects the appeal of a region in a negative way. Furthermore, we detect a significant negative response of schools in the funding year. Both employment and GDP responses show an immediate negative nonsignificant reaction to GRW. The reaction of both variables turns into a positive response after a few years (significant in the case of employment), but total effects are not necessarily positive. However, GRW funding seems to improve the economic situation in the long-term.

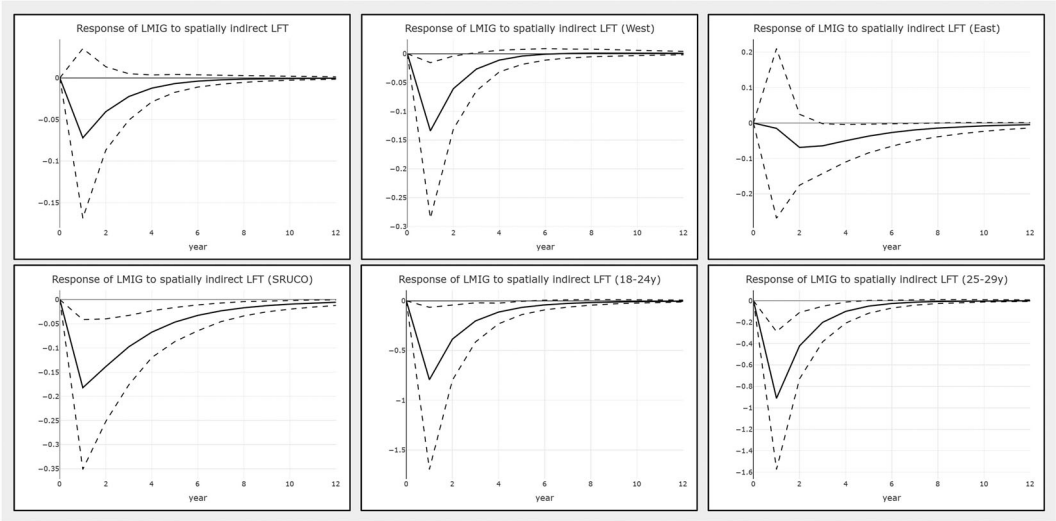

FIGURE 6 Selected spatially indirect impulse responses to isolated fiscal transfer shocks in neighboring regions based on SpVar estimations with fiscal transfer inputs. Note: Estimated impulse response functions are solid lines. Dashed lines represent 95% coefficient intervals from Monte Carlo simulations with 500 repetitions. IRFs display responses to orthogonal shocks in the amount of the standard deviations of the impulse variables. Responses are given in %. IRF, impulse-response functions; SpVAR, spatial vector autoregressive

The household income indicates no significant response to GRW as well as the net migration rate. This remains true for both GRW-industry and GRW-infrastructure scheme subsidies.

Further results do neither indicate significant responses of net migration rates to GRW funds in West—nor in East-German regions. Short-time significant effects appear in the year of funding in the subsample **STAXTOP**, but not in regions with lower tax income. Since only 5 out of 86 regions in the **STAXTOP** subsample received any GRW subsidies, results are built on small numbers. The significant positive response of net migration in rural regions

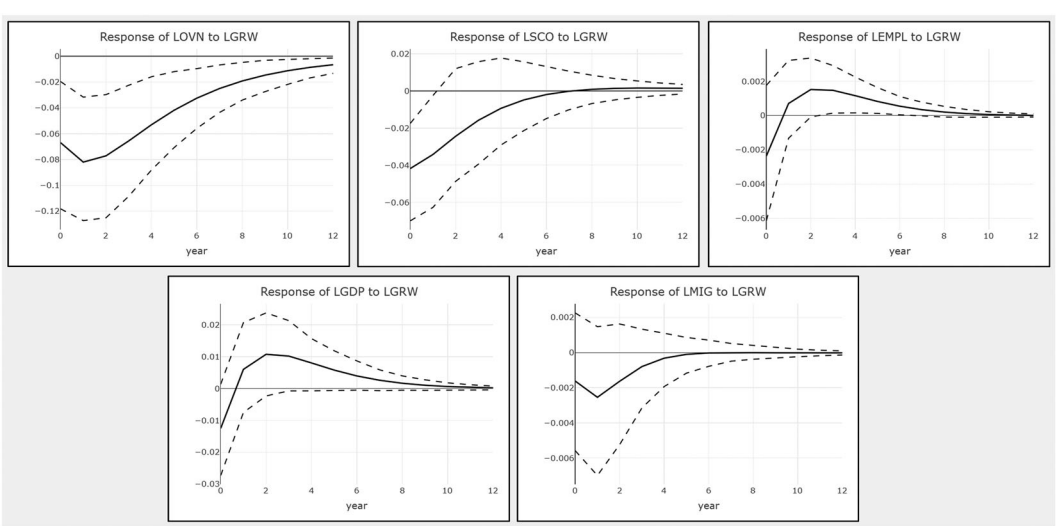

FIGURE 7 Selected impulse responses to isolated GRW shocks based on SpVar Estimation with GRW subsidies (LGRW). Specifications equal Figure 3

(**SRURAL**) up to 3 years after funding indicates that GRW has positive effects on living conditions in rural regions, although we find no evidence that this is accompanied by a significant GRW induced economic growth effects (Figure 8). This is accompanied by negative spatial-spillover effects on migration from spatially indirect shocks in neighboring regions, which suggests that the positive direct results in rural regions are driven by a small number of movers from neighboring regions.

