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## **ADDITIONALITY OF STATE AID FOR RESEARCH, DEVELOPMENT AND INNOVATION**

The aim of this paper is to investigate how EU state aid policy addresses the problem of the additionality of state aid for research, development and innovation. The methods used include a literature review of both theoretical and practical studies and document analysis.

The formalistic approach taken in the majority of cases in the ex-ante state aid control requires further studies on the actual effects of implemented state aid measures. A variety of methods have been developed to identify the causal impact of aid and to address the problem of selection bias properly. Recent studies largely apply propensity score matching and strive to identify different types of additionality as well as the relationships between them, acknowledging that behavioural additionality plays a critical role in understanding the long-term impact of public interventions.

**Keywords:** state aid, research, development and innovation policy, evaluation

### **1. INTRODUCTION**

Promoting research, development and innovation (RDI) is high on the political agenda at both the national and the EU level. The Europe 2020 Strategy identifies research and development as a key contribution towards objectives of smart, sustainable and inclusive growth. Gross domestic expenditure on R&D (% of GDP) is a headline Europe 2020 Strategy indicator. The target level is 3% of GDP to be invested in the research and development activity by the year 2020. The most challenging task, however, consists of stimulating business R&D investment (both individual and cooperative) in the wake of public intervention and improving the

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contribution of R&D investment to the final output – new products or processes that improve competitiveness and foster growth. The major concern is about the effective use of public resources. Therefore, policy makers need to understand the very nature of the innovation process so that they are capable of formulating relevant policies to achieve economic and social benefit and choose the appropriate policy tools to that end. They must adapt to new advances in innovation theory, grasp a broad set of assumptions regarding the factors that influence the sources, rate and direction of innovation, that, in turn, must be based on credible evidence of effects of the implementation of various public policy instruments to foster RDI, or in simple words, evidence of ‘what works’.

The paper addresses the problem of so-called ‘additionality’ of public support to business RDI confined to the form of state aid. Its objective is to ascertain whether EU state aid control places enough emphasis on the added value of aid. The issue is all the more crucial since the EU state aid policy was in recent years subject to significant modernization to encourage more focused and of a higher quality aid. This implies, *inter alia*, that state aid must have a real incentive effect and therefore foster growth; it should not crowd out private investment, keep inefficient and nonviable companies on indefinite life support and generally waste tax payers’ money [23].

The article follows four lines of inquiry. First, it deals with state aid as a public policy tool to foster innovation, explains its rationale and admissibility criteria. Secondly, it analyses the relevant EU rules and practice, in particular, concerning the requirements for the demonstration of the incentive effect and the proportionality of aid in order to identify the EU preconditions for state aid for research, development and innovation. These, in turn, impose relevant evaluation questions in assessments carried out at the EU and national level. The need for *ex post* impact evaluation, the methodological problems with measuring the added value of the public intervention constitute the third line of inquiry. Finally, the paper reviews evaluation studies on the additionality effect of state aid for research, development and innovation, in order to find evidence of different types of additionality and possible links between them. The methods used are: a literature review of both theoretical and practical studies, document analysis, in particular EU regulations and working papers, and a critical review of methods used for evaluation of state aid for research, development and innovation.

## **2. STATE AID AS A PUBLIC POLICY TOOL TO FOSTER INNOVATION**

The linear approach to innovation, viewing innovation as a one-way process, starting with the discovery of new knowledge (research), moving through various

development steps (development) and emerging in a final viable form (innovation) has been abandoned, in favour of the systemic approach, where interactions among many actors, (including companies, universities and research institutes) as well as the relevant knowledge flows, finance and power play a critical role. In essence, innovation is a lot more than R&D, it is not merely the result of science and technology. The innovation process involves continuous feedback loops between the different stages, the interplay between supply sources of science and the demand forces of the market place [13, p. 87-99]. There is a large body of literature regarding the relationship between R&D and innovation which may lead to the conclusion that although these two variables are interrelated, the relationship between them is not as strong as might have been expected [see: e.g. 15]. Innovations do not always require being engaged in R&D activity and on the other hand, R&D efforts do not always lead to innovation [16, p. 593-604, 19, p. 226-230].

