FEASIBILITY ANALYSIS OF DISEASE IMPACT MODELING IN CENTRAL AND EASTERN EUROPE - CEE FISCAL INDEX: UNLOCKING THE LINKAGES BETWEEN HEALTH OUTCOMES AND COUNTRY´S ECONOMIC PERFORMANCE

Analýza uskutočniteľnosti modelovania dopadov ochorenia v strednej a východnej Európe - CEE FISCAL Index: súvislosti medzi výsledkami v oblasti zdravia a ekonomickou záťažou

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Abstract
Introduction: This study evaluates the feasibility of implementing fiscal consequence modeling in healthcare across ten Central and Eastern European (CEE) countries: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Serbia, Slovakia, and Slovenia. Such modeling is crucial for understanding the economic impacts of health policies and investments, particularly in transitional economies where healthcare systems are evolving. The study aims to assess the readiness of these countries to adopt comprehensive fiscal modeling approaches in healthcare decision-making.
Methodology: The study developed a CEE FISCAL Index to assess data availability and quality across economic and healthcare domains. Countries were scored based on the accessibility and reliability of key economic indicators (such as mean and median income, employment rates, tax revenue, and GDP per hour worked) and healthcare metrics (including mortality rates, disease incidence, paid sick leave, disability data, and healthcare spending). Data sources were evaluated using a simple scoring system to enable cross-country comparisons. The methodology involved a thorough review of national statistical databases, international organizations' repositories, and consultations with local experts to ensure comprehensive data coverage. The pilot area was multiple myeloma.
Results: Lithuania and Croatia ranked highest with an 86.3% overall score, indicating strong data availability across both economic and healthcare metrics. Slovenia, Slovakia, and Estonia followed closely, each scoring above 84%. Czechia and Hungary showed somewhat lower levels of healthcare data availability, scoring 78.4% and 76.5% respectively, despite well-represented economic data. Bulgaria and Serbia scored lowest at 72.5% and 66.7% respectively, primarily due to significant gaps in healthcare data availability. The study revealed a consistent pattern across most countries: while economic data

Abstrakt
Úvod: Táto štúdia hodnotí realizovateľnosť implementácie modelovania fiškálnych dôsledkov v zdravotníctve v desiatich krajinách strednej a východnej Európy: Bulharsko, Chorvátsko, Česko, Estónsko, Maďarsko, Lotyšsko, Litva, Srbsko, Slovensko a Slovinsko. Takéto modelovanie je kľúčové pre pochopenie ekonomických dopadov zdravotných politík a investícií, najmä v transformujúcich sa ekonomikách, kde sa zdravotnícke systémy vyvíjajú. **Cieľom štúdie** je posúdiť pripravenosť týchto krajín na prijatie komplexných prístupov fiškálneho modelovania pri rozhodovaní v zdravotníctve.
Metodika: Štúdia vyvinula CEE FISCAL Index na posúdenie dostupnosti a kvality údajov v ekonomických a zdravotníckych oblastiach. Krajiny boli hodnotené na základe prístupnosti a spoľahlivosti kľúčových ekonomických ukazovateľov (ako sú priemerný a mediánový príjem, miera zamestnanosti, daňové príjmy a HDP na odpracovanú hodinu) a zdravotníckych metrík (vrátane úmrtnosti, incidencie chorôb, platenej práceneschopnosti, údajov o invalidite a výdavkov na zdravotníctvo). Zdroje údajov boli vyhodnotené pomocou bodovacieho systému, ktorý umožnil porovnanie medzi krajinami. Metodika zahŕňala dôkladnú revíziu národných štatistických databáz, repozitárov medzinárodných organizácií a konzultácie s miestnymi odborníkmi na zabezpečenie komplexného pokrytia údajov. Ako pilot slúžilo ochorenie mnohopočetný myelóm.
Výsledky: Litva a Chorvátsko sa umiestnili najvyššie s celkovým skóre 86,3%, čo indikuje silnú dostupnosť údajov v ekonomických aj zdravotníckych metrikách. Slovinsko, Slovensko a Estónsko nasledovali tesne za nimi, každé so skóre nad 84%. Česko a Maďarsko vykazovali o niečo nižšiu úroveň dostupnosti zdravotníckych údajov, so skóre 78,4% a 76,5%, napriek dobre zastúpeným ekonomickým údajom. Bulharsko a Srbsko dosiahli najnižšie skóre 72,5% a 66,7%, najmä kvôli významným medzerám v dostupnosti zdravotníckych údajov. Štúdia

