THE IMPACT OF EU FUNDS ON THE QUALITY OF HEALTHCARE IN HUNGARY

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Abstract

This thesis investigates EU funds channeled into the Hungarian healthcare sector across the 175 districts of the country between 2004 and 2019. The study seeks to answer the following research questions: 1) What factors played a significant role in the allocation of EU funds at a district level? 2) What has been the impact of EU funds on healthcare quality outcomes at the district level? 3) Have geographical health inequalities across districts been increasing or not?

District level treatable and preventable mortality ratios were calculated, and a comprehensive Hungarian district level healthcare database was built for the analysis. A panel ordinary least square regression was conducted with year and district fixed effects to discover factors that influenced the allocation of EU funds. To examine the causal impact of EU funds a two-stage least square panel regression was implemented with year and district fixed effects using the mayor of the district capital from the ruling party at the time as an instrument to deal with the endogeneity of EU funds variable. Geographical inequalities were assessed by calculating the Gini coefficient.

Results of the empirical analyses discovered that 1) EU funds targeted improvements of in- and outpatient care and county hospitals were preferred over university clinics and national institutions; 2) Political considerations also played a role in the allocation of EU funds; 3) EU funds had a positive effect on healthcare quality outcomes measured by treatable and preventable mortality; 4) Within-district disparities in healthcare capacity outcomes were reducing and disparities in healthcare quality outcomes were increasing simultaneously.

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1. INTRODUCTION[1]

Hungary has received a tremendous amount of EU funds after the country's accession to the European Union. The per capita amount of EU funds channeled to Hungary is higher than the amount of Marshall aid after WW2 (Weinhardt 2018). It is an "unprecedented and probably never recurring" opportunity to stimulate the country's economic and social development. (Bod 2019, p 1). However, there are several critics from Hungarian and international researchers regarding the efficiency, the (mis)management, and the actual impact of these funds (Apuzzo 2019; Fabók 2019; Istrate 2019; Wiedemann 2018a and 2018b; Weinhardt 2018).

A considerable amount of EU funds supported the health sector. Over two-thirds of the total Hungarian healthcare investments at the time were covered by EU funds (Mérték 2017). Alongside with massive EU funds inflows, one of the most popular topics of the social and the political discourse was the poor and continuously worsening quality of healthcare services, and health outcomes being below EU and regional averages. The obvious question emerges: where did these EU funds go?

Aid effectiveness has been widely researched (Alda and Cuesta 2019; Bourguignon and Sundberg 2007; Hansen and Finn 2000; Veiderpass and Per-Ake 2007), and the efficiency of aid in the health sector has also been gaining more attention (Martinez-Alvarez and Acharya 2012; Piva and Rebecca 2009). There is a consensus among authors that aid is an effective tool in building capacity, stimulating growth, promoting human development and reducing inequalities. However, measuring the actual impact of aid in the health sector on healthcare quality outcomes is challenging because financial support can directly influence the healthcare capacity and process outcomes (number of qualified nurses, number of patient-provider

[1] This chapter builds on the research proposal by Tóth (2019) developed for the class Introduction to Development

meetings, etc.) (Donabedian 2003) however, these outcomes can be distorted by factors that are outside of the provider's scope (quality of institutions, lifestyle, environment, individual biological characteristics, etc.) (AHRQ 2019; Álvarez and Acharya 2012; Donabedian 2003; Peabody et al. 2006).

The existing few studies that examine the effect of EU funds on the healthcare system concentrate on healthcare capacity outcomes (number of in and outpatient visits, in and outpatient expenditures, transportation time, ratio of one-day surgeries, etc.) (Elek et al. 2019; Kiss et al. 2014). To my knowledge, no research has examined the effects of EU funds supporting healthcare on healthcare quality outcomes in Hungary.

There is only a limited number of papers investigating the characteristics of EU funds channeled to the healthcare system (Dózsa 2015; Dózsa, Borcsek, and Tóth 2016; Balogh 2015), and the focus of these studies is limited to one reference period, one sub-sector (hospitals only) or one program only.

This thesis seeks to fill this gap and examine the whole scope of EU funds channeled to the various sub-sectors of Hungarian healthcare across all reference periods, as well as explore the impact of EU funds on healthcare quality outcomes. This study seeks to answer the following research questions: 1) What factors played a significant role in the allocation of EU funds at a district level? 2) What has been the impact of EU fund on healthcare quality outcomes at the district level? 3) Have geographical health inequalities across districts been increasing or not?

Reports regarding the Hungarian healthcare system usually concentrate on country-level indicators (European Commission and the OECD's Country Health Profile reports). Such aggregation can hide processes happening at a lower geographic level. Studies show that improving national statistics can be accompanied by continuously increasing regional and gender inequalities at a district level (Uzzoli et al. 2017 and 2018). Thus, empirical analyses of

healthcare programs are advised to be conducted at the lowest geographic level possible. In the case of Hungary, the district or municipality level would be the appropriate. However, the limited data availability in both healthcare and at a district-level in Hungary can prevent researchers from conducting examinations at lower geographic levels.

To tackle these obstacles and promote future research activities, a comprehensive Hungarian district-level healthcare database was built within the framework of this thesis. The database contains more than 50 indicators for the period of 2004-2019.

The research questions are explored by these different methods: 1) A panel ordinary least square regression is conducted with year and district fixed effects to discover factors that influenced allocation of funds. 2) To examine the causal impact of EU funds, a two-stage least square panel regression is implemented with year and district fixed effects using the mayor of the district capital from the ruling party at the time as an instrument to deal with the endogeneity of EU funds variable. 3) Geographical inequalities are assessed by calculating the Gini coefficient.

Results of the empirical analyses discovered that 1) EU funds targeted improvements of in and outpatient care and county hospitals were preferred over university clinics or national institutions; 2) political considerations also played a role in the allocation of EU funds; 3) EU funds had a positive effect on healthcare quality outcomes measured by treatable and preventable mortality; 4) Within-district disparities in healthcare capacity outcomes were reducing, while disparities in healthcare quality outcomes were increasing simultaneously.

The structure of this thesis is the following: the second chapter presents the local levels of the Hungarian administrative system, briefly introduces the characteristics of the Hungarian healthcare system to illustrate the broader context where EU funds arrived and summarizes the architecture of EU funds and describes the characteristics of EU funds channeled into the Hungarian healthcare system. The third chapter provides the literature review of measuring aid

efficiency, quality of healthcare and health inequalities, and presents the hypotheses. The fourth chapter introduces the various datasets that were used for this research, describes the empirical strategy, and demonstrates the results and discusses the possible limitations of this research. The fifth chapter discusses the conclusion and policy recommendations. The appendices demonstrate the full output of the used models and relevant background information.

2. BACKGROUND[2]

2.1. The local levels of the administrative system of Hungary[3]

The Hungarian administrative system has four local levels: municipalities, districts, counties, and regions:

1) Municipalities are equal to the local administrative unit (LAU) 2, these are the lowest administrative levels of Hungary. The country has 3155 municipalities (HCSO The Geographic Atlas of Hungary).

2) Districts are the next higher regional level, equivalent to LAU1. The country has 197 districts including the 23 districts of Budapest. The district system was established in 2013[4] to promote a more efficient and accessible local administrative system in the countryside (HCSO The Geographic Atlas of Hungary). A governmental agency was opened in each district where citizens can deal with administrative issues related to the central government (ID, passport, child-guardian cases, unemployment benefit, etc). Districts are demonstrated with lines in Figure 1.

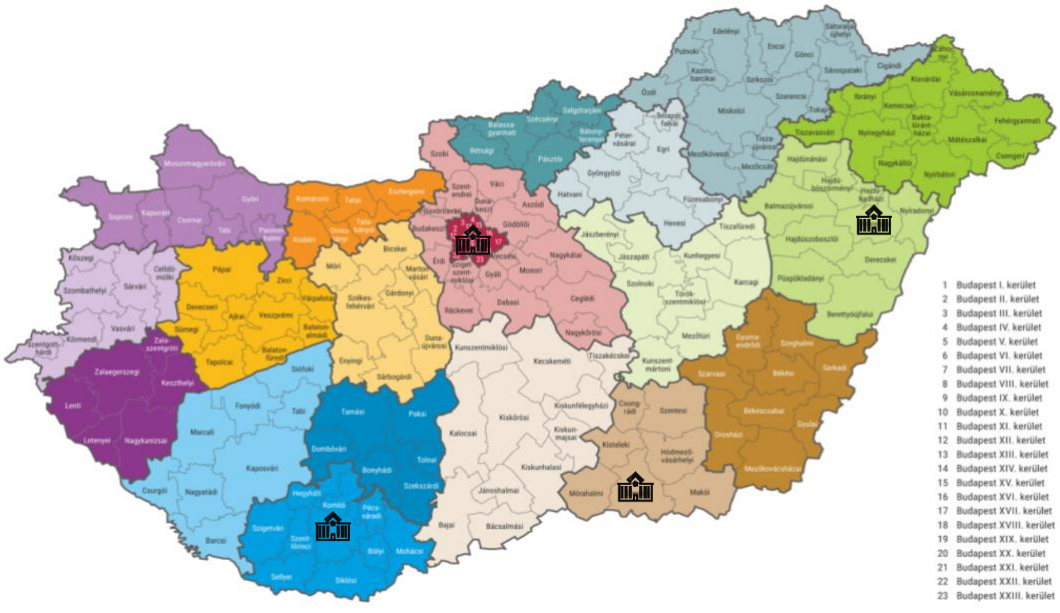

Figure 1. Counties and districts of Hungary

university clinics and national institutions

Source_ HCSB

[2] This chapter builds on the research proposal by Toth (2019) developed for the class Introduction to Development
[3] This chapter is based on the information available at the geographic atlas of the Hungarian Central Statistical office: https://www.ksh.hu/teruletiatlasz_jarasok
[4] Some minor changes were implemented in 2015, the district system of 2015 was used in this research.

Counties are equivalent to Nomenclature of Territorial Units for Statistic (NUTS) 3. These are the oldest administrative units between the municipalities and the national level. Hungary has 19 countries. Counties are illustrated with different colors in Figure 1.

Regions are the largest regional units of the country. They were established in 2003 to create a NUTS2 equivalent regional system fulfilling EU requirements. Hungary has 8 regions, one region consists of three counties, and Budapest and Pest county are classified as individual regions.

Certain EU funds[5] target regions as the local level of administration. Regions above a certain level of development[6] are not allowed to apply for most of the EU funds or can only receive a limited amount. mention that the most developed[7] regions are not allowed to receive funds or can only receive a limited amount. In Hungary, the Central-Hungarian Regions (Budapest and Pest county) fall into this category and are excluded from most of the EU funds.

With the exception of districts in Budapest, districts and regions exist rather purely administratively or statistically. Counties have a more important role in politics as they have their own government and they technically serve as a basis of local life. Healthcare and education are organized across counties and so as is local life and "geographic identity" (Hajdú 1996 p 11). Local level data is mostly collected at a regional or a county-level; the availability of district-level data is limited.

With the exception of Budapest, healthcare provision districts do not align with the local administrative units. In- and outpatient healthcare provision districts differ by disease and the exact institution the patient should visit depend on her municipality and the seriousness of the condition of the patient. In general, if a patient has a not-so-serious condition, the closest village hospital can serve her; with a more complicated or serious case a patient has to go to the usually

[5] European Regional Development Fund, European Social Fund, Cohesion Fund.
[6] (Different rules may apply for reference periods and Funds) EU funds are usually available for regions with a GDP per capita under 75% of the EU average.

better-equipped county hospital that is located in the county capital; and in the most serious or special cases are treated in the 3 university clinics or national institutions in Budapest. (The location of university clinics and national institutions is illustrated with a hospital icon in Figure). This geographic healthcare provision system is overly complicated, lacks transparency and access to service is not equal (Uzzoli 2019).

2.2. The Hungarian healthcare between 2004 and 2019

This section presents the broader context where EU funds arrived by briefly describing the most important characteristics of the Hungarian healthcare system and the significant policy changes that were implemented in the period examined.

2.2.1. Quality of healthcare

"The real performance, efficiency and quality of Hungarian healthcare are completely hidden from the patients, even policy actors have only distorted and limited amount of information" (Hungarian Medical Chamber 2020, p 6).

The most influential health quality assessments of Hungary are conducted by international organizations (EU, OECD, WTO, Health Consumer Powerhouse). These analyses describe the Hungarian healthcare system mostly with country-level indicators and concentrate on EU-level comparisons. The first – and until now the last – published comprehensive quality analysis of the Hungarian healthcare system focuses on national and regional levels (Mérték 2017).

The reports most important findings regarding the quality of healthcare:

1) Despite life expectancy, cancer and cardiovascular statistics have been improving, the country is still among the worst performers in these indicators in EU comparison;

2) There is a high prevalence of lifestyle related risk factors across the society (poor nutrition, low physical activity and high ratio of obesity, smoking and alcohol consumption); 3) Shortage of healthcare professionals is significant, and the distribution of the personnel is geographically

uneven; 4) Health provision is hospital-centric and there are regional inequalities in access to care; 5) The health sector is underfunded, there is a high level of co- and out of the pocket payments (around 30%); 7) There are significant regional, gender and socioeconomic inequalities in all the previously mentioned dimensions (European Commission and the OECD's Country Health Profile 2019; Mérték 2017).

2.2.2. Health equity

Nagy et al. (2012) demonstrate that socioeconomic status in itself does not explain geographic inequalities in avoidable mortality based on a hierarchical Bayesian model conducted at a municipality level for 2004 and 2008. Uzzoli (2016) finds that there are significant spatial and gender inequalities in life expectancy among districts and this pattern correlates with the socioeconomic status of the districts between 1990 and 2015. North Eastern Hungary and South Western Hungary is identified as the most disadvantaged areas in terms of health equities (Nagy et al. 2012; Uzzoli 2016).

Uzzoli et al. (2017) examine spatial and gender inequalities in access to health by examining acute myocardial infarction (AMI) at a district level between 2005 and 2015 conducting a spatial autoregressive lagged model and the GINI coefficient. Their results show that there is a paradoxical relationship: despite the overall, country-level improvement the regional and the gender inequalities of AMI mortality were increased at the same time. Uzzoli et al. (2018) further extends their previous study (Uzzoli et al. 2017) and discovers that the reason for this paradoxical relationship is related to the fact that the newly established AMI centers are not equally accessible across districts.

Bíró et al. (2021) study life expectancy inequalities by avoidable mortality and income at a municipality-level across three time periods 1991-96, 2001-2006, 2011-16. The research discovers significant inequalities in life expectancy at age 45 across municipality-level income ventiles (Bíró et al. 2021). This study also demonstrates that treatable and preventable mortality

has a significant impact on the overall inequality of life expectancy and this relationship is even more persistent among males (Bíró et al. 2021). This study proves that the inequality of avoidable mortality is associated with health behavior, access to care and healthcare use (Bíró et al. 2021).

2.2.3. Health policy measures

The healthcare system is quite complex with several interest groups and possible conflicts of interest. Reform attempts caused strong social protest and loss of popularity so no government could or had the courage to conduct fundamental changes. Developments and modernizations in the healthcare system were not "*implemented as a well-designed, long-term strategic plan, rather on a haphazard manner, following momentary political and lobbying interest*" (Lénárd 2018 p 2). It also occurred that the government advertised a new policy measure, but it was terminated quickly after or was not implemented properly[8]. Such cases were not documented in the official policy papers. In order to identify the most important policies that could have an actual effect on healthcare outcomes in the period examined expert interviews were conducted [9]. The following areas were identified:

1) *Public health*: There were four important public health related policies:

1.1.) At the beginning of the 2000s, regional cardiac catheterization centers were established to provide sufficient care for acute myocardial infarctions (AMI), which is among the leading mortality causes. This resulted in improvements in country-level AMI mortality.

1.2) Smoking was targeted by several measures: smoke-free laws were implemented, and access was restricted in 2012. The tax on tobacco products was increased gradually in the period examined.

[8] Such example includes the predetermined basic rate-based capacity financing (the Hungarian mosaic word is EMAFT) that was effective for only 9 months in 2009.

[9] Four interviews were conducted. The interviewees requested anonymity. Interviewees have work in the following areas for 15-20 years: financial director of a hospital, epidemiologist, expert of geographic inequalities and expert of public health policies.

1.3.) A "fat tax" was placed on food items high in sugar and fat in 2011. Despite these measures smoking ratio, fat and sugar consumption still remains high.

2) *Capacity and accessibility*: Three significant measures were identified in the period examined:

2.1.) Structural healthcare reforms were started in 2006-2007. As part of these reforms, the capacity of hospitals was cut drastically, several hospital departments were closed, and the number of active hospital beds was decreased. (Kaló 2007). Other parts of this healthcare reform package could not be finished as planned due to the strong protest from society and from the sector, as well as further protest to political conflicts.

2.2.) In- and outpatient care were centralized after 2010 aiming to improve efficiency and make primary and out-patient care more accessible locally (it was mostly financed by EU funds) (Uzzoli 2019).

2.3.) In 2012 hospitals that were previously owned by municipal or county governments were taken by the central government, and despite no hospital closures, some areas experienced decreases in capacity as parallel activities were ceased.

3) *Patient safety and quality control*: Healthcare Supervision Authority, an independent institution for controlling the quality of healthcare service and healthcare providers, patient safety and the spending of the National Healthcare Fund, started to operate in 2007. In 2010 it was closed, and its tasks were divided among four other institutions[10]. These four other institutions are burdened with several other tasks and they are in charge of the activities they should control. This measure probably hampered the effective quality, efficiency and patent security control over the system.

4) *Shortage of healthcare workforce*: The level of shortage of skilled and unskilled personnel is a pressing issue that can limit the quality of healthcare (Kosztolányi and Csiba

[10] Ministry of Human Resources, National Healthcare Fund, National Public Health Center, and the public health departments of local government offices.

2019). The direct causes of this shortage are the low salaries and the unfriendly working conditions. After Hungary's accession to the EU the emigration of healthcare workers was accelerated (Varga 2016). In response, the government increased wages in the sector gradually in several waves after 2010. However, wages of health professionals remained low compared to wages in the private sector and in European comparison as well (Varga 2016; Uzzoli 2019)[11].

The shortage of workforce remained persistent in the period examined (Kosztolányi and Csiba 2019; Uzzoli 2019). Healthcare institutions have been struggling to find qualified healthcare professionals and it also occurred that an institution or a department was closed or suspended temporarily due to the lack of the minim necessary personnel (Egri Ügyek 2019; Hang 2021; HVG 2019a and 2019b,–Magyar Nemzet 2018; Népszava 2017; Népszava 2019; SZOLJON 2019)

[11] Varga (2016) demonstrated, that between 2003-2011 12% of the doctors were leaving the healthcare system due to emigration, 14% retired or went on maternity leave and 17% found a job outside of the medical sector in Hungary.

2.3. EU funds

The structure, the conditions and the environment of the EU funds are significantly different from the classical development assistance for developing countries:

1) There is a fixed amount of financial development support for each EU member state for a given 6-year reference period.
2) Recipient governments can decide the specific aims of development, and they allocate, monitor and control the majority of the support dedicated to them.
3) Donor and recipient roles are not separated clearly. The EU is the one that provides financial assistance. Each member of the European community contributes to the common financial pool and the EU redistributes these resources. There are so-called 'net contributors' who pay a higher amount than what they get reimbursed, and 'net beneficiaries' who receive more than the amount they contributed. Hungary is a net beneficiary country.
4) There is a more balanced relationship between the parties. The recipients and donors are part of the same political community, thus there are stronger economic and political ties between them. Recipients also have the political power to influence EU-level decisions which can affect the donors. Consequently, recipients of EU funds enjoy a different treatment than most recipients of international development aid.

2.3.1. The architecture of EU funds [12] [13]

EU funds are available for a 6-year reference period. The total amount available for the reference period for a country is negotiated before the period. Hungary is receiving the vast majority of EU funds under the framework of partnership agreements (PA), which are

[12] This chapter builds on the research proposal by Tóth (2019) developed for the class Introduction to Development
[13] This chapter is based on information available at the official EU funds portal of the Hungarian government (https://www.palyazat.gov.hu/szechenyi_2020) and at the official website of the EU (https://europa.eu/european-union/about-eu/funding-grants_en)

contracted between the EU and the respective national governments[14]. The national government is in charge of allocating, monitoring and controlling the funds received by the PA. There are development plans (DP) for a longer period that articulate broader development aims. There were four DPs so far in Hungary: 1) National DP for the reference period 2004-2006; 2-3) New Hungary DP and New Széchenyi Plan for the reference period 2007-2013, 4) The Széchenyi2020 between 2014 and 2020.

Under the framework of DPs there are smaller operational programs[15] (OPs) which contain specific objectives, expected impacts[16] and the concrete budget. The EU sets thematic objectives for each reference period, and the national governments adjust their DPs and OPs to their own needs following these thematic objectives[17] . The DPs and the OPs are worked out by the national governments, but the European Committee has to approve them.

There are specific programs[18] within the scheme of an OP. The governmental body in charge of the EU funds launches a call for these programs and healthcare providers or their controlling authorities[19] can apply for funding for realizing projects fitting the program. There were no specific OPs for health or healthcare, but 153 health-related programs were launched within different OPs between 2004 and 2020. Figure 2 illustrates the architecture of EU funds visually.

[14] Funds that are managed directly by the EU are mostly research or other grants. Such grants are not included in this research

[15] For example: Szechenyi2020 DP has 7 OPs: 1) Competitive Central-Hungary, 2) Economic Development and Innovation, 3) Human Resource Development, 4) Integrated Transport, 5) Public Administration and 6) Civil Service Development and 7) Territorial and settlement development.

