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**Macro- and microeconomic ex post impact assessment of State
aid within the meaning of EU Competition Law**

PhD theses

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1. Choice of topic

I started my PhD studies in 2009 at the Doctoral School of 'Enterprise Theory and Practice', Faculty of Economics, University of Miskolc. In the course of my research I dealt mainly with the issues of σ and β convergence (Barro 1991; Barro-Sala-i-Martin 1995; Sala-i-Martin 1996; Martin 2000; Dedák 2000; Dedák-Dombi 2009; Halmai 2009; Kocziszky 2010), exogenous and endogenous growth theories (Solow 1956; Swan 1956; Romer 1990; Mankiw et al. 1992). In the focus of my research was the examination of regional economic growth by using statistical and econometric methods – general autoregressive distributed lag, vector autoregressive and error correction models – basing on the modified Cobb-Douglas (1928) production function.

I completed my studies at the doctoral school in 2012. Since that I work for the Hungarian State Aid Monitoring Office, which is the central coordinating body currently under the supervision of the State Secretary for European Union Development Funds at the Prime Minister's Office with the main responsibility to control State aid in Hungary within the meaning of EU Competition Law. My tasks cover inter alia examining the eligibility and therefore the compatibility of aid granted for infrastructure developments and regional investments, especially for large investments. So the subject of the dissertation is not only theoretical but also practical in my view.

Nearly all of the economic schools are interested in and examine the question of state intervention, from Adam Smith (1776), Keynes (1936) to Krugman (1991; 1994); the opinions are inhomogeneous [see e.g. the views of Kornai on the role of the State on the public administration and the private sector in „*A hiány*” in full contrast with Piketty (2015) on the role of capital in the 21st century as regards income inequality].

In the 20th century, there can be seen many examples that those developed countries with mixed (public- and private property-based, at the same time) economic models realised that the economy can not work efficiently without state intervention, i.e. merely under market terms, on the one hand because of the inequality of the distribution in goods, services and income, therefore redistribution is needed. On the other hand, if the market mechanisms do not function properly, the state has to intervene in the economy. In the 21st century the global challenges such as climate change, overpopulation, migration, limited availability of (natural) resources, the decrease of the number of areas under cultivation and parallel to that the likely increase in prices at the same time raise such questions which can not be solved on a purely market basis. Due to the fact that the market is basically interested in maximizing profits and/or minimizing costs. For example we can see the increasingly importance of innovation and R&D sector in the digitizing economies during the 21st century; its relevance was already recognized by Schumpeter (1912) and the State's role in stimulating it. Of course, competitiveness can not be without innovation in the 21st century: if a company does not produce more efficiently than its (innovative) market competitors, it will not remain competitive over time. Undoubtedly, but one of the characteristics of innovation is the partial or complete replacement of human labor force. If there is no work, there is no disposable income, there will be no demand, consumption etc. which is a barrier to economic growth. The state must also be able to handle such a situation. Otherwise, the basic frameworks and fundamentals of society can be cracked or even collapse in extreme cases, as Krugman (1994) or Huntington (2005) also points out. Contrary to this, Keynes had the vision in 1930 that the economic and social problems will be resolved within 100 years and prosperity will be general.

As the concept of subsidy (i.e. all of the sources redistributed) and State aid is still mixed in the public awareness nowadays, the lack of its unitary and consistent use is also confused and that is why a burning issue among researchers: although Berlinger et al. (2015) stresses that the impact of State aid is unclear both in theory and practice, even though they do not apply the right concept of State aid within the meaning of EU Competition Law. Subsidies are often considered as State aid and therefore the imputable effects are quite confused and can lead to misleading, distorted results and consequences, respectively. Kállay (2014) examined the impacts of State aid in the light of economic performance and found that there is no empirical (i.e. statistically significant) evidence between the aid and economic growth. Nagy-Lóránd (2013) concluded that besides that the non-refundable subsidies have a negative effect and threatening the competition. Laki-Voszka (2008; 2010) drew the attention to the share of (local)governmental participation among subsidies targeted for enterprises. The confusion around the concept of State aid can be observed internationally (or at least at European level) despite the fact that it dates back entirely to the Treaty of Rome (1957). In practice, however, there are lots of studies which relate to measuring and evaluating the average impact of State aid – on the investment, employment, productivity, innovation, etc. The international trend clearly shows the increasingly importance of the microsimulation-based impact assessments [eg. Aristei et al. (2015); Bronzini-Piselli (2014); Einiö (2014); Mouqué 2012; Combes-Tanguy (2012); Le Den et al. (2012); Criscuolo et al. (2012); Busillo et al. (2010); Martini-Bondonio (2012); Cerqua-Pellegrini (2011); Lelarge et al. (2010); Bade-Bastian (2010); Hart et al. (2008); Bronzini-Guido (2006)]. As regards Hungary Béres (2008) examined the counterfactual effects of subsidies granted to micro- and small enterprises from the aid scheme ECOP (Economic and Competitiveness Operating Programme) and found controversial results.

1.1. Purpose of research

There are many analyzes¹ about the multiplicative effects of EU funds on the Hungarian economy. However, EU funds are not the same as State aid: only a part of them qualify as State aid within the sense of EU Competition Law. Thus, the effect attributed to them is more likely to be overrepresented than it really should be. Therefore, I took the assumption that those subsidies which qualify as State aid should have an effect that is more realistic than those one falling outside the scope of EU Competition Law. In order to avoid repetition the term of State aid, I use the words "subsidy, support, source or fund", which under I mean State aid as it is defined in the EU terminology.

Between 2004 and 2014 the EU Member States (hereinafter referred to as "MSs") spent on average 0.5% of GDP on State aid with a standard deviation between 0.2% and 1.8%, while in Hungary on an annual average of 1.2% and with the exception of three years (2004 and 2011-2012) with a value over 1%. In comparison with the EU Hungary is at the forefront of State aid spending. It raises the question as Kállay (2014) also emphasizes how the sources are being really used and in what extent they contribute to the real economic growth, productivity and competitiveness.

Measuring the effectiveness of a public policy intervention and decision-making is quite not a novelty: impact assessments are compulsorily and systematically carried out on subsidies financed from EU funds about their use and effectiveness. The Directorate-General for

¹ See e.g. the study of *"Analysis of the use and impact of Hungarian EU funds for the 2007-2013 programming period"* by KPMG in 2017.

Regional Policy and the DG for Employment, Social Affairs and Equal Opportunities of the European Commission (hereinafter referred to as "Commission") and the DG for Joint Research Center prescribe for MSs to carry out an ex-post impact assessment with the primary purpose to measure the utilization and efficiency of Structural Funds but basically on non-econometric methods. However, the Commission's Directorate-General for Competition (hereinafter referred to as "DG COMP") has innovated in two areas: one is that aid schemes falling under the scope of ex-post impact evaluation shall be counterfactually evaluated by 2020 at the latest in the 2014-2020 programming period. It will not examine the compatibility criteria but the novelty lies in the need to point out the average impact of aid on a scientific basis. Depending on the results DG COMP will consider whether the aid scheme can be extended in the future. It does matter in Hungary, too: amongst others the tax benefit scheme shall be evaluated because of its average annual budget over EUR 150 million. Another innovation is the transparency requirement of individual grants over EUR 500,000 awarded from July 1 2016. Information shall be provided which will be synthesized and published by the Commission. It would be really welcome among researchers because it will be possible to directly compare and research the individual grants in all MSs and last but not least it will also improve the State aid control mechanisms both at the level Commission and MSs.

1.2. Issues examined within the research

In the dissertation I sought to answer the following questions:

1. What are the main differences between State intervention in the light of the main economic theories and State aid within the meaning of EU Competition Law?
2. What kind of similarities and differences can be observed as regards subsidies granted in the EU and Hungary?
3. Is there relationship between the income level and funds granted in the EU and Hungary and their annual average change?
4. On macroeconomic level the subsidies, especially the regional investment aid did have significant effect in the EU and Hungary between 2004 and 2014 on
 - the real GDP growth rate and
 - the employment rate?
5. Did have time lagged effects of grants?
6. How does the regional investment aid change the behavior of an enterprise at microeconomic level? How does the support affect the turnover and the number of employees?

1.3. Research logic and methodology

My dissertation consists of three parts:

- In the first chapter I present and synthesise the most relevant issues and different interpretations of State intervention in the light of the main economic theories.
- In the second part I analyze the legal environment of State aid within the meaning of EU Competition Law and the major changes in it – with special regard to the general and specific rules of the regional investment aid category – which basically determines

the level-playing field and frame within MSs can grant aid without significantly affecting trade between MSs and distorting or threatening competition. Focusing on the control mechanism of the Commission and its improvement up to now I put emphasise on the need and necessity of impact assessment and evaluation.

- In the third chapter I examined two topics on an empirical way:
 - at macroeconomic level the relationship between the income level and State aid and its effect on the real growth rate and employment rate in the EU and Hungary.
 - at microeconomic level I examined the average effect of subsidies on turnover and employment on the basis of a Hungarian regional investment aid scheme (the so called investment promotion aid scheme based on the Government's individual decisions, hereinafter referred to as "ECD") financed from the central budget.

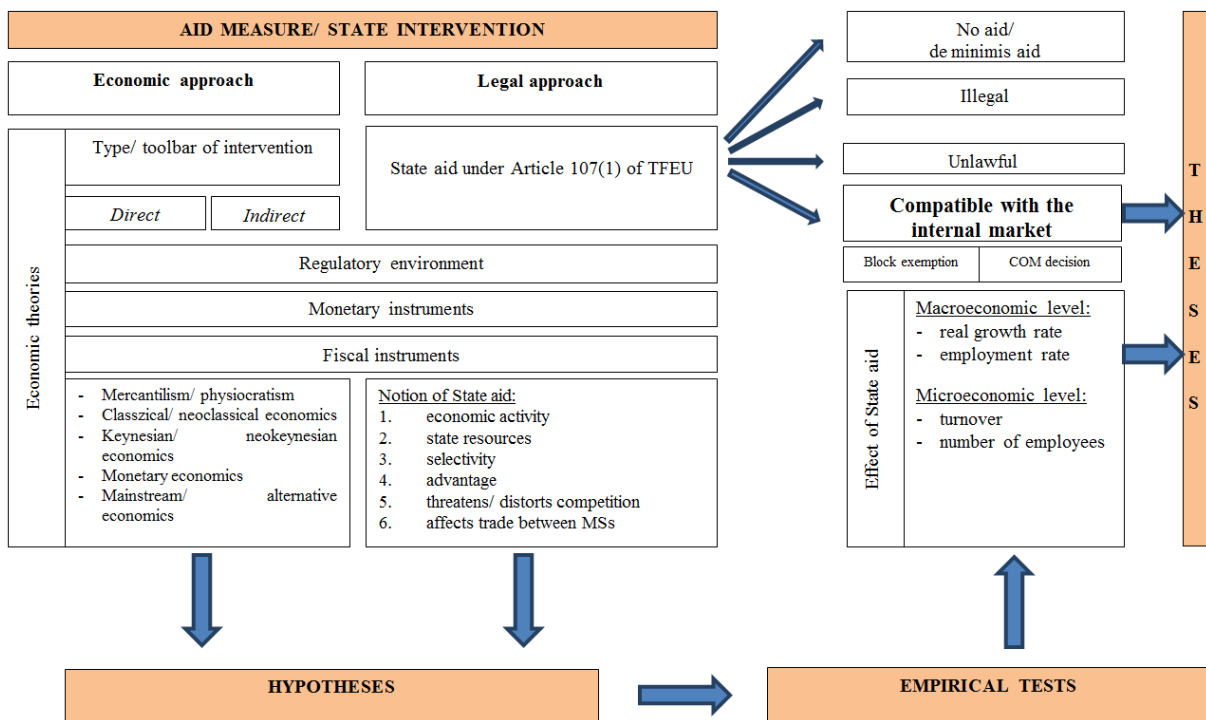


Figure 1. Structure of research
Source: author's compilation (2017)

The research relies on secondary information: primary and secondary sources of State aid law and the relevant international and national literature in economics. As regards empirics data being used from sources of the Statistical Office of the European Union (hereinafter referred to as "Eurostat"), the State Aid Scoreboard of DG COMP and the ECD aid scheme. In my dissertation I applied both statistical and econometric methods: the basic model of macro- and microeconomic impact assessment is the linear regression function based on the method of the Ordinary Least Squares (hereinafter referred to as "OLS") in three dimensions, namely in cross-sectional, time-series and panel regression models referring to Cottrell-Lucchetti (2016), Hans (1998), Koop (2005), Maddala (2001), Ramanathan (2003) Wooldridge (2002). In the case of nonlinearity between variables inbuilt in the models, I linearized by transforming them into logarithmic form. In order the regression estimations would lead to statistically significant results, on the one hand I examined the statistical preconditions of the variables and on the other hand checked the robustness of each model. In the course of research I

applied "hard" methods by using quantitative data (both in absolute and relative terms, ordinal, ratio and unit values), calculations were carried out in Excel and the open source Gretl (Gnu Regression, Econometrics and Time-series Library) softwares.