is generally well-documented and accessible, many countries lack comprehensive and reliable clinical data necessary for robust fiscal modeling in healthcare.
Conclusions: The study revealed significant disparities in data availability between economic and healthcare domains across CEE countries. While economic data is generally well-documented, many countries lack comprehensive clinical data necessary for robust fiscal modeling. This discrepancy poses challenges for accurate assessment of healthcare investments' economic impacts. Addressing these data gaps through improved collection methods, standardization of healthcare data metrics, and cross-sector collaboration is crucial for enhancing the accuracy and utility of fiscal models in healthcare decision-making. The study recommends prioritizing the development of integrated information systems that combine economic and clinical data, investing in capacity building for healthcare institutions in data management, and fostering international cooperation for data harmonization. These efforts could significantly improve the ability of CEE countries to model fiscal consequences in healthcare, leading to more informed policy decisions and more efficient resource allocation *(Tab. 4, Fig. 4, Ref. 35). Text in PDF www.lekarskyobzor.sk.*
KEY WORDS: Fiscal modeling, healthcare economics, Central and Eastern Europe, data availability, economic policy, health policy, transitional economies.

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odhalila konzistentný vzor vo väčšine krajín: zatiaľ čo ekonomické údaje sú všeobecne dobre zdokumentované a prístupné, mnohým krajinám chýbajú komplexné a spoľahlivé klinické údaje potrebné pre robustné fiškálne modelovanie v zdravotníctve.
Závery: Štúdia odhalila významné rozdiely v dostupnosti údajov medzi ekonomickými a zdravotníckymi oblasťami v krajinách regiónu. Zatiaľ čo ekonomické údaje sú všeobecne dobre zdokumentované, mnohým krajinám chýbajú komplexné klinické údaje potrebné pre robustné fiškálne modelovanie. Táto diskrepancia predstavuje výzvy pre presné posúdenie ekonomických dopadov investícií do zdravotníctva. Riešenie týchto medzier v údajoch prostredníctvom zlepšených metód zberu, štandardizácie zdravotníckych dátových metrík a medzisektorovej spolupráce je kľúčové pre zvýšenie presnosti a užitočnosti fiškálnych modelov pri rozhodovaní v zdravotníctve. Štúdia odporúča prioritizovať vývoj integrovaných informačných systémov, ktoré kombinujú ekonomické a klinické údaje, investovať do budovania kapacít zdravotníckych inštitúcií v oblasti správy údajov a podporovať medzinárodnú spoluprácu pri harmonizácii údajov. Tieto snahy by mohli významne zlepšiť schopnosť krajín regiónu modelovať fiškálne dôsledky v zdravotníctve, čo by viedlo k informovanejším politickým rozhodnutiam a efektívnejšiemu rozdeľovaniu zdrojov *(tab. 4, obr. 4, lit. 35). Text v PDF www.lekarskyobzor.sk.*
KĽÚČOVÉ SLOVÁ: ekonomika zdravotníctva, modelovanie dopadov, stredná a východná Európa, dostupnosť údajov, fiškálna politika, zdravotná politika, transformujúce sa ekonomiky.
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Introduction

Fiscal consequences modeling in healthcare has emerged as a powerful analytical tool for understanding and predicting the financial impacts of health-related changes on a macroeconomic scale. At the core of this modeling approach is the pursuit to establish a direct link between health outcomes, particularly changes in morbidity and mortality, and key economic variables such as healthcare costs, social care costs, productivity, tax revenues, and long-term economic growth (1).

Robust fiscal consequences model typically incorporates several key components: epidemiological data (incidence, prevalence, and mortality rates of various diseases), healthcare utilization (hospital admissions, outpatient visits, and prescription medication usage), cost data (both direct healthcare costs like hospital care and indirect costs such as lost productivity and social transfers), and economic indicators (GDP, labor force participation rates, and public sector spending) (2). Assumptions play a crucial role in these models, such as the expected effectiveness of health interventions, elasticity of healthcare demand, or future trends in disease prevalence. One of the primary applications of fiscal consequences modeling is in informing public policy decisions. Policymakers use these models to evaluate the potential economic returns on health investments. For instance, when considering a national cancer screening program, a fiscal model might weigh the long-term savings from early detection and treatment versus the costs of implementing the program not just on direct healthcare costs, but from a broader fiscal perspective. This analysis helps policymakers holistically determine whether the program is a sound investment for public funds (3,4).