[16] Some expected impacts of the Human Resource Development OP: "300 participants in health promotion and disease prevention programs"; "700 migrants and minorities (including roma people) will be involved".

[17] Some thematic objectives of the 2014-20 reference period: developing the most marginalized regions; promoting employment and supporting labor mobility.

[18] Some health-related programs: improving outpatient centers in small regions, developing neonatological care, developing modern oncology networks.

[19] In some cases, local governments, churches, universities.

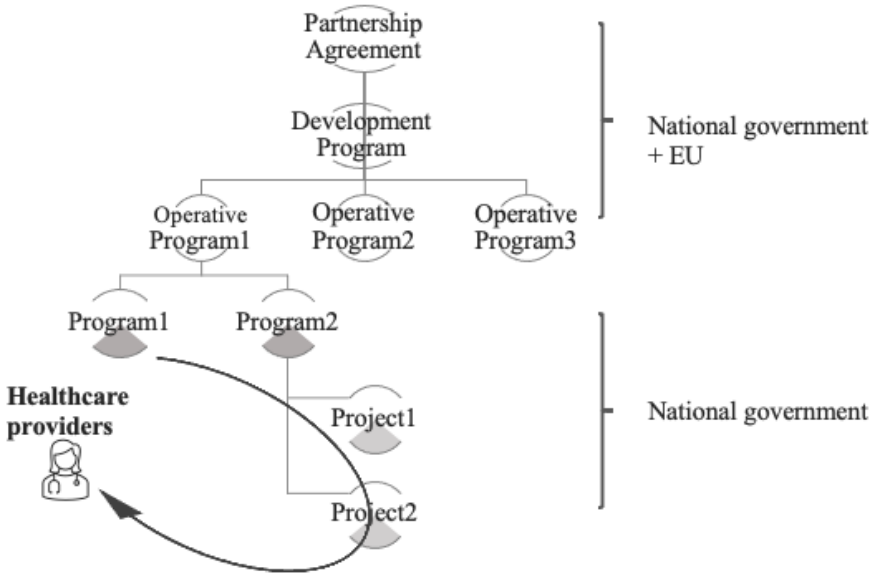

Figure 2. The architecture of EU funds

source: author's own work

2.3.2. EU funds in the Hungarian healthcare sector

Experts agree that EU funds have played a major role in the development of healthcare in Hungary in the last decades (Dózsa, Borcsek, and Tóth 2016; Mérték 2017; Balogh 2015). The Assessment Report of the Hungarian Healthcare System 2013-2015 concludes that the ratio of EU investment in Hungarian healthcare was nearly 77% in 2014 (Mérték 2017). Nagy (2008) demonstrated in the case of EU funds in general that the Hungarian government did not allocate any significant additional budget for development besides the compulsory state co-financing part of EU funds.

Dózsa (2015) analyzed EU funds that supported hospitals in the 2007-2013 reference period at a county level (NUTS3). The analysis concludes that the amount of EU funds targeting hospitals were influenced by the geographic location and the hierarchy of hospital. County hospitals received the largest portion of funds (compared to village level hospitals and university clinics) (Dózsa 2015).

Kiss et al. (2013) examined EU funds in healthcare during the 2007-2013 reference period. The study evaluates the impact of EU funds in the last year of the reference period, so

it could not measure long-term effects. The paper assessed the impact of EU funds across three dimensions[20]: 1) geographical targeting of funds based on avoidable mortality of the districts[21] (LAU1) conducting regression analysis and calculating Lorenz-curves, 2) accessibility and quality of outpatient services based on access time, usage and the ratio of one-day surgeries at district (LAU1) or municipality (LAU2) level conducting fixed-effect and difference-in-difference panel regressions; 3) health awareness programs based on expert interviews and surveys (Kiss et al. 2013). The most important findings of the paper[30]:

1) Districts with worse avoidable mortality received a higher amount of EU funds per capita than the average;

2) The accessibility of outpatient care was improving if measured in theoretical access time, however, the actual time to get there has no changed significantly. Only 35-45% of the population of the concerned districts started to visit the newly established outpatient centers that are located closer to them (the authors suggest that it can be related to the individual decisions of patients and to the referral practices of primary care providers and inpatient institutions). The ratio of one-day surgeries was increased and outpatient usage was also improved by 25-30%.

3) Health awareness-raising campaigns could reach about 250 thousand people (2.5% of the Hungarian population). The expert interviews concluded that the actual health effect of these programs is debatable due to the lack of clear goals and national-level coordination (Kiss et al. 2013).

Elek et al. (2019) examine the effects of EU funds supporting the establishment of new outpatient centers in the least developed districts on substitutions between outpatient and inpatient care conducting a fixed effect Poisson model at the patient level. The study suggests that improvements in the accessibility of outpatient care generate health benefits, and the study

[20] That is relevant for this thesis
[21] The paper used the district classification that was used before 2013

also proved that there is a strong substitution element between outpatient and inpatient care (Elek et al. 2019)

2.3.3. Descriptive statistics

All together 755 billion Hungarian forints arrived[22] in the Hungarian healthcare between 2004 and 2020 from the EU. 3154 projects were realized within 150 programs.

The government stated different development goals by reference periods. In the period between 2004 and 2006 the main goal was to improve healthcare infrastructure in the marginalized regions, the majority of the EU funds were used for establishing diagnostical centers (Balogh 2015).

For the 2007-2013 reference period the two main health development goals were to promote the *structural change* (concentrate in-patient care into well-equipped centers where different specialist can work together and substitute active inpatient care when it is feasible by promoting one-day cases) and improve regional accessibility. To promote these goals, programs in the following OPs were implemented: 1) establish regional centers and modernize the infrastructure of inpatient service, 2) special programs focusing on the following areas: emergency care and ambulance system, oncology, blood transfusion service; 3) establishing and/or improving outpatient centers; 4) e-healthcare by establishing informatics infrastructure and electronic health databases; 5) public healthcare programs and health-awareness-raising campaigns; 6) human resource development (Balogh 2015) (Kiss et al. 2013)

During the period of 2014-2020 achievement of the goals of the previous period were continued by improving 1) primary care; 2) special focus areas as: infection control, psychiatric care and mental health, child emergency and traumatology; 3) e-healthcare; 4) public healthcare programs; 5) human resource development; 6) infrastructure development.

[22] It is indeed a tremendous amount, however, it makes up only the 3.6% of the total EU funds that arrived to Hungary in the period examined.

Figure 3. demonstrates the total amount of EU funds by support schemes. 77 percent of the total amount was spent on infrastructural developments mostly related to structural change at different levels of care (inpatient, outpatient and primary care, special focus areas and equipment). It covered the establishment of new buildings or renovating already existing ones and purchasing medical equipment and machines. Among them, the greatest amount, 365 billion forints (48% of the total funds) was spent on infrastructure development in inpatient care[23] and 87 billion forints (11%of the total funds) was invested into special focus areas (emergency care and ambulance, infection control, psychiatric care, rehabilitation, oncology, childcare, neonatology and blood transfusion supply). 56 billion forints (7% of the total EU funds) was used exclusively for outpatient care, 18.6 billion (2 % of the total funds) on primary care and 14.6 billion forints (2% of the total EU funds) on primary and outpatient care (it was a common pool available for marginalized regions). 42 billion (5.5% of the total funds) was

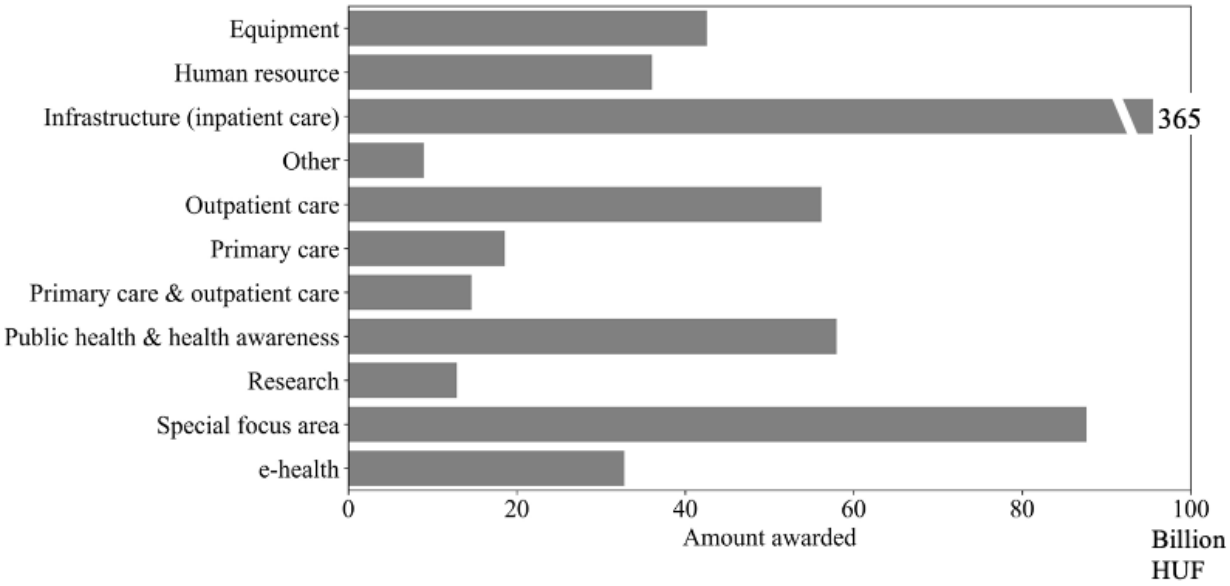

Figure 3. The total amount of EU funds in 2004-2010 by support schemes

source: author's own work, using data discribed in chapter 4.1.

[23] However, these developments probably had an effect on the out-patient care of the receiving institution as well.

spent especially on diagnostical equipment[24]. 36 billion (4.7% of the total funds) was spent on human development programs that technically provided extra income for healthcare professionals to compensate for their low salaries. Scientific and system development research[25] was conducted using up 13 billion forints (2% of the total funds). 32.7 billion forints (4% of the total funds) were spent on information technology and e-health, the majority of this amount (20 billion) was used to develop the Electronic Healthcare Service System that stores all healthcare-related data of patients in one platform. This system started to operate in 2017. 58 billion (7.5 % of the total funds) was used for public health and health awareness programs. 9 billion (1 percent of the total funds) was used for other schemes, such as: dental care, home assistance, patient rights.

Figure 4. demonstrates the total amount of EU funds by the year of the awarding decision. The graph shows that a significant amount arrived in the preceding year of the last three national elections (it does not hold for 2006, and 2014 was the last year of the 2007-2014

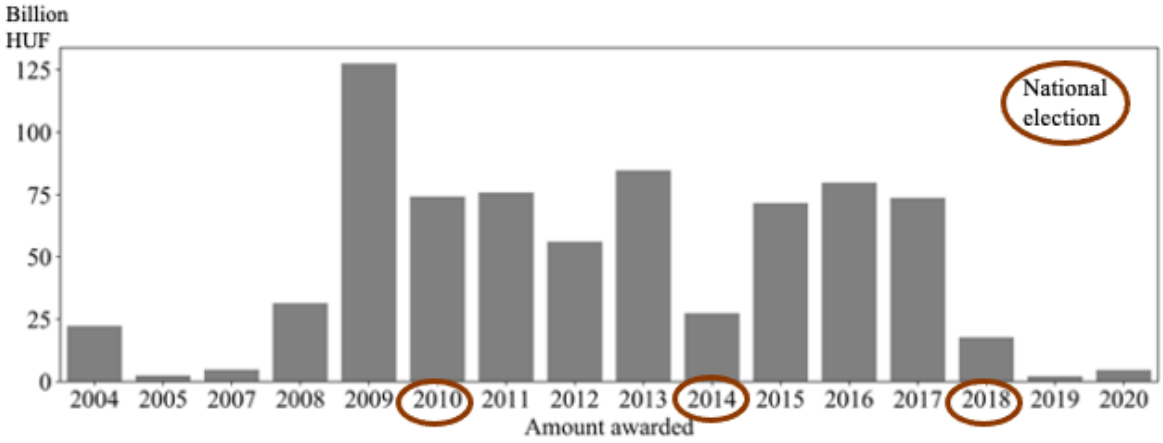

Figure 4. The total amount of EU funds in 2004-2020 by the year of decision

source: author's own work, using data discribed in chapter 4.1.

[24] It is related to one program that supported hospitals to purchase CTI, MRI and X-ray machines. The Hungarian Competition Authority conducted an examination that concluded that a cartel crime was committed. According to the testifying participating machinery providers the contracts were let with a 20% kickback (Sarkadi 2018).

[25] For example: „development of evidence-based health-improving practices and a national health-improving network', 'improving administrational capacity in the healthcare system', 'monitoring human resources', 'development of a common external monitoring system in the in- and outpatient care and the pharmacological care'.

reference period). EU funds started to flow into the country after 2007 since it was Hungary's first full-reference period. 2009 was the peak year with 127 billion forints (16.8 percent of the total funds) arrived.

Figure 5. demonstrates the amount of total EU funds by districts and Table 5. on page 57 demonstrates the 15 districts that have received the biggest and smallest amount of EU funds. 85 billion forints (11 % of the total funds) were used at a national level. The following operative programs were listed here: 1) research schemes; 2) development of national-level institutions or systems; 3) programs where the district of the development was not clear[26]. These EU funds were not included in the analysis part of this research.

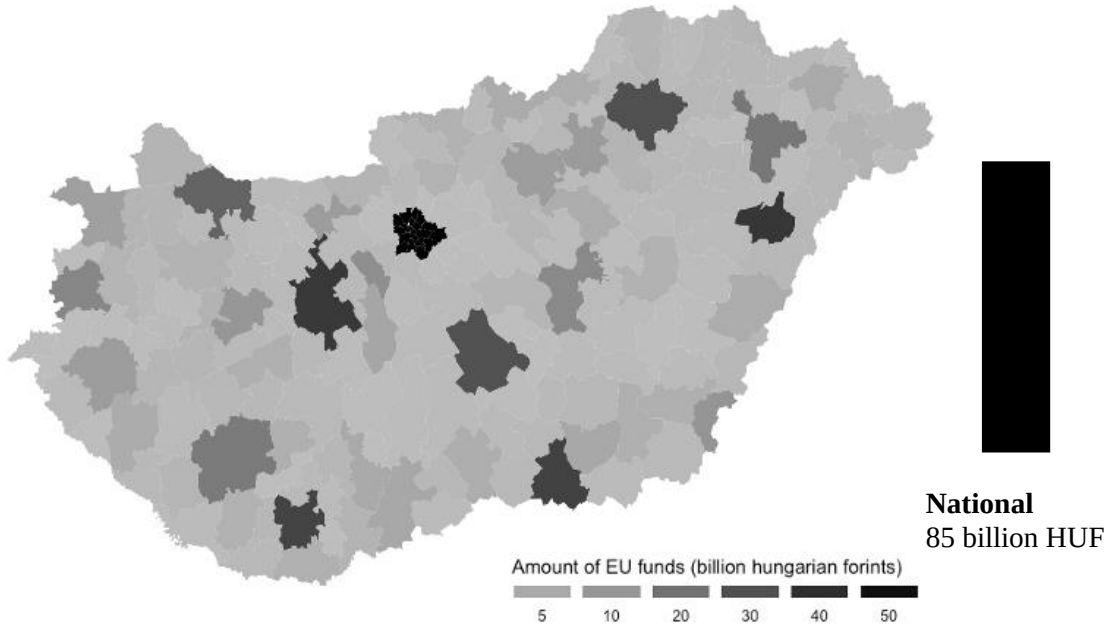

Figure 5. The total amount of EU funds in 2004-2020 by districts

source: author's own work, using data discribed in chapter 4.1.

All districts have received some EU funds. Despite the fact that the central Hungarian region was excluded from several EU funds - due to its higher GDP and GNI per capita, - Budapest has received the highest amount of EU funds across the 175 districts. The capital could use 11% percent of the total amount of EU funds that went to districts (excluding national funds).

[26] In the case of a few – but having a relatively high budget – programs the National Healthcare Service Center was the official beneficiary and allocated the funds among regional healthcare providers. In these cases, the exact share of the healthcare providers is not available.

Figure 5. and the Table 5. suggest that EU fund allocation supported the *structural change* target: Districts with important hospitals have received higher amounts and county hospitals in areas that are located further from university clinics and serve relatively large population (Székesfehérvár, Győr, Nyíregyháza, Miskolc, Szombathely, Kecskemét, Szombathely, Kaposvár, Veszprém). The only district that does not fit this company is Martonvásár, which has received a big amount for ambulance station development.

Districts in the Central Hungarian regions (Pest county) received the lowest amount of EU funds. Some districts received low amount of EU funds are located close to important hospitals (Tiszakécske, Nagykőrös, Bólyi, Hegyháti) or are considered "well-off" (Tolnai, Oroszláyni, Körmendi) by the official law about the districts that "need development" (290/2014 XI. 26). However, two districts (Devecseri and Hegyháti) are on the list of the most disadvantaged districts (thus available for special EU funds) and they still did not receive significant EU funds. One explanation can be, that these districts have only primary care, and hospitals and outpatient center development require more expensive investments.

3. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

3.1. Literature review[27]

3.1.1. Aid efficiency

Bendavid and Bhattacharya (2014) analyzed the relationship between the annual amount of development assistance directed to the health sector and changes in life expectancy and under-5-year mortality in developing countries. They conducted a first difference panel model for 140 countries between 1974-2010. Their results show that health aid was associated with improving life expectancy and infant mortality, and this relationship was even more significant between 2000 and 2010 when a higher amount of health assistance was provided for the examined countries (Bendavid and Bhattacharya 2014).

Beracochea (2015) focused on the effectiveness of aid from the perspective of the Paris Declaration Principles of Aid Effectiveness: ownership, alignment, harmonization, results, and mutual accountability. The author measures the results of development aid based on the Millennium Development Goals (MGDs). The MDGs have three, clear health-specific targets that are easy to measure: 1) reducing child mortality; 2) improving maternal health; 3) combating HIV, malaria, and other diseases (Beracochea 2015)

Both the Bendavid and Bhattacharya (2014) and the Beracochea (2015) papers concentrate on developing countries. As mentioned before, the mechanisms of EU funds are different and Hungary's healthcare system is facing problems of a different nature. Sustainable Development Goals (SDGs) – the successors of MDGs have more relevant health-related goals for Hungary.

The Sustainable Development Solutions Network recommends 84 health-related SDG target indicators (2015). Proposed SDG indicators that can be relevant for Hungary and were considered for this research: 1) ratio of health professionals to population; 2) public and private

[27] This chapter builds on the research proposal by Toth (2019) developed for the class Introduction to Development

R&D expenditures on health; 3) unhealthy behaviors and risk factors (insufficient physical activity, fat, sugar, salt, vegetable, fruit and alcohol consumption, smoking ratio, obesity ratio); 4) healthy life expectancy at birth, 5) waiting time for elective surgery; 5) incidence of certain diseases (diabetes, hypertension); 6) screening participation ratios; 7) probability of dying between exact ages 30 and 70 any of the cardiovascular disease, cancer, diabetes, chronic respiratory disease; 8) infant mortality ratio (Sustainable Development Solutions Network 2015).

Álvarez and Acharya (2012) examined the methodological challenges of estimating the effect of aid on the health sector across five different modalities: project, program-based, and sector-wide approaches, budget assistance, and global health initiatives. The paper concludes that international development assistance in the healthcare sector can have limited effects since the domestic factors and the status quo of the recipient countries (such as institutions, governance, and public policies) are more influential and can be change over a longer period (Álvarez and Acharya 2012). The obstacle of the local context and quality of political institutions described in Acemoglu and Robinson (Daron and James 2012) applies to Hungary as well and it could hamper the results of the analysis.

Corruption is another factor that is related to the local context and it can directly influence aid effectiveness (Kaufmann 2009). There has been a scandal about corruption and misuse of EU funds in Hungary (Baczynska 2021) (Kalan 2020). Fazekas et al. (2014) displayed empirical evidence that EU funding has considerably increased corruption risk in Hungary and the analysis of Transparency International concluded that '*various corruption methods are often used combined with one another'* regarding the allocation of EU funds in the country (Kállay 2015 p 36).

3.1.2. Quality of healthcare

A broadly applied conceptual method to evaluate health care is the donabedian method (AHRQ 2019; Peabody et al 2006). The model assesses the quality of medical care across three dimensions:

1. *Structure*: "is meant to designate the conditions under which care is provided" (Donabedian 2003, p 46). It incorporates material and human resources and organizational characteristics (Donabedian 2003). capacity, material characteristics, resources and financing. Examples include number of CAT machines, doctor-patient ratio, number board-certified physicians, number of active beds number of nurses, number of board-certified physicians, the ratio of providers to patients, number of beds, number of MRI scans, methods of paying for care etc. (AHRQ 2019).

2. *Process*: consist of "the activities that constitute healthcare, including diagnosis, treatment, rehabilitation, prevention and patient education" (Donabedian 2003, p 46). Examples include the number of patient-provider meetings, the ratio of people receiving necessary medication and checkups, number of people participating at prevention programs and screening and etc. (AHRQ 2019).

3. *Outcomes*: "desirable or undesirable mean changes in individuals and populations that can be attributed to health care" (Donabedian 2003, p 46) . Outcomes incorporate changes in health status, in the knowledge, behavior or satisfaction of patients. For instance: surgical mortality rates and complications, disability-adjusted life years, nosocomial infections, avoidable mortality, change in the ratio of smoking or alcohol consumption, etc. (AHRQ 2019; Peabody et al 2006).