Recognizing the systemic character of the innovation process, with its feedback loops, interrelations, and inherent complexity implies the need for a wider portfolio of public initiatives to address the performance of an innovation system at different levels. Governments are involved not only through the funding of R&D activity to compensate for market failures leading undertakings to underinvest in R&D (first generation policies), but also more widely in ensuring that an innovation system functions well as a whole, addressing systemic failures, such as, for instance, problems in interaction among various actors in the innovation system or deficiencies in regulatory framework (second generation policies). It may be argued that the market failure concept justifies public intervention for R&D and innovation at the level of target groups and leads to more specific types of intervention such as state aid, while the systemic failure concept usually involves more generic types of intervention such as improving framework conditions, especially in the field of intellectual property rights or public innovation platforms.

As mentioned above, state aid is one of the public policy tools used to foster innovation. According to article 107 (1) of the Treaty on the Functioning of the European Union (TFEU), state aid is a transfer of state resources which constitutes an economic advantage that the undertaking would not have received in the normal course of business. The advantage is conferred on a selective basis, (as opposed to general public measures) and thereby affects competition and trade in the EU internal market. Therefore, granting state aid is generally prohibited unless it is justified by reasons of general economic development, stipulated in article 107 (2) and (3) TFEU. A set of admissibility criteria must be fulfilled. First, a planned state aid measure must contribute to a well-defined objective of common interest. State aid may be targeted towards a situation where aid can bring about a material improvement that the market cannot deliver itself, (correcting a market failure, e.g. externalities, imperfect information, coordination problems). The Europe 2020 Strategy notes that: ‘State aid policy can also actively and positively contribute (...) by prompting and supporting initiatives for more innovative, efficient and greener technologies, while facilitating access to public support for investment, risk capital

and funding for research and development' [p. 22]. Importantly, under the new Framework for state aid for research and development and innovation (2014) there is a legal presumption of the necessity of state intervention for projects or activities that are also EU co-financed (recital 54).

Secondly, state aid must be an appropriate policy instrument to address the defined objective, i.e. being a selective instrument should be referred to as a last resort option where there are no other less distortive, general instruments (such as an increase in funding of public research and education or general fiscal measures), which may achieve the same results; moreover, state aid must have an incentive effect, (must be capable of inducing undertakings to do things which they would not otherwise do without public support and not subsidise activities it would have carried out anyway) and finally, be proportional (a state aid measure does not fulfil this criterion when the same effect may be obtained with less aid).

Lastly, the expected positive effects of state aid are always juxtaposed against its potential negative effects in terms of distortion of competition. State aid for RDI may, for instance, distort the competitive entry and exit processes, distort the dynamic incentives of market players to invest, create or maintain positions of market power. Therefore, they should be limited and outweighed by positive effects concerning contribution to the objectives of common interest.

Although the recent modernization of the EU rules on state aid for research, development and innovation (which took place in the year 2014), it can be concluded that to determine the admissible aid intensities for research and development projects, the EU rules rather correspond to a linear model than a systemic model, since they feature separated, sequential stages. On the other hand, under the new EU rules it is easier to transfer from the development to the production stage due to the significantly higher aid level for prototypes and pilot lines and the possibility to grant aid not only in the experimental stage but also at the stage of industrial research. Under the previous legal regime, no state aid was allowed for an activity that pertains to validation and user interaction as a prototype or product development, what was in fact discouraging for undertakings to strive for converting their publicly funded research and development efforts into successful innovation.