Fiscal modeling also sheds light on the relationship between health investments and economic performance. Healthy populations tend to be more productive, with lower rates of absenteeism and higher levels of workforce engagement for longer portions of life. This, in turn, boosts economic growth by increasing the availability of labor and reducing the burden on social services. For example, a country that invests heavily in reducing the incidence of chronic diseases like diabetes and hypertension might see significant economic gains as the workforce becomes healthier and more capable of sustained productivity. The results of fiscal consequences modeling are valuable for both the public and private sectors. Governments can use the model to forecast healthcare expenditures, model public health intervention impacts, increase revenue modeling precision, plan budgets, and allocate resources more effectively. In the private sector, businesses can use these models to understand how health trends might impact their operations, particularly in terms of employee health and productivity. Insurance companies, for example, can leverage fiscal modeling to set premiums and design coverage plans that align with projected healthcare costs and outcomes (5).

Advancements in technology, particularly in data analytics and machine learning, have significantly enhanced the capabilities of fiscal consequences modeling. These technologies enable the processing of large datasets, the identification of patterns and trends, and the development of more accurate and dynamic mod-

els. For example, machine learning algorithms can be used to predict future health trends based on historical data, improving the accuracy of fiscal models. Fiscal consequences modeling in healthcare is a powerful tool that provides valuable insights into the economic impacts of health outcomes. By linking health investments to economic indicators, these models help policymakers, healthcare providers, and businesses make informed decisions that promote both public health and economic growth. Despite its challenges, the continued development and refinement of fiscal consequences modeling will play a crucial role in shaping the future of healthcare and economic policy.

Importance of Modeling Fiscal Consequences in Healthcare

Modeling the fiscal consequences of healthcare interventions is crucial for understanding the economic impact of health policies and investments. This data-driven approach helps evaluate cost-effectiveness and long-term benefits, shaping informed decisions that align with public health goals and economic stability. Fiscal modeling enables optimal resource allocation by identifying interventions with the greatest return on investment, such as national vaccination programs. It enhances economic stability by demonstrating how reducing disease burden can maintain a healthier workforce and increase productivity. The approach informs policy development by providing evidence-based projections of economic outcomes, as seen in the implementation of sugar taxes in several countries. Fiscal modeling supports long-term strategic planning, helping governments prepare for future healthcare challenges like Japan's aging population (6). It also justifies healthcare expenditures, particularly during economic austerity, by demonstrating the value of investments. Public health campaigns benefit from fiscal modeling by quantifying potential economic impacts, as evidenced by anti-smoking initiatives in countries like Australia (7). The approach addresses health inequities by highlighting the economic costs of unequal healthcare access and supports managing public health emergencies, as demonstrated during the COVID-19 pandemic. Fiscal modeling evaluates the impact of technological advances in healthcare, such as telemedicine and electronic health records, and encourages preventive health measures by showing their long-term economic benefits. By providing a comprehensive understanding of the economic impacts of health interventions, fiscal consequences modeling plays a critical role in shaping effective health policies that contribute to both public health and economic growth (8).

Furthermore, fiscal modeling helps in assessing the sustainability of healthcare systems by projecting future costs and revenues. It enables policymakers to identify potential fiscal challenges and develop strategies to address them proactively. For instance, models can predict the impact of demographic shifts, such as an aging population, on healthcare expenditures and social security systems. Fiscal modeling also supports the evaluation of innovative healthcare delivery models, such as value-based care, by quantifying their potential to improve health outcomes while reducing costs. In the pharmaceutical sector, these models are crucial for determining fair drug pricing and reimbursement policies, balancing the need for innovation with affordability and accessibility. Additionally, fiscal modeling plays a vital role in international health policy, helping organizations like the World Health Organization prioritize global health initiatives based on their potential economic impact across different regions (9). It also aids in assessing the economic consequences of cross-border health issues, such as the spread of infectious diseases or the migration of healthcare professionals. In the context of climate change, fiscal models are increasingly being used to evaluate the health-related economic impacts of environmental policies, linking environmental protection measures to potential healthcare savings. Lastly, fiscal modeling supports the development of public-private partnerships in healthcare by providing a framework for assessing the long-term economic viability and mutual benefits of such collaborations.