1.4. Hypotheses

In the dissertation I defined the following five hypotheses.

H1: I suppose that State aid is State intervention but in a narrower sense. According to the EU terminology State aid concerns the area of competition law with the purpose and task to regulate the interactions between the State and economic actors (undertakings, except private persons with no legal entity and households), when the recipient undertaking compared to its competitors gets fund(s) from public sources for economic activity which is an advantage that can not at all be received under market terms, thus limiting competition and trade.

Testing the hypothesis:

The first hypothesis is justified on the one hand in the light of the very specific legal nature of State aid, on the other hand from the perspective of the main economic theories' approach about the role of State, primarily in the economy and in the society in a broader sense.

H2: I assume that the annual average growth rate of subsidies per capita and that of the income level are correlated. I suppose that the average annual change in both ratios has been more higher in countries with relatively lower income levels and supports per capita.

Testing the hypotheses:

In order to justify the second hypothesis, I relied essentially on descriptive statistics by examining the relationship between the initial value of 2004 per capita GDP (in PPS) and subsidies and their annual average growth rates until 2014 by their shape of distribution, frequency plot, standard deviation and for measuring the quantitative dependence for continuous variables by using the Pearson correlation matrix. The territorial level of research is the EU27.

H3: I suppose that the level of State aid per capita correlates to the real growth rate and employment rate both in the EU and Hungary. If the average impact of subsidies have significant effect, the regional investment aid can also be assumed to affect the macroeconomic performance.

H4: I assume that there is a causal relationship between State aid, the real growth rate and employment rate and subsidies have time-lagged effects.

Testing the hypothesis:

The third and fourth hypotheses are validated by applying regression models. The effect between State aid and the real growth rate and employment rate is first justified by the application of cross-sectional data based on the arithmetic mean values between 2004 and

2014. If the cross-sectional examinations show that the effect is significantly attributable to subsidies, I assume that its lagged values also have influence over time. For the causality I applied vector-autoregressive (hereinafter referred to as "VAR") and vector-error correction (hereinafter referred to as "VECM") models. If the VAR or VECM models lead to statistically significant results and prove to be robust, I assume that State aid has a longitudinal effect in the MSs by applying panel regression models. The territorial level of the time-series research is the EU27 and Hungary, in the cross-sectional and panel regression models the EU27.

H5: In competitive markets State aid can mean an advantage for the beneficiary undertaking comparing to its competitors. The subsidy may fundamentally change the behavior of the beneficiary undertaking as it reduces the eligible costs of its investment. In addition that the unit cost of investment becomes lower, the aid may have an impact on the company's output and its number of employees.

Testing the hypothesis:

The last hypothesis is tested at microeconomic level through the the example of the ECD aid scheme. I examine in what extent the aid reduced the eligible investment costs and changed the behavior of the beneficiary. By analogy of the macro analysis I applied VAR and VECM models for the causal relationship and in the case of significance I tempted to point out the longitudinal average effect on turnover and number of employees in panel regression models.

2. Theoretical framework of research

2.1. State intervention in the light of economic theories

2.1.1. Mercantilism versus physiocratism

In the 17th century mercantilism (Colbert) was the dominant economic policy which according to the wealth of a nation depended on its positive balance of payments (i.e. on the export surplus), so that the primary task of State was to promote export while replacing imports at the same time (either by protective tariffs or administrative measures). It is the accumulation which is the key factor of economic growth and competitiveness. The so called original accumulation of capital facilitated the process of industrialization, the improvement in mechanization enabled mass and surplus production: on the one hand the labor intensity of the agricultural sector decreased and became more technologically intensive, on the other hand it was the secondary sector which could absorb additional workforce: the agricultural and industrial sector were actually in symbiosis and (inter)dependent. The increase in relative capitalization was favorable to finance the industry through the provision of low interest loans but at the same time the consumption-based economy based on the artificial support of domestic demand could not be increased to an unlimited extent as the availability of natural resources, raw materials and labor are limited. Therefore the State had to take an active role in this process, i.e. it to intervene in it, in particular in promoting export growth and protecting the interests of the domestic industry, respectively.

The first critics of mercantilism were defined by physiocrats (Quesnay, Turgot) who found that it is the physical capital and agriculture-based economy which determine the wealth of a nation and on the contrary to the mercantilists the agriculture determines the industry and not vice versa; the dependence is one-sided. They thought that the industry was not capable of producing added value and therefore the State did not have to interfere in the industrial

processes. By analogy of mercantilism they had the view that the capitalist system shall be considered to give the basis of an economy, but not in the industry, rather in the agriculture.

2.1.2. Classical economics

Adam Smith summed up his criticisms of mercantilism in his book entitled "The Wealth of Nations", which formed the basis of classical economics, published in 1776. Smith considered that the State intervention is unnatural because it hampers free trade. In his work he emphasized the importance of free market, fair competition and market mechanisms. He assumed that the market forces – influencing supply and demand – will equilibrate where products and goods are exchanged at a natural price, in which the State should not intervene or only to a limited extent. Thus, the possibility of state intervention was not entirely rejected but it should not necessarily be directly (e.g. in the form of a grant) but through the regulation of tax system or trade (e.g. the level of duties on imported goods).

Besides market equilibrium classical economists have argued that free trade is beneficial for all of the economic players involved in it, irrespectively of the efficiency in production (i.e. productivity) a country could obtain comparative advantage of trade. However, the State must not intervene in the market equilibrium and free trade.

2.1.3. Neoclassical economics

The views of classical economics predominated again at the end of the 19th century and in the first half of the 20th century. Marshall (1890) and Walras (1872) laid down the basics of macro- and microeconomics and developed further the classicals' market equilibrium theory at the same time. They differentiated the concept of price and value: the former depending on the use of factors of production as inputs (i.e. work and capital invested), the latter being dependent on the utility of the rational consumer. The relationship between demand and consumer utility was modeled and demonstrated that beyond a certain point the consumption of a unit of goods does not raise the consumer utility, moreover, reduces it: the concept of marginal revenue and productivity has been introduced. The novelty of neoclassicalism was the micro-level (i.e. at the level of the enterprise) analysis and mathematical modeling of the law-like relationship of supply and demand (extreme value functions). Parallel to the classicals the neoclassical school basically rejected the possibility of State intervention: in perfectly competitive markets demand and supply equilibrate due to the market mechanisms. However, it does not examine the issue of market shortage and/or failure.

According to the Austrian school the economy goes ahead a steady-state (Hayek 1945), it did not reject the intervention in favor of welfare (society) besides the liberal economy and competitive markets. He has sharply criticized the centralized economic systems compared to the competing markets: the efficient allocation of resources to a particular individual or a group of individuals will never be possible in a centrally planned economy due to the information asymmetry because the central planning will never have enough information about the appropriate allocation of resources. In free (liberalized) markets, the price mechanism shall determine the efficient exchange and use of resources but the State can have role in creating a safety net of the society. He did not see any reason why should not be guaranteed a minimum level of general welfare if it does not violate the rights of liberty. Thus the minimum food, clothing and housing could be ensured in order to preserve healthiness. It could be feasible, too, if the State introduces a general social security system that covers these common, life-threatening risks which against only few people can afford to protect

themselves and provide for a welfare minimum. Hayek found compatible the competition-based economy and an extensive social system at the same time (up to a point until the effectiveness of competition is not undermined). Therefore, he could not be considered to be a full devotee of the Libertarian school but his work played a significant role in the creation of the German social market economy model by Ludwig Erhard.

2.1.4. Keynesian economics

Keynes was the first who comprehensively dealt with the necessity of State intervention and interpreted its role in the economy in a broader context following the global economic and financial crisis between 1929 and 1932. The crisis demonstrated that market mechanisms could not treat it and therefore did not work entirely. He recognised that the State had to intervene in the economy: in the case of recession by stimulating growth and when the economy prospers by restraining it with the use of the appropriate instruments. He argued that in times of crisis there is a need to induce demand artificially and indirectly: he thought that it could be realized through promoting investments in infrastructure and creating jobs, assuming that it will generate income in the economy by consumption and/or savings and raise the revenues of the State budget, too, during the 1930s in the United States of America. In contrast to monetary policy the artificially induced demand could primarily be realized through fiscal policy (fiscal instruments, incentives).

He assumed that a unit investment generates an income per unit which is realized in consumption, encouraging additional investments and multiplying income (in a decreasing extent) in the economy. This so-called budgetary multiplier effect was first estimated by Kahn (1934) through the change in output as regards government spending, taxes or the combination of them. The estimation of the multiplier effect of public expenditure on output is also a frequently discussed issue nowadays, especially in periods of recession (Corsetti et al. 2012; Auerbach-Gorodnichenko 2012; Baum et al. 2012; Blanchard-Leigh 2013) as it could be seen in 2008 and 2012 most recently. Keynes found interaction between the level of employment, unemployment and inflation: the rise in the level of employment is inflationary, while increasing money supply promotes growth on employment and output. On the contrary Wicksell (1936) argued that it is the monetary policy which can be more effective, primarily through the interest and exchange rates. His financial equilibrium model was based on interest rate mechanisms by differentiating natural (expressing the marginal productivity of capital) and market interest rates (which is the marginal productivity of reinvested capital). During reproduction the supply and demand of foreign capital will be balanced (and eventually the savings and investments) by the natural rate. Nevertheless, Keynes and Wicksell have also recognized that the aggregated demand and supply are not in line. Undoubtedly, Keynes has also realized the need to address the supply and demand of companies and that of the society, as they are influenced by different factors and varying degrees.

2.1.5. Monetary economics

In contrast to fiscal intervention, Friedman (1962) emphasized the role of money supply and its volume in circulation on the economy. He rejected the economic role of fiscal policy instruments in essence: the State shall not intervene in promoting economic growth through the central budget. Moreover, the (federal) government spending seems to make the economy less stable. In his opinion a per unit budgetary expenditure increases the level of GDP approx. to the same extent (as opposed to Keynes's multiplier effect). In his view the volume of money in circulation determines the nominal value of the output. Empirically, it has been

pointed out that the fluctuation in money supply contributes to economic volatility, in the short term mainly through the output, in the long run through the changes in price level. Friedman revealed the close relationship between inflation and money supply. In the wake of his work, the Monetary Economics School was formed, according to which inflation can be regulated mostly by monetary instruments.

Analyzing the change in the general price level of the 1970s oil price shocks, Friedman introduced the concept of cost-driven inflation. While considering the social security system as inequitable in the fight against poverty which could be remedied through the imposition of a negative income tax, i.e. through the provision of a guaranteed minimum State allowance, he did not reject the opportunity to impose a flat-rate income tax in order to "bleach the farm" because it has fewer loopholes compared to the progressive taxation for those with a higher income level. The impact of State intervention is often contrary to the original intent: he argued that the positive achievements of the United States are inherent in the free market and are not tied to the government (which, in spite of good intentions, should remain absent from interventions in areas where it would not be necessary). In any event, the Bretton Woods gold standard system (maintained up to the 1970s) had a significant influence on monetary theory, in which the dollar as a world currency had the exclusive right in the bonding of national currencies to its exchange rate and its convertibility into gold, which also led to the collapse of the system.

Learning from the lessons of the oil crisis in 1973 and then in 1979, the collapse of the Bretton Woods gold standard system, the fiscal and solidarity based Keynesian, the monetary economic theories (Friedman 1962; Stiglitz 2000) have lost weight and it was the liberal school which became more dominant in welfare: neoliberals are on the opinion of deregulation and say that State intervention shall be limited to the minimum necessary level and its role shall be reduced in the economy and the (yet not liberalized) industries shall be opened to the market. Besides ensuring the economic liberalism (free market and competition) the State intervention shall be confined to monetary policy instruments (e.g. by floating exchange rates).

2.1.6. Mainstream versus alternative economics

In one of the main focus of the contemporary economic literature and research stands the issue of economic growth and its driving forces and the role of State in it, respectively. It is the theory of the new economic geography which is one of the most popular branch of mainstream economics (Krugman 1991; 1994), which examines the spatial structure, correlations and causality of economies (geographic concentration and its differences). The spatial econometrics has an extensive international bibliography and is widely researched (see e.g. Dall'erba-Le Gallo 2005; 2006; 2008; Dall'erba et al. 2006; Fischer-Getis 2010; Lesage-Pace 2010), in Hungary one of the most important researchers is Varga (2005; 2006a; 2006b; 2009), who examines the relationship between macroeconomic growth and spatial structures in an empirical way – and in the light of the endogenous growth theory focusing on the technical progress. Lengyel (1999) emphasizes the relevance of competitiveness and spatial structures, Horváth (2001) examines the role of territorial cohesion in the light of regional competitiveness.