### **3. EX ANTE ASSESSMENT OF STATE AID FOR RESEARCH, DEVELOPMENT AND INNOVATION. VERIFICATION OF THE INCENTIVE EFFECT AS A PART OF THE BALANCING TEST**

All of the criteria discussed above are verified in the balancing test, which is an assessment method used by the European Commission in order to decide upon approval of a state aid measure (state aid control falls within the exclusive competence of the EU to ensure a level playing field for all undertakings operating in the common market). However, it is an ex ante assessment and moreover not every

state aid case is subject to specific, in-depth scrutiny. Only about 10–15 per cent of all state aid measures every year have been subject to the full balancing test [20, p. 155-165].

State aid for research, development and innovation may be granted on the basis of one of the two complementary EU acts: the Commission Regulation (EU) No 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (the so-called General block exemption Regulation) and the Framework for State aid for research, development and innovation (RDI Framework 2014). The General block exemption Regulation provides for some categories of state aid which are transparent and at least questionable from the point of view of the proper functioning of the common market. Based on the sufficient relevant Commission case experience, they are deemed to bring positive outcome in the balancing test, (i.e. to bring benefits to society that outweigh the possible distortions of competition), without the need for prior specific Commission scrutiny. In these cases, member states may grant state aid without prior notification and approval by the Commission, provided that certain conditions, stipulated in the said Regulation, are met. In terms of the incentive effect, the General block exemption Regulation adopts the simple criterion, which favours a purely formalistic approach to verify the presence of the incentive effect of a state aid measure. It requires that the application for state aid must be submitted before work on the investment project commences. It is enough for the Commission to presume that an aid measure has incentive effect. However, this simplification is not applicable to ad hoc aid for large enterprises. In their case as well any other notifiable cases, evidence must be provided that the planned aid has a positive impact on the decision of an undertaking and results in additional activities by an undertaking, which it would not carry out at all or it would carry out but in a different, restricted manner. It may be manifested, in particular, by a material increase in size or scope of the project or activity, a material increase in the total amount spent by the undertaking on the subsidised project or activity or a material increase in the speed of completion of the project or activity concerned. This is verified on the basis of a counterfactual scenario comparing a situation with aid and without aid. Various investment scenarios may be described in internal business plans, risk assessments or in documents submitted to investors. The elements which are typically taken into account while assessing the incentive effect of state aid for RDI are: changes in RDI spending, changes in the number of people assigned to RDI activities, changes in RDI spending as a proportion of total turnover and other relevant quantitative factors. Cases with the biggest impact on the internal market are subject to a more rigorous examination on the part of the Commission. The RDI Framework outlines the Commission approach to the issue. If a project would not, in itself, be profitable for an undertaking to carry out, but would generate significant benefits to society, there is a good chance for the aid to have an incentive effect. The same refers to a high start-up investment, a low level of appropriable cash flows and where a significant fraction of the cash flow is to arise in the very far

future or in a very uncertain manner. These elements are indicative for the incentive effects. The level of risk involved is also of importance. The assessment of risk takes into account, in particular, the irreversibility of the investment, the probability of commercial failure, the risk that the project will be less productive than expected, the risk that the project undermines other activities of the beneficiary and the risk that the project costs undermine its financial viability (recital 67 of the RDI Framework).

The substantive analysis of the incentive effect takes into account, on one hand, company-specific elements, for instance, its financial choices concerning maintenance of a certain liquidity buffer or limited exposure to high-risk R&D investments, and on the other hand, sector-specific elements, to ensure that the existence of an incentive effect is established on an objective basis [7].

#### **4. EX POST ASSESSMENT OF STATE AID FOR RESEARCH, DEVELOPMENT AND INNOVATION. VERIFICATION OF THE ADDITIONALITY EFFECT IN EVALUATION STUDIES**

In order to ensure that specific policy instruments that the government is applying are well designed for a problem, an interactive system of evaluation, constantly supporting policy formulation and implementation should be developed. Monitoring and evaluation of public interventions provides feedback on actual effects of public policy instruments. No wonder that a favourable view is taken regarding state aid measures, for which an ex post impact assessment is available. Besides, in some instances such an analysis is required by EU law. It refers to aid schemes which are: large, novel or face the possibility of significant market, technological or regulatory change in a short-time perspective which may require a review of the assessment of the scheme, e.g. aid for undertakings which operate on fast-developing markets.