Key Stakeholders

Fiscal consequences modeling in healthcare is crucial for a wide range of stakeholders, each with specific interests and responsibilities. Government agencies, including Ministries of Health, Finance, and Economic Planning, use fiscal models to shape policies, allocate resources, and ensure economic sustainability. For instance, Ministries of Health use these models to prioritize disease prevention and treatment programs, while Ministries of Finance assess long-term economic implications of healthcare expenditures. Economic Planning Agencies ensure that healthcare policies align with overall economic growth strategies, considering how investments contribute to a productive workforce and stimulate economic development through healthcare infrastructure improvements (10).

Healthcare providers, such as hospitals, clinics, and medical professionals, rely on these models to plan services, improve efficiency, and enhance patient care. Hospitals use fiscal models to predict patient demand, optimize resource allocation, and improve operational efficiency. Medical professionals leverage these models to advocate for preventive care and early interventions that may have higher upfront costs but lead to long-term savings and better health outcomes (11).

Insurance companies, both private and public, use fiscal modeling to manage risk, set premiums, and ensure financial sustainability of coverage plans. Private insurers use these models to assess risks associated with different health conditions and treatments, allowing them to set appropriate premiums. Public insurance programs like Medicare and Medicaid use fiscal models to predict future healthcare costs and ensure long-term viability. For example, the expansion of Medicaid under the Affordable Care Act was supported by fiscal mod-

eling showing long-term savings from improved health outcomes.

Pharmaceutical companies leverage these models for research and development decisions, pricing strategies, and market entry planning. Drug manufacturers use fiscal models to assess market potential for new drugs and vaccines, predicting their financial impact on healthcare systems and patients. Biotechnology firms use these models to justify the high costs of innovative therapies by demonstrating long-term economic benefits, particularly for treatments of previously incurable conditions.

Businesses, especially those with large workforces, use fiscal modeling to design employee health programs that improve productivity and reduce healthcare costs. Large corporations like Johnson & Johnson have demonstrated significant returns on investment in employee wellness programs through fiscal modeling. Small and medium enterprises (SMEs) use these models to determine cost-effective health interventions, such as providing flu vaccinations to reduce absenteeism (12).

The economy benefits from healthcare investments that contribute to economic growth, fiscal stability, and social welfare. Fiscal models have shown how health investments can improve workforce productivity, reduce long-term social welfare costs, and stimulate innovation and research. For example, Brazil›s maternal and child health programs have contributed to long-term economic growth by improving population health and reducing future healthcare costs (13). In Canada, models showing the benefits of preventive health measures like tobacco control policies have demonstrated significant long-term savings in healthcare spending (14).

Patients, as central stakeholders, benefit from improved access to affordable healthcare, higher quality care, reduced financial burdens, and increased health literacy. Fiscal modeling has supported initiatives like the expansion of Medicaid in the USA, which improved access to preventive and primary care services. It has also justified funding for preventive measures like vaccination programs and early screening initiatives, reducing out-of-pocket costs for patients (15). For instance, widespread breast cancer screening programs, supported by fiscal models, have led to early detection and treatment, reducing the need for more expensive, late-stage interventions (16).

Fiscal modeling supports equity in healthcare by addressing disparities in access to care and promotes the adoption of personalized medicine. These models can demonstrate the economic benefits of providing equitable healthcare services to underserved populations, leading to policy changes that ensure all patients receive necessary care regardless of socioeconomic status. In the realm of personalized medicine, fiscal models show how tailoring treatments to individual patients based on genetic, environmental, and lifestyle factors can be cost-effective in the long run, despite high upfront costs.

Fiscal modeling also enhances patients› trust in the healthcare system by ensuring transparent, evidence-based policies. When patients see that healthcare decisions are based on robust fiscal analysis aimed at improving public health while being economically sustainable, their trust in the system increases. This can lead to greater patient engagement, better adherence to prescribed treatments, and more proactive participation in preventive health measures.

By aligning healthcare investments with economic efficiency and patient-centered outcomes, fiscal modeling plays a crucial role in creating a healthcare system that effectively serves the needs of all stakeholders while contributing to broader economic prosperity. It helps balance immediate healthcare needs with long-term sustainability, ensuring that investments in health not only improve population well-being but also drive economic growth and social stability.

For the purpose of our study, we chose the area of multiple myeloma.

Methodology

Overview of the Methodology for Fiscal Consequences Modeling

Fiscal consequences modeling in healthcare is a multi-step process designed to link changes in health outcomes with their economic impact. The methodology is grounded in several basic principles: the intrinsic link between health outcomes and economic performance, data-driven decision making, scenario analysis, dynamic interaction between health and economic factors, and sensitivity analysis to address uncertainty.