In contrast to the mainstream views, as its name suggests one of the main characteristics of alternative economics is the questioning and reconsideration of fundamental economic

dogmas. However, there can not be put an equal sign between the downstream trends because their essence lies just in the different approach and handling of economic issues².

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Economic school	Need of state intervention	Role of state in the economy
Mercantilism	- Protection of domestic industry - Export promotion	Active engagement
Physiocratism	- Supporting agriculture against industry	
Classical	- Night-watchman state - Invisible hand („laissezfaire“)	Passive engagement
Neoclassical	- Perfectly competitive markets are equilibrated ($D = S$)	
Keynesian	- Market mechanisms do not work properly - Through fiscal means	Active engagement
Monetary	- Regulation of money supply	
Neoliberal	- Deregulation of the state - Gain the efficiency level - Market shortage, failures to handle	Passive engagement
Alternative (heterodox)	- Rethinking the role of state intervention - Contrary to mainstream trends use of non-orthodox instruments	Active/ passive engagement

Table 1. Need and role of state intervention in the light of the main economic theories
Source: author's compilation (2017)

T1. a) Perfectly competitive markets exist only at the level of abstraction. Therefore, even the classical economics school did not completely reject the opportunity of State intervention. Market failure is an immanent attribute of non-perfectly competitive markets because market mechanisms do not work properly and therefore can not be completely free from State intervention. The main economic schools recognized the role of State and its influence on welfare but are shared about the nature, form and methods of intervention.

2.2. State aid within the meaning of EU Competition Law

State aid is a special area of competition law. While the main task of competition law is basically to create and maintain fair market conditions focusing on price agreements, abuse of dominance and unfair market behavior at the same time, in the context of State aid it has the task to regulate the transactions between the market players irrespectively from the form and ownership background of them (including the State, too) when the State intervenes in the economy either directly (e.g. through cash grants) or indirectly (e.g. through the tax system).

² See e.g. inter alia the so-called heterodox, evolutionist, institutionalist, experimental economic schools and models based on blue, green, free or rainbow economy.

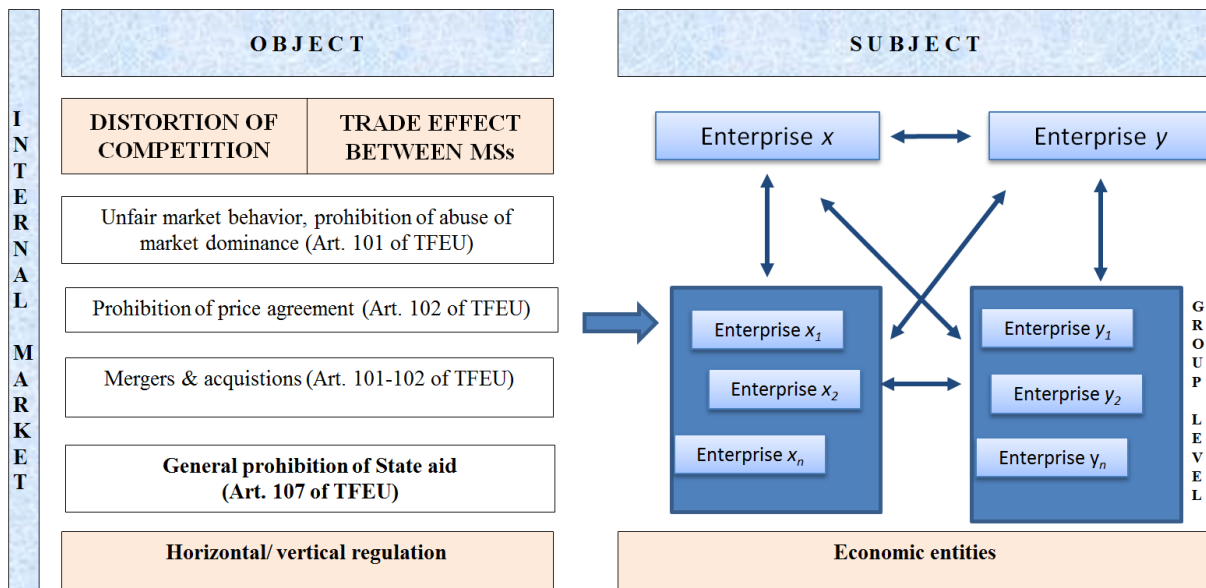


Figure 2. Typology of EU Competition law

Source: author's compilation (2017)

The history of competition law, such as rules on State aid goes back entirely to the roots of the European integration. The Treaty of Rome (1957) establishing the European Economic Community had already laid down the fundamentals and main provisions of rules on competition within the integration. As a general rule, any aid "granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States"³ normally be incompatible with the internal market and therefore prohibited.

The above mentioned provision defined in the Treaty of Rome as primary source of law are essentially unchanged, the legislation, especially the secondary and supplementary legal sources, legal acts have, however, significantly been extended over time. The main elements of the notion of State aid⁴ are the following:

- a) the beneficiary carries out an economic activity: any activity involving the supply of goods and services on a given market which presupposes the risk of service provided for it. Thus, the business is not merely a business with or without legal entity but any market player carrying out actually an economic activity in the internal market irrespective of its legal status.
- b) imputability and state resource: the term "state" includes both an institution established or managed or partly financed either by the central budget or its subsystems. Thus, any direct or indirect aid measure granted by the ministries, institutions (aid grantors) and other authorities belonging to the central government and any local government body (municipality, county, etc.), constitutes State aid. Moreover, lack in state revenue such as tax allowances (partial or entire tax benefit and tax credit, too) also constitutes aid within the meaning of the EU Competition Law.

³ Within the meaning of Article 107(1) of the Treaty on the Functioning of the European Union (TFEU).

⁴ See in detail Commission Notice on the notion of State aid as referred to in Article 107(1) of the Treaty on the Functioning of the European Union. 2016/C 262/01.

- c) selectivity: when undertakings in the same factual and legal situation are not automatically eligible for support, the aid measure constitutes State aid because of its selective nature. The selectivity can be sectoral (e.g. covering a particular market), geographic (e.g. limited to a particular region) or discriminatory by aiming at particular market players. If undertakings in the same factual and legal situation are automatically eligible for and benefit from subsidy from an aid scheme and fulfill all the required (general and specific) conditions, it qualifies for a general measure and therefore does not constitute State aid.
- d) advantage at the level of the beneficiary: under the same market and financing conditions, the beneficiary will not be able to obtain advantage on the market compared to its competitors.
- e) impact on competition: in competing markets, including those which have not yet been liberalized (that is closed by the state or will be opened gradually) but competition may arise, the aid measure is considered to distort or threaten to distort competition and therefore it qualifies for State aid. If a particular market had been liberalized earlier but later closed in front of market players, it also distorts or threatens to distort competition.
- f) effect on trade between Member States: in case when due to subsidy it is likely that customers, investments or services are attracted from other MSs or the establishment of companies are obstructed from other MSs in the area concerned and the free movement of goods and services in the internal market are breached.

The six different constituent elements of the notion of State aid are conjunctive, that is, all of them must be fulfilled for an aid measure to qualify as State aid and vice versa: if one of the constituent elements is not met, the aid measure does not constitute State aid. However, the Commission basically has the assumption that an aid measure distorts or threatens to distort competition and trade (from the supply and/or demand side). In my dissertation my intention was to give an overview about the very specific legal nature of State aid as regards the relevant rules, the different aid categories that can be compatible with the internal market and those aid measures that qualify as non-state aid as well.

It can be assessed that State aid is State intervention but not vice versa: only a part of (state) sources qualify as State aid that are allocated to economic players during the redistribution. State aid therefore is a subset of state intervention according to the EU terminology, a narrow segment focusing on the interactions between the State and business sector with the exception of households (consumers and individuals).

T1. b) A subsidy that constitutes State aid within the meaning of the European Union Competition Law is a public intervention but in a narrower sense which is uniformly regulated by the primary, secondary and ancillary sources of EU law for all Member States.

The rules basically determine the scope which under and the frames within that a MS can grant subsidies, so I believe that giving an overview about the legal background could provide a better understanding and basis both of the macro- and microeconomic simulation. As the empirical part of the dissertation deals with subsidies that constitute State aid within the meaning of EU Competition Law I consider it essential and necessary to reflect on the legal environment, in particular on the regional investment aid category, on the one hand given the fact that it is the most relevant aid category in Hungary at macroeconomic level and on the

other hand it forms the legal basis of the aid scheme I examined during the microeconomic impact assessment.

3. Empirical results of research

3.1. Macroeconomic effects of State aid

There is no MS where no State aid is granted but there is a significant difference between the total spending as percentage of GDP and the absorption capacity: between 2004 and 2014, 0.5% of GDP was spent on average (compared to the GDP on average EUR 13,000 billion). On the basis of data provided by the MSs DG COMP summarizes and publishes yearly data on subsidies according to the category, form (direct/indirect) and purpose (horizontal, sectoral) of the aid. Based on the latest statistics⁵ on State aid under Article 107(1) of TFEU 0.72% of GDP was spent in the MSs (including agriculture, rural development and fisheries with a total spending of EUR 101.2 billion⁶) with a standard deviation of 0.3 to 2.1%. In terms of the absolute amount, the difference is more spectacular with a value of 500 times higher from EUR 72.8 million (Lithuania, 0.22% of GDP) to EUR 38.54 billion (Germany, 1.32% of GDP). In Hungary it was amounted to 1.45 billion euros (1.4% of GDP)⁷. Interestingly, Latvia's relative expenditure was the highest on State aid (1.88% of GDP) in 2014. The aid amounts are collected at current price and with the exception of the euro area are converted into constant prices by the inflation rate of the given reference year in the given MS.

	2009	2010	2011	2012	2013	2014
Total State aid (1+2) in EUR millions*	1 532.7	2 051.1	1 172.7	1 167.1	1 452.1	1 702.3
(1) Non-agricultural aid	1 310.4	1 855.1	933.1	896.8	1 168.1	1 451.5
(2) Agricultural aid	222.3	196.1	239.6	270.4	284	250.8
Transport aid*	39.4	173.3	22.9	23.3	24	47.7
Co-financed**	263.4	189.5	163.8	189.9	173.6	683.6
No co-financed	1 047.1	1 665.6	769.3	706.9	994.5	768.0

* less railways.

** From year 2014, MSs are required to indicate for co-financed schemes: (i) the percentage of aid that is co-financed; (2) the total amount of aid that is co-financed including both national and EU Structural Funds expenditure. Before 2014, only national expenditure was reported for aid measures that were co-financed by Community funding.

Table 2. State aid in Hungary between 2009 and 2014

Source: author's compilation based on data of Eurostat and State aid Scoreboard (2017)

⁵ Including individual grants from aid schemes under block exemption regulations, ad-hoc grants and individual grants approved by COM, less de minimis aid, the amount of services of general economic interest, the rail sector and aid granted as provisional measures to ease the impacts of the financial crisis. However, the amount of non-notified aid measures if constituting State aid and in the case of compatibility with the internal market approved COM decisions should be added. As regards the EU funds the methodology on collecting data has been changed since 2014: not only the amount of the domestic but the EU co-financing shall be provided.

⁶ Less the provisional subsidies granted to the financial sector in the context of the financial crisis. Data on financial subsidies are subject to separate statistics.

⁷ By comparison the average value of per capita EU funds for agriculture, rural development and cohesion was EUR 437 (around 4% of GDP) between the 2007-2015 programming period according to a study of KPMG, the total amount of State aid from domestic budgets and EU funds, too amounted to EUR 133 per capita (on average 1.27% of GDP) between 2007 and 2014.

Regarding the relative weight and allocation of State aid in Hungary, it is the regional investment aid which had a dominant role: only with the exception of 2010 and 2013, an increasing trend (almost 60% by 2014) can be observed, while the weight of some categories almost has significantly declined, for example the sectoral aid reached its peak in 2010 due to the global financial crisis and because of the temporary subsidies granted to the banking sector, but has decreased since that. Similarly to that aid for restructuring, employment and training has been reduced over time, while aid for R&D&I and SME investments has increased in favor of promoting economic development as well as the role of cultural subsidies has also grown. Certain aid categories such as social support to individual consumers, aid for environmental protection, culture and heritage conservation that are significant in the EU are less typical in Hungary.