A look into the age groups within different subsamples reveals positive responses to direct GRW funding for the age group 25–29 in the intersection of **STAXTOP, SRUCO**, and **SRURAL**. This proves the hypothesis H2 stating age group 25–29 to be most sensitive to GRW funding, probably due to the economic effects. Against this hypothesis, we observe slight positive short-time migration responses for the age group 50–64 in the East and in rural regions. This might be caused by supporting low-level jobs in these regions. Less explainable, significant effects for persons older than 65 years are found 1 year after funding in the western regions. Detailed information for significant effects on direct funding in all subsamples and age subgroups is again given in Table 3.

We can conclude that GRW funding has only small effects on regional living conditions as there is no significant response in the total sample and only a few significant responses in specific subsamples. Present effects are found mainly for regions with high tax income and for rural regions, which indicates differing mechanisms between GRW and equalization grants. In addition, we do not find any evidence for spatial-spillover effects on migration due to GRW shocks in neighboring regions.

In summary, GRW does not satisfy the equity criterion of funding, as migration rates do not show any measurable improvements in the regional utility function in regions with low endogenous capabilities.

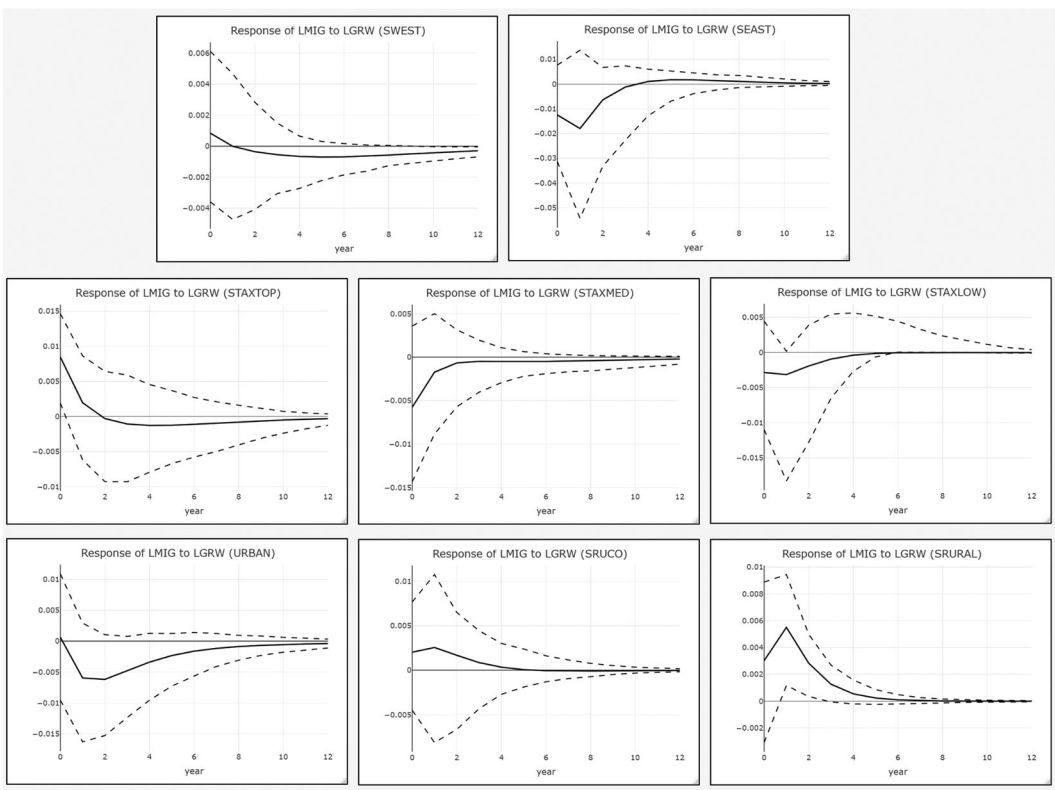

FIGURE 8 Response of net migration to GRW subsidy shocks in the defined subsamples. Specifications equal Figure 7. Estimated policy shocks are hold constant over subsamples

8 | CONCLUSIONS

The central aim of this paper is to investigate whether regional redistribution policies are able to contribute to the decline of regional inequalities and improve the quality of life in supported regions. A further aim is to examine whether different policy measures have different effects. Variations in regional net migration rates are used as an indicator for the development of regional living conditions. Germany is an adequate study object because it applies to two large and quite different regional redistribution policies. Indeed, the results from our SpVAR-model point to very different effects of fiscal equalization and structural GRW funding in Germany. Given their different aims, this is not surprising, but the detailed differences in their effects on the migration rates have not been studied before. This provides insights beyond the German case on how redistribution policies should be designed to change the regional quality of life and the resulting migration flows.

First, we find empirical evidence that the German fiscal equalization scheme is an appropriate and effective policy to enhance regional quality of life in supported regions, since it is able to significantly improve migration development in particular in regions with low endogenous fiscal capacities and for all age groups up to 50-year-old persons. Especially labor market regions with small tax incomes that predominantly experience outward migration and are structurally lagging behind seem to benefit from the additional financial capabilities. As no evidence for substantial economic growth is found, we conclude that the higher degree of financial freedom allows to enhance or maintain supply and quality of public infrastructure, public goods and further cultural amenities financed by the municipal budget. This results in enhancements in the individual's regional utility function and hampers outward migration from structurally weak regions. However, part of this effect, especially in the case of younger people, seems to be rather local, influencing the migration between neighboring regions.