It is important to note that Donabedian emphasizes that these dimensions are not the attributes of quality so these should be interpreted as "kinds of information one can obtain, based on which one can infer whether quality is good or not" (Donabedian 2003, p 47) .

There is a predetermined relationship between the three dimensions such as structure affects processes and processes influence outcome, so the three dimensions are recommended to be used together for evaluations (Donabedian 2003). The structure and process dimensions are mostly based on exact indicators that are relatively easy to measure. On the contrary, measuring the outcome dimension can be challenging methodologically and conceptually (disability-adjusted life years or avoidable death ratios are less straightforward than the number of CAT machines). Moreover, the real effect of the first two dimensions on the outcome is not measurable, since there are several factors outside the provider's scope that can distort the outcomes, such as lifestyle, environment, personal attitudes, or individual biological characteristics (AHRQ 2019; OECD 2012; OBSSR 2019; Peabody et al 2006)

3.1.3. Health equity

Several papers examined the health equity effects of development assistance mostly in Africa taken advantage of the establishment of AidData that provides the precise geographic location of projects (Kotsadam, et al. 2018; Marty, Leu and Runfola 2017; Odokonyero, et al. 2015). All these studies used a difference-in-difference methodology. Marty and his partners examined malaria prevalence and self-reported health quality (2017); Odokonyero and his colleagues examined disease severity and disease burdens in Uganda (2015); and Kotsadam and his partners studied infant mortality as outcome variable (2018). Their findings suggest that development assistance managed to decrease regional or social health inequalities among the recipient societies even if aid was not targeted for the regions with the poorest health indicators (Kotsadam, et al. 2018; Marty, Leu and Runfola 2017; Odokonyero, et al. 2015).

Skaftun et al. (2018) analyzed Norwegian regional health inequalities by the Gini coefficient. The study reported that health inequalities were constantly decreasing between 1980 and 2014 in Norway (Skaftun et al. 2018). Steibeis et al. (2019) also used the Gini index as a measure of relative inequality to discover patterns of global health inequality and burden

of disease (Steinbeis et al. 2019). Their results show that relative inequality has not change significantly in the examined period (1990-2017) across countries and it is still considered high (Steinbeis et al. 2019).

3.2. Hypotheses

3.2.1. Factors that influence the allocation of EU funds

As mentioned before EU funds came by 6-year reference periods and the national governments had to carefully plan the most important expected targets and the use of EU funds prior to the period. The most important target of EU funds in the Hungarian healthcare was to promote *structural change* (expanding outpatient care; establishing well-equipped inpatient centers; and improve accessibility). Thus, EU funds are expected to target districts with more professionalized hospitals (that have an operating intensive care unit); and districts with significant outpatient care capacity (higher per capita spending on outpatient care). EU funds are also expected to flow towards the poorer districts (lower per capita revenues).

Lastly, the political dimension is expected to play a role in the allocation of EU funds. Since the national government has a power to allocate EU funds, districts with majors from the ruling party are expected to receive higher amount of EU funds.

Mayors from the ruling party with overwhelming victory are expected to receive higher amount of EU funds as a reward for their performance. On the other hand, it is also possible that the central government would allocate higher amount of EU funds for mayors from the ruling party with a close run to secure their position for the next elections.

3.2.2. Effect of EU funds

EU funds can have an effect on the Hungarian healthcare across five main channels:

1) infrastructural developments; 2) structural change and improved geographical accessibility; 3) medical equipment development; 4) human resource development; 5) public health and health awareness-raising.

All these channels have a direct effect on the *structure* (conditions under care is provided) and *process* (activities to maintain or improve health) dimensions of healthcare (Donabedian 2003). Infrastructural developments can promote efficiency, working conditions and patient satisfaction. Improved geographical accessibility also enhance efficiency by increasing patient-provider meetings and shorten patient pathways. Medical and human resource development improves capacity directly and increases efficiency as well. Public health and health awareness programs might influence the lifestyle and screening participation ratios of society. All five channels are expected to have an indirect effect on the outcome dimension. Consequently, EU funds are expected to improve the quality of health outcomes (treatable and preventable mortality). However, some other factors might hamper the effect of funds, such as: quality of institutions, corruption, environmental risks and the shortage of healthcare workforce.

Improvements in regional healthcare accessibility and the special projects targeting the health development of marginalized areas are expected to reduce regional health inequalities, especially in terms of the gap between Budapest and the rest of the country. However, the effect of the previously discussed obstacles (corruption, quality of institutions, etc.) might be more significant. So, regional inequalities in indicators that were directly affected by the EU funds (capacity indicators) are expected to reduce. Although, regional disparities in healthcare quality outcomes might have experienced the distortion of these other factors and could not improve as expected.

The hypotheses of this thesis are the following:

H1) EU funds are expected to *target districts with more professionalized hospitals* and with *significant outpatient care capacity* (ICU department and budget outpatient per capita);

H2) EU funds are expected to *flow towards the poorer districts* (company revenues);

H3) Districts with *mayors from the ruling party* are expected the receive *higher* amount of EU funds.

H4) Districts with mayors from *the ruling party with an overwhelming victory* are expected to receive *higher amount* of EU funds;

H5) EU funds are expected to *improve the quality of health outcomes* (treatable and preventable mortality);

H6) Within-district disparities in *healthcare capacity outcomes are expected to reduce*.

4. EMPIRICAL STRATEGY AND RESULTS

4.1. Data

Collecting and generating a reliable complex healthcare database at a district level was an important aim of this research. The data generation process was challenging. This chapter introduces the sources, the datasets and their limitations. Table 22. on page 99 demonstrates the data and Table 23 on page 106 shows the codes used for database generation[28]. Table 6. on page 58 shows the descriptive statistics of the variables.

4.1.1. EU funds

EU Fund database came from the Corruption Research Center Budapest (CRCB). CRCB has converted the official data available in the project finder application of the official database of the Hungarian EU funds (Széchenyi 2020 n.d.) into a clear format that is easy to research[29]. The data contains all EU funds awarded to Hungarian recipients within the framework of national development plans between 2004 and 2020 November.

The total dataset contains 140 796 records. Health-related programs were selected based on program names. Programs that implicitly targeted the healthcare system or health awareness were included[30]. 150 such programs were identified[31] and 3154 total healthcare projects remained in the final dataset.

Seven different support schemes[31] were identified by studying the program descriptions: equipment infrastructure, outpatient care, primary care, public health and health awareness, research and informatics developments and e-health[32]. Human development, equipment, research and public health and health awareness schemes were clear to identify. There is no strict separation among the other schemes, some schemes were even advertised within the same

[28] Codes are available here: https://github.com/mannatt/CEU_thesis_2021
[29] The full dataset is going to be available at https://www.crcb.eu/
[30] Healthcare institutions were eligible to apply for other programs (e.g.: energetic infrastructure development for public institutions or local-government-owned-institutions). Such cases were not included in this analysis.
[31] The list of the selected programs and their support scheme is in Table 8 on page 61
[32] These can be further divided into smaller categories, see Figure 3. on page 17

program in some cases (primary and outpatient care in microregions). Furthermore, infrastructural programs sometimes also included medical equipment development, and in-patient care developments might have had an impact on the outpatient care as well because in hospitals inpatient care is not fully separated from outpatient care (same building, same personnel, same equipment etc.). Moreover, it was a general practice that healthcare providers applied for available funding and tried to find ways to use some part of these funds to implement other urging lower-cost developments (based on expert interviews)[33].

Some projects were established in national level institutions or were applied at a national level (Emergency medical service, National Blood Transfusion System, etc.). In some cases, several institutions applied together and the amount that was allocated to each institution was not published. 52 national-level projects were identified, these projects were not included in the models.

4.1.2. Treatable and preventable mortality [34]

Avoidable mortality has been widely used as a quality measure of the health system and healthcare delivery quality across geographical regions, social groups and over time (Kossarova, et al. 2009; Nolte and Mckee 2004). According to the joint paper of the OECD and the Eurostat avoidable mortality indicators "provide a good starting point to assess the performance of public health and health care policies" (OECD & EUROSTAT 2019, p 3).

Preventable mortality is a set of causes of death that "can be mainly avoided through effective public health and primary prevention interventions" (infections, cancer types associated with unhealthy habits, injuries, alcohol and drug-related deaths) (OECD & EUROSTAT 2019, p 4).

[33] For example: a hospital needs a new CAT machine for its oncology department but there is available funding for the cardiology department only. Then the hospital might use some parts of the awarded funds to purchase a new CAT machine for the oncology department as well.

[34] The cost of avoidable mortality calculation was covered by the Economic Department of the Central European University.

Treatable mortality can be "mainly avoided through timely and effective health care interventions, including secondary prevention and treatment"[35] (adverse effect of medical care, and diseases that can be reduced through prevention and earlier detection and treatment) (OECD & EUROSTAT 2019, p 4). The ratios focus on premature deaths, so the ratios are calculated by mortalities of people under 75 years (OECD & EUROSTAT 2019) .

District-level treatable and preventable mortalities were calculated from individual-level mortality data and district-level midyear population data accessible in the researcher's room of the Hungarian Central Statistical Office. Age-standardized mortality ratios (SMR) were determined per 100 000 population. The methodology of SMR calculations is based on Curtin and Klein 1995; the ICD codes were selected according to the OECD/Eurostat joint list of preventable and treatable causes of death (OECD and EUROSTAT 2019) and the weights of the European Standard Population 2013 (EUROSTAT 2013) were used for the age standardization. SMR is technically the weighted average of the age-specific crude death rates (Curtin and Klein 1995) given by[36] :

$$SMR_{district} = \sum_{age\ cohorts} weight_{age\ cohort} * \frac{deaths_{age\ cohort,district}}{total\ population_{age\ cohort,district}}$$

SMR allows comparison across years and districts (since the same standard population was used) but the rates can be imprecise for districts with a small population.

4.1.3. National Land information System of Hungary

The Land Information System of Hungary (LIS)[37] collects and processes data of several national authorities at different geographic levels of the country. The following data came from LIS at a district level: crude mortality and infant mortality, crude numbers of cardiovascular,

[35] There are causes of deaths when no strong evidence of the predominance of either type of avoidable mortality ratios were identified, such causes are calculated 50% percent treatable and 50% preventable. Such causes of death included diabetes, cervical cancer and diseases of the circulatory system

[36] Avoidable mortality ratios were calculated by gender as well, but only the total indicators were used for this research.

[37] In Hungarian: Országos Területfejlesztési és Területrendezési Információs Rendszer (TEIR)

respiratory and cancer patients, total care days of in-patient care, total hours in outpatient care, number of general practitioners (GPs), total number of qualified healthcare professionals (at least with higher vocational education), population, 65-and-older population, companies income from export, total revenues of companies, total personal income of people before tax, population data, number of students in secondary grammar school, territory of woods. Ratios and per capita data were calculated by dividing the crude numbers with the relevant population data[38], in case of infant mortality with the number of live births and in case of secondary grammar school ratio with the 14-20-year-old midyear population[39].

Distance to county capital data measures the minutes of reaching the county capital via the fastest route. The district mean was used.

Secondary grammar school data measures the number of secondary grammar school students studying in a district (not living), so districts without a secondary grammar school have zero values. This indicator probably underestimates the number of such students. However, statistics of the disadvantaged students suggest that the number of students from districts without a secondary grammar school who study in secondary grammar school is marginal[40] (LIS).

The data of qualified healthcare professionals contains employees only, self-employed and contractors are excluded, so it is probably underestimating the real number.

Some datasets are available only for a limited time period (cancer, cardio and respiratory numbers, number of healthcare professionals are available between 2011 and 2018) and some datasets are not available for 2019 (revenues and export) or before 2007 (territory of woods and hours of outpatient care). Hours in outpatient care have missing values for 20 districts in 2007.

[38] In some cases, ratios were directly available at LIS for 2004-2018 and only 2019 data was calculated in the described way.
[39] Midyear population data is from the Hungarian Central Statistical Office
[40] The most disadvantaged districts do not have secondary grammar schools. Students from these districts are usually classified as "disadvantaged" and thus should appear in the statistics of the disadvantaged students in secondary grammar schools.

4.1.4. Other sources

There are several datasets that are published and available online but stored in a "messy" form that is hard to analyze without data cleaning. Four[41] such datasets were identified as valuable for this research: 1) election data, 2) the budget of the National Healthcare Fund, 3) annual hospital reports, and 4) data regarding the areas without a general practitioner.

1) Election data was obtained from the National Election Office of Hungary. The original dataset is not easy to use since the name of the candidate, the results, and nominating party are stored in a separate file each and the structure of the data is not the same across the different elections (National Election Office n.d.). Candidate, nominating party names and results were merged, then the voting margin was calculated between the winner and the candidate who received the second-most votes. For this research, only results of the local elections were used. As districts are usually organized around one dominant municipality, the major election data of the district capital was used to represent the district.

Five dummy variables were created to grab different political situations: 1) governing_party takes 1 if the major of the district capital is from ruling party at the time; 2) close_run_governing_party takes 1 if the major is from ruling party at the time and won with up to 10% margin; 3) close_run_opposition takes 1 if the major is not from ruling party at the time and won with maximum 10% margin; 4) overwhelming_victory_governing_party takes 1 if the major is from ruling party at the time and won with at least 50% of the votes; and 5) overwhelming_victory_non_governing_party takes 1 if the major is not from the ruling party at the time and won with at least 50% of the votes.

2) Healthcare budget data was obtained from the annual report of the National Healthcare Fund that contains healthcare provider-level financial data by categories (primary,

[41] The annual mean of ozone concentration, co2 emission, particulate matter concentration was also extracted and calculated from AidData. This dataset was not used in the final models because the variables are available for a limited time period.

outpatient or in-patient service, CAT examination, and so on) containing 156 443 total records between 2006 and 2019 (National Healthcare Fund 2020a). The data was aggregated into a district level and total, general practitioner, outpatient and CAT budget per capita was calculated.

3) Annual hospital capacity reports were obtained from the National Healthcare Fund (National Healthcare Fund 2020b). Extracting the data was technically challenging as each year's data is stored in a different word file that contains the report of each hospital in a separate table. The full dataset contains 30 836 records by institutions and departments between 2004 and 2019.

The dataset was filtered to departments where one-day surgeries are relevant (general surgery, urology, dermatology, orthopedics, otorhinolaryngology)[42] and then aggregated into a district level. Three variables were calculated from this data source: 1) one_day_ratio, the ratio of one-day surgeries which is the number of one-day surgery patients divided by the total number of patients; 2) mean_care_days which is the number of total care days divided by the total number of patients; 3) ICU_department which is a dummy variable that takes 1 if that district has a hospital with an operating intensive care unit that year.

Some hospitals have operating units in different districts. The hospital report only contains data that is aggregated at a hospital-level based on the official district (and most important operating unit) of the hospital. So, some districts have zero values in the dataset even if there is an operating hospital. The Hungarian Central Statistical Office follows the same practice. Only 3-7 such cases were identified, and these operating units usually do not have intensive care units.

4) Data regarding the areas without a general practitioner (GP) was obtained from the National Healthcare Fund (National Healthcare Fund 2020c). The dataset was aggregated into

[42] Based on expert interviews and the absolute number of one-day surgeries in the data. Obstetrics and gynecology were excluded because surgical and motherhood cases are not separated in the dataset.

a district level and the population of the areas without a GP within a district was divided with the total population of the district to calculate the ratio of population without a GP (gp_empty_ratio). This dataset only contains areas that are currently without a GP and the year when the GP left the position. It does not provide information regarding areas that were without a GP for a few years in the examined period but have a GP again by now (January 2021).

4.1.5. Data that could not be obtained

Despite every effort lifestyle and environmental pollution-related indicators could not be obtained at a district-level. The National Tax Authority administers tobacco, alcohol and unhealthy food tax at a county level only (NUTS3). The National Tobacco Retailer Ltd manages store-level tobacco sales data, but they refused to provide district level data for this research. National and EU surveys that have lifestyle-related questions are only available at a regional (NUTS2) level. The Hungarian Meteorological Service does not collect pollution data at a district level. Consequently, two important health-factors lifestyle and environment cannot be added to the models.

4.2. Empirical strategy

4.2.1. Allocation of EU funds

An ordinary least squares (OLS) panel model with time and district fixed effects was conducted to examine which factors were associated with the allocation of EU funds. The logarithm of the amount of EU funds by the year of decision[43] was used as a dependent variable. The following explanatory variables were used in the models:

1) Health outcomes of the society were measured by the logarithm of crude, treatable and preventable mortality ratio. 2) Outpatient care was described by the logarithm of the per capita outpatient budget and the ratio of one-day surgeries. 3) Primary care was measured by the ratio of the population without a general practitioner. 4) The presence of a hospital with an intensive care unit (ICU-department) was used to provide information about the accessibility of in-patient care. 5) To measure the political channel all the five political variables regarding the mayor of the district capital were tried[44] . 6) The logarithm of company revenues per capita, the total population, the ratio of secondary grammar school students was implemented as controls for socio-economic characteristics[45].

The equitation for the three fixed-effect models (the three mortality ratios were included in different models to avoid multicollinearity) is given by:

$$\text{Funds\_decision}_{it} = \alpha_i + \beta_1\text{revenues}_{it} + \beta_2\text{population}_{it} + \beta_3\text{budget\_outpatient}_{it} + \beta_4\text{gp\_empty\_population}_{it} + \beta_5\text{secondary\_school\_ratio}_{it} + \beta_6\text{ICU\_department}_{it} + \beta_7\text{oneday\_surgery\_ratio}_{it} + \beta_8\text{local\_political\_indicator}_{it} + \beta_9\text{preventable\_mortality\_ratio}_{it} \text{ OR treatable\_mortality\_ratio}_{it} \text{ OR crude\_mortality\_ratio}_{it} + \mu_{it}$$

α_i = intercept for each district β = coefficients μ = error term i = districts t = years

[43] The EU fund database contains two dates: 1) the year of decision when the grant was awarded (funds_decision); and 2) the year when the contract came into effect and the implementation of the project started (funds_effective).
[44] Section 4.1.4. part 1) describes the calculated political variables.
[45] Correlation plot of the variables is demonstrated at Figure 9. on page 76 and descriptive statistics are in Table 6. on page 58.

4.2.2. Effect of EU Funds

To measure the effect of EU funds an ordinary least square (OLS) model, a two-stage least square model and Gini coefficients were calculated.

The OLS panel model with time and district fixed effects was conducted to investigate the relationship between the explanatory variable the amount of EU funds by the year of effective[46] and the dependent health outcome variables logarithm of treatable, preventable and crude mortality ratios. The following control variables were used in the models: 1) population, secondary grammar school ratio and revenues per capita to measure socioeconomic characteristics; 2) the ratio of the population without a general practitioner to measure primary care (gp_empty_population); 3) the presence of a hospital with an intensive care unit (ICU-department) to measure the accessibility of in-patient care; 4) per capita hours in outpatient care to measure the expansion of outpatient care; and 5) the logarithm of total healthcare budget per capita to measure the level of healthcare services in general. ICU department per capita hours in outpatient care and per capita total budget of the healthcare fund was not used in the same model to avoid multicollinearity[47]. The models are given by:

$$\text{Preventable\_mortality\_ratio}_{it} \text{ OR treatable\_mortality\_} =$$
$$\alpha_i + \beta_1 \text{EU\_funds\_effective}_{it} + \beta_2 \text{population}_{it} + \beta_3 \text{secondary\_school\_ratio}_{it} + \beta_4 \text{gp\_empty\_population}_{it} + \beta_5 \text{mean\_incidence}_{it} +$$
$$\beta_6 \text{ICU\_department}_{it} \text{ OR hours\_outpatient\_percapita}_{it} \text{ OR budget\_total}_{it} + \mu_{it}$$

α_i = intercept for each district β = coefficients μ = error term i = districts t = years

[46] The EU fund database contains two dates: 1) the year of decision when the grant was awarded (funds_decision); and 2) the year when the contract came into effect and the implementation of the project started (funds_effective).
[47] The correlation plot of the variables is demonstrated at Figure 10 on page 77 and descriptive statistics are in Table 6. on page 58

To test whether there is a causal relationship between EU funds and health quality outcomes (treatable and preventable mortality) a two-stage least square (2SLS) model was implemented with district and year fixed effects.

The explanatory variable(s) of the OLS model can be endogenous, one or more explanatory variables are correlated with the error term (Schmidheiny 2020). In this situation, the results of the OLS regression are biased and cannot consistently estimate the causal effect (Schmidheiny 2020). Several reasons can distort causality and bias the OLS estimates (Schmidheiny 2020):

1) reverse causality: if treatable and preventable mortality influence the amount of EU funds allocated. This scenario is possible, treatable and preventable mortality were even used to explain EU funds in the first part of this research. (However, no significant relationship was discovered between them);
2) omitted variable bias: if there is another variable that is not included in the model which influences EU funds and avoidable mortalities. As discussed before the quality of institutions or other unmeasured characteristics can bias the results;
3) measurement error in the explanatory variable.

The 2SLS model can establish a causal pathway and account for endogeneity and by the implementation of an *instrument.* "The instrument is a variable that determines the endogenous regressor (EU funds) but only affects the dependent variable (mortalities) through its effect on the independent variables" (McKee 2015 p 5). A valid instrument has to meet the following requirements (Schmidheiny 2020):

1) Exogeneity: the instrument has to be uncorrelated with the error term (Schmidheiny 2020);

2) Relevance: the instrument has to be correlated with the endogenous regressor after controlling for the exogenous regressors. The F-test of the first stage regression can test this requirement (Schmidheiny 2020).

