Land Use Policy 77 (2018) 126–134

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Region-specific budgeting of rural development funds—An application study

Ewa Kiryluk-Dryjska*, Patrycja Beba

Faculty of Economics and Social Sciences, Poznań University of Life Sciences, 28 Wojska Polskiego St., 60-637, Poznań, Poland

ARTICLE INFO

Keywords:
Rural development
Regions
Budget

ABSTRACT

We propose a method for region-specific budgeting of European Union rural development funds, based on objectively measured indexes of rural development. The indexes are calculated based on statistical data with the use of factor analysis. Next, they are implemented in a linear programming model in order to allocate the given rural development budget. The results demonstrate that the proposed approach allocates the funds according to an assumed logic that supports the weaker and underdeveloped regions and features of agriculture. However, it can be also used as a discussion tool for allocation taking into account different assumptions.

1. Introduction

In Poland, rural areas represent about 90% of the country's total area, engaging about 38% of total workforce. About 10% of Poles work directly in agriculture, producing 2,3% of the national GDP. Although productivity indexes of Polish agriculture have recently increased, agriculture sector and rural areas in Poland are still underinvested compared to the western UE countries.

One of the ways of ameliorating the situation in rural areas in Poland is to improve the effective allocation of the funds coming from the EU. For each budget period of the EU, member states are entitled to submit their structural rural-development programs to the European Agricultural Fund for Rural Development (EAFRD). The programs are prepared based on the EU's strategic guidelines that offer a range of possible policy measures to be implemented. The government of each member country selects the key political programs (measures) to support national or regional development plans.

Poland has benefited substantially from the structural programs since its accession to the European Union in 2004. The budget of the rural development program, financed from the II Pillar of the CAP, in Poland, exceeded 35 billion Euros for years 2004–2020, with over 13.5 billion Euros budgeted for the current Polish Rural Development Program (PRDP, 2014–2020) [1]. PRDP (2014–2020), co-financed by the EU, is the fourth program designed to support rural areas and agriculture in Poland. It was established by the Ministry of Agriculture and Rural Development (MARD), based on the EU Council Regulation No 1305/2013. It comprises a number political programs designed for different groups of beneficiaries, with a special emphasis on the three main priorities: increasing the competitiveness of Polish agriculture, providing sustainable management of natural resources, and ensuring sustainable regional development of rural development.

The effective allocation of these funds is of crucial importance, as it has a significant impact on the state, as well as the future structure and competitiveness of agriculture and rural areas. However, the multi-objectivity of the program and the diversity of proposed measures makes the budgeting of the program very complex. Moreover, the allocation decisions are complicated by the lack of commonly accepted indexes to measure policy effects. Thus, the emerging question is how to provide the best support for country-level decision makers to set the priorities and allocate structural budgets in a way that diminishes conflicts of interest among stakeholders. Candler et al. (1981) emphasize that political problems are usually characterized by the multitude of different aims which decision-makers want to achieve and limited resources. Thus, in order to support decision-making, formal and objective allocation rules are needed.

In current literature, there are attempts to conceptualize this issue based on different public choice criteria. Kiryluk-Dryjska (2014a) emphasizing the criterion of fairness, presents how fair division procedures can be applied to budget allocation. She proves that these approaches enhance beneficiaries' acceptance of the programs and diminish conflict among stakeholders.

Another possible way to address this problem is to use Multiple Criteria Decision Analysis (MCDA). MCDA provides insights into the problem structure, explores trade-offs, and provides a set of Pareto-efficient solutions. In politics, MCDA can be used to rationalize the decision-making and reduce conflicts among stakeholders (Matsatsinis

* Corresponding author.
E-mail addresses: kiryluk-dryjska@up.poznan.pl (E. Kiryluk-Dryjska), beba@up.poznan.pl (P. Beba).

[1] The Polish agricultural sector as well as rural areas benefit also from Pillar I funds and other structural EU funds. However, because of separate budgets of these programs, in this paper we concentrate on Rural Development Program financed from the II pillar of the CAP.

https://doi.org/10.1016/j.landusepol.2018.05.029
Received 30 January 2018; Received in revised form 3 April 2018; Accepted 12 May 2018

and Samaras, 2001).

The concept was introduced by Tinbergen (1952) and further developed by Chiang (1984). Since, a dynamic development of computer models designed to solve policy problems has taken place (Ruiz Estrada and Fei Yap, 2013). However, the attempts of their practical application in the public sector are still limited (Dyer et al., 1992 and Matsatsinis and Samaras, 2001). Thus, there is a continuing need for possible applications and case studies.

Dyer et al. (1992) presents the usefulness of multiple objective models to improve the efficiency of the public sector in Finland. The application of multi-criteria optimization to solve the public sector problems concerning the access to natural resources is presented by Tecle et al. (1998), Bell et al. (2001), Kangas et al. (2001), Bojorquezi et al. (2005), De Agostini (2006) and Stewart et al. (2010). Kim (2008) considers the efficiency of the method to analyze the budgetary process in Porto Alegre in Brazil. To support the budgeting of structural policies, Kirschke and Jechlitschka (2002, 2003) propose linear interactive parametric programming. Schmid et al. (2010) demonstrate a real life example of its use to model the allocation of European Agricultural Fund for Rural Development funds in Saxony-Anhalt.