As mentioned above, the requirements for the demonstration of the incentive effect in the ex ante assessment vary greatly and depend, in particular, on the amount of aid to be granted and the size of the beneficiary. In many instances the requirement is rather formal in nature. All the more so as the policy makers seek to stimulate business R&D investment, they are keen on measuring the actual changes in the ways firms conduct R&D in the wake of public policy intervention. In particular they are interested in the additional effect of public intervention.

Buisseret et al. [3] defines additionality as the change in business R&D spending, undertaking's behaviour or performance that would not have occurred without the public program or subsidy. These three situations correspond respectively to (1) input additionality, (2) behavioural additionality and (3) output additionality.

Input additionality occurs when an undertaking, due to public support, increases its level of R&D expenditure. It occurs when public resources supplement private

funds and do not substitute them. The latter case is called the ‘crowding-out effect’. So input additionality refers, in essence, to the problem of the complementary versus substitute character of public and private funding for R&D. Although it is a central evaluation question in reference to state aid measures, a rejection of the crowding-out effect of public support does not automatically translate into product or process innovations since the linear approach to innovation process has been abandoned for being oversimplified and insufficient to explain the complete phenomena of innovation (as discussed above).

Therefore, there is a strong case for evaluation of the output of publicly funded projects or activities. Output additionality of public R&D support can be described as the proportion of outputs of an undertaking that would not have been achieved without public intervention. In other words, due to public support an undertaking achieves more when compared to the output that would result without public support. This additional output can be confined to the introduction of new products or production processes or patenting activity of an undertaking (e.g. a number of patented inventions), or more frequently, be affiliated with productivity growth and such factors as growth in turnover and export, in employment, value of an undertaking, etc.

It is argued that examining the input and output side of the innovation process is for policy makers not sufficient. In order to understand the long term effects of public support for R&D, factors concerning the change in behaviour of the recipient undertaking should be taken into account [18, 1, 10]. Steurs et al. [23] state: ‘The impact has typically been approached in terms of input or output measures only, treating the firm as a black box and not adequately capturing the impact of public intervention on the innovation process, the company rationale and attitude itself’. To fill this gap, the concept of ‘behavioural additionality has been developed which refers to ‘the change in a company’s way of undertaking R&D, which can be attributed to policy action’ [3]. It concerns especially collaborative strategy of an undertaking. Undertakings seldom innovate alone. Being more specialised and focused on their core competencies, for complementary knowledge, know-how they increasingly rely on interactions with others. Empirical studies showed that collaborating undertakings are more innovative than non-collaborating ones [21]. For this reason the impact of public support on the collaborative strategy of the recipient undertaking is of the importance. In the ex ante assessment of state aid for RDI, the fact that the project involves collaborative interactions, in particular, among a larger number of partners, or organizations of different sectors, or undertakings of different sizes is regarded as a general positive indicator (recital 20 (e) of the RDI Framework).

The most challenging task, however, in estimating additionality of public interventions consists in constructing the counterfactual situation – what would have happened if no intervention had taken place, and more precisely: how much the undertaking would have spent on RDI without receiving public support, what outputs of the RDI activity would have been achieved without being subsidised, how the aid beneficiary would have behaved when it had not received state aid for RDI?

It is crucial to compare the outcome with the aid and the outcome in the absence of the aid and capture the difference between these two situations. It is not sufficient to analyse only the outcome, confined to the beneficiary itself. A positive change, for instance in the performance of the aid beneficiary can be the result of other than public support factors, such as general macroeconomic conditions. Public interventions are not carried out in a proverbial vacuum and the changes observed in socio-economic reality are, for the most part, affected by many various factors. It is a problem directly linked to the identification of a causal relationship between aid measures and their effects. Only then evaluation provides proper feedback on the effectiveness of the public intervention. On the other hand, just comparing subsidized undertakings with non-subsidized ones, even operating in the same sector or of the same size, to calculate the average effect of state aid is not sufficient either. It is argued that public authorities may follow a ‘picking-the winner’ strategy, what means that the undertakings which are already more engaged in RDI activity are also more likely to receive state aid for RDI [1]. Undertakings who decide to apply for state aid are those who have an idea, a project, who are not lacking interest or creativity, what may well be the case in the reference to non-beneficiaries. Evaluation studies must take this sample selection bias into account.