Second, we find no evidence for an overall impact on migration rates of GRW policy. In contrast to fiscal equalization grants, some positive effects on migration are found in rural regions and regions with higher endogenous tax revenues. We find no evidence that GRW funding increases regional equity in the form of improving quality of life in poor regions. Taking into account all findings, both examined policy measures contribute to quality of life in a specific way. Fiscal equalization seems to have no short- or medium-run economic effects, but is quite effective in regions with low fiscal income to improve living conditions, especially in urban areas. In contrast, GRW funding rather affects the economy and is most effective in rural regions with comparably high fiscal income.

It seems likely that the basic insights of our study apply also to other countries, especially other developed countries as well as in the European context. Hence, the obtained knowledge can be helpful also for the European Structural and Cohesion Policy. If the reduction of migration flows is the main aim, fiscal transfers seem to be most adequate, especially for very poor and rather urban regions. However, they do not improve the economic situation—so that permanent transfers might be necessary—and seem to address to some extent the short-distance migration. Economic orientated policies, such as the GRW funds, seem to be effective only in regions with some economic strength and in the very rural regions and seem to have, on average, much lower effects on migration.

The conducted analysis can be easily applied to further place-based policies. For instance, we did not find any empirical evidence for significant effects on migration rates for the German Federal Urban Development Program in any of the presented subsamples. Beyond that, it would be interesting to apply our approach to the EU structural cohesion funds or to similar policies in other countries. Since our model has some limitations in terms of selection and availability of appropriate indicators displaying noneconomic amenities, future research can refer to these findings and attain a more detailed look into the actual transmission paths and the underlying mechanisms.

ACKNOWLEDGMENT

The authors gratefully thank the VolkswagenStiftung for funding their project (grant number: 89 472).

ORCID

Sven Wardenburg http://orcid.org/0000-0002-1486-6177

REFERENCES

Albouy (2012). Evaluating the efficiency and equity of federal fiscal equalization. *Journal of Public Economics*, *96*, 824–839.

Alecke, B., Mitze, T., & Untiedt, G. (2013). Growth effects of regional policy in Germany: Results from a spatially augmented multiplicative interaction model. *The Annals of Regional Science*, *50*, 535–554. https://doi.org/10.1007/s00168-012-0503-7

Arntz, M. (2010). What attracts human capital? Understanding the skill composition of interregional job matches in Germany. *Regional Studies*, *44*, 423–441. https://doi.org/10.1080/00343400802663532

Baldwin, R., Forslid, R., Martin, P., Ottaviano, G., & Robert-Nicoud, F. (2005). *Economic Geography and Public Policy*. Princeton: Princeton University Press.

Beenstock, M., & Felsenstein, D. (2007). Spatial vector autoregressions. *Spatial Economic Analysis*, *2*, 167–196. https://doi.org/10.1080/17421770701346689

Bernanke, B.S. (1986). Alternative Explanations of the Money-Income Correlation, *Carnegie-Rochester Conference Series on Public Policy*, 25, 49-99.

Biagi, B., Faggian, A., & McCann, P. (2011). Long and short distance migration in Italy: The role of economic, social and environmental characteristics. *Spatial Economic Analysis*, *6*, 111–131. https://doi.org/10.1080/17421772.2010.540035

Blöchliger, H., & Charbit, C. (2008). Fiscal equalization. *OECD Economic Studies*, *44*, 1–22. https://doi.org/10.1787/19952856

Borjas, G. J., Bronars, S. G., & Trejo, S. J. (1992). Self-selection and internal migration in the United States. *Journal of Urban Economics*, *32*, 159–185.

Brachert, M., Dettmann, E., & Titze, M. (2019). The regional effects of a place-based policy—Causal evidence from Germany. *Regional Science and Urban Economics*, *79*, 79. https://doi.org/10.1016/j.regsciurbeco.2019.103483

Brückner, Y., & Böhm-Kasper, C. (2010). Finanzierung des allgemeinbildenden Schulwesens. In H. Barz (Ed.), *Handbuch Bildungsfinanzierung* (pp. 201–212). Wiesbaden: Springer Fachmedien.

Buchanan, J. M. (1950). Federalism and fiscal equity. *American Economic Review*, *40*, 583–599.

Buchanan, J. M., & Wagner, R. E. (1970). An efficiency basis for federal fiscal equalization. In J. Margolis (Ed.), *The Analysis of Public Output*. New York: Columbia University Press.

Bundesregierung (1969). Gesetz über die Gemeinschaftsaufgabe "Verbesserung der regionalen Wirtschaftsstruktur" vom 6. Oktober 1969. In Bundesgesetzblatt Teil I (pp. 1861–1863). Bonn.

Cebula, R., & Vedder, R. (1973). A note on migration, economic opportunity and the quality of life. *Journal of Regional Science*, *13*, 205–211.

Dettmann, E., Titze, M., & Weyh, A. (2017). Who Benefits from GRW? Heterogeneous Employment Effects of Investment Subsidies in Saxony Anhalt. Halle: Leipniz-Institut für Wirtschaftsforschung Halle. (IWH Discussion Papers, 27/2017).