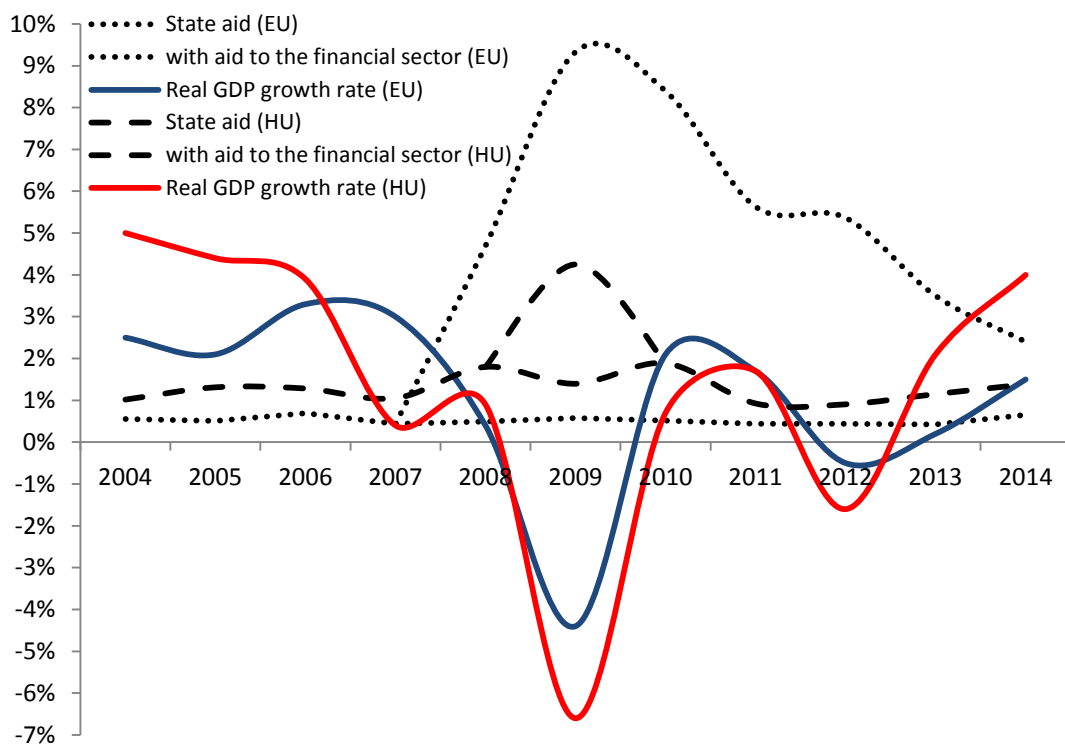


Figure 3. State aid and real growth rate in the EU-27 and Hungary between 2004 and 2014 között

Source: author's compilation based on data of Eurostat and State aid Scoreboard (2017)

As shown in Figure 3, State aid can be considered to be relatively independent of economic growth and constant over time both in the EU27 and Hungary. As a result of the financial crisis in 2008 the total expenditure on subsidies (i.e. with the provisional aid granted to the financial sector) reached its peak in 2009 as a percentage of GDP 9% in the EU and 4% in Hungary. It can be seen that basically it had the aim to remedy the recession and to help recover the economy to its pre-crisis growth path in line with the Keynesian theory, the State intervened in the economy in a spectacular way in order to alleviate the effects of the crisis. Not is the same vice versa when the economy relatively prospered between 2004 and 2007 or after 2012 there can not be observed that MSs would have decreased their expenditure on State aid. Within the framework of the macroeconomic impact assessment, therefore my aim is to examine the correlations between the income level and subsidies and their average annual growth rates with a focus on productivity and competitiveness and the long-term casual effects of State aid on the economic growth and employment rate.

SA	ΔSA	Y	ΔY	
1.0000	-0.5692**	0.2415	-0.2895	SA
	1.0000	-0.0990	0.2148	ΔSA
		1.0000	-0.5795**	Y
			1.0000	ΔY
0.8288	0.0914	0.4534	0.0191	V

n=27; ** $p < 0,05$ ($r=0,3809$)

Table 3. Correlation matrix and relative standard deviation (V) of State aid per capita (SA), GDP per capita in purchasing power standards (Y) and their annual average growth rates ($\Delta SA, \Delta Y$) between 2004 and 2014

Source: author's calculation (2017)

Barro (1991) and Sala-i-Martin (1995; 1996) found that per capita income levels converge to a steady-state as the rate of income growth is faster in countries with relatively low income levels compared to those with higher ones (absolute β convergence). Similarly to that it can also be observed that the the annual average growth rate of per capita subsidies between 2004 and 2014 was significantly higher in those MSs who spent relatively less on State aid in 2004 than in those MSs with relatively higher initial values. Based on the correlation matrix the income level, however, is slightly and positively correlated with government subsidies but not significantly, so it can not be proven that where the higher level of income is, the higher the level of State aid and their annual average growth rates. By examining the distribution function of the examined indicators, it is the level of subsidies that does not follow normal distribution (with left skewness and peakness, ex-kurtosis), indicating that the lower values (between 0 and EUR 150 per person) are typical and there are only few outliers.

While the standard deviation is less typical for growth rates (with values between -11.33% and +30.84% and -0.67% and + 7.32%, respectively), it is much more spectacular as regards GDP and subsidies per capita (with values between EUR 10 and 484 and EUR 7,500 and 55,000 respectively). The annual average change in government spending was the highest in the Baltic countries: 31% in Estonia, 23% in Latvia and 8% in Lithuania and Eastern-Central Europe, 16% in the Czech Republic and 5.7% in Hungary. In six MSs, namely Slovakia, Italy, Spain, Malta, Cyprus, Romania and Portugal did not grow but even declined the amount of State aid on average. In Hungary subsidies were above 1% of GDP on average (1,88% in 2010) with the exception in 2004 and and 2011-2012 and the annual average growth rate of 4% compared to the average 3% in the EU between 2004 and 2014.

T2. As the annual average change of GDP per capita was higher in countries with relatively lower income levels, Member States with relatively lower subsidy level spent more on State aid between 2004 and 2014. There is no significant correlation between subsidies and income level, nor between their annual average growth rates.

3.1.1. Results of cross-sectional regressions

Using the average values between 2004 and 2014, I estimated the impact of State aid in cross-sectional bivariate regression models: the explanatory variable is the per capita subsidies, the explained variables are the real GDP growth and employment rate, respectively. I assumed that State aid has a significant effect on the value of the dependent variable but explains it at a less extent.

Variables inbuilt in the regression models:

- real GDP growth rate (Y);
- State aid per capita at constant price (SA);
- employment rate ($EMPL$);

<i>OLS</i>	<i>Explanatory variables</i>	<i>Coefficient (α, β)</i>	<i>Std. error</i>	<i>t-value</i>	R^2	<i>adj. R^2</i>
$y=Y$	const	2,49214 ($<0,0001^{***}$)	0,4669	5,3371	0,1250	0,0901
	SA	-0,00515868 (0,0343**)	0,0023	-2,2390		
$y=EMPL$	const	60,5193 ($<0,0001^{***}$)	1,7138	35,3137	0,2108	0,1793
	SA	0,0274312 (0,0304**)	0,0119	2,2952		

(*** $p < 0,01$ ** $p < 0,05$)

Table 4. Average effect of State aid on the real growth rate and employment rate between 2004 and 2014 in bivariate cross-sectional regression models

Source: author's calculation (2017)

It can be assessed that the per capita subsidies significantly influenced both the real GDP growth and employment rate but to varying degrees:

- the real growth rate negatively and to a minimum extent;
- the employment rate, however, positively and to a larger extent.

Based on the positive results of the F-probe (with values of 5,0132 and 5,2679) of the two OLS models the null hypothesis of the homoskedastic residuals can be rejected at 3.42% and 3.03% significance level. In order to determine whether there is a significant correlation between State aid and the standard deviation of the error term (μ) of the model, besides F-statistics I also tested the heteroskedasticity of the residuals by using an auxiliary regression function (so-called White test), which explains the square of the error term by the squares of the explanatory variables in bivariate regression models. In the model of growth rate and employment rate the standard error and t-statistics of the explanatory variable and its square seemed to be heteroskedastic-robust and its t-statistic, too, that is, the value of the square of residuals are not dependent on the explanatory variable and its squares, so the relationship between the variance of the error term and the explanatory variable is better explained by the linear function.

The relatively low value of the determination coefficients in the bivariate regression models ($0,12 \leq R^2 \leq 0,21$), however, suggests that other latent variables may have been omitted from the two models and may have affected the dependent variables and been reflected in the coefficient of subsidies. It also can not be excluded if the explanatory variables are iteratively or simultaneously inbuilt in a multivariate regression model, then they would not have been got as their linear combination, so even a three-variable model could lead to false regression due to the multicollinearity of the explanatory variables.

OLS	Explanatory variables	Coefficient (α, β)	Std. error	t-value	R ²	adj. R ²
y=Y	const	1,77135 ($<0,0001^{***}$)	0,262682	6,7433	0,0735	0,0364
	SA	-0,000433053 (0,082*)	0,000244055	-1,7744		
y=EMPL	const	64,4586 ($<0,0001^{***}$)	1,26421	50,9874	0,0008	-0,0391
	SA	-0,000192876	0,00119892	-0,1609		

(*** $p < 0,01$ ** $p < 0,05$ * $p < 0,1$)

Table 5. Average effect of regional investment aid on the on the real growth rate and employment rate between 2004 and 2014 in bivariate cross-sectional regression models

Source: author's calculation (2017)

Though, in the OLS model of regional investment aid it can be seen that the subsidy has a negative but significant effect on the real growth rate to a small extent but the results of the heteroskedastic tests did not show that the residuals would have followed normal distribution and being dependent on the aid. At the same time the regression model of the employment rate did not lead to significant results. That is why I ignored the examination of the effect of regional investment aid in time-series and panel regression models of the macroeconomic impact assessment.

T3.a) It can not be entirely rejected that State aid would not have had a significant impact on the two individual macroeconomic variables, separately, namely on the real economic growth rate and employment rate in bivariate cross-sectional regression models. Due to the low value of the determination coefficients, however, it can not be excluded that other variables would have been omitted and affected the value of the dependent variables to a larger extent. I found no impact of regional investment aid on the economic growth or employment rate in the EU between 2004 and 2014.

OLS	Explanatory variables	Coefficient (α, β)	Std. error	t-value	R ²	adj. R ²
y=Y	const	2,34547 (0,5545)	3,91276	0,5994	0,1250	0,0521
	SA	-0,00522515 (0,0786*)	0,00284407	-1,8372		
	EMPL	0,00242342 (0,9689)	0,0614558	0,0394		
y=EMPL	const	60,248 ($<0,0001^{***}$)	3,56651	16,9432	0,2108	0,1451
	SA	0,0276203 (0,0789*)	0,0150485	1,8354		
	Y	0,0366503 (0,9685)	0,919427	0,0399		
y=SA	const	-271,319 (0,2944)	253,087	-1,0720	0,2926	0,2337
	Y	-19,8455 (0,0090***)	6,97881	-2,8437		
	EMPL	6,93655 (0,0952*)	3,99375	1,7369		

(*** $p < 0,01$ ** $p < 0,05$ * $p < 0,1$)

Table 6. Average effect of State aid, the real growth rate and employment rate between 2004 and 2014 in multivariate cross-sectional regression models

I examined the effect of subsidies in multivariate model which led to significant results at least for the case of one variable [$y=f(SA)$; $EMPL=f(SA)$; $SA=f(Y;EMPL)$] in each model indicating that the variables are both regressors of one another. The dependent and

explanatory variables, therefore mutually explain and correlate, that is, multicollinearity. Based on the result of White test, the null hypothesis of homoskedasticity can be rejected only in the regression model of employment rate. I could not reject it even if I took the logarithm of the variables and built their differences into the model.

T3.b) In multivariate cross-sectional regression model the effect of State aid can not be examined because of the partial correlation and collinearity between the explanatory variables and the presence of heteroskedastic residuals.

Based on the results of the cross-sectional bivariate regression models, it can be proved that subsidies had significant average effect on the two dependent variables, although the causal relation can not be assessed, so I took the assumption that the real growth and employment rate as dependent variables are subject to their own lagged values and that of State aid, too.