In this research, the governing party was used as an instrument. It is a binary variable that takes 1 if the mayor of the district capital is from the ruling party at the time. The rationale for governing party as an instrument is based on the heterogeneous treatment effect: that political ties between the districts and the ruling party would determine the probability and the amount of awarded EU funds. Governing party should not be correlated with mortalities since the political party of mayor of the district capital cannot affect treatable and preventable mortality ratios directly. Governing party is expected to influence avoidable mortality ratios only through EU funds. The models are given by:

1) stage one of 2SLS

$$\widehat{EU\_funds\_effective}_{it} = \alpha_i + \beta_1 governing\_party_{it} + \mu_{it}$$

The second stage uses the part of EU_funds_effective that was correlated with governing_party.

2) stage one of 2SLS

$$Treatable\_mortality\_ratio_{it} \text{ OR } Preventablet\_mortality\_ratio_{it} = \alpha_i + \beta_1 \widehat{EU\_funds\_effective}_{it} + \beta_2 population_{it} + \beta_3 secondary\_school\_ratio_{it} + \beta_4 population\_without\_GP_{it} + \beta_5 mean\_incidence_{it} + \beta_6 ICU\_department_{it} \text{ OR } hours\_outpatient\_percapita_{it} \text{ OR } budget\_total_{it} + \mu_{it}$$

α_i = intercept for each district β = coefficients μ = error term i = districts t = years

The OLS and the 2SLS models were calculated in Stata14.2 program.

To test the robustness of the models two conditions specifications were implemented: 1) the first difference of variables was used if it was necessary based on unit root test; for the OLS model: 2) one- and two-year lags of EU funds were included

The inequality between districts is measured by the Gini coefficient. The Gini coefficient is a broadly applied measure of geographic health inequalities (Skaftun et al. 2018; Spinakis et al. 2011; Stebenis et al. 2019; Uzzoli et al 2017). A report of the European Commission recommends this method for measuring health inequalities in the case of examining mortality, life expectancy or health expectancy ratios (Spinakis et al. 2011 p 32) and Uzzoli et al. (2017) concludes that the Gini coefficient is a suitable indicator for analyzing spatial mortality differences in Hungarian data[48].

The Gini coefficient is the average absolute difference between the examined indicator for all pairs of districts divided by twice the national mean of the examined indicator (Atkinson and Bourguignon 2015 p 621). The indicators were calculated in the *ineq* package of R statistical software (Zeileis 2014) based on the following formula:

$$\frac{\sum_{n=1}^{N} = \sum_{j=1}^{N} |x_i - x_j|}{2N^2\mu}$$

x = district indicator
N = total number of districts
i and j = index each district in all possible pairings of districts
μ = national mean

The Gini coefficient was calculated for 16 indicators as Table 7. demonstrates on page 60 the time period of these indicators varies from 8 to 15 years. Besides the 13 health-related measures 3 socioeconomic indicators (personal income and revenues per capita and the ratio of students in secondary grammar school) were also included.

[48] The Gini coefficient as a measure of (health) inequalities have several limitations, for more information see: Spinakis et al. 2011

4.3. Results

4.3.1. Allocation of EU funds

A panel OLS regression was carried out with district and year fixed-effects to investigate the relationship between the allocation of EU funds and different socioeconomic and health-related factors. Table 1. shows the models for different healthcare outcomes (mortality ratios) using the same other health-related factors and controls across 175 districts and for 13 years between 2006 and 2018[49].

The coefficients illustrate that there is no statistically significant relationship between mortality ratios, the ratio of population without a general practitioner, the ratio of one-day surgeries, company revenues per capita, secondary grammar school ratio and the allocation of EU funds. On the other hand, there is a significant relationship between population, ICU department, the per capita budget of outpatient care and close-run governing party and the allocation of EU funds.

Districts with a hospital that has an ICU department are associated with 190 percentage higher EU funds on average compared to districts without and ICU department. 1 percent change in the per capita outpatient budget is associated with 6 percent higher EU funds inflow. Districts where the mayor of the district capital is from the governing party and won the local elections by a close margin of victory (maximum 10%) are expected to receive 133% less EU funds than other districts. The negative coefficient of the population suggests that higher amount of EU funds flow into districts with a smaller population. The value of the coefficients and the R^2 value does not change significantly across the different models.

The results suggest that EU funds targeted improvements in outpatient care and central county hospitals over university clinics or national institutions. These findings align with the proposed *structural change* target. The lack of relationship between company revenues

[49] Table 9. demonstrates the full output table of the Allocation of EU funds OLS model on page 79.

Table 1. Allocation of EU funds - OLS output

Variables *Y: EU funds by year of decision*	**(1)** **Treatable mortality ratio**	**(2)** **Preventable mortality ratio**	**(3)** **Crude mortality ratio**
Company revenues	0.91 (0.621)	0.95 (0.624)	0.96 (0.627)
Population	-0.00** (0.000)	-0.00** (0.000)	-0.00** (0.000)
Secondary grammar school ratio	-0.34 (6.684)	-0.16 (6.744)	-0.19 (6.749)
Population without a GP	11.23 (11.879)	10.54 (11.816)	10.43 (11.781)
One day surgery ratio	0.52 (0.925)	0.53 (0.934)	0.48 (0.938)
ICU department	1.87** (0.806)	1.85** (0.810)	1.85** (0.820)
Outpatient budget per capita	5.79*** (2.048)	5.75*** (2.063)	5.52*** (2.071)
Close run governing party	-1.33** (0.657)	-1.35** (0.665)	-1.34** (0.671)
Treatable mortality ratio	-1.57 (1.245)		
Preventable mortality ratio		0.14 (1.637)	
Crude mortality ratio			2.66 (2.821)
Constant	0.50 (10.830)	-9.34 (12.788)	2.72 (14.343)
Observations	2275	2275	2275
R-squared	0.354	0.353	0.353
Number of districts	175	175	175
VIF	1.28	1.31	1.28
District and year fixed effects	YES	YES	YES

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

suggests that the amount EU fund supporting the improvements of primary and outpatient care in the less favored districts was marginal compared to the total amount. It is probably related to the fact that development in inpatient care and implementing infrastructural developments related to the *structural change* target required more expensive investments. Despite the fact

that increasing the ratio of one-day surgeries was an important goal of the *structural change* target this variable does not have a significant relationship with EU funds.

Furthermore, the model uncovers evidence that political considerations also played a role in the allocation of EU funds. The ruling party might use EU funds as part of a 'carrot or stick' political strategy following local elections. The reasons behind this relationship and the lack of significance of other political indicators would require further investigation[50]. One reason can be, that the power of the national government over the whole country is secured as much that it can "punish" its own poor performers. Another possible explanation is the role of independent mayors. They were classified as opposition party in this research, but the governing party might treats them differently.

For robustness check the 1- and 2-year lags of mortality ratios were included, and the first difference of variables was used where it was needed based on the unit root test. As Table 10. on page 81 displays the coefficients did not change significantly. The only important change is that the coefficient of the 1-year lag of treatable mortality and crude mortality ratio was significant suggesting that higher mortality ratios were associated with a lower amount of funds on average. This requires further investigation.

The results of this model do not align with the findings of Kiss et al. (2013). Findings of that study proved that districts with higher avoidable mortality ratios have received a higher amount of EU funds (Kiss et al. 2013 p 41). Possible reasons for the different results can be the different specifications between the two models: that model used a different geographic classification of districts (the one that was used before 2013), the timeline covered only 2007-2012, different controls were used (that model controlled for age composition), the methodology of avoidable mortality calculation was different, and that model used only EU funds channeled to outpatient care (Kiss et al. 2013 p 41).

[50] Table 11. demonstrates the output of models with different election variables on page 83.

4.3.2. Effect of EU Funds

4.3.2.1. Ordinary least squares models

First, a panel OLS regression was carried out with district and year fixed effects to investigate the relationship between EU funds and treatable and preventable mortality ratios. Intensive care units, hours in outpatient care per capita and the total budget of the healthcare fund per capita were included in separately to avoid multicollinearity. All models were carried out among the 175 districts, but the time period differs depending on the availability of the variables. Model 1. (ICU departments) was conducted for 15 years between 2004 and 2018; model 2. (hours outpatient per capita) was conducted for 11 years between 2007 and 2018 non including 2015[51]; model 3. (total budget per capita) was conducted for 13 years between 2006 and 2018.

Table 2. demonstrates the results for preventable and treatable mortality ratio[52]. There is no relationship between the amount of EU funds and preventable mortality. There is a significant relationship between hours outpatient per capita and the total healthcare budget per capita and preventable mortality ratio. The results suggest that one more outpatient per capita hour was associated with 1 percent lower preventable mortality ratio on average across districts. Districts with 1 percent change in total healthcare funds per capita on average have 0.1% higher preventable mortality ratio. The latter relationship seems irrational, the model might be biased.

The OLS model suggests that there is no relationship between treatable mortality and the amount of EU funds either. In the case of treatable mortality more variable is significant in the model, however, the R^2 values of this model are lower than the ones for the preventable mortality. The results suggest that one more hour outpatient per capita is associated with 1 percent lower preventable mortality ratio on average across districts. 1 percent increase in the

[51] For 2007 20 districts have missing data four hours outpatient per capita
[52] Table 12. demonstrates the full output of the preventable mortality OLS model on page 85, Table 13. demonstrates the full output of the treatable mortality OLS model on page 86.

Table 2. Effect of EU funds - Preventable and treatable mortality - OLS output

	Y: Preventable mortality			Y: Treatable mortality		
Variables	**(1) ICU department**	**(2) Hours outpatient per capita**	**(3) Budget per capita**	**(1) ICU department**	**(2) Hours outpatient per capita**	**(3) Budget per capita**
EU funds	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Revenues	-0.00	-0.00	0.00	-0.03**	-0.03**	-0.03**
	(0.009)	(0.014)	(0.013)	(0.012)	(0.014)	(0.013)
Population	-0.00	-0.00	-0.00	-0.00**	-0.00**	-0.00**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population without a GP	0.22	0.14	0.16	0.42**	0.40**	0.43**
	(0.150)	(0.177)	(0.153)	(0.178)	(0.198)	(0.193)
ICU department	0.02			0.00		
	(0.014)			(0.011)		
Hours outpatient per capita		-0.01**			-0.01***	
		(0.004)			(0.003)	
Budget total per capita			0.01*			-0.02
			(0.008)			(0.012)
Constant	6.18***	6.12***	6.05***	5.82***	5.81***	5.84***
	(0.076)	(0.121)	(0.111)	(0.098)	(0.121)	(0.119)
Observations	2625	1895	2275	2625	1895	2275
R-squared	0.535	0.414	0.451	0.447	0.292	0.339
Number of districts	175	175	175	175	175	175
VIF	1.25	1.21	1.27	1.20	1.17	1.22
District and year fixed effects	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

ratio of population without GP is associated with 0.42 percent increase in treatable mortality ratio on average. 1 percent higher revenues per capita is associated with 0.03 percent lower treatable mortality ratio on average. The negative coefficient of population suggests that treatable mortality ratio is lower in districts with a smaller population on average. The results of treatable mortality ratio seem to be more plausible than the results of preventable mortality.

4.3.2.2. Two- stage least square models

In order to estimate the causal relationship between avoidable mortality ratios and the amount of EU funds a two-stage least square model was conducted with year and district fixed-effects using governing party as instrumental variable. Governing party proves to be a suitable instrument since Table 3. shows that the F-statistics of the first stage regression is 20.9 that is higher than 10 which is the threshold for valid instruments (Schmidheiny 2020).

Table 3. Effect of EU funds - 2SLS - first stage results

Y: Eu funds	**(1)**
Governing party	2.17***
	(0.475)
Constant	4.79***
	(0.255)
Observations	2800
R-squared	0.011
Number of districts	175
F test model	20.92
P value	0.000
District and year fixed effects	YES

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 4. demonstrates the results using different healthcare controls to avoid multicollinearity[53]: 1) ICU department, 2) hours outpatient per capita and 3) total healthcare budget per capita.

The relationship between EU funds and avoidable mortality ratios became significant. Results show that the coefficients of revenues, ICU departments, hours in outpatient care per capita and the total healthcare budget per capita also became significant across different settings.

Districts that received 1 percent higher EU funds improved both their preventable and mortality ratios by 0.01-0.02 percent on average. The significance level of this relationship is higher for preventable mortality. 1 percent higher revenues per capita is associated with 0.1-

[53] The full output of 2LSL models are demonstrated in Table 16. for preventable mortality on page 93 and Table 17. for treatable mortality on page 94

0.2 percent lower treatable mortality ratio on average. One more hour outpatient per capita is associated with 1 percent lower preventable mortality ratio on average. 1 percent higher total healthcare budget per capita is associated with 0.05-0.07 percent improvement in avoidable mortality ratios. The positive coefficient of ICU department and population without a GP suggests that the presence of ICU department and the lack of a GP are both associated with higher avoidable mortality ratios on average. This seems irrational together with the positive coefficient of ratio of population without GP that implies a positive relationship.

Table 4. Effect of EU Funds - Preventable and treatable mortality - 2SLS output

	Y: Preventable mortality			**Y: Treatable mortality**		
Variables	**(1) ICU department**	**(2) Hours outpatient per capita**	**(3) Budget per capita**	**(1) ICU department**	**(2) Hours outpatient per capita**	**(3) Budget per capita**
EU funds	-0.02***	-0.01***	-0.01***	-0.02**	-0.01**	-0.01**
	(0.008)	(0.005)	(0.004)	(0.006)	(0.005)	(0.003)
Revenues	-0.11***	-0.22***	-0.14***	-0.15***	-0.22***	-0.15***
	(0.029)	(0.027)	(0.024)	(0.026)	(0.026)	(0.018)
Population without a GP	-0.73*	-0.72*	-0.37	-0.34	-0.42	0.02
	(0.379)	(0.376)	(0.253)	(0.340)	(0.356)	(0.242)
Population	-0.00	0.00	0.00	-0.00	0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ICU department	0.11**			0.06*		
	(0.046)			(0.037)		
Hours outpatient per capita		-0.01***			-0.01***	
		(0.005)			(0.005)	
Budget total per capita			-0.05**			-0.07***
			(0.021)			(0.016)
Constant	6.97***	7.70***	7.32***	6.72***	7.24***	6.90***
	(0.193)	(0.388)	(0.189)	(0.185)	(0.344)	(0.143)
Observations	2625	1895	2275	2625	1895	2275
Number of districts	175	175	175	175	175	175
District and year fixed effects	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Results of the analysis proved that EU funds had a positive effect on healthcare quality outcomes measured in treatable and preventable mortality ratios. However, the financial circumstances of the districts, hours in outpatient care per capita and the total healthcare budget per capita proved to have stronger effect on treatable and preventable mortality than EU funds have. The significant change in the coefficients of the 2SLS model compared to the OLS model suggests the endogeneity of EU funds variable.

For testing the robustness of the models, the analyses were conducted using the first difference of the ratio of population without a GP since this variable is not stationary based on the results of the unit root test. Output tables of the robustness checks are illustrated in Table 18. On page 95 for preventable mortality ratio and in Table 19. on page 96 for treatable mortality ratio. The analyses imply that the results of the 2SLS models are robust. The coefficient of the first difference of the ratio of the population without a GP becomes insignificant[54].

Table 20. on page 97 demonstrates reduced models including the revenues and ICU department only. The significant and positive coefficient of ICU department suggests that the positive coefficient of ICU department in the main model can be related to the selection effects (life-threatening cases are more likely to hospitalized in institution with ICU and more likely to die). It is also possible that the presence of a better equipped hospital (ICU department) increases the probability of a proper diagnostic of causes of death.

4.3.2.2. GINI coefficient

Gini coefficients were calculated to measure within district divergence in healthcare capacity and quality outcomes. Table 21. on page 98 displays the calculated annual indicators. UNICEF suggests that a Gini coefficient above 0.4. represents high inequality and a value above 0.5 corresponds to severe inequality (UNICEF 2018).

[54] It is important to mention that the expert interviews discovered that local governments and the GPs are both financially incentivized not to permanently fill an empty GP position but to keep employ substituting GPs on a contract basis for long-term instead.

Figure 6. demonstrates the scatter plot of within-district Gini coefficients for the first and the last available year. In absolute terms, the geographic distribution of the ratio of one-day surgeries, CAT budget per capita, revenues per capita, general practitioner budget per capita, total healthcare budget and infant mortality ratio was highly unequal in the examined period. Inequalities of hours in outpatient care per capita and ratio of secondary grammar school students were also higher. The regional disparities in personal income per capita, the number of general practitioners and qualified healthcare workers per capita, treatable and preventable mortality ratio, the ratio of cancer, cardiovascular and respiratory diseases can be considered low in absolute terms.

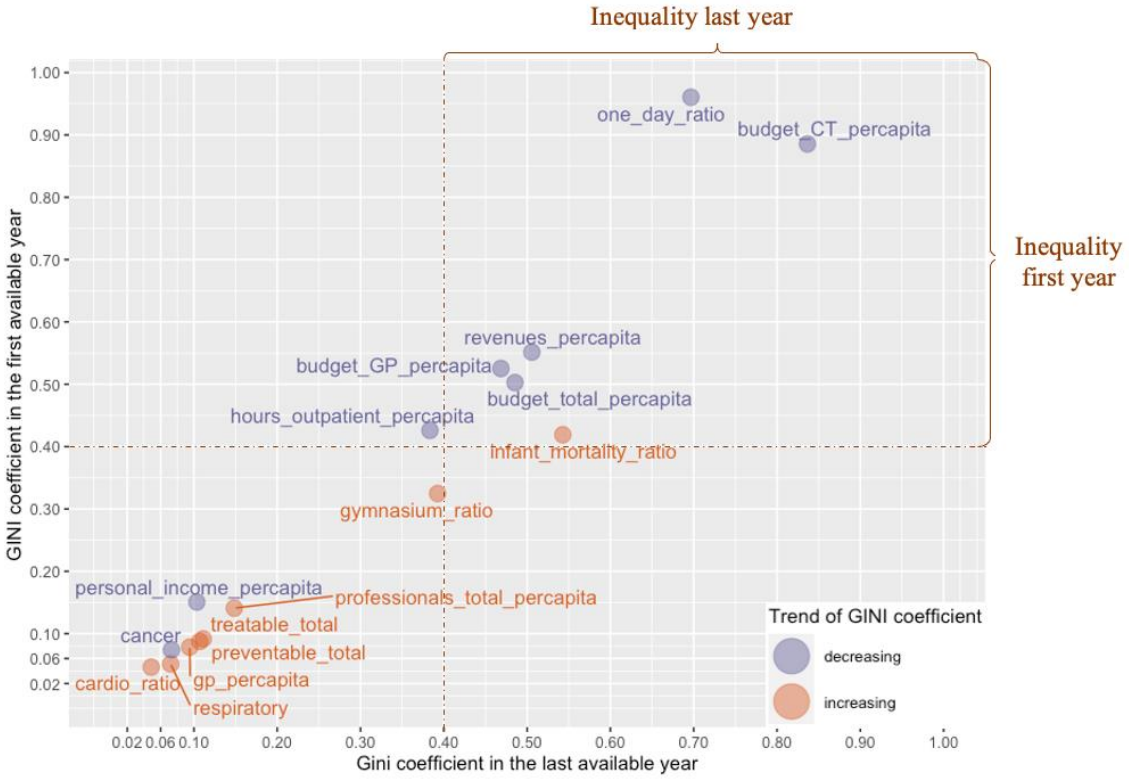

Figure 6. Scatter plot of Gini coefficients in first and last available year

source: author's own work, using data discribed in chapter 4.1.

The relative changes of the Gini coefficients in the examined period are demonstrated in Figure 7. and Figure 8. (The two graphs display different scales). Geographic disparities in personal income per capita, ratio of one day surgeries, CAT budget per capita, revenues per capita,

general practitioner budget per capita, total healthcare budget and hours in outpatient care per capita were decreasing across the examined period. While geographic inequalities of secondary grammar school student ratio, infant, treatable and preventable mortality ratio, number of qualified healthcare workers and general practitioners per capita and the ratio of respiratory and cardiovascular diseases experienced increases. The ratio of cancer was rather stagnant.

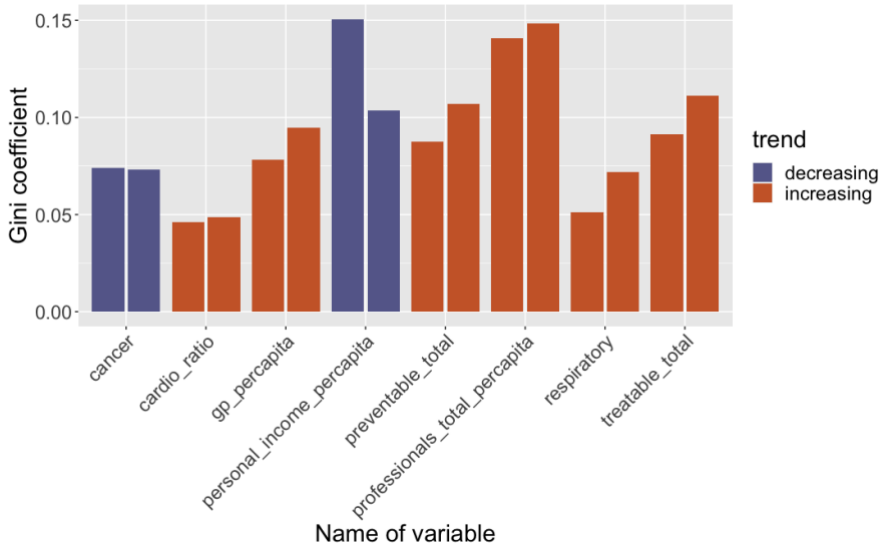

Figure 7. Gini coefficients in the first and last available year (scale: 0-0.15)

source: author's own work, using data discribed in chapter 4.1.