Deutscher Bundestag. (2014). *Koordinierungsrahmen der Gemeinschaftsaufgabe „Verbesserung der regionalen Wirtschaftsstruktur" ab 1. Juli 2014*. In Deutscher Bundestag 18. Wahlperiode, *Drucksache 18/2200*. Berlin

Di Giacinto, V. (2010). On vector autoregressive modelling in space and time. *Journal of Geographical Systems*, *12*, 125–154. https://doi.org/10.1007/s10109-010-0116-6

Dijkstra, L., Poelman, H., & Rodríguez-Pose, A. (2019). The geography of EU discontent. *Regional Studies*, *54*, 737–753. https://doi.org/10.1080/00343404.2019.1654603

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for granger non-causality in heterogenous panels. *Economic Modelling*, *29*, 1450–1460. https://doi.org/10.1016/j.econmod.2012.02.014

Eberle, J. (2019). Regional fiscal equalization in Germany—A simultaneous equation approach to assess the economic effects of fiscal policy. *Working Papers on Innovation and Space*. Marburg: Geography Department, Philipps-University Marburg.

Eberle, J., Brenner, T., & Mitze, T. (2019). A look behind the curtain: Measuring the complex economic effects of regional structural funds in Germany. *Papers in Regional Science*, *98*, 701–735. https://doi.org/10.1111/pirs.12373

Egger, P., Eggert, W., & Larch, M. (2014). Structural operation and net migration across european union member countries. *Review of International Economics*, *22*, 352–378. https://doi.org/10.1111/roie.12112

Faggian, A., Olfert, M., & Partridge, M. (2012). Inferring regional well-being from individual revealed preferences: The voting with your feet approach. *Cambridge Journal of Regions, Economy and Society*, *5*, 163–180. https://doi.org/10.1093/cjres/rsr016

Feldstein, M. (1970). Comment on an efficiency basis for federal fiscal equalization. In J. Margolis (Ed.), *The Analysis of Public Output*. New York: Columbia University Press.

Glaeser, E., & Gottlieb, J. (2008). The economics of place-making policies. *Brookings Papers on Economic Activity*, *39*, 155–253.

Gottlieb, P. (1995). Residential amenities, firm location and economic development. *Urban Studies*, *32*, 1413–1436.

Granato, N., Haas, A., Hamann, S., & Niebuhr, A. (2015). The impact of skill-specific migration on regional unemployment disparities in Germany. *Journal of Regional Science*, *55*, 513–539. https://doi.org/10.1111/jors.12178

Greenwood, M. J. (1975). Research on internal migration in the United States: A survey. *Journal of Economic Literature*, *13*, 397–433.

Greenwood, M. J. (1985). Human Migration: Theory, models and empirical studies. *Journal of Regional Science*, *25*, 521–544.

Haug, S. (1998). Migration networks and migration decision making. *Journal of Ethnic and Migration Studies*, *34*, 587–605.

Heise, S., & Porzio, T. (2019). *Spatial Wage Gaps and Frictional Labor Markets. (Staff Report No. 898)*. New York: Federal Reserve Bank of New York.

Henkel, M., Seidel, T., & Suedekum, J. (2019). *Fiscal Transfers in the Spatial Economy. (DICE Discussion Paper No. 322)*. Düsseldorf: Düsseldorf Institute for Competition Economics.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector autoregressions with panel data. *Econometrica*, *56*(6), 1371–1395.

Hunt, G. L., & Mueller, R. E. (2004). North American migration: Returns to skill, border effects and mobility costs. *The Review of Economics and Statistics*, *86*, 988–1007.

Iammarino, S., Rodrguez-Pose, A., & Storper, M. (2019). Regional inequality in Europe: Evidence, theory, and policy implications. *Journal of Economic Geography*, *19*, 273–298.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, *115*, 53–74.

Kanbur, R., & Rapoport, H. (2005). Migration selectivity and the evolution of spatial inequality. *Journal of Economic Geography*, *5*, 43–57.

Kline, P., & Moretti, E. (2014). Local economic development, agglomeration economies, and the Big Push: 100 Years of evidence from the Tennessee Valley Authority. *Quarterly Journal of Economics*, *128*, 275–331.

Lehmann, I., & Wrede, M. (2019). The Bavarian Municipal Fiscal Equalization Scheme: Emphasis on equity rather than efficiency. *Finanz-Archiv*, *75*, 127–151.

Lenk, T., Hesse, M., & Lück, O. (2013). *Synoptische Darstellung der kommunalen Finanzausgleichssysteme der Länder aus finanzwissenschaftlicher Perspektive*. Leipzig: Studie im Auftrag des Landesrechnungshofs Mecklenburg-Vorpommern.

Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, *22*, 3–42.

Lütkepohl, H. (2005). *New introduction to multiple time series analysis*. Berlin: Springer.

Martin, P. (1999). Public policies, regional inequalities and growth. *Journal of Public Economics*, *73*, 85–105.

Mitze, T., Schmidt, T. D., Rauhut, D., & Kangasharju, A. (2018). Ageing shocks and short-run regional labour market dynamics in a spatial panel VAR approach. *Applied Economics*, *50*, 870–890. https://doi.org/10.1080/00036846.2017.1346360

Oakland, W. H. (1994). Fiscal equalization: An empty box? *National Tax Journal*, *47*, 199–209.