The process involves six key steps:

1. Define the scope and objectives: This involves identifying specific health outcomes, populations, and economic indicators to be analyzed.
2. Data collection: This step involves gathering comprehensive data, including epidemiological, healthcare cost, demographic, and economic data.
3. Develop the model: This involves creating a mathematical framework linking health outcomes with economic indicators. It includes modeling disease progression, estimating costs, and linking health and economic outcomes.
4. Scenario testing: This step involves running various scenarios to explore different possible outcomes, including baseline, optimistic, and pessimistic scenarios.
5. Sensitivity analysis: This is conducted to test how changes in key assumptions affect the model‘s results. For instance, in the analysis of smoking cessation programs, sensitivity analysis was used to test the impact of different smoking reduction rates on long-term healthcare costs.
6. Interpretation and reporting of results: The final step involves interpreting the model‘s outputs and translating them into actionable insights for stakeholders.

The methodology‘s effectiveness is demonstrated through various real-world applications. For example, the UK‘s diabetes prevention program and the U.S.

HPV vaccine introduction used fiscal modeling to show long-term economic benefits and guide implementation. During the COVID-19 pandemic, these models helped countries like Israel and the UK guide their vaccination strategies, predicting healthcare savings and broader economic benefits (17,18).

Fiscal modeling has supported long-term public health initiatives, such as smoking cessation programs, and has been important in expanding national immunization programs (19). It has also been applied to broader health system reforms, helping countries assess the economic impact of shifting towards more preventive and primary care-focused systems.

This methodology provides a structured, data-driven approach to understanding the complex interplay between health interventions and economic outcomes, equipping decision-makers with information to make choices that benefit both public health and economic prosperity.

CEE FISCAL Index Approach

The assessment of fiscal consequence modeling in the context of emerging and transitional economies represents a critical endeavor towards enhancing fiscal sustainability and economic resilience. This feasibility study aims to evaluate the potential for implementing a comprehensive fiscal model in ten Central and Eastern European countries: Bulgaria, Croatia, Czechia, Estonia, Hungary, Lithuania, Latvia, Slovenia, Slovakia, and Serbia. These nations share a unique set of historical, economic, and institutional characteristics that render such an assessment both relevant and imperative.

The implementation of a robust fiscal consequence model is paramount for policymakers to predict, analyze, and mitigate the economic impact of various fiscal policies. In the context of the European Union and its neighboring regions, where economic integration and convergence are ongoing processes, understanding potential fiscal outcomes is essential for maintaining economic stability and fostering sustainable growth. A well-structured fiscal model can provide these countries with the analytical tools necessary to assess the impact of taxation, government spending, and public debt management on their economies, thereby facilitating more informed and evidence-based decision-making (20).

For the aforementioned countries, this study is particularly timely and relevant. As these nations navigate the complexities of post-transition economies, often characterized by varying levels of economic development, EU integration challenges, and dynamic socio-political landscapes, a comprehensive fiscal model could play a pivotal role in aligning national policies with broader European objectives. Moreover, such a model could enhance their capacity to respond to exogenous shocks and structural changes in the global economy (21).

Commonalities among the Countries

These ten countries exhibit several salient commonalities that will significantly impact the feasibility and potential efficacy of implementing a fiscal consequence model.

Transition Economies: All these nations underwent a transition from centrally planned to market economies in the late 20th century. This transition has resulted in significant economic restructuring, which is critical to consider when designing fiscal models that can accommodate both legacy economic issues and current market dynamics (22). The process of economic transition has left indelible marks on their institutional frameworks, market structures, and policy-making processes, which must be accounted for in any fiscal modeling endeavor (23).

EU Membership: With the exception of Serbia, all the countries in this study are members of the European Union. This membership imposes certain fiscal constraints and obligations, such as adherence to the Stability and Growth Pact, which need to be integrated into any fiscal consequence model. For Serbia, as an EU candidate country, alignment with EU fiscal standards remains a key objective in its accession process. The fiscal governance framework of the EU, including the European Semester and the Macroeconomic Imbalance Procedure, provides a common ground for fiscal policy coordination that should be reflected in the modeling approach (24).

Small Open Economies: These countries are characterized by relatively small and open economies that are highly integrated with global markets. This openness exposes them to external economic shocks, which must be accounted for in any fiscal modeling to ensure robust predictions under various global scenarios. The vulnerability to external shocks necessitates the incorporation of international trade dynamics and global economic conditions into the fiscal models (25).