The European Commission, in order to provide guidance to member states’ authorities, adopted the document: Common methodology for State aid evaluation (2014), where it presents the relevant methods which take into account the specificity of state aid, in particular, the selection bias and interference of the causal impact problem. None of the method is free from its limitations, however, when certain assumptions hold, they are regarded as credible. The methods are presented one by one, but they can be, and usually are, combined (Table 1).

Table 1. List of methods to identify the causal impact of state aid measures

Methods	Assumptions and limitations
<p><b>Linear regression</b> – makes use of mathematical models to describe the relationship between observed characteristics of undertakings and the outcomes; on this basis, the impact of characteristics on the outcomes are examined.</p>	<p>All significant differences in characteristics between aid beneficiaries and non-aid beneficiaries are observable and are taken into account, as well as there is a linear relationship between the outcome (e.g. R&amp;D expenditure) and other characteristics of an undertaking, its size, age, sector of operation, the granting of the aid etc.; however, in practice, it may be difficult to exclude the existence of unobserved differences between the two groups: beneficiaries and non-beneficiaries that may lead to a persistent difference in outcomes even in the absence of the aid; the method is only valid under the so-called conditional independence assumption (CIA), according to which treatment participation and treatment outcomes are independent conditional on a set of (observable) characteristics.</p>



Table 1 – continued

Methods	Assumptions and limitations
<p><b>Matching techniques</b> – treatment effects are constructed by matching each beneficiary with another similar undertaking that did not receive aid and comparing their outcomes; in the process of matching, characteristics of undertakings are taken into account or the estimated probability to receive aid (propensity score matching).</p>	<p>Similar to linear regression, all characteristics of undertakings that influence the outcome and reasons explaining eligibility or attribution of aid must be captured by observable variables. The method is only valid under the so-called conditional, independence assumption, described above; heavy data requirements</p>
<p><b>Difference-in-difference</b> - compares the difference in the performance between beneficiaries and non-beneficiaries before granting the aid to the first group as well as after the aid; pre-existing differences between these two groups are attributed to other factors than aid and the change in these differences is attributed to the aid; from a technical point of view, this approach can be implemented either within a linear regression model or with matching; (It is also possible to implement a triple difference estimator (DDD), where more control groups are formed).</p>	<p>The differences between beneficiaries and non-beneficiaries are stable over time and that both groups are affected by other than aid factors in the same way during the period under review; although the method controls for some aspects of unobserved differences between beneficiaries and non-beneficiaries, the proper choice of a control group is essential for the validity of the method; therefore, in most cases difference-in-difference approach is taken to complement matching techniques; the control group as well as the group of beneficiaries should not be too homogeneous, otherwise the interference will be biased; it will be hard to separate the effects of the macroeconomic shocks shared within each group and the effects of the aid; it should be taken into account that in the case of panel data, characteristics of undertakings are usually auto-correlated, what may lead, far more often than justified, to the conclusion that the aid has had no effect.</p>
<p><b>Instrumental variables</b> – are used to deal with endogeneity of explanatory variables, i.e. variables which are correlated with an unobserved element which at the same time influences the outcome; for instance more able persons may choose to benefit from training aid as well as enjoy higher wages. The impact of training aid on the wage is confounded by the variable that is unobserved and cannot be directly accounted for in the analysis. Therefore such a variable is transformed into an instrumental variable, i.e. a variable that explains the fact of receiving the aid (participating in the training program) but has no direct impact on the other unobserved determinants of the outcome that has to be measured.</p>	<p>In practice, it might be very difficult to find a plausible instrument, a variable that determinates the participation in an aid scheme but does not influence the outcome of such participation. Even relying on the lagged values is questionable, since lags are often highly correlated with future values of the variable.</p>