Partridge, M., Rickmann, D., Ali, K., & Olfert, M. (2008). Lost in space: Population growth in the American hinterlands and small cities. *Journal of Economic Geography*, *8*, 727–757.

Pieńkowski, J., & Berkowitz, P. (2016). Econometric assessments of cohesion policy growth effects: How to make them more relevant for policymakers? In J. Bachtler, P. Berkowitz, S. Hardy & T. Muravska (Eds.), *EU Cohesion Policy: Reassessing Performance and Direction* (pp. 55–68). Abingdon and New York: Routledge.

Rappaport, J. (2004). Why are population flows so persistent? *Journal of Urban Economics*, *56*, 554–580.

Rhoden, I. (2016). Econometric analysis of regional productivity convergence in Germany from 2000 to 2012. Bochum: Ruhr–Forschungsinstitut für Innovations– und Strukturpolitik e.V. (RUFIS) Nr. 2/2016, Universitätsverlag Brockmeyer.

Rickman, D. S. (2010). Modern macroeconomics and regional economic modeling. *Journal of Regional Science*, *50*, 23–41.

Rodriguez-Pose, A. (2018). The revenge of the places that don't matter (and what to do about it). *Cambridge Journal of Regions, Economy and Society*, *11*, 189–209. https://doi.org/10.1093/cjres/rsx024

Rodriguez-Pose, A., & Ketterer, D. (2012). Do local amenities affect the appeal of regions in europe for migrants? *Journal of Regional Science*, *52*, 535–561.

Romer, P. M. (1990). Endogenous technical change. *Journal of Political Economics*, *98*, 71–102.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, *48*, 1–48.

Storper, M. (2011). Justice, efficiency and economic geography: Should places help another to develop? *European Urban and Regional Studies*, *18*, 3–21. https://doi.org/10.1177/0969776410394553

Thomas (2013). The effect of EU accession on internal migration in Poland. *Studies in Comparative International Development*, *48*, 482–502. https://doi.org/10.1007/s12116-013-9141-z

von Ehrlich, M., & Seidel, T. (2015). *The persistent effects of place-based policy: Evidence from the West-German Zonenrandgebiet*. Munich: CESifo Group. (CESifo Working Paper No. 5373).

Wolpert, J. (1965). Behavorial aspects of the decision to migrate. *Papers in Regional Science*, *15*, 159–169.

Zukowska-Gagelmann, K. (2017). *Do EU Regional Funds Hamper or Foster Interregional Migration? A panel data analysis for Poland*. Lörrach: Cooperative State University Lörrach. (*DHBW Working & Discussion Paper* No. 2/2017).

How to cite this article: Wardenburg S, Brenner T. How to improve the quality of life in peripheral and lagging regions by policy measures? Examining the effects of two different policies in Germany. *J Regional Sci*. 2020;60:1047–1073. https://doi.org/10.1111/jors.12500

APPENDIX A

See Tables A1, A2, A3 and Figures A1, A2, A3, A4

TABLE A1 Results from panel granger causality test

Granger causes	LFT		*LGRW*		LUDP		LOVN		LSCO		LEMPL		LINC		LLAPR		LGDP		LMIG	
	Value	*p* value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value	Value	*p* Value
lft	x	x	–	–	–	–	5.647	.000	7.805	.000	12.25	.000	−2.70	.007	0.821	.411	−0.40	.689	6.666	.000
LGRW	–	–	x	x	–	–	1.679	.093	2.983	.003	4.114	.000	−0.36	.717	2.066	.039	−0.26	.788	1.309	.191
LUDP	–	–	–	–	x	x	6.102	.000	3.618	.000	8.631	.000	0.638	.524	2.545	.011	−1.53	.125	2.513	.012
lOVN	11.76	.000	7.962	.000	7.217	.000	x	x	11.16	.000	25.89	.000	0.054	.957	3.086	.002	2.259	.024	18.14	.000
lSCO	5.240	.000	3.079	.002	5.776	.000	16.42	.000	x	x	21.39	.000	2.808	.005	2.424	.015	5.93	.000	6.174	.000
lEMPL	1.614	.107	−1.39	.163	−1.18	.237	6.359	.000	9.565	.000	x	x	8.891	.000	0.555	.579	5.961	.000	19.31	.000
LINC	−0.02	.977	−2.34	.019	−1.38	.166	3.782	.000	4.304	.000	3.863	.000	x	x	0.773	.439	9.307	.000	7.561	.000
LLAPR	1.084	.279	1.889	.059	1.659	.097	4.348	.000	2.769	.006	5.994	.000	1.953	.051	x	x	1.135	.257	1.661	.096
LGDP	17.06	.000	12.39	.000	10.59	.000	25.41	.000	9.617	.000	29.73	.000	−4.89	.000	10.64	.000	x	x	10.29	.000
LMIG	1.139	.255	−1.32	.186	−0.54	.584	3.158	.002	2.441	.015	6.392	.000	3.301	.001	−6.85	.493	−1.41	.158	x	x

Notes: Granger causality test performed as given in Dumitrescu and Hurlin (2012). The test is performed for every region. Alternative hypothesis = Granger causality given for at least one region. In the cases of LFT, LGRW_IND, LGRW_INF, and LUDP, only regions that not equal zero are tested.