3.1.2. Results of time series and panel regressions

During the time series analysis I applied multivariate autoregressive models, that is why I transformed the variables first into logarithmic form in order to compress data with relatively high standard deviation and to filter out the outliers on the one hand and to treat the nonlinearity relation between the dependent and independent variables on the other hand. I tested the autocorrelation and stationarity of each variable. By analogy of the cross-sectional analysis I examined the homoskedasticity and collinearity of the variables and the unobserved ones (i.e. residuals). The unit roots of the variables were tested by applying the extended Dickey-Fuller (Augmented Dickey-Fuller, ADF), ADF-GLS and Kwiatkowski's KPSS test. If at least one of the variables had unit root in its time series, but not cointegrated with other variables, I took their differences $[(Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2}) - (\dots) - (Y_{t-n} - Y_{t-n-1})]$ in order for the time series to be stationary. If the model is not merely dependent on its own lagged values besides stationarity I tested their cointegration with the tests of Engle-Granger and Johansen, i.e. whether there is a common trend in their time series. The territorial dimension of the analysis is the EU27 and Hungary.

Based on the results of the test statistics, the employment rates were significantly autocorrelated both in the case of EU27 and Hungary and the current value of the dependent variable proved to be also dependent on its lagged values with a maximum lag order 2. The time series, however proved to be heteroskedastic- and collinearity-robust: the results of the Breusch-Godfrey test showed that the explanatory variables of the autoregressive model did not have a significant effect on the value of the residual. The hypothesis of the autocorrelated residuals therefore could be rejected: neither the first- nor the second-order lags had significant effect on its current value. On the basis of the the p-value of the Ljung-Box Q value the autocorrelation of third-order lagged residuals can even be rejected in the case of Hungary. When unit root and cointegration of the variables could not be rejected basing on one of the applied test statistics that the time series would not be stationary and non-cointegrated (along with residuals) I took the te first- or second-order differences of the variables in the VAR or VECM models. Both models are based on the autoregressive model [AR(p)] but with the exception that all variables are treated as dependent variables in the model at the same time, so that in a bivariate regression model it can be estimated whether X is the cause of Y , or vice versa Y explains X (Granger 1969; 1981; 2010; Engle 2001). Therefore, the VAR model assumes that all variables are stationary (and have no unit roots) and consequently not cointegrated, otherwise the VECM model can be applied.

Variables inbuilt and their time lags			Coefficient	Std. error	t-value	R ²	Causality
EU-27							
VAR(2)	ΔLgY	$\Delta LgSA_{t-1}$	8,54167 (0,0090***)	1,40598	6,075	0,9033	$\Delta LgSA \rightarrow \Delta LgY$
		$\Delta LgSA_{t-2}$	11,4542 (0,0252**)	2,74940	4,166		
VECM(2)	LgY	LgY_{t-1}	-0,180838 (0,6502)	0,375178	-0,4820	0,3374	-
		$LgSA_{t-1}$	-8,54726 (0,4417)	10,2337	-0,8352		
VAR(2)	$\Delta LgEMPL$	$\Delta LgSA_{t-1}$	0,0341743 (0,0069***)	0,00513879	6,650	0,8762	$\Delta LgEMPL, \Delta LgSA \rightarrow \Delta LgEMPL$
		$\Delta LgSA_{t-2}$	0,0534910 (0,0040***)	0,00666984	8,020		
VECM(2)	$LgEMPL$	$LgEMPL_{t-1}$	0,575173 (0,0218**)	0,175068	3,28540	0,7386	$LgEMPL, LgSA \rightarrow LgEMPL$
		$LgSA_{t-1}$	-0,0623537 (0,0193**)	0,0183642	-3,3954		
Hungary							
VAR(2)	ΔLgY	ΔLgY_{t-1}	-0,195887 (0,6774)	0,426698	-0,4591	0,5339	-
		ΔLgY_{t-2}	-0,56724 (0,2894)	0,441888	-1,2837		
		$\Delta LgSA_{t-1}$	-8,8496 (0,2997)	7,07624	-1,2506		
		$\Delta LgSA_{t-2}$	-3,39631 (0,5505)	5,06433	-0,6706		
VECM(2)	LgY	LgY_{t-1}	-3,39631	5,06433	-0,6706	0,7332	-
		$LgSA_{t-1}$	0,749905 (0,8404)	3,48976	0,2149		
VAR(2)	$\Delta LgEMPL$	$\Delta LgEMPL_{t-1}$	2,76492 (0,2133)	1,78059	1,5528	0,8086	-
		$\Delta LgEMPL_{t-2}$	-1,67 (0,1532)	0,87755	-1,9030		
		$\Delta LgSA_{t-1}$	0,681521 (0,7946)	2,39634	0,2844		
		$\Delta LgSA_{t-2}$	2,20855 (0,5889)	3,6611	0,6032		
VECM(2)	$LgEMPL$	$LgEMPL_{t-1}$	1,62143 (0,1300)	0,852705	1,9015	0,6101	-
		$LgSA_{t-1}$	-1,57908 (0,4992)	2,12786	-0,7421		

(*** $p < 0,01$ ** $p < 0,05$ - non significant)

Table 7. Results of VAR(2) and VECM(2) models in the EU27 and Hungary between 2005 and 2014

Source: author's calculation (2017)

Based on the Akaike, Schwarz-Bayesian and Hannan-Quinn criteria, in Hungary the second-order lags proved to be significant for both factors, at EU level only for the employment rate. According to the VECM model subsidies have a slight but significant effect on the employment rate with negative sign (similarly to the result of the VAR model but with positive sign), however, the first-order lagged value of the dependent variable also significantly influenced its current value. The causal relationship was determined by decomposing the variance of the variables, which shows how the change of one variable explains the variance of the prediction error of the other variable(s) over the examined period. As a result of the variance decomposition the lagged values explained that of the current ones to a decreasing extent but even in the 10th period with a value of 84%, while the support explained it less but at an increasing rate both in the VAR and the VECM model. The lagged values of State aid, however, had no effect on its current value. Since both the VAR and VECM models showed different results of the effect on the real growth rate (the former model

was significant and positive but the latter one showed that there is no causal relationship between the two variables), I concluded that the causality can not be clearly assessed. Therefore I did not examine the longitudinal effects on it. In Hungary, however, there is no effect of subsidies neither on the economic growth nor on the employment rate.

T4.a) State aid had a significant but slight and contradictory impact on the employment rate in the EU. From the point of view of the causality, the first-order lagged value of employment rate explained its current one significantly better, while subsidy only to a lesser extent. However, the effect of the aid can not be clearly assessed on the real growth rate. In Hungary there is no effect of State aid neither on the employment rate nor on the growth rate.

In view of the fact that the results of VAR and VECM models and variance decomposition there only exists casual relationship between state support and employment rate I examined its longitudinal effect in panel regression models. Compared to the cross-sectional and time series models, these models are characterized by the fact that there is not a constant value (α_i). The choice between the models is basically determined by the fact that each cross-sectional variable varies over time (or invariant) and whether there is a group effect (based on the timely constant differences of the mean between the groups). If the variable is invariant, the fixed-effect model can be applied, usually in the case of smaller sample size. According to Cottrell-Lucchetti (2016) if the number of observation units is relatively small as an example in the EU, a fixed effect can be presumed, therefore I examined at the macroeconomic impact in this model. If we take into account the constant value of each time series of the 27 MSs it will make regression estimates more difficult on the one hand and on the other for the impact assessment the estimated β_i values are relevant. By analogy, I assumed that α_i values take a constant value in the long run and thus the effect of the timely independent support can be found.

Fixed-effects		Coefficients	Std. error	t-value	LSDV R ²
Panel model	const	64,4557 ($<0,0001^{***}$)	0,0147	483,3503	0,8482
	$\Delta LgSA$	0,8560 (0,0527*)	0,4217	2,0298	
Dynamic panel model	const	64,4334 ($2,40e-067^{***}$)	0,0371	1732	0,8645
	$\Delta LgSA$	1,0713 (0,0626*)	0,5505	1,946	
	$\Delta LgSA_{t-1}$	1,4649 (0,0525*)	0,7209	2,32	

(*** $p < 0,1$ * $p < 0,1$)

Table 8. Average effect of State aid in the EU27 between 2005 and 2014

Source: author's calculation (2017)

Unlike the results of VECM (2) model both the non-lagged and the dynamic fixed-effect regression panel models have resulted in positive significant average effect of State aid on the employment rate which can refer to the heterogeneity of the annual cross-sectional data. Depending on the causal relationship the support is assumed to have little impact on the long run but the regression models based merely on time-series data may have lead to less accurate results than the panel models. According to Welch's statistics the null hypothesis of the timely variant constant can be rejected. Based on the value of the F-test the heteroskedasticity of the the omitted variables can be rejected at 5.27% and 14.32% significance level as regards the non-lagged and the dynamic fixed-effect regression panel models, respectively. The value of

the determinant coefficient (LSDV R^2) which can be applied for relatively small cross-sectional observations and longer-time series explains that the current value of subsidies and its first-order lags have influenced significantly and positively the employment rate. Filtering out the trend effect the impact of the second-order lags can also be observed besides the fact that it has led to significant results only in the 5th and 9th-10th periods, respectively. In the dynamic panel regression model (adjusted by the time lags of the dependent variable) both the current value of the employment rate and subsidies proved to have a significant effect but the homoskedastic constant has to be rejected. However, the real growth rate was not significantly influenced by State aid in the fixed-effect panel model either.

T4.b) It can be assessed that the current value of subsidies and its first-order lags have a positive, significant and fixed impact on the employment rate in the EU.

3.2. Microeconomic effects of State aid

Meiklejohn (1999) modeled the effects of State aid on competition by entering into and intervening in monopoly markets, which was described by Hargita (2003) in Hungary. The main feature of the monopolistic market is its dominance to set the price in the market. Similarly to competitive markets the monopoly maximises its profit where the marginal revenue is equal to the marginal cost ($MR = MC$) meaning that the final unit of output still results in the same cost and revenue gains. The difference is, however, that the monopoly sets its price to be above the marginal cost ($P > MC = MR$ and the profitmaximum $\Pi_{max} = AR > AC$), that is to say, it provides lesser output compared to a competing business. Smith already recognized in 1776 the fundamental differences between perfectly competitive and non-competitive markets, inter alia that the monopoly raises its revenue above "*the natural rate*" because it can sell its goods at a higher price on the market. There is no doubt that the state has to intervene as a result of abuse of market dominance but it is quite not sure that by facilitating the enter-into-market of new player(s) in the monopoly market the oligopolistic one would be less distortive to competition if the expenditure of State is compared to the lower price on the market. That is, if the effect of a lower price on the consumer's level is not at least the same extent than the State's expenditure it can be counterproductive and can not contribute to an increase in the welfare level at the same time. In competitive markets, therefore, aid is more likely to have effect on the costs of an enterprise and consumers either directly or indirectly from the aspect of distortion of competition and trade, i.e. how the cost functions and so the output of a business will change and how do they contribute to the consumers' utility and welfare. According to Friederiszick et al. (2006) State aid distorts competition in markets which are more competitive because it has a greater impact on the market due to lower profit margins or the volatility of market share as a result of competition. It is the operating aid which always and distorts competition at a large extent compared with investment subsidies because it is directly aimed at financing the variable costs of a firm, which has an impact on the competitiveness and market share of it. Fingleton et al. (1999) examined the impact of State aid on the change in consumers' and producers' surplus, which according to the incurred losses of a business and yields realised by a consumer have to be differentiated.

3.2.1. Scheme for investment promotion⁸

The aid scheme for investment promotion, the ECD is a regional investment aid category in the form of direct (non-refundable) cash grant with the primary aim to target investments mostly of large enterprises⁹ in productive sectors, to create jobs and added value. It contributes to attract foreign direct investments¹⁰ (hereinafter referred to as "FDI") on a large scale, therefore it is of great importance for the industrial and economic policy because FDI investments are mainly realised by multi- and transnational companies. The role of the large corporate sector is significant in the Hungarian economy: according to the Yearbook 2015 of the Hungarian Central Statistical Office (hereinafter referred to as "HCSO") it gave about 73% of the total industrial production and more than 80% of export sales in 2014. The foreign-controlled and export-oriented subsidiaries therefore have a prominent role, especially in the manufacturing sector which gives about 95% of the total industrial production: in 2013 about 50% of the total manufacturing industry (97%) and vehicle manufacturing (96%), electrical products (87%) and mechanical engineering (86%). Overall, 75% of the investment portfolio of the manufacturing sector, 70% of production value, net sales and value added, 62% of R&D&I expenditures and some 50% of employees are linked to FDIs. The manufacturing industry has the most significant share (21.4%) in Hungary, including the total vehicle investment with 3.4 billion euros, representing 20.2% of total FDIs in the manufacturing industry. The manufacturing of computers, electronics and optical products has a 12.7% share, while the third largest manufacturing subgroup is the production of food and tobacco products with a 10.7% share¹¹.