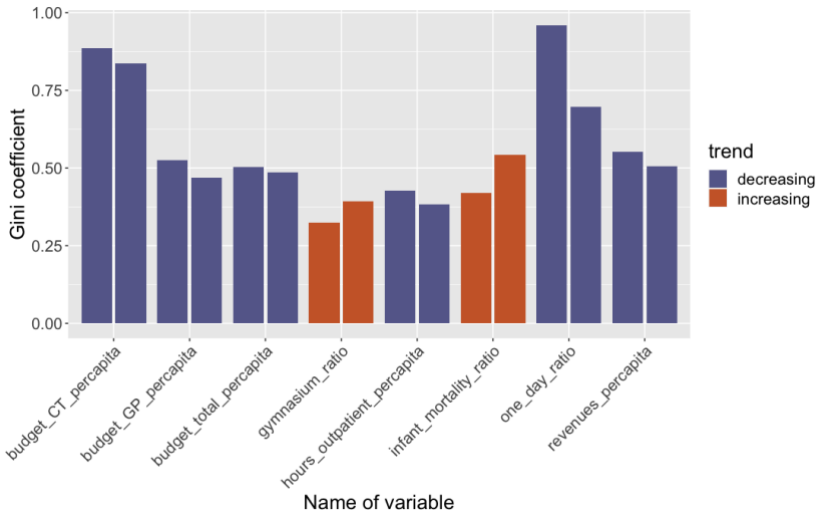

Figure 8. Gini coefficients in the first and last available year (scale: 0-1)

source: author's own work, using data discribed in chapter 4.1.

The magnitude of this increase was rather large in infant mortality ratio (33%), the ratio of respiratory diseases (31%) treatable mortality (19%), preventable mortality, secondary

grammar school ratio and the number of general practitioners per capita (18% each). The magnitude of the decrease was significant in disparities of personal income per capita (47%) and the ratio of one day surgeries (38%).

Controversary, within district disparities in healthcare capacity outcomes were decreasing and the inequalities of healthcare quality outcomes were increasing in the examined period. Regional disparities in the distribution of healthcare professionals were also widening. Simultaneously, massive EU funds were flowing into the healthcare system and income inequalities were decreasing.

These findings suggest that improvements in healthcare capacity outcomes could not promote improvements in healthcare quality outcomes. The country's poor performance in statistics measuring lifestyle risks can be one explanation (smoking, alcohol, unhealthy diet, lack of physical activity). Another important contributing factor might be the shortage and the inadequate qualifications of healthcare professionals (Kosztolányi and Csiba 2019). The expert interviews have also added inefficiency and coordination problems as possible reasons for the deepening healthcare quality outcome gap.

4.4. Possible limitations

The empirical results reported herein should be considered in the light of some limitations.

1) Treatable and preventable mortality are age standardized ratios that can be imprecise for districts with small population.

2) Measuring the political dimension: the discovered relationship between the political dimension (close_run_governing party: districts where the mayor of the district capital was from the ruling party at the time and won the local elections by a margin of no more than 10 percent have received 130% less EU funds on average) is difficult to explain. The fact that EU funds by the year of decision had a stronger relationship with close_run_governing_party variable, but EU funds by the year of effect had a stronger relationship with the governing_party

variable (district where the mayor of the district capital was from the ruling party) suggests that the five political variables used in this thesis could not entirely grab the political dimension related to EU funds. In order to further research this issue results of the national elections, the independent mayor and the party composition of the local councils could be used.

3) Year of EU funds: the actual end date of EU-supported projects was not registered in the database across the whole period. There were significant time delays in the case of several larger scope healthcare projects (Dózsa 2016). Conducting the examinations by the year of EU funds when the projects actually started to operate would probably deliver more reliable results.

4) Omitted variable bias and limited access to data: the positive coefficient of ICU departments in the final results of the 2SLS model (suggesting that districts with ICU departments had higher treatable and preventable mortality ratios) implies the possibility of omitted variable bias. As mentioned before the analysis could not consider corruption, quality of institutions, environmental and lifestyle risks due to the lack of available data. As discussed before the quality and availability of district level healthcare data is limited.

A generalized method of moments estimation might improve the model.

5. CONCLUSION

This thesis has empirically examined EU funds channeled into the healthcare sector of Hungary between 2004 and 2019 across the 175 districts of the country investigating three areas: 1) factors that influence allocation of EU funds; 2) the impact of funds on healthcare quality outcomes (measured by treatable and preventable mortality ratio); and 3) trends in geographic divergence of various healthcare quality and capacity outcomes.

To study these topics, a comprehensive district-level healthcare panel database was built from various available sources, including the data available at the National Land Information System of Hungary, National Election Office of Hungary, National Healthcare Fund, and treatable and preventable mortality ratios were calculated from individual level mortality data from the Hungarian Central Statistical Office. District level healthcare-related EU funds were created from the project-level database of Hungarian EU funds – created by the Corruption Research Center Budapest.

A panel ordinary least square regression was conducted with year and district fixed effects to discover factors that influenced allocation of funds. To examine the causal impact of EU funds, a two-stage least square panel regression was implemented with year and district fixed effects using the mayor of the district capital from the ruling party at the time as an instrument to deal with the endogeneity of EU funds variable. Geographical inequalities were assessed by calculating the Gini coefficient.

The results regarding the allocation of funds show that districts with an operating ICU department received 190 percent higher EU funds and 1 percent higher outpatient budget per capita spending is associated with 6 percent higher EU inflows on average. These findings align with the emphasized target of *structural change*, more EU funds were allocated to county hospitals and districts with advanced outpatient care.

Furthermore, the model uncovers evidence that political considerations also played a role in the allocation of EU funds. Districts where the mayor of the district capital from the ruling party at the time and won the local elections by a margin of no more than 10 percent, on average, have received 133 percent less EU funds than other districts. From this, the possibility follows that the ruling party EU funds were used as part of "carrot or stick" political strategies following local elections. The specific reasons behind this relationship and the lack of significance of other political indicators would require further investigation.

Findings regarding the impact of the EU funds suggest that EU funds managed to improve both treatable and preventable mortality. On average 1 percent higher EU funds were associated with a 0.01-0.02 percent improvement in mortality ratios. The financial circumstances of the districts and the per capita spending on healthcare proved to have a stronger effect on treatable and preventable mortality than EU funds.

Results regarding the inequalities show that within-district disparities in healthcare capacity outcomes (per capita healthcare spending on CAT examinations, primary care, outpatient care and total; per capita hours in outpatient care and ratio of one day surgeries) were reducing and inequalities in healthcare quality outcomes (treatable, preventable and infant mortality, ratio of cardiovascular and respiratory diseases) were increasing simultaneously in the examined period. Regional disparities in the distribution of healthcare professionals were also widening and income inequalities were reducing among districts (income and revenues per capita). These findings suggest that the improvements in healthcare capacity outcome could not promote improvements in healthcare quality outcomes.

The results of this thesis identified four possible further research areas 1) The political dimension in the allocation of EU funds could be approached by other variables. National elections, the role of independent mayors and the party composition of the local councils could be examined. 2) The effects of EU funds could be tested by a generalized method of moments

model; this may improve the efficiency of the estimation. 3) To discovere the reasons behind the different trends in geographic disparities of healthcare capacity and quality outcomes, a panel OLS with year and district fixed effect could be implemented including more socioeconomical variables to identify which factors are related to these indicators. Furthermore, qualitative methods could also be considered (interviews, surveys). 4) The reason of inequalities in infant mortality could be approached by examining the characteristics of districts with high infant mortality.

This research has some possible limitations: 1) Funds were aggregated by the year when the contract came into effect. The variation in the length of implementation of the projects is high (1-5 years). The actual end date of the projects would probably deliver more reliable results, but it is not always registered in the data. 2) There are some important factors in terms of the models that could not be used due to the lack of data (lifestyle risks, environmental pollution) or difficulties to measure (actual level of corruption, quality of institutions). 3) The standardized mortality ratios (SMR) of treatable and preventable mortality were used in the model. SMR rates can be imprecise for districts with significantly small population.

The most important contribution of this thesis is the development of a comprehensive Hungarian district level healthcare panel database that contains over 50 variables. In addition to practical implications, this study also filled a gap in existing literature since it 1) analyzed the whole scope of EU funds targeted the healthcare sector of one country; 2) proved the impact of EU funds on healthcare quality outcomes; 3) examined the regional inequalities associated with EU-funds in healthcare.

5.1. Policy recommendations

Addressed to:

Ms. Stella Kyriakides

European Commissioner for Health

European Commission's Directorate General

1.The findings suggest that political incentives had a significant role in the allocation of EU funds in healthcare. Political incentives often do not map onto the fundamentally apolitical interests and objectives of healthcare and are certainly not intended to play any role at all in the allocation of EU funds. Therefore, the EU is advised to revise the mechanisms of allocation that are currently in place and that are mainly controlled by national governments, so as to eliminate the role of political incentives and prioritize the realization of healthcare policy goals (or other relevant, apolitical policy goals).

2. While improvements in the disparity of *health capacity outcomes* were in fact achieved, contrary to their expected and desired downstream effect, they were instead accompanied by a simultaneous widening of inequalities when it comes to *health quality outcomes*. Rather than mere inefficiency or lack of meaningful impact, this points to a critical systemic failure of the injection of funds in achieving its desired outcome. One possible reason behind this systemic failure is the lack of central coordination regarding the spending of EU funds in healthcare. Considering that EU funds are a major source of investment in the healthcare system of some countries, it would be advisable for the European Commission to call upon an independent expert committee to establish long-term healthcare goals and identify the necessary developments at the national and regional levels. Subsequently, the allocation of EU funds can be structured and coordinated accordingly.

3. The results demonstrated that despite the existence of special programs targeted the development of the less favored areas the magnitude of such programs was marginal. Furthermore, the research also proved that income is strongly related to healthcare quality

outcomes (treatable and preventable mortalities). The European Commission is advised to consider allocating more resources for the development of less favored areas, with special emphasis on early childhood and parental education programs.

4. The study suggests that the EU funds targeting special human development programs could not mitigate the shortage and the uneven geographical distribution of healthcare professionals. The European Commission is strongly advised to increase the compulsory co-payment ratio paid by the national governments. Furthermore, the European Commission is advised to require the implementation of domestic policy programs to help stimulate the effect of EU-sponsored projects. For example: the European Commission could require the Hungarian government to increase wages significantly in healthcare sector as a condition for receiving EU funds.

5. In accordance with the principles and goals of the European Health Data Space initiative, the European Commission is advised to require national governments to collect various healthcare data at a lower geographical level (LAU1 or LAU2), and make it accessible for each EU citizen to promote transparency and foster research activities.

6. APPENDICES

Table 5. The first 15 districts that received the highest and the lowest amount of EU funds

District	Amount awarded (billion forints)	Characteristics	District	Amount awarded (billion forints)	Characteristics
Budapest	76,8	National institutions and University Clinic	Aszódi	0,01	Pest county
Debreceni	39,3	University Clinic	Dunaekeszi	0,02	Pest county
Székesfehérvári	36,8	County hospital	Gyáli	0,03	Pest county
Pécsi	36,3	University Clinic	Pilisvörösvári	0,03	Pest county
Szegedi	35	University Clinic	Hegyháti	0,04	Primary care
Miskolci	30,6	County hospital	Vecsési	0,05	Pest county
Kecskeméti	29,2	County hospital	Gyomaendrődi	0,07	Outpatient center
Győri	24	County hospital	Bólyi	0,07	Primary care
Nyíregyházi	19,2	County hospital	Tolnai	0,09	Primary care
Kaposvári	17,6	County hospital	Tiszakécskei	0,10	Outpatient center
Szombathelyi	14,3	County hospital	Nagykőrös	0,11	Outpatient center
Szolnoki	13,7	County hospital	Budakeszi	0,11	Pest county
Martonvásári	12,2	Ambulance station	Körmendi	0,12	Outpatient center
Veszprémi	11	County hospital	Devecseri	0,15	Outpatient center
Gyulai	11	County hospital	Oroszlányi	0,16	Outpatient center

Table 6. Descriptive statistics of the variables

Variable	Obs	Mean	Std.Dev.	Min	Max	Year
EU funds by year of decision and effective (in Hungarian forints)						
equipment_effective (total funds spent on medical equipment)	2986	2.15e+07	4.81e+08	0	2.54e+10	2004-2020
funds_decision (total funds by year of decision)	2986	3.59e+08	1.98e+09	0	5.78e+10	2004-2020
funds_effective (total funds by year of effective)	2986	3.69e+08	2.39e+09	0	9.14e+10	2004-2020
hr_effective (total funds spent on human resource)	2986	1.90e+07	1.70e+08	0	7.46e+09	2004-2020
ln_funds_decision	2986	6.781	9.23	0	24.16	2004-2020
ln_fund_effective	2986	5.95	8.89	0	23.95	2004-2020
Mortality ratios						
preventalbe_mortality_total (for 100 000 people)	2800	395.075	77.992	189.304	770.11	2004-2019
treatable_total (for 100 000 people)	2800	216.939	46.836	93.834	511.604	2004-2019
mortality_ratio (crude)	2800	.014	.002	.008	.023	2004-2019
infant_mortality_ratio	2800	.005	.005	0	.049	2004-2019
ln_preventable_mortality	2800	5.96	.197	5.24	6.64	2004-2019
ln_treatable_mortality	2800	5.36	.211	4.54	6.24	2004-2019
ln_mortality_ratio	2800	-4.28	.150	-4.79	-3.78	2004-2019
Budget of the national healtcare fund (in 100 000 forints)						
budget_ct_percapita	2450	1.021	2.929	0	40.972	2006-2019
budget_gp_percapita	2450	10.197	11.068	0	139.335	2006-2019
budget_outpatient_percapita	2450	13.276	5.493	3.68	45.937	2006-2019
budget_total_percapita	2450	72.856	89.096	6.549	1077.198	2006-2019
Incidence ratios						
cancer_ratio	1400	.02	.003	.012	.03	2011-2018
cardio_ratio	1400	.333	.029	.239	.428	2011-2018
respiratiory_ratio	1400	.353	.041	.239	.479	2011-2018
Other health-related variables						
care_days_percapita (in-patient)	2800	1.263	1.626	0	13.231	2004-2019
empty_gp_praxis (count per district)	2800	.136	.429	0	6	2004-2019
gp_empty_population_ratio (ratio of population without a gp)	2800	.005	.017	0	.259	2004-2019
gp_percapita	2800	4.977	.773	2.633	9.144	2004-2019
hours_outpatient_percapita (hours in outpatient care)	2069	1.165	.995	.005	14.091	2007-2019 (ex 2015)
icu_department (intensive care unit available in the district)	2800	.321	.467	0	1	2004-2018

mean_care_days (mean care days in the areas of one day surgeries)	2800	1.555	2.104	0	7.684	2004-2019
one_day_ratio (ratio of one day surgeries)	2800	.145	.297	0	1	2004-2019
professionals_total_percapita (number of qualified healthcare employees)	1400	.014	.004	.001	.035	2012-2018
Results of the local elections (major)						
close_run_governing_party (margin <10%)	2800	.137	.344	0	1	2004-2019
close_run_opposition (margin <10%)	2800	.08	.271	0	1	2004-2019
governing_party (major)	2800	.536	.499	0	1	2004-2019
overwhelming_victory_governing_party (margin >50%)	2800	.06	.238	0	1	2004-2019
overwhelming_victory_non_governing_party (margin >50%)	2800	.085	.28	0	1	2004-2019
Controls						
distance_county_capitals (fastest route in minutes)	2275	44.376	19.934	0	122.169	2007-2019
elderely_ratio	2800	.229	.031	.144	.325	2004-2019
export_percapita	2625	2096.971	5627.9	.233	111000	2004-2018
gymnasium_ratio	2800	.165	.102	0	.608	2004-2019
personal_income_percapita (before tax)	2800	1140000	568000	243000	3510000	2004-2019
population_male	2800	27010.38	61457.51	3932	819000	2004-2019
population_female	2800	29717.86	71769.48	4269	944000	2004-2019
population_total	2800	56728.24	133000	8201	1760000	2004-2019
revenues_percapita	2625	5532.46	8137.494	182.395	118000	2004-2018
territory_woods	2275	11700.51	8974.443	0	51053	2004-2017 (ex 2008)

Table 7. List of variables for the Gini coefficient

Variable	**Year**
Preventable mortality ratio (for 100 000 people)	2004-2019
Treatable mortality ratio (for 100 000 people)	2004-2019
Infant mortality ratio	2004-2019
Budget CAT examination per capita (in 100 000 Hungarian forints)	2006-2019
Budget general practitioners per capita (in 100 000 Hungarian forints)	2006-2019
Budget total per capita (in 100 000 Hungarian forints)	2006-2019
Cancer ratio	2011-2018
Cardiovascular ratio	2011-2018
Respiratory ratio	2011-2018
General practitioners per capita	2004-2019
Hours in outpatient care per capita	2007-2019 (ex 2015)
Ratio of one day surgeries	2004-2019
Number of healthcare professional per capita	2012-2018
Ratio of secondary grammar school students	2004-2019
Personal income per capita (before tax)	2004-2019
Company revenues per capita	2004-2018

Table 8. List of health-related EU projects

program_code	program_name	support scheme	Operative program
TÁMOP-6.2.2/A-09/2	„A" komponens: Képzési díj támogatása az intézmények számára a konvergencia régiókban // Training support for institutions in the convergence regions	human_resource	DAOP
KMOP-4.3.3/B_2	A Közép-Magyarországi régió egészségügyi informatikájának fejlesztése // Development of health informatics of the Central-Hungarian Region	IT	DAOP
EFOP-2.2.0-16	A minőségi egészségügyi közszolgáltatásokhoz való hozzáférés biztosításának fejlesztése // Development of the accessibility of healthcare services	infrastructure	DAOP
TIOP-2.2.2/C-10/1	A Perinatális Intenzív Centrumok és az Intenzív Neonatológiai Osztályok műszaki fejlesztése // Development of Perinatal intensive centers and intensive neonatological departments	child_emergency_neonatology	DAOP
DAOP-5.1.3-11	A régió lakosságának egészségtudatos életmódját támogató civil szervezetek infrastrukturális feltételeinek fejlesztése //Development of the infrastructure of regional non-governmental organizations promoting health-awareness	public_health_awareness	DAOP
TIOP-2.2.3-11/1	A regionális vérellátó központok fejlesztése // Development of regional blood transfusion centers	blood_transfusion_center	DAOP
TÁMOP-4.1.1.C-13/1/KONV	Ágazati felsőoktatási együttműködés támogatása, vidéki felsőoktatási integráció elősegítése az egészségtudomány területén // Promoting sectorial cooperations in the field of health sciences	research	DAOP
TIOP-2.1.3-07/1	Aktív kórházi ellátásokat kiváltó járóbeteg szolgáltatások fejlesztése // Development of cervices substituting active hospital care	outpatient_care	DAOP
TIOP-2.1.3-08/1	Aktív kórházi ellátásokat kiváltó járóbeteg szolgáltatások fejlesztése // Development of cervices substituting active hospital care	outpatient_care	DDOP
TIOP-2.1.3-10/1	Aktív kórházi ellátásokat kiváltó járóbeteg szolgáltatások fejlesztése // Development of cervices substituting active hospital care	outpatient_care	DDOP

ÉMOP-4.1.1/C-09	Alap- és járóbeteg-ellátás fejlesztése (LHH-33) // Development of primary and outpatient care	primary_outpatient	DDOP
DAOP-4.1.1/C-09	Alap- és járóbeteg-ellátás fejlesztése a komplex programmal kezelendő LHH kistérségekben // Development of primary and outpatient care in the marginalized microregions	primary_outpatient	DDOP
ÉMOP-4.1.1/A-09	Alapellátás fejlesztése // Development of primary care	primary_care	ÉAOP
KDOP-5.2.1/A-09	Alapellátás fejlesztése // Development of primary care	primary_care	ÉAOP
NYDOP-5.2.1/A-09	Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of primary care, establishing local health centers	primary_care	ÉAOP
DAOP-4.1.1/A-09	Alapellátás fejlesztése, helyi egészségházak kialakítása // Primary care development, establishing local health centers	primary_care	ÉAOP
EFOP-1.10.1-VEKOP-16	Ápoló tanulók részére pályaválasztást támogató ösztöndíjas program // Scholarhip programs for nurse students	human_resource	ÉAOP
EFOP-1.8.2-17	Az alapellátás és népegészségügy rendszerének átfogó fejlesztése - alapellátás fejlesztése // Development of the public health system of primary care, primary care	primary_care	ÉAOP
EFOP-1.8.19-17	Az alapellátás és népegészségügy rendszerének átfogó fejlesztése - népegészségügy helyi kapacitás fejlesztése // Development of the public health system, public health system	public_health_awareness	ÉAOP
EFOP-1.8.20-17	Az alapellátás és népegészségügy rendszerének átfogó fejlesztése - népegészségügy helyi kapacitás fejlesztése a mentális egészség területén // Development of the public health system, public health system in the field of mental health	public_health_awareness	ÉAOP
VEKOP-7.2.3-17	Az alapellátás és népegészségügy rendszerének átfogó fejlesztése – alapellátás fejlesztése // Development of the public health system of primary care / primary care	public_health_awareness	EFOP
VEKOP-7.2.2-17	Az alapellátás és népegészségügy rendszerének átfogó fejlesztése // Development of the public health system of primary care	public_health_awareness	EFOP