TABLE A2 Regression results of SpVar fixed effects panel model estimations with fiscal equalization grants and 1 year time lag

Dependent variables Regressors (t-1)	lft	LOVN	LSCO	lempll	linc	LLAPR	LGDP	lmig
lft	0.491*** (0.000)	−0.020* (0.012)	0.016* (0.015)	$-3.45e^{-4}$ (0.796)	0.001 (0.671)	−0.012 (0.581)	−0.009* (0.013)	0.005* (0.037)
lovn	0.001 (0.967)	0.758*** (0.000)	−0.037*** (0.000)	0.002 (0.282)	0.003 (0.097)	0.099** (0.001)	0.006 (0.254)	0.006** (0.091)
lsco	0.134** (0.001)	−0.027 (0.113)	0.727*** (0.000)	0.002 (0.557)	0.004 (0.088)	−0.045 (0.324)	0.005 (0.480)	0.010 (0.055)
lempl	0.249 (0.250)	−0.160 (0.080)	−0.193 (0.802)	0.524*** (0.000)	−0.007 (0.590)	0.230 (0.350)	−0.106* (0.010)	0.029 (0.279)
linc	−0.266 (0.296)	−0.031 (0.774)	0.010 (0.915)	0.115*** (0.000)	0.627*** (0.000)	0.263 0.361	0.061 (0.208)	0.145*** (0.000)
llapr	0.021 (0.160)	−0.003 (0.687)	−0.003 (0.528)	−0.001 (0.384)	−0.002 (0.101)	0.272*** (0.000)	−0.003 (0.270)	3.04^{e-6} (0.987)
lgdp	−0.607*** (0.000)	0.016 (0.597)	0.068** (0.008)	0.025*** (0.000)	−0.006 (0.191)	−0.226** (0.005)	0.657*** (0.000)	0.037*** (0.000)
lmig	−0.226 (0.098)	0.022 (0.703)	−0.004 (0.930)	0.005 (0.618)	−0.022** (0.009)	0.002 (0.988)	−0.080** (0.002)	0.374*** (0.000)
spl_ft	0.021 (0.481)	0.028* (0.026)	0.038*** (0.000)	0.003 (0.187)	−0.004* (0.047)	−0.030 (0.367)	0.004 (0.443)	−0.005* (0.149)
spl_ovn	−0.038 (0.407)	0.001 (0.966)	0.003 (0.833)	−0.004 (0.248)	0.001 (0.693)	−0.171*** (0.001)	−0.016 (0.064)	−0.003 (0.654)
spl_sco	0.071 (0.221)	−0.026 (0.292)	−0.038 (0.062)	−0.023*** (0.000)	−0.004 (0.325)	0.110 (0.092)	−0.019 (0.067)	−0.014* (0.045)
SPL_EMP	−0.574 (0.109)	−0.025 (0.870)	0.337** (0.008)	$-1.45e^{-4}$ (0.995)	0.019 (0.389)	0.224 (0.581)	0.014 (0.839)	−0.227*** (0.000)
spl_inc	0.403 (0.337)	0.145 (0.412)	0.378* (0.012)	−0.012 (0.676)	−0.168*** (0.000)	−0.243 (0.609)	−0.091 (0.253)	−0.001 (0.988)
spl_Lapr	0.057* (0.30)	0.028* (0.012)	−0.017 (0.072)	−0.007*** (0.000)	−0.004* (0.015)	0.194*** (0.000)	−0.012* (0.018)	−0.006 (0.057)
spl_gdp	−0.364** (0.005)	0.063 (0.256)	0.114* (0.014)	$-2.88e^{-4}$ (0.975)	−0.021* (0.012)	−0.549*** (0.000)	0.087*** (0.000)	2.34^{e-4} (0.989)
spl_mig	−0.446 (0.112)	0.038 (0.748)	0.067 (0.505)	0.027 (0.174)	−0.153*** (0.000)	−0.601 (0.058)	−0.043 (0.417)	−0.071* (0.042)
N	3598	3598	3598	3598	3598	3598	3598	3598
R^2	.428	.794	.714	.714	.596	.159	.944	.278

Notes: Number of regions = 257, *p* values are given in parentheses. Significance codes: ***$p < .001$, **$p < .01$, *$p < .05$.
Abbreviation: SpVAR, spatial vector autoregressive.

TABLE A3 Regression results of SpVar fixed effects panel model estimations with GRW subsidies and one year time lag