As a matter of fact under the ECD aid is granted for those eligible investments that can not be funded from EU funds for example because of the size of the company or on the same legal basis for the same investment are a priori excluded because of the relatively high investment cost as an eligibility criterion.

As for the microeconomic impact assessment data was provided by the Hungarian Investment Promotional Agency (hereinafter referred to as "HIPA"). The sample covers 83 investment projects, including 34 projects with final audits, the financially closed ones (aid actually paid out and already audited, but yet not closed, 33 investments) and the ongoing projects (16 investment projects) out of which payments have already been made. Investments that are financially not yet closed, are still in the monitoring period and in the case of the ongoing investments yet not started. Its importance is that the beneficiary company shall maintain its investment in the recipient area for at least five years or at least three years in the case of SMEs after completion of the investment, which means that the beneficiary has to maintain the number of employees and turnover as it was undertaken in the incentive agreement, otherwise it has to reimburse the aid proportionally to non-fulfillment (partially or fully). This obligation basically determines the fact that the number of staff and turnover is dependent on the subsidy during the monitoring period, as the beneficiary is interested in not having

⁸ The aid scheme in its current form was launched in 2001 but data on payments are only available from 2004 onwards.

⁹ Given the fact that one of the most important criteria for eligibility is the realisation of an investment with a minimum eligible cost of EUR 10 million at present value and the minimum number of jobs to be created depends on the region and the sector (industry, tertiary and ICT or until 2012 R & D sector) where the investment is to be carried out.

¹⁰ According to figures of the Ministry for National Economy FDIs in Hungary were amounted to EUR 80.6 billion in 2013 out of which 77.2% came from the EU with the largest share from Germany (24.7%).

¹¹ In addition, the manufacture of pharmaceuticals, rubber, plastic products, metal raw materials and processed products and non-metallic mineral products also had an average capital investment of over EUR 1 billion.

reimbursement obligation. Therefore, I examined the effect of State aid actually paid out on the audited turnover and the number of employees in the given financial years of actual payments using data between 2004 and 2014 by applying time-series and panel regression models, given the fact that the average investment period was 2 years 8 months and 5 days for the completed investments and 3 years 10 months for the financially closed ones¹².

Under subsidies I mean the aid actually paid out, which was converted into constant prices together with the investment volume for 2005 on the basis of the harmonized CPI to eliminate the price effect. I have used the audited reports in electronic format published on the site of the Ministry of Justice: in the case of one large company only the consolidated audit was available (including other affiliates with different sites), therefore I excluded from the examination. In other cases where consolidated reports were made it was also available for the given beneficiary affiliate at site level where the investment was actually carried out. If the financial year did not coincide with the calendar (i.e. from 1st of January to 31st of December), on a pro rata basis I took the period which was closer to the actual business year (i.e. if it fell between 1st of April and 31st of March data for the given year was taken into consideration and if was actually between 31st of August and 1st of September data of the following year were used). If data were available in foreign currencies were converted to HUF by the annual average exchange rate of the National Bank of Hungary (hereinafter referred to as "NBH"). Sales figures were corrected by the export sales price index of HCSO and calculated for constant 2005 prices due to the fact that about 82% of the average turnover of the beneficiaries coming from exports between 2005 and 2014 (with a standard deviation between 73% and 91%).

As regards the eligible costs the volume of investments carried out between 2004 and 2014 was HUF 1,302.4 billion at a constant price of 2005 where there were actually made payments. There is no available data on the total cost of the subsidized investments, the volume of investments, therefore, was likely to be higher because the non eligible costs of the project or the costs linked to non-eligible activities are ineligible for State aid. The aid at constant prices amounted to HUF 207.5 billion between 2004 and 2015, out of which HUF 133.5 billion was actually paid out with an average of HUF 12.1 billion per year. There were altogether 31,500 new jobs were created with an average of 394 employees per investment. The average number of employees of the beneficiary enterprises was 1,221 with an average turnover of HUF 333 billion and the average eligible cost of an investment was HUF 19.7 billion with an average cash grant HUF 1.81 billion. Overall, the average turnover per a job created was HUF 687.2 million with HUF 4.6 million subsidies. The weight of reinvestments is considered to be significant: nearly a quarter of the investments (20 projects) are linked to 7 groups of companies, out of which 2-2 investments for 5, 3 and 7, respectively for one group company. In reality it does not mean that other large corporations would not have carried out investments but did not request aid for ECD (or for other purposes and from other sources) but it also happened that a beneficiary submitted its application (and received a bidding offer) but did withdraw from contract¹³. There can be found example when the investment was completed but there were no payments, that is, it waived the whole subsidy because the

¹² I did not examine those ongoing projects out of which no payment was made in 2015 and no data were available for 2016 as of 31 January 2017. The regression analysis, therefore, encompasses 65 businesses and their investments.

¹³ Or even if the incentive agreement has been signed but due to the size of the investment and the amount of aid it could not be granted without the approval decision of the Commission.

company did not foresee that the commitments as undertaken in the contract could be fulfilled 100%¹⁴.

The standard deviation of investment volumes, subsidies and jobs created is considered to be significant with left skewness and peakness, indicating that these functions do not follow normal distribution. The relatively lower values were typical for the subsidized investments with volume less than 22 billion HUF and the number of created jobs less than 11 persons, which means that there were only a few large investments projects (above 50 million EUR), whereas investment projects on a small scale were rather dominant. The amount of the grant is proportional to the volume of the investment volume and the number of jobs created but the aid ratio does not correlate with the size of the investment. On the one hand it can be explained by the degressivity rule on regional investment aid (in which case aid above EUR 50 million shall be adjusted) and on the other hand it is jurisdiction of the granting authority to determine the amount of support, i.e. less aid can be granted than as of the regional aid map provided that all of the general and (aid category) specific provisions are met.

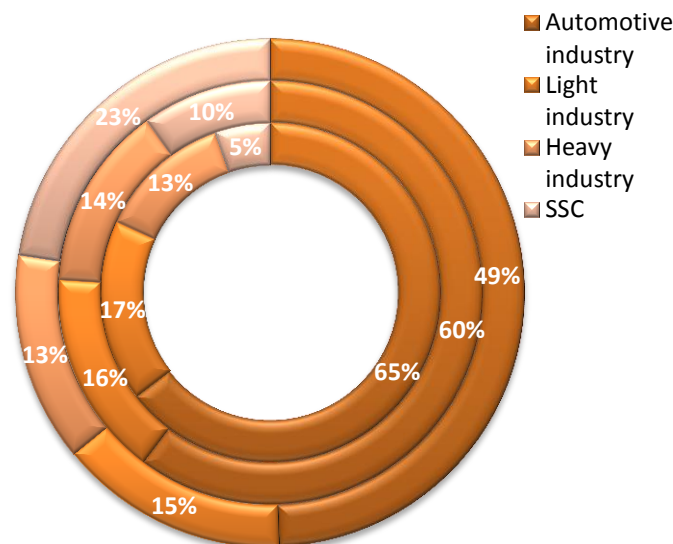


Figure 4. Sectoral relative distribution of investment volume, State aid and jobs established¹⁵
 Source: author's compilation based on data by HIPA (2017)

Based on the investment projects with final audits most of them (25 projects) have been realized and concentrated in the automotive industry (and in its related supplier branches) as regards both the eligible costs (850 billion HUF) and jobs created (12,760 employees). Approximately 60% of the aid amount were granted to this sector. In the light industry (manufacturing of paper, pharmaceuticals and electronics) 20 investments have been carried out with a relative weight similarly to the heavy industry (machinery, metal, chemicals, construction products, 11 investments altogether). In the typically labor-intensive service sector (the number of jobs created is close to those in the light and heavy industries) 10 investments have been made in order to create shared service centers (hereinafter referred to as "SSC") concentrating in Budapest with only one exception, probably due to the fact of the

¹⁴ For example due to changes in market conditions and/or in the macroeconomic environment or the company's business policy it would have been almost impossible to have partial (or full) recovery obligation in proportion to non-fulfilment.

¹⁵ The internal arc indicates the relative distribution of size of the investment, the intermediate one that of the support and the external is that of the jobs created.

availability of skilled and qualified workforce and of course being as a core region. Aid granted to the industry sector is ususally characterized by eligible costs based on tangible and intangible assets, while in the tertiary sector it is mostly based on personnel costs. The dominance of the automotive industry is clearly indicated by the fact that the number of jobs created in all the other sectors was nearly the same but the investment volume was twice as much.

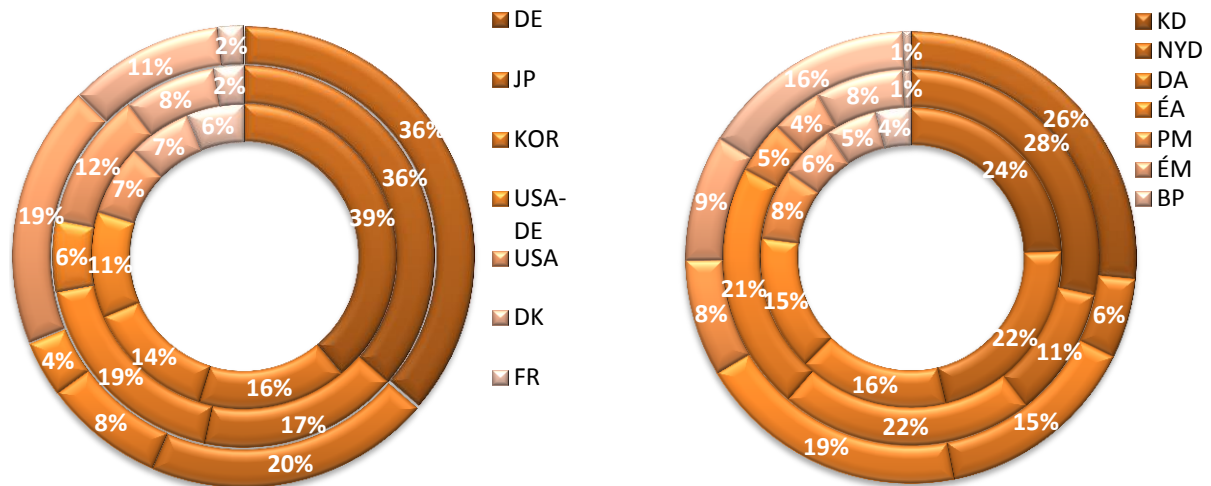


Figure 5. Geographical relative distribution of investment volume, State aid and jobs established as regards the investor companies' country of origin (left side) and investments realised in the Hungarian regions (right side)

Source: author's compilation based on data by HIPA (2017)

As a whole only 3 companies with Hungarian background (all of them in Northern Great Plain region) received aid, all other investments came from 17 countries, out of which 9 from the EU, one as a joint-venture of 2 countries and two related to 2 countries. In Hungary the most relevant investor is considered to be Germany with its relatively largest weight carrying out 14 investments, out of which only two were SSC related while all of the rest were realized in the automotive industry with more than half of the eligible costs and jobs created of all investments and the amount of subsidies paid, respectively. The largest investments amounted to nearly 950 billion HUF and more than 14,500 jobs are realized in Central and Western Transdanubia, Northern and Southern Great Plain followed by Central Hungary (Budapest with a lower amount invested in than in Pest County but almost twice as many jobs). In total with Northern Hungary and Southern Transdanubia the size of the investments is approximately equal to that of Western Transdanubia. The average investment volume was HUF 154 billion with subsidies of HUF 13.4 billion and 2,736 employees per region. An investment had an eligible cost HUF 27.6 billion (mostly concentrated in Southern Transdanubia amount of HUF 46.6 billion, exceeding the average value), for which HUF 1.8 billion was granted on average. Regarding the number of investments and jobs created (126 employees) in the Southern Transdanubia region only one supported project was implemented. Most of the subsidized investments (15 projects) were realized in Budapest, on average 8. Given the fact that the aim of my the dissertation was not to deal with territorial analysis, the regional contexts and impacts of State aid were not subject of my research.