Attempts of a practical implementation of linear programming for structural policy in Poland have been made by Zawalińska (2005) and Kiryluk-Dryjska (2014b), who propose a country level budgeting. However, while rural areas and agriculture in Poland are strongly regionally differentiated in terms of natural, economic, socio-cultural or technical conditions (Bański et al., 2009; Rosner, 2010; Poczta and Bartkowiak, 2012; Wilkin, 2012; Stanny, 2013), it seems that allocative decision-making should take into account these specific features.

The importance of enhancing regional aspects in rural development policy has also been expressed in PRDP (2014–2020), where 'ensuring sustainable regional development of rural areas' remains a key objective.

Attempts to consider regional differentiation in budget modelling were undertaken by Wegener and Kiryluk (2008). The importance of political programs was based on assessments by the Program's beneficiaries in these studies. While this approach may simplify the budget allocation, it requires a representative sample of beneficiaries in different regions attained by survey, which can be costly and time consuming. Moreover, the beneficiaries' assessments remain subjective.

In this paper, we propose an algorithm for region-specific budgeting of rural development funds, based on objectively measured indexes of rural development. The indexes are calculated based on statistical data with the use of factor analysis. Next, they are implemented in a linear programming model that allocates a given rural development budget. Our method differs from the previous approaches by its regional scope of the study and by using objective metrics of the program's political importance.

The outline of the paper is as follows. First, a general methodological framework for the proposed budget-allocation procedure is provided. Next, the method is applied to a practical structural policy budget allocation problem involving the EU's rural development program in Poland (PRDP for years 2014–2020). Finally, we conclude with a discussion of potential limitations and practical problems that may arise in the application of the procedure.

2. Material and methods

In order to construct regional budgets, several steps need to be undertaken. First, regions need to be designated. It is advisable that the regions are delimitated based on the European Classification of Territorial Units for Statistics (NUTS). This standard is developed and regulated by Eurostat in agreement with each member state and it remains instrumental in the European Union's Structural Fund delivery mechanisms. However, the delimitation can also be based also on the literature concerning regional differentiation of agriculture and calculations based on statistical data.

Next, the data concerning agriculture and rural areas need to be gathered for the entire country as well as for each of the selected regions, at the lowest possible level of aggregation. It is important that the data include a wide range of indexes covering all possible dimensions of regional differentiation of agriculture and rural areas (such as economic, socio-cultural, or technical indexes).

In the following step, based on gathered indexes, the main features of agriculture and rural areas at the country level are determined. For this purpose, we propose factor analysis - a useful tool for investigating variable relationships of complex concepts that are not easily measured directly - which collapses a large number of variables into a smaller number of interpretable factors. The number of factors and the amount of the overall variance explained by the factors is determined by their eigenvalues. Factor score is a composite measure created for each observation of each factor extracted in the factor analysis. The factor weights are used in conjunction with the original variable values to calculate a score for each observation.

In our approach, we construct the main features describing agriculture and rural areas at the country level and observe their average factor scores in each region. We assume that averaged factor scores for the regions can be used as indicators of the differences in regional development of agriculture and rural areas. The factor scores are standardized to reflect a z-score. Thus, factor scores for the whole country sum up to zero, while factor scores for individual regions differ, reflecting the relative differences in the main features of agriculture and rural areas. Simply, the negative values of average regional scores for a given factor suggest that this factor (feature) is underdeveloped in the region. Conversely, positive values indicate that the factor (feature) is better developed than on average in Poland.

We assume that: the lower the level of development of certain factor (features) in the region; the higher the financing that should shall be devoted to the political programs positively influencing this factor in analyzed area. Conversely, if a factor (feature) is already well developed it does not need to be stimulated by higher level of financing. According to this assumption, regional average factor scores are used to build objective function coefficients for the linear optimization model.

The national or regional RDP consist of a certain number of political programs (measures) chosen by the member states. The next step of the procedure requires definition of the political programs chosen by a country that positively influence the factor analysis-extracted features of agriculture and rural areas. The linear optimization model is built based on the results of this procedure as well as on previously calculated factor scores for the regions.

The model is constructed under the assumption that *sustainable regional development of rural areas* is the central goal of the rural development policy. The question that the proposed linear optimization approach can solve is: how can the budget be allocated to different measures of RDP in selected regions, assuming that the less developed features of agriculture require more support?

Following Kirschke and Jechlitschka (2003), and assuming constant marginal and average coefficients, the linear objective function can be defined as:

$$\max_{B_1,\ldots B_n} Z = \sum_{i=1}^{n} z_i * B_i$$

with: Z objective (sustainable regional development of rural areas)

B_i budgetary expenses for a measure i

$i = 1, \ldots, n$ index of considered measures

z_I constant marginal and average coefficient of the objective function

subject to: $\sum_{i=1}^{n} a_{ri} \cdot B_i \begin{Bmatrix} \leq \\ = \\ \geq \end{Bmatrix} b_r$ for r = 1, …, m and $B_i \geq 0$ for i = 1, …, n where: r = 1, …, m is the index of restrictions (equations or inequations)

a_{ri} is the coefficient of restriction r for measure i

b_r is the value of restriction r.