Table 1 – continued

Methods	Assumptions and limitations
<p><b>Regression discontinuity design</b> – attracts researcher's attention to the variables which have a discontinuous impact on the probability to be affected by a state aid measure, such as: geographical borders (aid may be addressed only to some regions) or conditions that must be fulfilled by undertakings to receive aid; for instance, impact of a given state aid measure is assessed by comparing outcomes of undertakings which received aid and those who applied for aid and fulfilled all of the criteria but due to small budget of an aid scheme did not receive aid.</p>	<p>The probability to receive aid is discontinuous while all the other variables are continuous; the degree to which generalizations can be made to those undertakings that are away from the threshold is limited.</p>

Source: own elaboration based on [8].

## 5. EMPIRICAL STUDIES ON ADDITIONAL EFFECT OF STATE AID FOR RESEARCH, DEVELOPMENT AND INNOVATION – INSIGHTS FOR POLICYMAKERS

There has been a number of studies conducted to ascertain whether research and development subsidies stimulate and thus are "additional" to private R&D spending or substitute (crowd out) private R&D spending. David et al. [6, p. 497-529] surveyed the body of evaluation studies accumulated over the period of 35 years prior to the year 2000. The conclusion is that the empirical evidence of the input additionality of public R&D funding is mixed. At the same time the authors criticize that most of that time studies do not take into account the problem of sample selection bias. More recent studies tend to reject the full crowding out effect, however, the findings differ depending on the firm's size, its characteristics or the type and value of the aid [see e.g. 17, 24, 12, 14, 2].

Lach [17, p. 369-390] found significant additionality effects in small Israeli manufacturing firms, but none for large firms. Streicher et al. [24] estimated the effect of subsidies granted by the Austrian Industrial Research Promotion Fund on firms' R&D expenditure by panel regression. A leverage of about 40 percent has been identified for the sample of 495 firms, i.e. one additional euro of public funding induced firms to contribute additional 40 cents of their own resources. All firm sizes exhibited complementarity but to a differing degree. Both very small and large firms exhibited the highest leverage, while small and medium-sized firms smaller leverage. Moreover, the leverage estimates for firms that perform R&D only occasionally were higher than for those which performed R&D on a regular

basis. Görg [14, p. 215-234] investigated the impact of government support for R&D on firms from manufacturing sector in the Republic of Ireland. He found that in the case of domestic plants, small grants increased private R&D spending, while too large a grant might crowd out private financing of R&D. However, in the case of foreign establishments grant provision caused neither additionality nor crowding out effects of private R&D financing, regardless of the value of the aid.

Evaluation studies also strive to identify the additional effect not only restricted to input but also output additionality. Alecke et al. [2, p. 174-195] analysed the input and output additionality of subsidies on R&D activity for East German firms using propensity score matching. They found out that subsidised firms showed a higher level of R&D intensity (on average the R&D intensity increased from 1.5% to 3.9%) as well as showed a higher probability for patent application in comparison with non-subsidised firms (the probability raised from 20% to 40%). Moreover, similar to Streicher et al. [24] while taking a closer look at SMEs, the highest input additionality has been reported in the case of very small firms, micro-businesses. Catozella and Vivarelli [5], combine the two dimensions: input and output, by estimating the impact of public funding on the ratio between innovative sales and innovative expenditures (innovative productivity) to 'explore whether supported innovative firms are really doing better, not just more, than their non-supported counterparts'. The research proved, however, the lower efficiency of externally-funded innovative expenditures compared to privately-funded expenditures.