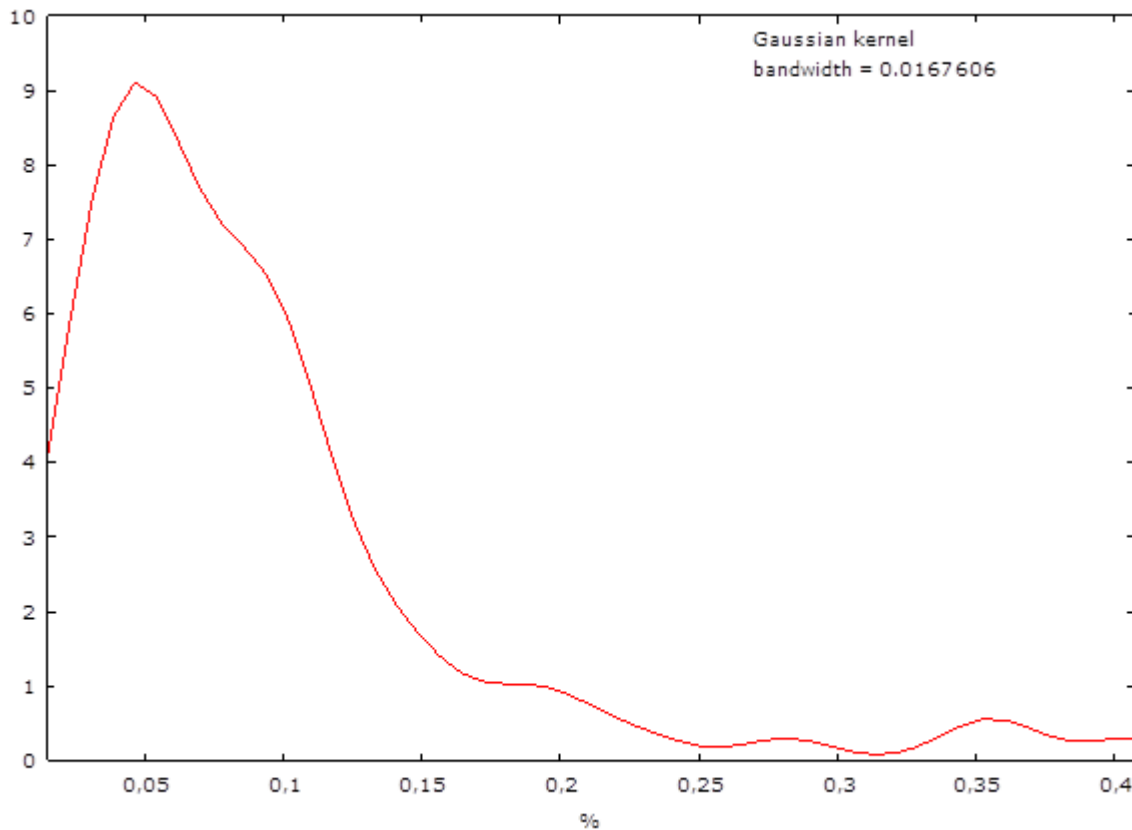


Figure 6. Estimated density function of aid ratio
Source: author's calculation (2017)

The probability of normal distribution of a variable can be tested by applying the Gaussian kernel density function which according to it can be observed whether it follows gamma distribution¹⁶. In nearly 90% of cases (70 investments), the aid ratio was below than 15%, while even in Budapest¹⁷ the maximum aid intensity was 25%, 30% in Pest county and Western Transdanubia, 40% in Central Transdanubia and with the maximum of 50% in the other four regions (Northern Hungary, Northern and Southern Great Plain, Southern Transdanubia). There were 9 investments being carried out in Budapest, 3 in Pest county out of the financially audited contracts (and 6 out of the financially closed ones, 4 in Pest county) and there was only one investment for which aid was granted after 2011 with the lower (10%) aid intensity.

This asymmetry in aid ratio can be explained by two main reasons:

1. the public finance impact assessment of the grant: the general government return is a must in response for the grant. It means quantifying and summarizing the extra revenues¹⁸ expected for the budget during the investment and monitoring period and it

¹⁶ That is, the expected value of the normal distribution ranges from -1 to 1 but the aid ratio can not be interpreted as negative values.

¹⁷ As a "phasing-in" region due to its economic development with a maximum aid intensity of 10% (for large enterprises) from 2011 onwards.

¹⁸ By quantifying the expected contributions paid by the employers and employees, the amount of income tax (VAT, excise tax, reduced corporate income tax and personal income tax), while estimating cost savings as generated revenues (e.g. unemployment benefit savings) that are expected from and linked to the investment. The multiplying effects, however are not taken into consideration such as the indirect contributions of job creation, contributions paid by suppliers, paid to employees, local taxes, additional benefits, training aid and the share of employees' incomes on consumption.

is balanced by the net present value of the grant. That is, in all cases it has to be a pocumulated sitive outcome at least no later than at the end of the monitoring period.

2. Firms requesting ECD support typically claim for development tax benefit for the investment, which can be used up to the amount of the maximum aid intensity (reducing by the amount of ECD grant).

The real aid ratio may, however, be theoretically higher by cumulating the grant awarded for the same eligible costs of the investment and under the same aid title but there is a return requirement on the public finance which has to be ensured.

Within the framework of my dissertation I examined the cost-reducing, revenue-generating and employment-enhancing effect of the ECD scheme based on data available between 2004 and 2015. I divided the microeconomic impact assessment into two parts:

- the relationship between investment aid and eligible costs;
- impact on the growth of the company's turnover (Y) and the number of employees ($EMPL$) given that most of the relevant studies also focus on the impact on employment and productivity (see e.g. Criscuolo et al 2012, Hart et al 2008, Mouqué 2012).

I took the assumption that the aid contributes to increasing the average sales revenue of the beneficiary enterprise, besides that reduces their eligible investment costs. Criscuolo et al. (2012) concluded that due to the aid the company's effective capital cost significantly reduced, while increased its capital in contrast to a non-subsidized situation. The total factor productivity, however, did not change, so the aid had no significant impact on it. The theoretical basis of my hypothesis is the profit maximizing and cost-minimizing behavior of a competing firm, presuming that the output is determined only by price and quantity.

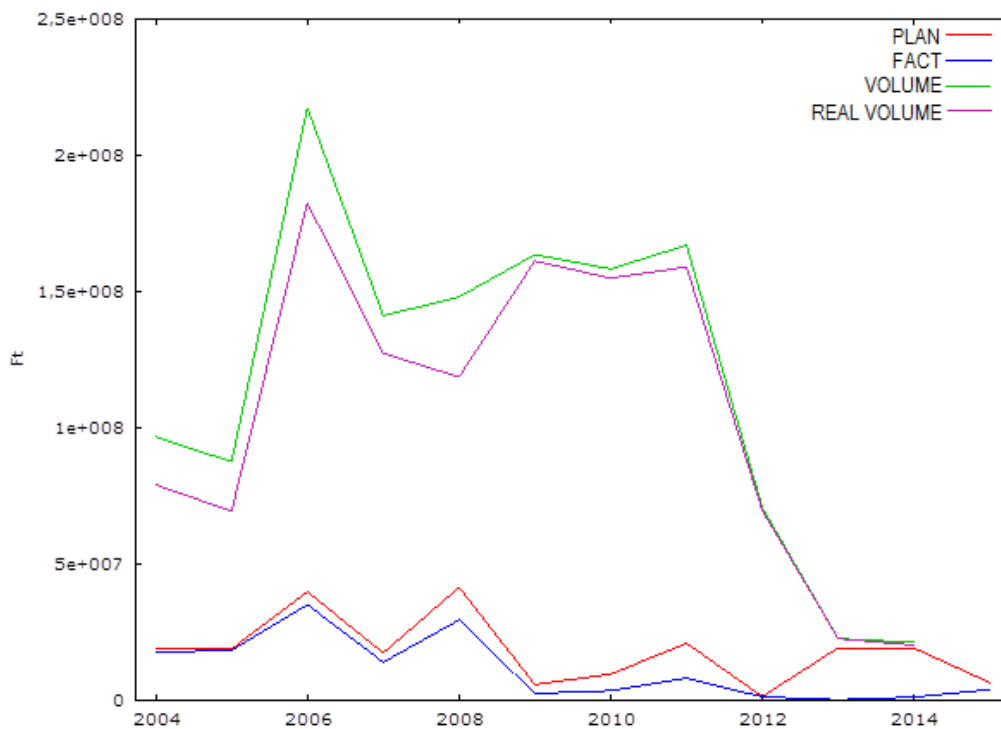


Figure 7. Investment volume (Volume), eligible costs minus State aid paid out (Real volume) and State aid granted (Plan) and actually paid out (Fact) from the aid scheme between 2004 and 2015

Source: author's compilation (2017)

Regarding the grants and the actual payments, there is a significant difference. The former is a commitment according to the eligible costs and grant (payable in several instalments) for the given budget year: in extreme cases it could happen that the last instalment actually took place 7 years after signing the incentive agreement. There are, of course, many reasons behind that. Thus, the approved aid is always a hypothetical amount because on the one hand the payment depends on the realization of the investment and thus on the incurred eligible costs, on the other hand on external factors such as the macroeconomic environment (e.g. the financial crisis in 2008) and/or from the demand side because of the changes in consumer habits. If the investment is on delay and thus the eligible costs may reduce, the payment will be proportionally decreased, too. Or vice versa if costs arise earlier in time, it may seem that it could lead to an increase in the aid intensity, meaning that it will result in a higher amount of subsidy at net present value. This is prohibited according to the rules on State aid. Assuming that the beneficiary only invests a lower volume as it was originally, it means that it will be entitled to a reduced amount of grant. Or, in turn, if everything goes better than expected and the beneficiary decides to invest a higher amount it will not be eligible for more support because it committed to a lower investment and thus a lower amount of grant at the time of signing the incentive agreement and aid was granted, that is, any increase in aid would not have an incentive effect, therefore the beneficiary is no more eligible any additional support. In all cases amendment of the incentive agreement is required.

Due to State aid actually paid out, the eligible costs of investments decreased by HUF 210.9 billion to HUF 1,081.7 billion, i.e. by HUF 19.2 billion less on average per investment between 2004 and 2014. The significant decline in the costs and payments of the last two years can be consequently explained by the closure of the previous projects and their payments and due to the fact that information on actual payments will only be available at the time of the first financial audits for the ongoing contracts.

3.2.2. Results of time series and panel regressions

During the microsimulation I examined the impact of State aid on the number of employees of the beneficiary companies and on their audited turnover. By analogy of the macroeconomic analysis in the first step I tested the autocorrelation, -regression, collinearity, stationary and cointegration of the given variables. Among them it was the employees' time series which have been correlated with their lags and the turnover is dependent on its second-order lagged values (results of the collinearity test are also close to 1 as well as in the case of the number of employees). I could not reject the unit root of each variables and their cointegration, therefore I transformed them into logarithmic form and built in the VECM model, in the VAR model I used their differences.

Variables inbuilt and their time lags			Coefficient	Std. error	t-value	R ²	Causality
VAR(2)	ΔLgY	$\Delta LgSA_{t-1}$	0,465904 (0,0092***)	0,077459	6,0148	0,8735	$\Delta LgSA \rightarrow \Delta LgY$
	$\Delta LgSA$	$\Delta LgSA_{t-1}$	-0,520188 (0,0027***)	0,0566934	-9,1754	0,5604	
VECM(2)	LgY	$LgSA_{t-1}$	0,305794 (0,0367**)	0,108111	2,8285	0,9612	$LgSA \rightarrow LgY$
	$LgSA$	LgY_{t-1}	0,641535 (0,0578*)	0,261645	2,4519	0,8163	$LgY \rightarrow LgSA$
VAR(2)	$\Delta LgEMPL$	$\Delta LgEMPL_{t-1}$	0,419933 (0,6902)	0,955961	0,4393	0,3626	-
		$\Delta LgSA_{t-1}$	-0,102005 (0,6770)	0,221905	-0,4597		
VECM(2)	$LgEMPL$	$LgEMPL_{t-1}$	1,09809 (0,0140**)	0,296978	3,6975	0,6618	$LgEMPL \rightarrow LgEMPL$
	$LgSA$	$LgEMPL_{t-1}$	2,04235 (0,0144**)	0,555685	3,6754	0,9160	

(*** $p < 0,01$ ** $p < 0,05$ * $p < 0,1$ - non significant)

Table 9. Results of VAR(2) and VECM(2) models of the aid scheme

Source: author's calculation (2017)

In choosing the length of the delay the second-order values were also significant in both cases. However, the autoregressive models only lead to significant results in the case of turnover and only up to the first-order lags: according to both models, support paid at time $t-1$ significantly increased the current value of the sales revenue. Nevertheless, the explanatory power of the VECM model is higher (81.63% and 96.12%) than the VAR model but the causal relationship can only be proved clearly in this model which according to the first-order lag of subsidy have affected significantly and positively the current value of turnover. The variance decomposition has also led to a more precise result in the VAR model: in the 10th period State aid explains the sales revenue by 50% while it is 76% dependent on its own lags. In the VECM model the explanatory power of subsidies increases over time but at a lower rate (32%), while sales revenue turned to be dependent on its lagged values on a large scale. However, the subsidy did not have a significant impact on the change of employees.