Dependent variables Regressors (t-1)	lft	LOVN	LSCO	lempll	linc	LLAPR	LGDP	lmig
lGRW	0.491***	−0.002**	0.001	$1.84e^{-4}$	$5.87e^{-5}$	$-3.28e^{-4}$	0.001**	$-1.30e^{-4}$
	(0.000)	(0.001)	(0.265)	(0.075)	(0.521)	(0.843)	(0.008)	(0.477)
lovn	−0.226	0.759***	−0.038***	0.002	0.003	0.100**	0.008	0.005**
	(0.440)	(0.000)	(0.000)	(0.212)	(0.109)	(0.001)	(0.134)	(0.143)
lsco	−0.325	−0.037*	0.732***	0.002	0.005	−0.048	0.002	0.012*
	(0.448)	(0.031)	(0.000)	(0.582)	(0.064)	(0.291)	(0.744)	(0.021)
lempl	1.946	−0.151	−0.030	0.524***	−0.007	0.231	−0.106**	0.029
	(0.401)	(0.098)	(0.701)	(0.000)	(0.598)	(0.348)	(0.010)	(0.281)
linc	2.570	−0.021	0.020	0.113***	0.626***	0.261	0.059	0.145***
	(0.345)	(0.843)	(0.823)	(0.000)	(0.000)	0.365	(0.218)	(0.000)
llapr	−0.358*	−0.002	−0.002	−0.001	−0.002	0.270***	−0.003	$-2.53e^{-5}$
	(0.023)	(0.785)	(0.680)	(0.443)	(0.078)	(0.000)	(0.259)	(0.989)
lgdp	−2.365**	0.033	0.044	0.025***	−0.006	−0.207**	0.670***	0.031***
	(0.001)	(0.250)	(0.069)	(0.000)	(0.155)	(0.007)	(0.000)	(0.000)
lmig	−0.857	0.024	−0.015	0.005	−0.022*	0.003	−0.080**	0.375***
	(0.557)	(0.675)	(0.763)	(0.641)	(0.011)	(0.983)	(0.002)	(0.000)
spl_GRW	0.068	−0.001	−0.001	$2.418e^{-4}$	$9.06e^{-6}$	−0.006*	$-1.27e^{-4}$	$2.01e^{-4}$
	(0.002)	(0.465)	(0.329)	(0.095)	(0.943)	(0.015)	(0.743)	(0.431)
spl_ovn	−0.057	−0.011	−0.011	0.004	0.002	−0.185***	−0.016	−0.001
	(0.907)	(0.582)	(0.501)	(0.193)	(0.460)	(0.000)	(0.059)	(0.901)
spl_sco	0.671	−0.012	−0.020	−0.021***	−0.005	0.090	−0.019	−0.017*
	(0.262)	(0.603)	(0.319)	(0.000)	(0.126)	(0.157)	(0.079)	(0.017)
SPL_EMP	−7.695*	−0.082	0.249	$-4.349e^{-5}$	0.025	0.236	0.023	−0.226***
	(0.043)	(0.584)	(0.051)	(0.999)	(0.255)	(0.559)	(0.731)	(0.000)
spl_inc	0.038	0.154	0.424**	−0.012	−0.170***	−0.254	−0.094	$-1.99e^{-4}$
	(0.993)	(0.385)	(0.005)	(0.698)	(0.000)	(0.593)	(0.235)	(0.997)
spl_Lapr	0.446*	0.027*	−0.011	−0.007***	−0.004*	0.192***	−0.012*	−0.006
	(0.101)	(0.015)	(0.229)	(0.000)	(0.010)**	(0.000)	(0.015)	(0.058)
spl_gdp	−1.815	0.021	0.056	−0.003	−0.015*	−0.514***	0.083***	0.006
	(0.173)	(0.61)	(0.213)	(0.699)	(0.049)	(0.000)	(0.000)	(0.644)
spl_mig	−6.019*	0.028	0.018	0.025	−0.151***	−0.558	−0.036	−0.071*
	(0.044)	(0.814)	(0.858)	(0.205)	(0.000)	(0.078)	(0.490)	(0.040)
N	3598	3598	3598	3598	3598	3598	3598	3598
R^2	.259	.794	.711	.714	.596	.160	.944	.278

Notes: Number of regions = 257, *p* values are given in parentheses. Significance codes: ***$p < .001$, **$p < .01$, *$p < .05$. Abbreviation: SpVAR, spatial vector autoregressive.

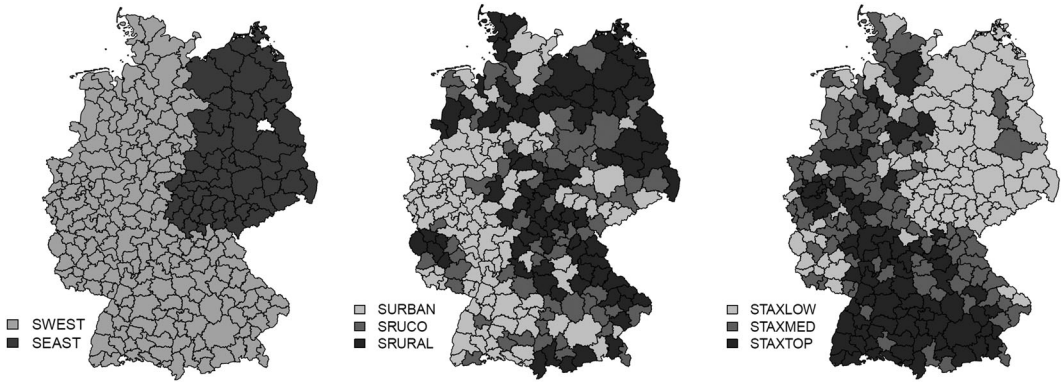

FIGURE A1 Regional subsamples used for the region-specific SpVAR analyses. SpVAR, spatial vector autoregressive