EKOP-3.1.1-09	Az ÁNTSZ gyors reagálási képességét növelő komplex információs rendszerének fejlesztése a külső szolgáltatások és belső hatékonyság növelésének támogatására // Development of a complex it system to promote the faster reaction and efficiency of the National Public Health Service	IT	EFOP
TÁMOP-6.1.6-14/1	Az egészségre nevelő és szemléletformáló életmódprogramok közvetítése a fogyasztóvédelmi intézkedések megfelelő racionalizálásával // Public health awareness programs by the racionalization of consumer protection measures	public_health_awareness	EFOP
EFOP-2.2.20-17	Az egészségügyi ellátórendszer orvostechnikai infrastruktúra készültségi szintjének javítása // Development of medical infrastructure	equipment	EFOP
KMOP-4.3.1/C	Az onkológiai és gyermek onkológiai ellátást végző intézmények infrastrukturális fejlesztése // infrastructural developments of oncology and child oncology institutions	oncology	EFOP
KMOP-4.3.1/C_2-09-2f	Az onkológiai és gyermek onkológiai ellátást végző intézmények infrastrukturális fejlesztése // infrastructural developments of oncology and child oncology institutions	oncology	EFOP
TIOP-2.2.9-15/1	Az otthoni szakápolás kialakítandó rendszerében működő szolgáltatók eszközeinek, orvosi gép-műszer beszerzéseinek támogatása pénzügyi eszköz biztosításával // Supporting equipment development of home care providers	home_care	EFOP
EFOP-2.2.18-17	Betegbiztonság növelését célzó komplex infrastrukturális fejlesztések az egészségügyi ellátórendszerben // Development of complex infrastructural programs to improve patient safety	infrastructure	EFOP
VEKOP-6.3.5-17	Betegbiztonság növelését célzó komplex infrastrukturális fejlesztések az egészségügyi ellátórendszerben // Development of complex infrastructural programs to improve patient safety	infrastructure	EFOP

TÁMOP-5.5.7-08/1	Betegjogi, ellátottjogi és gyermekjogi képviselői hálózat és civil jogvédő munka fejlesztése // Improving the system of patient right organizations	patient_rights	EFOP
TÁMOP-6.1.1-12/1	Bizonyítékokon alapuló egészségfejlesztési ismeretek kidolgozása az oktatás különböző szintjei számára, valamint egészségfejlesztési szakmai hálózat létrehozása // Development of evidence-based health development knowledge for the different levels of education, development of a health development professional network	research	EFOP
EKOP-2.3.7-2012	Egészségbiztosítási ügyfélkapcsolatok fejlesztése, egészségügyi rendszerekbe integrált adatkezelés és azonosítás megvalósítása // Development of health insurance customer service, data integration	IT	EFOP
NKFP_07_A1	Egészséges ember (NKFP_07_A1) // Healthy human	research	EFOP
TÁMOP-6.1.2.B-14/1	Egészséges táplálkozás elterjesztése a közétkeztetésben // Promoting healthy diet in public canteens	public_health_awareness	EFOP
TÁMOP-6.1.2-11/1	Egészségre nevelő és szemléletformáló életmód programok - lokális színterek // Health awareness-raising programs	public_health_awareness	EFOP
TÁMOP-6.1.2-11/2	Egészségre nevelő és szemléletformáló életmódprogramok // Health awareness-raising programs	public_health_awareness	EFOP
TÁMOP-6.1.2-13/1	Egészségre nevelő és szemléletformáló életmódprogramok // Health awareness-raising programs	public_health_awareness	EFOP
TÁMOP-6.1.2-13/2	Egészségre nevelő és szemléletformáló életmódprogramok // Health awareness-raising programs	public_health_awareness	NKFP_07_A1
TÁMOP-6.1.2/A-09/1	Egészségre nevelő és szemléletformáló életmódprogramok // Health awareness-raising programs	public_health_awareness	EKOP
TÁMOP-6.1.2/A-09/1-KMR	Egészségre nevelő és szemléletformáló életmódprogramok // Health awareness-raising programs	public_health_awareness	EKOP
TÁMOP-6.1.2-11/4	Egészségre nevelő és szemléletformáló életmódprogramok	public_health_awareness	ÉMOP

	// Health awareness-raising programs		
TÁMOP-6.1.2-11/3	Egészségre nevelő és szemléletformáló életmódprogramok a kistérségekben // Health awareness-raising programs in microregions	public_health_awareness	ÉMOP
TÁMOP-6.1.2/LHH-09/1	Egészségre nevelő és szemléletformáló életmódprogramok a leghátrányosabb helyzetű kistérségekben // Health awareness-raising programs in the marginalized microregions	public_health_awareness	ÉMOP
TÁMOP-6.1.2/LHH-09/2	Egészségre nevelő és szemléletformáló életmódprogramok a leghátrányosabb helyzetű kistérségekben // Health awareness-raising programs in the marginalized microregions	public_health_awareness	ÉMOP
TÁMOP-6.1.2/LHH/11-A	Egészségre nevelő és szemléletformáló életmódprogramok a leghátrányosabb helyzetű kistérségekben // Health awareness-raising programs in the marginalized microregions	public_health_awareness	ÉMOP
TÁMOP-6.1.2/LHH/11-B	Egészségre nevelő és szemléletformáló életmódprogramok a leghátrányosabb helyzetű kistérségekben // Health awareness-raising programs in the marginalized microregions	public_health_awareness	ÉMOP
TÁMOP-4.2.6-15/1	Egészségtudományi, egészségipari innovációs környezet fejlesztése, szakmai hálózatosodás elősegítése // Development of an innovation environment in health sciences and health industry, improving professional networks	research	ÉMOP
DDOP-3.1.3/G-14	Egészségügyi alapellátás fejlesztése //Development of primary care	primary_care	ÉMOP
TOP-4.1.1-15-BO1	Egészségügyi alapellátás infrastrukturális fejlesztése // Development of the infrastructure of primary care	primary_care	ÉMOP
TOP-6.6.1-15-SL1	Egészségügyi alapellátás infrastrukturális fejlesztése // Development of the infrastructure of primary care	primary_care	GOP1
TOP-6.6.1-16-VP1	Egészségügyi alapellátás infrastuktúrális fejlesztése // Development of the infrastructure of primary care	primary_care	HEFOP

ÉAOP-4.1.2/A-09	Egészségügyi alapellátás korszerűsítése // Modernizing primary care	primary_outpatient	HEFOP
ÉMOP-4.1.1/A-12	Egészségügyi alapellátás, egészségházak és járóbeteg szakellátás fejlesztése //Development of primary care, health centers and outpatient care	primary_outpatient	HEFOP
ÉMOP-4.1.1/B-12	Egészségügyi alapellátás, egészségházak és járóbeteg szakellátás fejlesztése //Development of primary care, health centers and outpatient care	primary_outpatient	KDOP
NYDOP-5.2.1/A-12	Egészségügyi alapellátás, egészségházak és járóbeteg szakellátás fejlesztése //Development of primary care, health centers and outpatient care	primary_outpatient	KDOP
ÉAOP-4.1.2/A-12	Egészségügyi alapellátás, egészségházak és járóbeteg szakellátás fejlesztése //Development of primary care, health centers and outpatient care	primary_outpatient	KDOP
EFOP-1.8.0-VEKOP-17	Egészségügyi ellátórendszer szakmai módszertani fejlesztése // Methodological development of the healthcare system	research	KDOP
KEOP-5.6.0/E/15	Egészségügyi eszközök energia-megtakarítást célzó beszerzésének támogatása // energy-efficient medical equipments	equipment	KDOP
TÁMOP-6.2.1-11/1	Egészségügyi humánerőforrás monitoring // Monitoring human resource in healthcare	research	KEHOP
EFOP-1.10.2-17	Egészségügyi humánerőforrás-fejlesztés // Human resource devleopment	human_resource	KEOP
VEKOP-7.2.4-17	Egészségügyi humánerőforrás-fejlesztés //Human resource development in healthcare	human_resource	KEOP
HEFOP-4.4	Egészségügyi információ-technológia fejlesztés az elmaradott régiókban // Devleopment of information-technology in the marginalized regions	IT	KMOP
HEFOP-4.3	Egészségügyi infrastruktúra fejlesztése a hátrányos helyzetű régiókban // Devleopment of information-technology in the marginalized regions	infrastructure	KMOP
KEOP-7.4.0.	Egészségügyi intézmények energetikai racionalizálása (EgInER) // Energetic development of health institutions	infrastructure	KMOP

ÉAOP-4.1.2/D-09	Egészségügyi intézmények fejlesztése a komplex programmal kezelendő LHH kistérségekben //Development of healthcare institutions in the marginalized microregions	outpatient_care	KMOP
EFOP-1.10.4-18	Egészségügyi ösztöndíjak támogatása // Healthcare scholarships	human_resource	KMOP
NYDOP-5.2.1/C	Egészségügyi rehabilitációs ellátási központok kialakítása // Devleopment of healthcare rehabilitation centers	rehabilitation	KMOP
DDOP-3.1.3/B	Egészségügyi szolgáltatások fejlesztése / Járóbeteg szakellátó központok fejlesztése //Development of healthcare services/Development of outpatient centers	outpatient_care	KMOP
ÉMOP-4.1.1/C-10	Egészségügyi szolgáltatások fejlesztése / Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése a komplex programmal kezelendő LHH kistérségekben //Development of health services/Development of outpatient centers in the marginalized microregions	primary_outpatient	KMOP
DAOP-4.1.1/C-10	Egészségügyi szolgáltatások fejlesztése / Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése a komplex programmal kezelendő LHH kistérségekben //Development of health services/Development of outpatient centers in and modernizing primary and outpatient care in the marginalized microregions	primary_outpatient	KMOP
ÉAOP-4.1.2/D-10	Egészségügyi szolgáltatások fejlesztése / Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése a komplex programmal kezelendő LHH kistérségekben //Development of health services/Development of outpatient centers in the marginalized microregions	primary_outpatient	KMOP
DAOP-4.1.1/B-09	Egészségügyi szolgáltatások fejlesztése / Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás	primary_outpatient	KMOP

	korszerűsítésea // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care		
ÉMOP-4.1.1/A	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care/Development of primary care, establishing local health centers	primary_care	KMOP
KDOP-5.2.1/A	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care/Development of primary care, establishing local health centers	primary_care	NYDOP
NYDOP-5.2.1/A	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care/Development of primary care, establishing local health centers	primary_care	NYDOP
DAOP-4.1.1/A	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care/Development of primary care, establishing local health centers	primary_care	NYDOP

ÉAOP-4.1.2/A	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Alapellátás fejlesztése, helyi egészségházak kialakítása // Development of health services/Development of outpatient centers in microregions, modernizing primary and outpatient care/Development of primary care, establishing local health centers	primary_care	NYDOP
ÉMOP-4.1.1/B	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Kistérségi önálló járóbeteg szakrendelők fejlesztése // Development of health services/Development outpatient centers in microregions, modernizing primary and outpatient care/ Development of outpatient care in microregions	outpatient_care	NYDOP
KDOP-5.2.1/B	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Kistérségi önálló járóbeteg szakrendelők fejlesztése // Development of health services/Development outpatient centers in microregions, modernizing primary and outpatient care/ Development of outpatient care in microregions	outpatient_care	NYDOP
NYDOP-5.2.1/B	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Kistérségi önálló járóbeteg szakrendelők fejlesztése // Development of health services/Development outpatient centers in microregions, modernizing primary and outpatient care/ Development of outpatient care in microregions	outpatient_care	TÁMOP
DAOP-4.1.1/B	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Kistérségi önálló járóbeteg szakrendelők fejlesztése //	outpatient_care	TÁMOP

	Development of health services/Development outpatient centers in microregions, modernizing primary and outpatient care/ Development of outpatient care in microregions		
ÉAOP-4.1.2/B	Egészségügyi szolgáltatások fejlesztése /Kistérségi járó beteg szakellátó központok fejlesztése, alap-, járóbeteg szakellátás korszerűsítése / Kistérségi önálló járóbeteg szakrendelők fejlesztése // Development of health services/Development outpatient centers in microregions, modernizing primary and outpatient care/ Development of outpatient care in microregions	outpatient_care	TÁMOP
KMOP-4.3.2/A-13	Egészségügyi szolgáltatások, járóbeteg-szakellátás fejlesztése a Közép-Magyarországi régióban // Development of healthcare services and outpatient care in the Central-Hungarian region	outpatient_care	TÁMOP
KEHOP-5.2.1-15	Egyházi fenntartású kórházak, valamint a Magyar Honvédség Egészségügyi Központ épületenergetikai fejlesztése // Energetic development of church-owned hospitals and the Health Center of the Hungarian Defence Forces	infrastructure	TÁMOP
TÁMOP-6.2.5.A-12/1	Egységes külső felülvizsgálati rendszer kialakítása a járó- és fekvőbeteg szakellátásban, valamint a gyógyszertári ellátásban // Development of an external monitoring system in out, inpatient care and pharmacy provision	research	TÁMOP
EFOP-1.9.6-16	Elektronikus egészségügyi ágazati fejlesztések // Electronic healthcare developments	IT	TÁMOP
EFOP-3.8.1-14	Felzárkóztató egészségügyi ápolói szakképzési programok // Training programs for nurses	human_resource	TÁMOP
TÁMOP-6.2.4.A-11/1	Foglalkoztatás támogatása A) komponens: Foglalkoztatás támogatása egészségügyi intézmények számára // Promoting employment in healthcare institutions	human_resource	TÁMOP
TÁMOP-6.2.4/A-09/1	Foglalkoztatás támogatása A) komponens: Foglalkoztatás támogatása egészségügyi	human_resource	TÁMOP

	intézmények számára // Promoting employment in healthcare institutions		
TÁMOP-6.2.4/A-09/1/KMR	Foglalkoztatás támogatása A) komponens: Foglalkoztatás támogatása egészségügyi intézmények számára // Promoting employment in healthcare institutions	human_resource	TÁMOP
TÁMOP-6.2.4/A-08/1	Foglalkoztatás támogatása egészségügyi intézmények // Promoting employment in healthcare institutions	human_resource	TÁMOP
TÁMOP-6.2.4/A-08/1/konv	Foglalkoztatás támogatása egészségügyi intézmények // Promoting employment in healthcare institutions	human_resource	TÁMOP
EFOP-2.2.1-VEKOP-16	Gyermek sürgősségi, baleseti ellátás fejlesztése // Development of child emergency care	emergency_ambulance	TÁMOP
EFOP-1.8.21-18	Infekciókontroll tevékenységek gyakorlati megvalósítása a fekvőbeteg ellátást nyújtó intézményekben // Infection control in in-patient care	infection_control	TÁMOP
TIOP-2.2.7-07/2F/2	Infrastruktúra-fejlesztés az egészségpólusokban // Infrastructural development in the health poles	infrastructure	TÁMOP
GOP-1.3.1-11/F	Innováció a fogászatban // Innovation in dentistry	dentistry	TÁMOP
KMOP-1.1.4-11/F	Innováció a fogászatban // Innovation in dentistry	dentistry	TÁMOP
DDOP-3.1.3/A-2f	Integrált mikrotérségi alapfokú egészségügyi és szociális szolgáltató központok fejlesztése //Development of integrated primary care and social service centers in microregions	primary_care	TÁMOP
EFOP-2.2.19-17	Járóbeteg szakellátó szolgáltatások fejlesztése // Development of outpatient care	outpatient_care	TÁMOP
TÁMOP-6.2.2.A-11/1	Képzési díj és ösztöndíj támogatása az intézmények számára a konvergencia régiókban // Trainings and scholarships in the convergence regions	human_resource	TÁMOP
TÁMOP-6.2.2.A-KMR/11-1	Képzési díj és ösztöndíj támogatása az intézmények számára a Közép-magyarországi Régióban // Trainings and scholarships in the convergence regions	human_resource	TÁMOP
TÁMOP-6.2.2/A-09/1	Képzési programok az egészségügyben foglalkoztatottak számára, hiányszakmák képzése,	human_resource	TÁMOP

	kompetenciafejlesztés // Trainings for the healtcare employees		
TÁMOP-6.2.2/A-KMR-09/1	Képzési programok az egészségügyben foglalkoztatottak számára, hiányszakmák képzése, kompetenciafejlesztés // Trainings for the healtcare employees	human_resource	TÁMOP
TÁMOP-6.2.2/A-KMR-09/2	Képzési programok az egészségügyben foglalkoztatottak számára, hiányszakmák képzése, kompetenciafejlesztés // Trainings for the healtcare employees	human_resource	TÁMOP
TÁMOP-6.2.2/B-09/1	Képzési programok az egészségügyben foglalkoztatottak számára, hiányszakmák képzése, kompetenciafejlesztés // Trainings for the healtcare employees	human_resource	TÁMOP
TÁMOP-6.2.2/B-09/2	Képzési programok az egészségügyben foglalkoztatottak számára, hiányszakmák képzése, kompetenciafejlesztés // Trainings for the healtcare employees	human_resource	TÁMOP
TÁMOP-6.2.2.B-12/1	Képzési programok az egészségügyi ágazat szolgáltatás-fejlesztése érdekében // Trainings for improving the service of the healthcare sector	human_resource	TÁMOP
EFOP-1.10.3-17	Képzési programok az egészségügyi ágazat szolgáltatás-fejlesztése érdekében // Trainings for improving the service of the healthcare sector	human_resource	TÁMOP
KMOP-4.3.1/A	Kiemelt ellátást biztosító egészségügyi intézmények korszerűsítése	infrastructure	TÁMOP
KMOP-4.3.1/A_2-09-2f	Kiemelt ellátást biztosító egészségügyi intézmények korszerűsítése	infrastructure	TÁMOP
KMOP-4.3.2	Kistérségi járóbeteg szakellátás fejlesztése a Közép-Magyarországi régióban	outpatient_care	TÁMOP
ÉAOP-4.1.2/B-09	Kistérségi járóbeteg szakellátó központok fejlesztése // Development of outpatient care in microregions	outpatient_care	TÁMOP
TIOP-2.1.2-08/1	Kistérségi járóbeteg-szakellátó központok kialakítása és fejlesztése // Development of cervices substituting active hospital care	outpatient_care	TÁMOP
TIOP-2.1.2-07/1	Kistérségi járóbeteg-szakellátó központok kialakítása és fejlesztése // Development of cervices substituting active hospital care	outpatient_care	TÁMOP
ÉMOP-4.1.1/B-09	Kistérségi önálló járóbeteg szakrendelők fejlesztése //	outpatient_care	TÁMOP

	Development of outpatient care in microregions		
KDOP-5.2.1/B-09	Kistérségi önálló járóbeteg szakrendelők fejlesztése // Development of outpatient care in microregions	outpatient_care	TÁMOP
TÁMOP-6.1.2.A-14/1	Komplex intézményi mozgásprogramok és kapcsolódó egészségfejlesztési alprogramok megvalósítása az általános iskolákban, többcélú intézményekben valamint szabadidős közösségi mozgásprogramok és kapcsolódó egészségfejlesztési alprogramok megvalósítása az iskolán kívüli szereplők bevonásával // Sport awareness raising campaigns	public_health_awareness	TÁMOP
TÁMOP-6.1.2.A-14/2	Komplex intézményi mozgásprogramok és kapcsolódó egészségfejlesztési alprogramok megvalósítása az általános iskolákban, többcélú intézményekben valamint szabadidős közösségi mozgásprogramok és kapcsolódó egészségfejlesztési alprogramok megvalósítása az iskolán kívüli szereplők bevonásával // Sport awareness raising campaigns	public_health_awareness	TÁMOP
EFOP-1.8.1-VEKOP-15	Komplex népegészségügyi szűrések // Comlex public health screenings	public_health_awareness	TÁMOP
TIOP-2.2.5-09/1	Korszerű regionális onkológiai hálózat kialakítása // Development of moder regional oncology system	oncology	TÁMOP
KMOP-4.3.3/B-09-2F	Közép-Magyarországi régió egészségügyi informatikájának fejlesztése // Devleopment of the informatic infrastructure of the Central-Hungarian region	IT	TÁMOP
TÁMOP-6.1.7-15/1	Közösségek kohéziójának erősítése összhangban az egészséges életmód elterjesztésével // Improving the cohesion of the society in accordance with promoting health-awareness	public_health_awareness	TÁMOP
TIOP-2.3.4-09/2	Mentésirányítási rendszer fejlesztése // Improving ambulance system	emergency_ambulance	TÁMOP
TÁMOP-6.2.7-13/1	Nemzeti Egészségügyi Informatikai (e-Egészségügyi) Rendszer bevezetését támogató módszertan-, szolgáltatás-, képzés- és humánerőforrás-fejlesztés //Metholdogical, service, training	IT	TÁMOP

	and human resource developments to support the National Heatlh Information System		
KMOP-4.3.3.A-12	Nemzeti Egészségügyi Informatikai (e-Health) Rendszer - Elektronikus közhiteles nyilvántartások és ágazati portál fejlesztése // Development of a National E-Heatlh System	IT	TÁMOP
TÁMOP-6.1.3.B-12/1	Népegészségügyi kommunikáció fejlesztése // Development of public health communication	public_health_awareness	TÁMOP
TÁMOP-6.2.3-12/1	Országos egészségmonitorozási és kapacitástérkép adatbázis- és alkalmazásfejlesztés // Development of a national health monitor capacity and database	research	TIOP
TÁMOP-6.1.3.A-13/1	Pilot jellegű szűrőprogramok (védőnői méhnyakszűrési illetve vastagbélszűrési programok) kiterjesztésének támogatása // Development of pilot screening programs (colorectal and cervical cancer)	public_health_awareness	TIOP
EFOP-2.2.6-VEKOP-16	Pszichiátriai ellátórendszer strukturált fejlesztése // Structural development of psychiatric care	psychiatry	TIOP
KMOP-4.3.2/B-13	Pszichiátriai és addiktológiai egészségügyi szolgáltatások fejlesztése a Közép-Magyarországi régióban // Development of addictology and psychiatric services in central hungary	psychiatry	TIOP
HEFOP-4.3.1	Regionális Egészségcentrum modell-intézmény létrehozása // Development of a regional healhcare center model	infrastructure	TIOP
ÉMOP-4.1.2/A-11	Rehabilitációs szolgáltatások fejlesztése// Improving rehabilitation services	rehabilitation	TIOP
KDOP-5.2.1/C-11	Rehabilitációs szolgáltatások fejlesztése// Improving rehabilitation services	rehabilitation	TIOP
NYDOP-5.2.1/C-11	Rehabilitációs szolgáltatások fejlesztése// Improving rehabilitation services	rehabilitation	TIOP
DDOP-3.1.3/C-11	Rehabilitációs szolgáltatások fejlesztése // Improving rehabilitation services	rehabilitation	TIOP
ÉAOP-4.1.2/C-11	Rehabilitációs szolgáltatások fejlesztése // Improving rehabilitation services	rehabilitation	TIOP
DAOP-4.1.2/B-11	Rehabilitációs szolgáltatások fejlesztése //Imroving rehabilitation services	rehabilitation	TIOP