Based on the results of the VAR models and causal relationship I examined the longitudinal effect in panel regression models. In the case of timely non-constant variables the fixed-effect panel regression model can not be applied and/or if the sample size is large and/or there are missing values (or it is a randomly selected sample) it is assumed that the model has a group effect (Cottrell-Lucchetti 2016; Arellano 2003; Arellano-Bond 1991). The random effect is the average of the weighted matrix of the "pooled"¹⁹ and the so-called "between" models. In the microsimulation, therefore, I examined the effect of the subsidy on sales revenue and employees in a random effect model.

¹⁹ In the "pooled" regression model the fixed and random effects model can be compared but it can easily lead to distorted results, therefore I did not apply it.

Random effect	Coefficient	Std. error	z-value	Breusch-Pagan test	Hausman test
Model 1 (y=turnover)					
const	0,400669 ($<0,0001^{***}$)	0,00967641	41,4068	6,85103 ($0,008859^{***}$)	154,23 ($2,05803e-035^{***}$)
$\Delta lgSA$	0,0681051 ($<0,0001^{***}$)	0,00261738	26,0203		
Model 2 (y=EMPL)					
const	0,239639 ($<0,0001^{***}$)	0,00386112	62,0645	8,00559 ($0,004663^{**}$)	15,3154 ($9,09725e-005^{***}$)
$\Delta lgSA$	0,0004852 ($0,0023^{***}$)	0,00015886	3,0547		

(*** $p < 0,01$ ** $p < 0,05$)

Table 10. Random effect of the aid scheme on turnover and number of employees

Source: author's calculation (2017)

According to results of the random effect panel regression model both of the sales revenue and the number of employees have raised due to subsidies, albeit slightly. However, based on the Breusch-Pagan test, the null-hypothesis of the timely constant variance of the unit-specific error can not be rejected. According to the Hausman test, the model is consistent but the value of χ^2 is relatively high. By analogy to the results of the VAR and VECM models, the panel regression models also proved the positive effect of State aid on the turnover (and on the number of employees) but the time-constancy of the residuals can not be rejected. Therefore I took the assumption that subsidies have influence on the current value of the dependent variable adjusted by its the delayed values, too, in panel regression models up to the second order lags.

Random effect	Coefficient	Std. error	z-value	Wald test	Sargan test	
Model 1 (y=turnover)						
<i>Without trend</i>	ΔlgY_{t-1}	0,591636 ($<0,0001^{***}$)	0,110549	5,3518	120,282 ($0,0000^{***}$)	20,1228 ($0,7404$)
	const	6,78782 ($<0,0001^{***}$)	1,55032	4,3783		
	$\Delta lgSA_t$	0,0358013 ($0,0467^{**}$)	0,0179977	1,9892		
	$\Delta lgSA_{t-1}$	0,0658502 ($0,0024^{***}$)	0,0216494	3,0417		
<i>With trend</i>	ΔlgY_{t-2}	0,0780599 ($0,0038^{**}$)	0,0269681	2,8945	26,0449 ($0,0001^{***}$)	32,2267 ($0,0555^{**}$)
	$\Delta lgSA$	0,0503257 ($0,0004^{***}$)	0,0143193	3,5145		
	$\Delta lgSA_{t-1}$	0,0697875 ($0,0007^{***}$)	0,0206194	3,3846		
Model 2 (y=EMPL)						
<i>Without trend</i>	$\Delta lgEMPL_{t-2}$	0,135272 ($0,0104^{**}$)	0,052816	2,5612	11,4596 ($0,0430^{**}$)	17,2784 ($0,3678$)
	$\Delta lgSA_{t-2}$	-0,0093602 ($0,0891^*$)	0,00550539	-1,7002		
<i>With trend</i>	$\Delta lgEMPL_{t-1}$	0,21601 ($<0,0001^{***}$)	0,0176401	12,2454	148,32 ($0,0000^{***}$)	8,68075 ($0,5626$)
	$\Delta lgEMPL_{t-2}$	0,173481 ($<0,0001^{***}$)	0,0187157	9,2693		
	$\Delta lgSA_{t-2}$	-0,0090759 ($0,0834^*$)	0,00524233	-1,7313		

(*** $p < 0,01$ ** $p < 0,05$ * $p < 0,1$)

Table 11. Dynamic random effect of the aid scheme on turnover and number of employees

Source: author's calculation (2017)

Similarly to the results of autoregressive and random effect panel regression models State aid had significant effect in the dynamic models, i.e. not only its current value but the first and second order time lags affected significantly both the turnover and employment: adjusting by deterministic trend the second order lags of variables proved to be significant only in the 8th period as regards the turnover meaning that there is no trend effect²⁰. The Wald test gives the significance level of regressors (and the bivariate time variables) in dynamic panel regression models. The results of test statistics showed that the presence of trend effect can not be rejected. The combined significance of Wald tests and the first and second order autocorrelation of the variables with the residuals is given by the Sargan test which is asymptotic to the Wald-test: in the case of sales revenue the model without trend, in the model of employees the trend-effected model has led to more robust results. While both the current and first order lag of State aid contributes significantly to the increase in sales, has a negative impact on the change in the number of employees (albeit only the second-order delayed value). Both models, however, depend on their own lags. The results of dynamic random effect panel regression models confirm the results of the VAR and VECM models: the first-order lags and the current value of the support also had a positive impact on the turnover and explained it better than its own lagged values, but the causal relationship can be clearly assessed in the VAR model.

T5. Besides the fact that the regional investment aid reduced the eligible investment costs of the beneficiaries, it contributed to the increase in their output: both the current value and the first-order lags of State aid had a positive and significant impact on sales. However, the impact on the number of employees is unclear.

The results of the microeconomic impact assessment show similarities with that of Csoma (2017). He focused on the social utility and absorption of subsidies and concluded that the support could only be effective when the financial net present value of the investment is negative (meaning that under market terms returns on the investment will not cover the costs) but socially it is desirable and necessary taking into account its external effects. However, it would be unrealistic and irrational from an economic aspect to expect that the "cheaper capital" would generate additional investments and result in an increase in the number of employed people and consequently would raise the level of employment and contribute to economic growth at the macroeconomic level. In his study he used a sample size²¹ similar to that of mine and examined the effects of non-refundable investment subsidies (financed from EU funds). He found clear evidence on the positive and significant impact of support on the turnover of the beneficiary companies but on the number of employees not. Beyond the impact assessment he also emphasized the relationship between competitiveness and subsidies and came to the conclusion that grants awarded to larger enterprises²² did not contribute to improve their competitiveness at international level.

Banai et al. (2017) studied the microeconomic impact of non-refundable EU funds in the 2007-2013 programming period granted to micro-, small and medium-sized enterprises and came to the conclusion that subsidies, though contributed to the growth of sales, added value and number of employees but their competitiveness and productivity have not improved over time. In addition, they assessed that there was no significant difference between the forms of

²⁰ While the model of the first order lags of variables depends on the deterministic trend.

²¹ By examining on the basis of a non-representative random sampling about 80 enterprises receiving subsidies above HUF 100 million.

²² Under the term larger enterprises they meant those enterprises which employ at least 20 persons covering about 87% of the total sample size.

support, that is, independently whether it was refundable or non, direct or indirect assuming that the beneficiaries were basically more capital-competitive compared to their competitors with a sound financial background (e.g. with a better access to financial markets). State aid may, therefore have a disproportionate effect: a company that is active on a given market but received no support may be have or get into a competitive disadvantage or have an entry barrier for new competitors to enter into market.

In international comparison Martini-Bondonio (2012) examined the impact of sources financed from the Cohesion Fund (which is not the same with State aid) in Italy at two territorial levels and two different time intervals. They have come to the conclusion that grants to large companies had not at all incentive effect since projects funded under the aid scheme would have been realized without support. They have found even no or negative effects on employment, sales and investment.

The results of microsimulation, however should be carefully and prudently treated due to the fact that the impact of State aid can not be estimated and attributed to that by 100% and can not be attributed to it because in practice the final date of actual payment coincides with the start of the monitoring period, which means that the obligation of the beneficiary undertaking to maintain the investment as it was in the incentive agreement. Therefore, it is nearly impossible to exclude the selection effect and subjectivity (i.e. the willingness) of the beneficiary being interested in not having a reimbursement obligation during the monitoring period. It is also important to mention, that during the analysis grants under the same title (regional investment aid, e.g. development tax benefit) and other subsidies have not been taken into consideration so their impacts were not filtered out.

4. Possible application of results

Analysis of economic impact of State aid has so far been considered a less researched field. According to the international economic research institute for economic growth and impact assessment of subsidies, namely the "What Works Center for Local Growth" has examined studies on grants awarded in eleven sectors²³ and concluded that only a part of impact assessments²⁴ can be considered to be real ones complying with their own minimum requirements. Moreover, counterfactual impact assessments of aid schemes are still in infancy not only in Hungary (see e.g. Béres 2008) but even at international level. It is not by accident, as State aid is a unique set of rules that of the European Union determining the level playing-field and frames within MSs can maneuver and grant State aid. Such a complex and comprehensive rule system does not exist nowhere else in the world whether it is a state, federation or integration of states. Nevertheless, the need for impact assessment has strengthened over time in parallel with the progress of State aid control.

As it can be seen the real impact of subsidies is also disputed internationally. In my dissertation I have attempted to examine the non-counterfactual average effect of State aid at macroeconomic level on the real economic growth rate and employment rate in the EU and Hungary, respectively between 2004 and 2014, at microeconomic level on the eligible costs, turnover and number of employees of the beneficiary enterprises through an existing aid

²³ Including sectors inter alia transport, innovation, employment, training, business advice, access to financial sources, broadband, etc.

²⁴ By the end of 2015 for example 2300 studies related to the transport sector in OECD member countries, out of which only 29 were considered to be impact assessments and only 6 analyzed the effect of subsidies on the employment and in only two cases were identified positive impact.

scheme between 2005 and 2014. Results of the regression models have shown the macro-level significant impact of support on the employment rate but on the economic growth the causal relationship can not be clearly identified. At microeconomic level the positive impact and causality on sales revenue is clearly significant but not on the employees.

In the light of the above mentioned I consider that my my results of non-counterfactual ex-post impact assessment can contribute to have an overview of the utilization and effectiveness of subsidies both at micro- and macroeconomic level and, therefore can be relevant in decision-making, first of all in terms of a (more) effective designing of aid schemes.

5. Future prospects of research

As regards the future prospects my intention is to go on examining the effects of State aid but at a deeper level: at macroeconomic level to analyze the relationship between subsidies and productivity and competitiveness, focusing on the territorial differences, respectively on the basis of the State Aid Scoreboard data of DG COMP. According to a report of NBH in 2015 the GDP proportional FDIs and the reinvested capital are relatively the highest (and per capita the second largest) in Hungary in comparison with the Eastern Central European region. Given that the expected returns are higher than in the EU on average, at the micro level my aim is to examine the effect of subsidies on the profitability and productivity of the beneficiaries compared to a control group (which can be the most likely to be similar with the treated group) by eliminating the effect of other subsidies. Furthermore the examination of indirect impacts could also be interesting and informative both at regional and macroeconomic level (e.g. in export promotion). In the absence of quantitatively and qualitatively sufficient control group, the analysis of the effect compared to the most comparable aid scheme could be an alternative, too, by comparing with another regional investment aid scheme to measure the real effectiveness (as if a subsidy race). But it can be instructive to compare the aid schemes of the neighboring countries similar to Hungary.

Another future researchal topic is the examination of territorial effects and contexts of State aid by applying spatial econometric methods. The basic question is whether the grants awarded to a region and/or company have effect on another region and/or enterprise (i.e. the subsidy contributes to spill-over, backwash or neutral effects) and lead to significant spatial dependence, interdependence or heterogeneity.

Depending on the causal relationship, the effect of State aid would be worth examining on the following variables and indicators:

- **Investment:**
 - *Microlevel:*
 - capitalized investments after completion;
 - investment value for the current year;
 - value of fixed assets;
 - *Regional and macrolevel:*
 - value of fixed assets;
 - GDP (per capita), real economic growth rate;
- **Employment:**
 - *Microlevel:*
 - average number of employees;
 - personnel costs;
 - *Regional and macrolevel:*

- number of employees;
- **Gross Value Added (GVA)** = *net sales + value of capitalized own assets - value of goods sold - value of mediated services - material costs - value of services used - value of other services*;
- **Labor productivity:**
 - GVA per employee;
 - GVA per personnel costs;
- **Profitability:**
 - ROA, ROE, ROS;
 - EBT, EBIT;
- **Filtering out other support(s):**
 - regional investment aid:
 - *direct cash grant*;
 - *tax benefit*;
 - other subsidies from central budget (e.g. aid for training, employment or in the R&D&I sector);
 - other financed from EU funds;
- **Filtering out deadweight loss:**

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