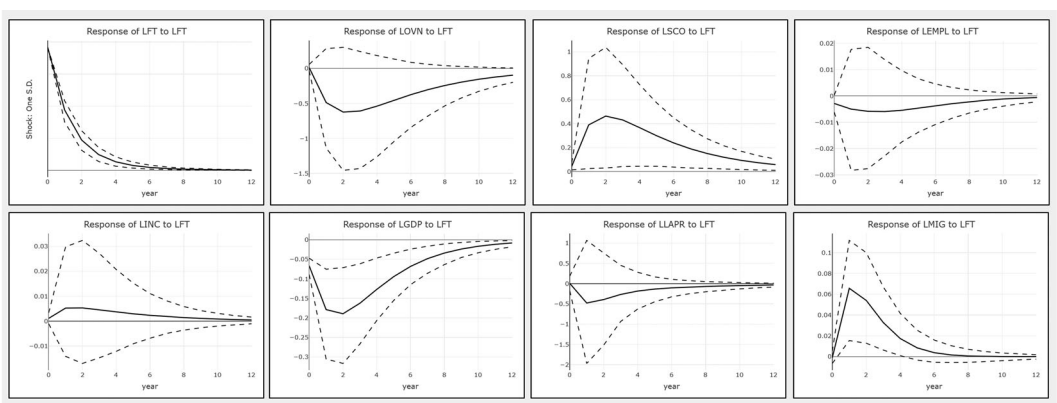

FIGURE A2 Full impulse responses to isolated fiscal transfer shocks based on SpVar estimation with fiscal transfer inputs in total subsample. Estimated impulse response functions are solid lines. Dashed lines represent 95% coefficient intervals from Monte Carlo Simulations with 500 repetitions. IRFs display responses to a shock = standard deviation of impulse variables. Responses are given in %. IRF, impulse-response functions; SpVAR, spatial vector autoregressive

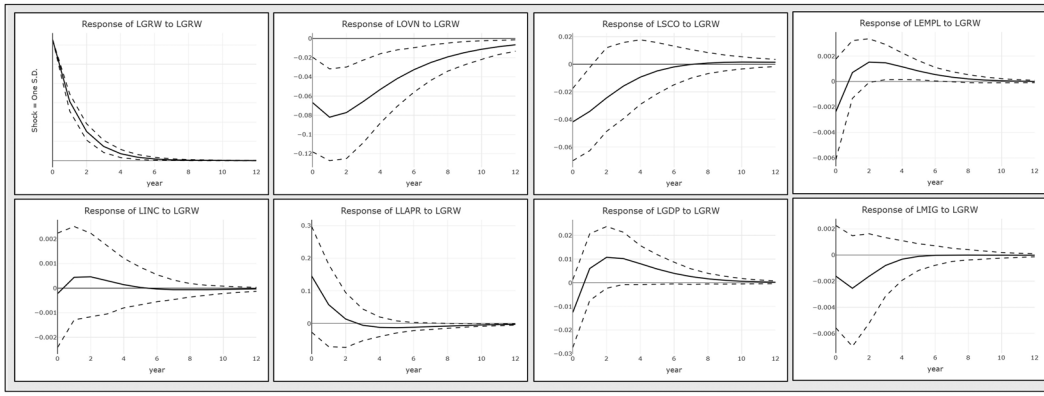

FIGURE A3 Full impulse responses to isolated GRW shocks based on SpVar estimation with GRW inputs in total subsample. Estimated impulse response functions are solid lines. Dashed lines represent 95% coefficient intervals from Monte Carlo Simulations with 500 repetitions. IRFs display responses to a shock = standard deviation of impulse variables. Responses are given in %. IRF, impulse-response functions; SpVAR, spatial vector autoregressive

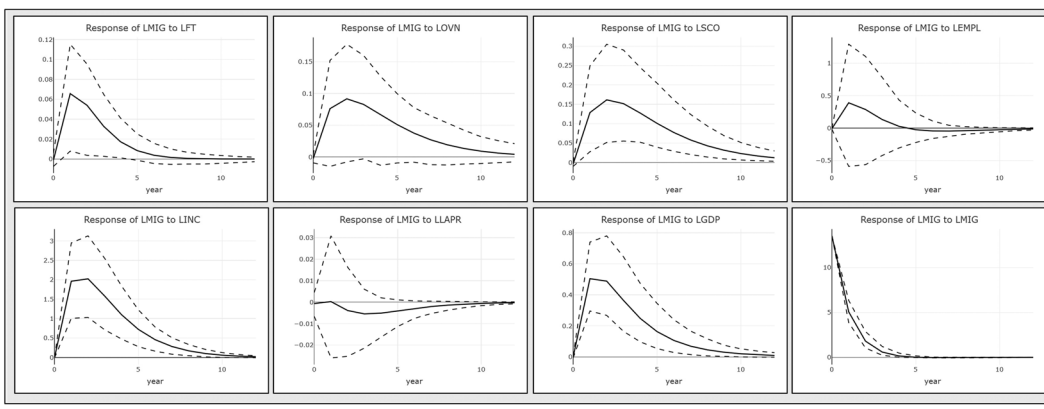

FIGURE A4 Full impulse responses to isolated variable shocks on regional net migration rates based on SpVar estimation with fiscal transfer inputs in total subsample. Estimated impulse response functions are solid lines. Dashed lines represent 95% coefficient intervals from Monte Carlo Simulations with 500 repetitions. IRFs display responses to a shock = standard deviation of impulse variables. Responses are given in %. IRF, impulse-response functions; SpVAR, spatial vector autoregressive