TIOP-2.2.6-12/1B	Struktúraváltás támogatása a járó- és fekvőbeteg ellátás fejlesztésével // Supporing the structural change by the development of outpatient and inpatient care	infrastructure	TIOP
TIOP-2.2.6-12/1A	Struktúraváltás támogatása az onkológia centrumok fejlesztésével // Supporting the structural change by the development of oncology centers	oncology	TIOP
TÁMOP-6.2.4.B-12/1	Struktúraváltáshoz kapcsolódó képzést és foglalkoztatást támogató fejlesztés // Development of employment and trainings related to structural changes	human_resource	TIOP
TÁMOP-6.2.4.B-12/2	Struktúraváltáshoz kapcsolódó képzést és foglalkoztatást támogató fejlesztés // Development of employment and trainings related to structural changes	human_resource	TIOP
TÁMOP-6.2.4.B-14/2	Struktúraváltáshoz kapcsolódó képzést és foglalkoztatást támogató fejlesztés // Development of employment and trainings related to structural changes	human_resource	TIOP
TIOP-2.2.4-09/1	Struktúraváltoztatást támogató infrastruktúrafejlesztés a fekvőbeteg-szakellátásban // Supporing the structural change by infrastructural developments in in-patient care	infrastructure	TOP4
TÁMOP-6.2.8-15/1	Sürgősségi Akadémia // Emergency Academy	emergency_ambulance	TOP6
TIOP-2.2.1-11/1	Sürgősségi ellátás fejlesztése – mentés // Development of emergency care	emergency_ambulance	TOP6
TIOP-2.2.2-08/2	Sürgősségi ellátás fejlesztése – SO1 és SO2 (és ezeken belül gyermek sürgősségi ellátás) támogatására //Development of emergency care	emergency_ambulance	VEKOP
KMOP-4.3.1/B-11	Sürgősségi, gyermeksürgősségi ellátás fejlesztése" Perinatális Intenzív Centrumok fejlesztése Közép-Magyarországon // Development of emergency care in Central Hungary	emergency_ambulance	VEKOP
TÁMOP-6.2.5-B-13/1	Szervezeti hatékonyság fejlesztése az egészségügyi ellátórendszerben – Területi együttműködések kialakítása // Improving organizational development in the healthcare system	research	VEKOP
TÁMOP-6.1.3-08/1	Szűrőprogramok országos kommunikációja //National	public_health_awareness	VEKOP

	communication of screening programs		

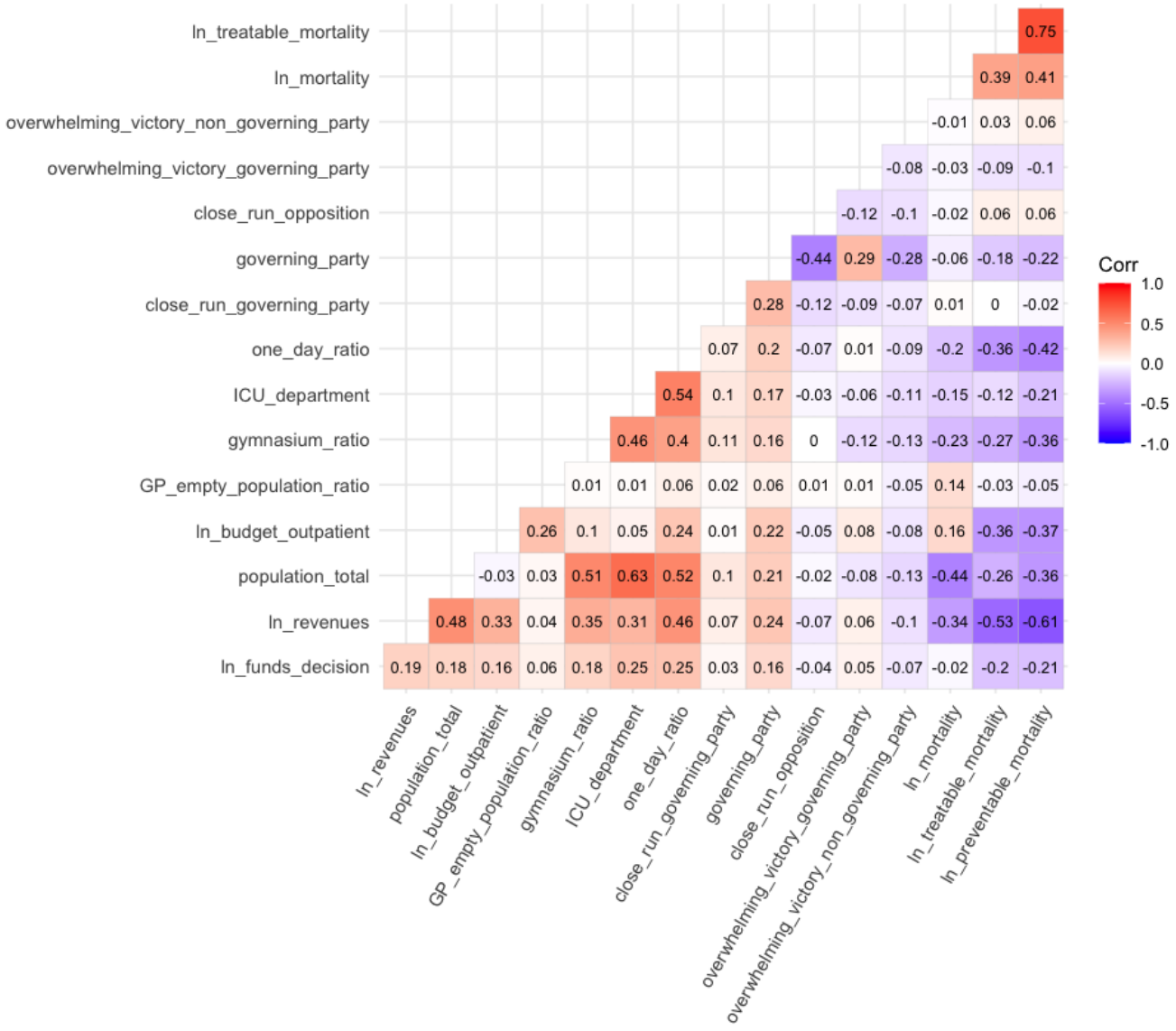

Figure 9. Allocation of EU funds - Correlation plot

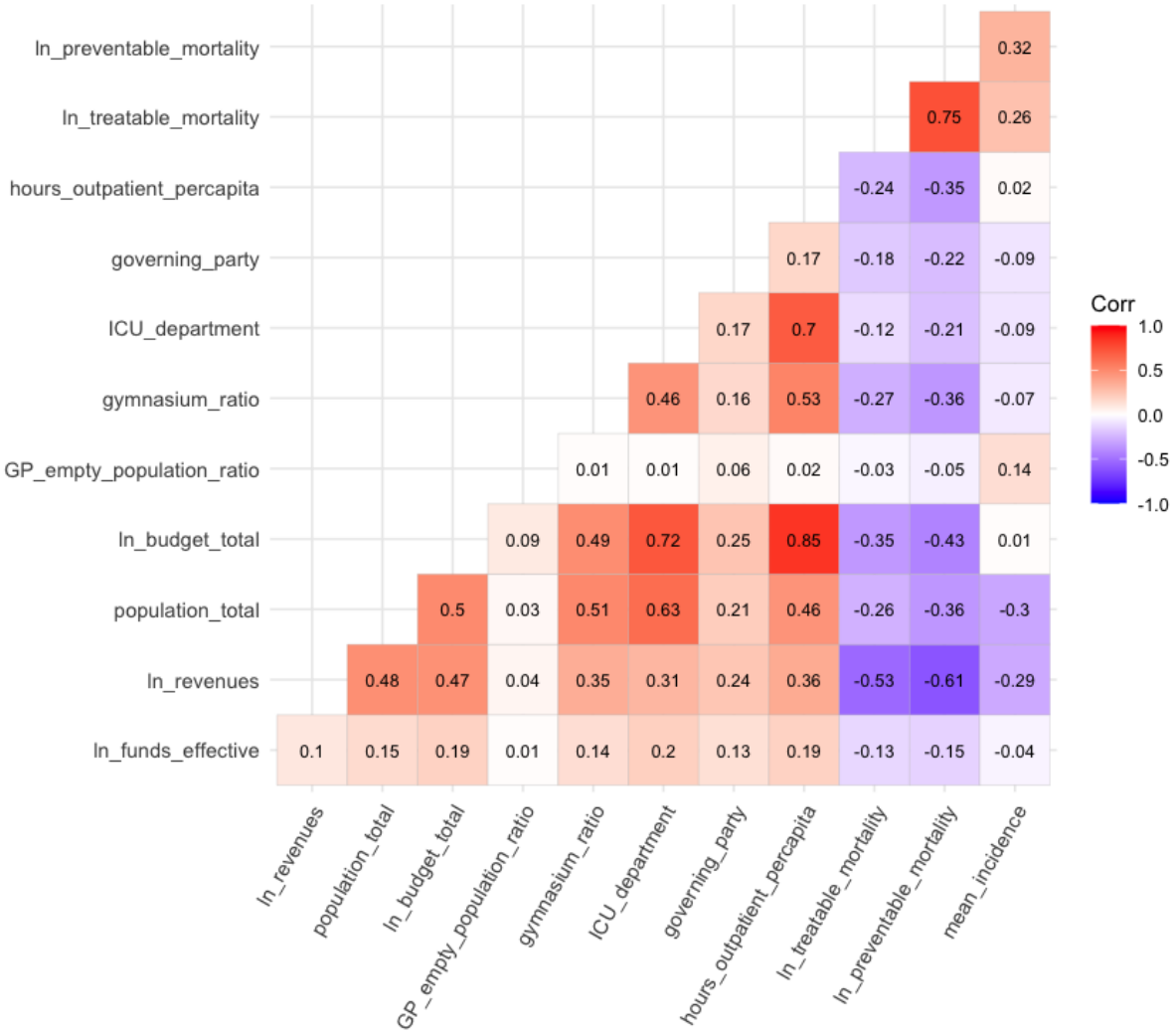

Figure 10. Effect of EU funds - Correlation plot

Table 9. Allocation of EU funds - OLS - full table

y: ln funds_decision, no lags, no difference, sc and year fixed effects	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
ln_revenues	0.43	0.40	0.41	0.40	0.41	0.49	0.94	0.95	0.91	0.95	0.96
	(0.552)	(0.549)	(0.548)	(0.547)	(0.548)	(0.543)	(0.626)	(0.624)	(0.621)	(0.624)	(0.627)
population_total		-0.00	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.00**	-0.00**	-0.00**	-0.00**
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
gymnasium_ratio			2.94	3.12	2.70	2.67	0.17	-0.18	-0.34	-0.16	-0.19
			(6.216)	(6.210)	(6.240)	(6.243)	(6.905)	(6.735)	(6.684)	(6.744)	(6.749)
gp_empty_population_ratio				10.46	10.51	10.58	11.00	10.56	11.23	10.54	10.43
				(10.866)	(10.835)	(10.812)	(11.830)	(11.803)	(11.879)	(11.816)	(11.781)
one_day_ratio					0.60	0.64	0.54	0.53	0.52	0.53	0.48
					(0.821)	(0.815)	(0.943)	(0.936)	(0.925)	(0.934)	(0.938)
icu_department						1.78**	1.80**	1.85**	1.87**	1.85**	1.85**
						(0.807)	(0.830)	(0.808)	(0.806)	(0.810)	(0.820)
2005.year	-0.64*	-0.65*	-0.66*	-0.64*	-0.64*	-0.64*					
	(0.362)	(0.363)	(0.362)	(0.363)	(0.363)	(0.363)					
2006.year	-0.98***	-0.99***	-1.02***	-0.99***	-0.99***	-1.01***					
	(0.342)	(0.343)	(0.343)	(0.343)	(0.343)	(0.346)					
2007.year	-0.12	-0.13	-0.17	-0.14	-0.18	-0.24	0.00	0.05	0.01	0.05	0.04
	(0.481)	(0.488)	(0.485)	(0.485)	(0.493)	(0.500)	(0.409)	(0.409)	(0.413)	(0.412)	(0.409)
2008.year	1.76**	1.74**	1.68**	1.70**	1.65**	1.58**	0.88	0.97	0.87	0.98	04.Jan
	(0.690)	(0.695)	(0.716)	(0.714)	(0.718)	(0.728)	(0.788)	(0.781)	(0.789)	(0.787)	(0.782)
2009.year	11.00***	10.97***	10.90***	10.93***	10.87***	10.81***	9.64***	9.77***	9.66***	9.78***	9.82***
	(0.875)	(0.878)	(0.876)	(0.874)	(0.886)	(0.891)	(1.039)	(1.037)	(1.038)	(1.058)	(1.038)

2010.year	12.28***	12.23***	12.16***	12.18***	12.12***	12.04***	10.45***	10.53***	10.38***	10.54***	10.56***
	(0.795)	(0.802)	(0.798)	(0.796)	(0.800)	(0.802)	(1.057)	(1.049)	(1.061)	(1.059)	(1.048)
2011.year	4.96***	4.88***	4.81***	4.83***	4.75***	4.66***	2.54**	2.64**	2.44**	2.66**	2.76**
	(0.810)	(0.821)	(0.832)	(0.831)	(0.843)	(0.846)	(1.160)	(1.160)	(1.181)	(1.215)	(1.174)
2012.year	13.24***	13.14***	13.09***	13.11***	13.00***	12.91***	10.57***	10.68***	10.45***	10.71***	10.78***
	(0.759)	(0.762)	(0.745)	(0.744)	(0.761)	(0.760)	(1.262)	(1.253)	(1.261)	(1.312)	(1.260)
2013.year	13.98***	13.87***	13.81***	13.82***	13.70***	13.69***	10.63***	10.78***	10.49***	10.82***	10.95***
	(0.813)	(0.820)	(0.816)	(0.814)	(0.830)	(0.829)	(1.457)	(1.452)	(1.478)	(1.533)	(1.471)
2014.year	7.42***	7.30***	7.24***	7.24***	7.12***	7.10***	3.64**	3.86**	3.54**	3.89**	4.02**
	(0.879)	(0.886)	(0.884)	(0.882)	(0.900)	(0.900)	(1.577)	(1.577)	(1.597)	(1.656)	(1.589)
2015.year	7.94***	7.80***	7.74***	7.69***	7.57***	7.54***	3.47*	3.72**	3.42*	3.75**	3.79**
	(0.995)	(1.005)	(1.006)	(1.010)	(1.025)	(1.027)	(1.775)	(1.782)	(1.803)	(1.866)	(1.786)
2016.year	-0.27	-0.43	-0.50	-0.53	-0.66	-0.67	-5.26***	-4.98***	-5.36***	-4.94***	-4.81***
	(0.754)	(0.801)	(0.794)	(0.795)	(0.813)	(0.814)	(1.760)	(1.753)	(1.780)	(1.837)	(1.763)
2017.year	8.06***	7.90***	7.81***	7.76***	7.63***	7.61***	2.57	2.87	2.52	2.91	2.97
	(0.989)	(0.975)	(0.966)	(0.971)	(0.985)	(0.982)	(1.989)	(1.991)	(2.011)	(2.079)	(1.995)
2018.year	9.78***	9.61***	9.52***	9.41***	9.28***	9.25***	3.42	3.77	3.39	3.81	3.90*
	(1.041)	(1.059)	(1.071)	(1.073)	(1.096)	(1.100)	(2.326)	(2.317)	(2.344)	(2.384)	(2.323)
ln_budget_outpatient							6.14***	5.76***	5.79***	5.75***	5.52***
							(2.071)	(2.052)	(2.048)	(2.063)	(2.071)
close_run_governing_party								-1.35**	-1.33**	-1.35**	-1.34**
								(0.664)	(0.657)	(0.665)	(0.671)
ln_treatable									-1.57		
									(1.245)		
ln_preventable										0.14	
										(1.637)	

ln_mortality											2.66
											(2.821)
Constant	-2.36	4.72	4.23	4.12	4.18	3.37	-10.22	-8.52	0.50	-9.34	2.72
	(4.107)	(7.265)	(7.302)	(7.279)	(7.333)	(7.421)	(8.585)	(8.373)	(10.830)	(12.788)	(14.343)
Observations	2625	2625	2625	2625	2625	2625	2275	2275	2275	2275	2275
R-squared	0.391	0.392	0.392	0.392	0.392	0.393	0.352	0.353	0.354	0.353	0.353
Number of sc_code	175	175	175	175	175	175	175	175	175	175	175
VIF	1.03	1.08	1.17	1.14	1.16	1.23	1.26	1.23	1.28	1.31	1.28

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 10. Allocation of EU funds - OLS - lags and first differences

y: lag of mortality, ln_funds_decision, first difference where needed, sc and year fixed effects	Treatable mortality	Preventable mortality	Mortality ratio
treatable_total	-0.00		
	(0.006)		
L.treatable_total	-0.01*		
	(0.006)		
L2.treatable_total	-0.00		
	(0.006)		
ln_revenues	0.87	0.95	0.93
	(0.629)	(0.620)	(0.626)
population_total	-0.00**	-0.00**	-0.00***
	(0.000)	(0.000)	(0.000)
ln_budget_outpatient	5.80***	5.83***	6.22***
	(2.063)	(2.098)	(2.069)
D.gp_empty_population_ratio	4.21	4.40	4.31
	(8.643)	(8.533)	(8.505)
gymnasium_ratio	0.18	0.09	0.11
	(6.690)	(6.675)	(6.768)
icu_department	1.84**	1.86**	1.87**
	(0.783)	(0.792)	(0.775)
D.one_day_ratio	1.93	2.03	1.88
	(1.347)	(1.329)	(1.351)

close_run_governing_party	-1.33**	-1.38**	-1.40**
	(0.650)	(0.656)	(0.658)
preventable_total		0.00	
		(0.004)	
L.preventable_total		-0.01	
		(0.004)	
L2.preventable_total		0.00	
		(0.004)	
ln_mortality			3.66
			(2.839)
L.ln_mortality			-10.26***
			(2.930)
L2.ln_mortality			-2.12
			(2.643)
Constant	-3.89	-6.57	-44.79**
	(8.967)	(8.701)	(18.837)
Observations	2275	2275	2275
R-squared	0.355	0.354	0.358
Number of sc_code	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 11. Allocation of EU funds - OLS - different election dummies

y: ln funds_decision, no lags, no difference, sc and year fixed effects	1	2	3	4	5
ln_mortality	2.66	2.80	2.79	2.69	2.82
	(2.821)	(2.828)	(2.833)	(2.826)	(2.840)
ln_revenues	0.96	0.95	0.97	0.96	0.95
	(0.627)	(0.631)	(0.628)	(0.634)	(0.633)
population_total	-0.00**	-0.00**	-0.00**	-0.00**	-0.00**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln_budget_outpatient	5.52***	5.88***	5.83***	5.84***	5.88***
	(2.071)	(2.088)	(2.077)	(2.109)	(2.100)
gp_empty_population_ratio	10.43	10.87	10.82	10.78	10.85
	(11.781)	(11.837)	(11.808)	(11.816)	(11.807)
gymnasium_ratio	-0.19	0.15	0.04	0.58	0.08
	(6.749)	(6.967)	(6.919)	(6.997)	(6.967)
icu_department	1.85**	1.79**	1.81**	1.89**	1.79**
	(0.820)	(0.868)	(0.842)	(0.845)	(0.842)
one_day_ratio	0.48	0.49	0.49	0.49	0.49
	(0.938)	(0.944)	(0.948)	(0.946)	(0.945)
close_run_governing_party	-1.34**				
	(0.671)				
governing_party		0.00			
		(0.487)			
overwhelming_victory_governing_p			-0.23		
			(0.720)		

close_run_opposition				0.41	
				(0.618)	
overwhelming_victory_non_governi					-0.16
					(0.939)
Constant	2.72	1.65	1.55	0.84	1.78
	(14.343)	(14.485)	(14.497)	(14.486)	(14.588)
Observations	2275	2275	2275	2275	2275
R-squared	0.353	0.352	0.352	0.352	0.352
Number of sc_code	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 12. Effect of EU funds - OLS - preventable mortality - full table

y_ ln preventable mortality, no lags, no differences, sc and year fixed effects	1	2	3	4	5	6	7
ln_funds_effective	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln_revenues		-0.00	-0.00	-0.00	-0.00	-0.00	0.00
		(0.009)	(0.009)	(0.009)	(0.009)	(0.014)	(0.013)
population_total			-0.00	-0.00	-0.00	-0.00	-0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
gp_empty_population_ratio				0.22	0.22	0.14	0.16
				(0.151)	(0.150)	(0.177)	(0.153)
icu_department					0.02		
					(0.014)		
hours_outpatient_percapita						-0.01**	
						(0.004)	
ln_budget_total							0.01*
							(0.008)
Constant	6.12***	6.16***	6.19***	6.19***	6.18***	6.12***	6.05***
	(0.007)	(0.070)	(0.076)	(0.076)	(0.076)	(0.121)	(0.111)
Observations	2800	2625	2625	2625	2625	1895	2275
R-squared	0.543	0.534	0.534	0.534	0.535	0.414	0.451
Number of sc_code	175	175	175	175	175	175	175
VIF	1.28	1.28	1.34	1.30	1.25	1.21	1.27