More recently, behavioural additionality is of interest to researchers and policy makers alike. These studies aim to capture the impact of public intervention on the way the firm conducts RDI activity, for instance, whether subsidised firms strive for more cooperation while pursuing RDI activity or develop competencies and expertise. They confirm the general conclusion that behavioural additionality plays a critical role in understanding the long-term impact of public interventions. Busom and Fernández-Ribas [4, p. 240-254] explored the effects of R&D subsidies on the way the firms organise their innovation process. Their main findings are that public support significantly increases the chances that a subsidised undertaking will cooperate with a public research organisation and to a smaller extent also with other undertakings. Madsen et al. [18] found that input additionality, output additionality as well as behavioural additionality are interrelated. Moreover, behavioural additionality is a prerequisite to gain indirect input additionality and output additionality. The concept of indirect input additionality refers to the relationship between the subsidised project and other undertaking's projects and activities (i.e. a subsidy for one RDI project enhances the ability of a given undertaking to initiate a new RDI project). They also found a direct link between direct and indirect input additionality and output additionality.

## 6. CONCLUSIONS

The paper explains the main aspects of the current EU regulations and guidelines which are applicable to state aid for research, development and innovation. An emphasis is placed on two state aid admissibility criteria: the incentive effect and proportionality of aid which should translate into aid effectiveness. The reason for it is that state aid control lies within the EU exclusive competences and secondly, the changing paradigm of EU state aid control means moving beyond the problem of ensuring fair competition on the European single market towards promoting better quality aid. It has been demonstrated that in the majority of cases in the ex ante state aid control a purely formalistic approach is taken to verify the incentive effect of aid. Similarly, the proportionality criterion is assessed to a great extent against the set of presumptions created by the EU regulations and guidelines. Therefore, it is crucial to develop an interactive system of evaluation to provide feedback on actual effects of state aid measures. The most challenging problem in this field is to identify the causal impact of aid and to address the selection bias properly, since state aid as a selective measure is not randomly granted. In the literature a variety of methods have been developed to correct estimations of the so-called treatment effect of such endogeneity, for instance, selection models, matching, instrumental variable estimations or difference-in-difference estimations. It can be argued that in recent studies propensity score matching is largely applied and impact assessments strive to identify the additional effect not only restricted to input or output additionality, but also to different types of behavioural additionality acknowledging that the latter one plays a critical role in understanding the long-term impact of public interventions. This type of additionality, however, is multi-layered. Changes in enterprises' behaviour are usually difficult to capture and measure and are sometimes referred to as 'soft effects' as opposed to 'hard effects' which are, generally, the subject of the input and output additionality studies. Moreover, behavioural additionality does not operate at a point in time and may be expected to sustain beyond the life of a given project or aid scheme and affects the general capabilities of a beneficiary enterprise. Although, current econometric studies recognize the specificity of state aid measures, in particular the selection bias and interference of causal impact problem, the new perspective of the research may bring an ethnographic approach [see e.g. 10]. The emphasis of the ethnographic approach is on studying the entire 'culture' of a business or a defined group of entities, in particular, by participant observation as a part of field research.

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## WSPARCIE PAŃSTWA NA BADANIA, ROZWÓJ I INNOWACJE

### Streszczenie

Celem niniejszej pracy jest ustalenie, jak kontrola unijna podchodzi do problemu wsparcia państwa na badania, rozwój i innowacje. Zastosowano metody zarówno analizy literaturowej jak badań praktycznych i analizy dokumentacji.

Formalistyczne podejście przyjęte w większości przypadków kontroli *ex-ante* pomocy państwa wymaga dalszych badań na temat rzeczywistych skutków wprowadzonych środków. Zostało opracowanych wiele metod w celu określenia wpływu doraźnej pomocy i rozwiązania problemu stroniczej selekcji. Najnowsze badania stosuje się głównie po to, aby dążyć do identyfikacji różnych typów wsparcia, a także relacji między nimi, uznając, że zasada behawioralnego wsparcia odgrywa kluczową rolę w zrozumieniu wpływu długotrwałej interwencji publicznej.

**Słowa kluczowe:** pomoc publiczna, efekt zachęty, proporcjonalność pomocy państwa, badania, rozwój i innowacje