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 13. Effect of EU funds - OLS - treatable mortality - full table

y_ ln treatable mortality, no lags, no differences, sc and year fixed effects	1	2	3	4	5	6	7
ln_funds_effective	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln_revenues		-0.03**	-0.03**	-0.03**	-0.03**	-0.03**	-0.03**
		(0.013)	(0.012)	(0.012)	(0.012)	(0.014)	(0.013)
population_total				-0.00**	-0.00**	-0.00**	-0.00**
				(0.000)	(0.000)	(0.000)	(0.000)
gp_empty_population_ratio			0.42**	0.42**	0.42**	0.40**	0.43**
			(0.178)	(0.178)	(0.178)	(0.198)	(0.193)
icu_department					0.00		
					(0.011)		
hours_outpatient_percapita						-0.01***	
						(0.003)	
ln_budget_total							-0.02
							(0.012)
Constant	5.54***	5.74***	5.74***	5.82***	5.82***	5.81***	5.84***
	(0.009)	(0.092)	(0.091)	(0.098)	(0.098)	(0.121)	(0.119)
Observations	2800	2625	2625	2625	2625	1895	2275
R-squared	0.453	0.445	0.447	0.447	0.447	0.292	0.339
Number of sc_code	175	175	175	175	175	175	175
VIF	1.23	1.01	1.24	1.22	1.20	1.17	1.22

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 14. Effect of EU funds - OLS - preventable mortality - lags and first differences

y_ ln preventable mortality, lags, differences where needed, sc and year fixed effects	1	2	3	4	6	7	8
ln_funds_effective	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.ln_funds_effective	0.00*	0.00*	0.00*	0.00*	0.00*	0.00	0.00*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L2.ln_funds_effective	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L3.ln_funds_effective	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2008.year	-0.03**	-0.03**	-0.03**	-0.03**	-0.03**	-0.02**	-0.03***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
2009.year	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.05***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
2010.year	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***	-0.07***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)
2011.year	-0.12***	-0.12***	-0.12***	-0.12***	-0.12***	-0.11***	-0.12***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)	(0.012)
2012.year	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***	-0.14***	-0.15***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.014)
2013.year	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.19***	-0.20***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.016)	(0.015)
2014.year	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.19***	-0.21***

	(0.012)	(0.013)	(0.013)	(0.013)	(0.012)	(0.014)	(0.013)
2015.year	-0.19***	-0.19***	-0.19***	-0.19***	-0.19***		-0.20***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)		(0.015)
2016.year	-0.22***	-0.22***	-0.22***	-0.22***	-0.22***	-0.22***	-0.23***
	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)
2017.year	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.19***	-0.21***
	(0.012)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
2018.year	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.22***
	(0.012)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)
2019.year	-0.23***						
	(0.011)						
ln_revenues		-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
		(0.014)	(0.014)	(0.014)	(0.013)	(0.014)	(0.013)
population_total			-0.00	-0.00	-0.00	-0.00	-0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D.gp_empty_population_ratio				0.02	0.02	0.05	0.02
				(0.100)	(0.101)	(0.111)	(0.101)
icu_department					0.03**		
					(0.015)		
hours_outpatient_percapita						-0.01**	
						(0.004)	
ln_budget_total							0.02*
							(0.009)
Constant	6.06***	6.08***	6.11***	6.11***	6.09***	6.12***	6.04***
	(0.007)	(0.108)	(0.113)	(0.113)	(0.111)	(0.118)	(0.117)
Observations	2275	2100	2100	2100	2100	1895	2100

R-squared	0.422	0.414	0.414	0.414	0.415	0.415	0.415
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 15. Effect of EU funds - OLS - treatable mortality, lags and first differences

y_ ln treatable mortality, lags, differences where needed, sc and year fixed effects	1	2	3	4	5	6	7
ln_funds_effective	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L.ln_funds_effective	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L2.ln_funds_effective	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
L3.ln_funds_effective	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2008.year	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)	(0.012)
2009.year	-0.05***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***	-0.04***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
2010.year	-0.06***	-0.05***	-0.05***	-0.05***	-0.05***	-0.05***	-0.05***
	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)
2011.year	-0.10***	-0.09***	-0.09***	-0.09***	-0.09***	-0.08***	-0.08***
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)
2012.year	-0.12***	-0.11***	-0.11***	-0.11***	-0.11***	-0.11***	-0.10***
	(0.017)	(0.018)	(0.018)	(0.017)	(0.017)	(0.018)	(0.018)
2013.year	-0.16***	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***	-0.14***
	(0.018)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)
2014.year	-0.17***	-0.16***	-0.16***	-0.16***	-0.16***	-0.15***	-0.15***

	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
2015.year	-0.16***	-0.15***	-0.15***	-0.15***	-0.15***		-0.14***
	(0.018)	(0.019)	(0.020)	(0.019)	(0.019)		(0.021)
2016.year	-0.22***	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***
	(0.017)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)
2017.year	-0.20***	-0.18***	-0.18***	-0.18***	-0.18***	-0.17***	-0.17***
	(0.016)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.020)
2018.year	-0.22***	-0.20***	-0.20***	-0.20***	-0.20***	-0.20***	-0.19***
	(0.015)	(0.019)	(0.019)	(0.019)	(0.019)	(0.020)	(0.021)
2019.year	-0.23***						
	(0.013)						
ln_revenues		-0.03*	-0.03*	-0.03*	-0.03*	-0.03**	-0.03*
		(0.014)	(0.014)	(0.014)	(0.014)	(0.015)	(0.014)
D.gp_empty_population_ratio			0.15	0.15	0.15	0.19	0.16
			(0.139)	(0.139)	(0.139)	(0.141)	(0.139)
population_total				-0.00**	-0.00**	-0.00**	-0.00**
				(0.000)	(0.000)	(0.000)	(0.000)
icu_department					0.01		
					(0.015)		
hours_outpatient_percapita						-0.01***	
						(0.003)	
ln_budget_total							-0.01
							(0.012)
Constant	5.46***	5.66***	5.66***	5.76***	5.75***	5.81***	5.81***
	(0.008)	(0.109)	(0.109)	(0.115)	(0.115)	(0.121)	(0.124)
Observations	2275	2100	2100	2100	2100	1895	2100

R-squared	0.295	0.285	0.285	0.286	0.286	0.293	0.286
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 16. Effect of EU funds - 2SLS - preventable mortality – full table

y: ln preventable, no lags, no differences; ln_funds_effective instrumented on governing party, year and sc fixed effects	1	2	3	4	5	6	7
ln_funds_effective	-0.04***	-0.02***	-0.02***	-0.02***	-0.02***	-0.01***	-0.01***
	(0.008)	(0.006)	(0.006)	(0.006)	(0.008)	(0.005)	(0.004)
ln_revenues		-0.13***	-0.13***	-0.13***	-0.11***	-0.22***	-0.14***
		(0.024)	(0.023)	(0.024)	(0.029)	(0.027)	(0.024)
gp_empty_population_ratio				-0.64*	-0.73*	-0.72*	-0.37
				(0.333)	(0.379)	(0.376)	(0.253)
population_total			0.00	0.00	-0.00	0.00	0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
icu_department					0.11**		
					(0.046)		
hours_outpatient_percapita						-0.01***	
						(0.005)	
ln_budget_total							-0.05**
							(0.021)
Constant	6.17***	7.14***	7.08***	7.07***	6.97***	7.70***	7.32***
	(0.045)	(0.159)	(0.173)	(0.174)	(0.193)	(0.388)	(0.189)
Observations	2800	2625	2625	2625	2625	1895	2275
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 17. Effect of EU funds - 2SLS - treatable mortality - full table

y: ln treatable, no lags, no differences; ln_funds_effective instrumented on governing party, year and sc fixed effects	1	2	3	4	6	7	8
ln_funds_effective	-0.04***	-0.01**	-0.01**	-0.01**	-0.02**	-0.01**	-0.01**
	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.003)
ln_revenues		-0.16***	-0.16***	-0.16***	-0.15***	-0.22***	-0.15***
		(0.022)	(0.022)	(0.023)	(0.026)	(0.026)	(0.018)
gp_empty_population_ratio				-0.29	-0.34	-0.42	0.02
				(0.309)	(0.340)	(0.356)	(0.242)
population_total			-0.00	-0.00	-0.00	0.00	-0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
icu_department					0.06*		
					(0.037)		
hours_outpatient_percapita						-0.01***	
						(0.005)	
ln_budget_total							-0.07***
							(0.016)
Constant	5.57***	6.78***	6.78***	6.77***	6.72***	7.24***	6.90***
	(0.047)	(0.149)	(0.165)	(0.167)	(0.185)	(0.344)	(0.143)
Observations	2800	2625	2625	2625	2625	1895	2275
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 18 Effect of EU funds - 2SLS - preventable mortality - first difference

y: ln preventable, first difference where needed; ln_funds_effective instrumented on governing party, year and sc fixed effects	1	2	3	4	5	6	7
ln_funds_effective	-0.04***	-0.02***	-0.02***	-0.02***	-0.02***	-0.01***	-0.01***
	(0.008)	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)	(0.004)
ln_revenues		-0.13***	-0.13***	-0.15***	-0.14***	-0.22***	-0.14***
		(0.024)	(0.023)	(0.020)	(0.022)	(0.027)	(0.024)
D.gp_empty_population_ratio				0.09	0.10	-0.01	0.05
				(0.165)	(0.179)	(0.143)	(0.146)
population_total			0.00	0.00	0.00	0.00	0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
icu_department					0.11**		
					(0.043)		
hours_outpatient_percapita						-0.01***	
						(0.005)	
ln_budget_total							-0.05***
							(0.021)
Constant	6.17***	7.14***	7.08***	7.20***	7.13***	7.73***	7.34***
	(0.045)	(0.159)	(0.173)	(0.192)	(0.191)	(0.393)	(0.191)
Observations	2800	2625	2626	2450	2450	1895	2275
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 19. Effect of EU funds - 2SLS - treatable mortality - first difference

y: lntreatable, first difference where needed; ln_funds_effective instrumented on governing party, year and sc fixed effects	1	2	3	4	5	6	7
ln_funds_effective	-0.04***	-0.01**	-0.01**	-0.01***	-0.01***	-0.01**	-0.01**
	(0.008)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.003)
ln_revenues		-0.16***	-0.16***	-0.18***	-0.17***	-0.23***	-0.15***
		(0.022)	(0.022)	(0.019)	(0.021)	(0.026)	(0.018)
D.gp_empty_population_ratio				0.22	0.23	0.12	0.17
				(0.186)	(0.193)	(0.186)	(0.176)
population_total			-0.00	0.00	-0.00	0.00	-0.00
			(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
icu_department					0.06*		
					(0.033)		
hours_outpatient_percapita						-0.01***	
						(0.005)	
ln_budget_total							-0.07***
							(0.016)
Constant	5.57***	6.78***	6.78***	6.87***	6.83***	7.25***	6.90***
	(0.047)	(0.149)	(0.165)	(0.176)	(0.180)	(0.348)	(0.143)
Observations	2800	2625	2626	2450	2450	1895	2275
Number of sc_code	175	175	175	175	175	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 20. Effect of EU funds - 2SLS - ICU department

VARIABLES	y: ln_preventable	y: ln_treatable
ln_funds_effective	-0.04***	-0.04***
	(0.008)	(0.008)
icu_department	0.21***	0.20***
	(0.054)	(0.052)
Constant	6.12***	5.52***
	(0.047)	(0.048)
Observations	2800	2800
Number of sc_code	175	175

Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 21. Annual Gini coefficients

year	Respiratory	cancer	Gp percapita	Gymnasium	One day ratio	Hours outpatient percapita	Infant mortality	Treatable total	Preventable total	Budget total percapita	Professiols total percapita	Revenues percapita	Persol income percapita	Budget CT percapita	Budget GP percapita	Cardio ratio
2004	-	-	0,078	0,325	0,961	-	0,419	0,091	0,088	-	-	0,552	0,151	-	-	-
2005	-	-	0,076	0,321	0,958	-	0,447	0,101	0,096	-	-	0,505	0,147	-	-	-
2006	-		0,075	0,318	0,944	-	0,446	0,088	0,089	0,503	-	0,519	0,142	0,886	0,525	-
2007	-		0,082	0,321	0,890	0,426	0,456	0,097	0,094	0,501	-	0,514	0,138	0,884	0,513	-
2008	-		0,081	0,322	0,859	0,402	0,456	0,106	0,093	0,501	-	0,529	0,132	0,884	0,525	-
2009	-		0,085	0,319	0,845	0,402	0,459	0,099	0,094	0,487	-	0,521	0,127	0,883	0,524	-
2010	-		0,090	0,315	0,854	0,406	0,494	0,099	0,097	0,500	-	0,542	0,121	0,887	0,517	-
2011	0,051	0,074	0,084	0,320	0,786	0,354	0,477	0,104	0,097	0,499	-	0,531	0,139	0,884	0,493	0,046
2012	0,064	0,070	0,081	0,336	0,759	0,330	0,468	0,109	0,094	0,492	0,141	0,487	0,130	0,881	0,441	0,047
2013	0,061	0,070	0,085	0,343	0,753	0,351	0,479	0,104	0,102	0,472	0,144	0,486	0,124	0,853	0,429	0,046
2014	0,058	0,069	0,086	0,350	0,751	0,362	0,485	0,106	0,096	0,468	0,135	0,512	0,117	0,852	0,432	0,047
2015	0,064	0,071	0,084	0,356	0,738	-	0,543	0,108	0,093	0,459	0,150	0,507	0,112	0,848	0,433	0,048
2016	0,067	0,071	0,086	0,370	0,729	0,372	0,504	0,105	0,102	0,490	0,147	0,499	0,108	0,845	0,445	0,048
2017	0,067	0,073	0,087	0,380	0,715	0,381	0,527	0,106	0,105	0,489	0,147	0,507	0,105	0,844	0,459	0,048
2018	0,072	0,073	0,089	0,386	0,704	0,381	0,548	0,109	0,096	0,494	0,148	0,506	0,102	0,840	0,465	0,049
2019	-	-	0,095	0,393	0,697	0,383	0,543	0,111	0,107	0,485	0,148	-	0,103	0,837	0,469	-

Table 22. Data matrix

data	name of dataset	Source	Time	comments	public ?
Treatable mortality ratio	treat_SC.scv, treat_SC_gender_adv.csv, treat_countRy_gender.csv, treat_countRy.csv	KSH	2004-2019		yes
Preventable mortality	pver_SC.scv, prev_SC_gender_.csv, pver_countRy_gender.csv, prev_countRy.csv	KSH	2004-2019		yes
midyear population 14-20 year-old	highschool_population.csv	KSH	2004-2019		yes
Elderly ratio	elderely_ratio.csv	TEIR	2004-2019	65-year and older population / total population (official populatoin)	yes
Sub-county development indicator	HDI_cat.csv	GVI	2005, 2012, 2014, 2017	indicator 2007 uses data from 2001 and 2005; indicator 2013 used data from 2010-2012; indicator 2016 used data from 2012 and 2014; indicator 2019 uses data from 2017; converted to 4-categories ordinal: 1) worse than the average difference is higher than the average difference, 2) worse than the average difference is lower than the average difference,	yes

				3) better than the average difference is lower than the average, 4) better than the average difference is higher than the average	
Tax paying companies	tax_paying_companies.csv	TEIR	2004-2019	-	no
Unemployment ratio	unemployment_ratio.csv	TEIR	2004-2019	-	no
Company_income: - amount of company revenues, - income from exports	company_income.csv	TEIR	2004-2018		no
Income: - personel income before tax, - number of tax payers	personal_income.csv	TEIR	2004-2019	-	no

Number of high school(gymnasium) students/number of 0-17 year inhabitants	gymnasium_students.csv	TEIR	2004-2019	Based on the address of high school	no
results of local, national and EP elections winner, and marginal victory	local_elections_final.csv	National Election Office	2002-19	-	yes
Village tye (regional center-county capital-sub-county capital)	village_codes_final.csv	KSH	-	-	yes
number of cities	village_codes_final.csv	KSH	-	-	yes
prescription exemption certificates	prescription_exemption_certificate.csv	TEIR	2004-2019	-	no
mortality: -infant mortality, - crude mortality total, - crude mortality male	mortality.csv	TEIR	2004-2019	-	no

budget of the national healtcare fund	budget_health_care_fund.rds	National Healthcare Fund	2006-2019	-	yes
hours by professionals in out-patien care	hours_outpatient_care.csv	TEIR	2007-2019, 2015 missing	data quality issues, missing values for the poorest sub-counties for 2007 (20 NAs)	no
number of GPs	number_of_GPs.csv	TEIR	2004-2019	-	no
Empty GP praxis: - number of empty praxis in the sub-county, - population without a GP in the sub-county	empty_GP.csv	National Healthcare Fund	actual as of 2021 January	2021 january, only actually empty praxis are included	yes
Outpatient and inpatient care institutions	jarobeteg_szakellato_intezmenyek_telephellyel_202103.xlsx, fekvobeteg_szakellato_intezmenyek_telephellyel_202103.xlsx	National Healthcare Fund	actual as of 2021 January		yes
number of hospital beds	hospital_beds.xls	TEIR	2004-2019		no
actual care days	actual_care_days.xls	TEIR	2004-2019		no

Hospital reports: - available hospital beds, - patients served, - patients died, - patients sent to other departments, - patients sent home, - dare days quota, - actual care days	hospital_reports_total.csv	National Healthcare Fund	2006-2019	departmental-level data is also available	yes
cancer, cardiovascular and respiratory diseases incidence based on medicine consumption	cancer_patients.csv, cardiovascular_patients.csv, respiratory_patients.csv	TEIR	2011-2018	-	no
ambulance stations (number of villages with ambulance stations)	ambulance_stations.csv	TEIR	2008, 2011,2014,2017-19	data quality (Budapest is 0 for one year)	no

stadium/sport hall (number of villages that has at least one stadium or sport hall)	stadiums.csv	TEIR	2008, 2011,2014,2017-19	data quality (some villages has 0 values for one year)	no
number of healthcare workers: -upper secondary certification, -higher education certification	healthcare_workers.csv	TEIR	2012-2019	broad scope of trained healthcare workers (doctors, nurses, pharmacist, dietetics, veterinarians, etc.) detailed description of the occupations in Hungarian: https://feorszam.hu/csoport/egeszsegugyi-foglalkozasok-felsofoku-kepzettseghez-kapcsolodo	no
Distance to: - nearest town with at least 50 000 inhabitants - to county capital via roads (county hospital) - regional capital via roads	distances_mean_minutes.csv	TEIR	2008-19, 2010 missing	mean of sub-county, shortest access on roads in minutes	no
Length of state-owned roads (km)	state_owned_roads.csv	TEIR	2004-2019	-	no
CO2 concentration	aid_data_cleaned_final.csv	Aid Data	2015-2018	-	yes

Particulate matter concentration	aid_data_cleaned_final.csv	Aid Data	2005, 2010-13	-	yes
Ozone concentration	aid_data_cleaned_final.csv	Aid Data	2005, 2010-13	-	yes
Precipication	aid_data_cleaned_final.csv	Aid Data	2004-2016	-	yes
Territory of woods	territory_woods.xls	TEIR	2004-2017	-	no
migration (domestic inward and outward)	migration.csv	TEIR	2004-2019	-	no
Population (elderely ratio): - actual population, - actual population male, - official population total, - offical population 18-59 years, - official population 60-x years	population.csv [actual population by gender], official_population.csv [official population total, 18-59 years, 60-x years, elderely ratio]	TEIR	2004-2019		no
Project level EU Fund data arrived to Hungary	eu_health_funds_final.csv	CRBC's official site of	2004-2020	It is going to be published at https://www.crcb.eu/	in progress

		Szechenyi2020			
CPI	CPI.xlsx	KSH	2004-2020	-	yes

Table 23. Codes

Data	**Code**
Creating treatable, preventable mortality ratios and mid-year population of 14-20 years	Mannatt_KSH_codes_20210518.R
Econometric models (OLS and 2SLS)	Mannatt_ econometric_models _0528.do
Correlation plot, Gini coefficient calculation	Mannatt_ analysis_20210522.R
Creating long data and merging datasets	Mannatt_Data_cleaning_20210522.R
EU Funds descriptive statistics and graphs	Mannatt_EU_Funds_descriptives.ipynb
Cleaning hospital report data	Mannatt_Hospital_bed_cleaning_final.ipynb
EU funds cleaning	Mannatt_EU_Funds_cleaning.ipynb
Election data cleaning	Mannatt_Election_results_cleaning_local_final.ipynb

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Table on page 99 demonstrates the data and Table on page 106 shows the codes used for the database generation[56].

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[55] Date of acces the online sources: 2/June/2021

[56] Codes are available here: https://github.com/mannatt/CEU_thesis_2021

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