Demographic Challenges: Many of these nations face similar demographic trends, such as aging populations and declining birth rates. These factors have significant implications for future fiscal policies, particularly in areas such as pension systems and healthcare financing. The fiscal sustainability of social security systems in the face of these demographic shifts poses a critical challenge that must be addressed in the fiscal modeling framework (26).

Post-Crisis Recovery: The recent global financial crises and the COVID-19 pandemic have highlighted the vulnerabilities in the fiscal frameworks of these countries. Lessons learned from these crises underscore the need for advanced fiscal modeling to better prepare for and manage future economic shocks. The heterogeneous impact of these crises across the region emphasizes the importance of tailoring fiscal models to country-specific circumstances while maintaining a degree of comparability (27).

Our study aims to contribute to the broader discourse on fiscal policy in transitional economies and provide a foundation for evidence-based policymaking in the region.

Scalling approach and essential model elements

Developing a comprehensive fiscal consequence model for the ten Central and Eastern European countries requires a multi-faceted approach. Complete links for the data sources for each country, in case there is data available, is included in Appendix 1. Following tables form the backbone of the specific dísease fiscal modeling approach applied to the selected healthcare systems. Table 1 and Table 2 serve as a structured framework for evaluating the economic and clinical data necessary for populating the disease fiscal model. Each table breaks down various data components, assessing the availability and reliability of the information required to ensure a comprehensive analysis of healthcare investments and their fiscal consequences.

The first table focuses on the economic components of the model, while the second table deals with clinical data components. Both tables employ a standardized scoring system, enabling the comparison of data availability across different countries. The structure and organization of these tables are essential for understanding the potential of fiscal consequence modeling in CEE countries, where economic and clinical data discrepancies pose challenges to accurate healthcare evaluation.

Table 3 shows detailed breakdown of the structure of datasets necessary for populating the fiscal model. This table highlights both economic and clinical components required for comprehensive fiscal consequence modeling. The information is categorized by years of availability and age groups, with additional specifications provided where necessary, such as whether data are reported in local currencies or constant euros. This structured data layout ensures that the fiscal model is populated with accurate and comparable information, improving the reliability of healthcare and economic forecasts. The use of well-defined parameters enables the model to assess fiscal outcomes with greater precision, thereby informing policymaking and resource allocation across Central and Eastern European countries.

Table 1. Scaling approach to the economic components including minimal, maximal and total scores.

Component name / Score	Data available with valid source	Data available but not complete with valid source*	Data unavailable or only partly available with valid source	Data unavailable
Mean and median income by age and sex	3	2	1	0
Employment rate	3	2	1	0
Average annual sick leave allowance	3	2	1	0
Average annual disability pension	3	2	1	0
Tax wedge	3	2	1	0
Value added type taxes (VAT)	3	2	1	0
Reference and discount rates	3	2	1	0
Inflation rate	3	2	1	0
GDP per hour worked	3	2	1	0
Tax revenue	3	2	1	0
Maximum score	30			

**e.g. information not available for all years needed for the analysis*

Table 2. Scaling approach to the healthcare components including minimal, maximal and total scores.

Component name/Score	Data available with valid source	Data publicly unavailable, special request needed, with valid source*	Data unavailable or only partly available with valid source	Data unavailable
Mortality	3	2	1	0
Incidence	3	2	1	0
Paid Sick Leave	3	2	1	0
Paid disability	3	2	1	0
Disability years expectancy	3	2	1	0
Healthcare spending	3	2	1	0
Caregivers data availability	3	2	1	0
Maximum score	21			

**e.g. information not available for all years needed for the analysis*

Table 3. Structure of the datasets needed for populating the economic part of the model.

Component	Years	Age Groups (Y/N)	Details (Local Currency or EUR, constant)
Mean and median income by age and sex / Annual gross earnings from employment	2009+	5 Years Age Groups	In EUR, Before tax, annual, earnings from employment and not from other sources
Employment rate	2009+	5 Years Age Groups	% of population employed
Average annual sick leave allowance	2009+	5 Years Age Groups (Nice to have)	Total in EUR % receiving annual sick leave allowance
Average annual disability pension	2009+	5 Years Age Groups (Nice to have)	Total/Yearly/in EUR % receiving disability pension
Tax Wedge	2009+	N.A.	OECD/Eurostat
Value added type taxes (VAT)/ Indirect tax e.g. VAT/	2009+	N.A.	ECD/Eurostat
Reference and discount rates	Current or latest available	N.A.	European Council, Eurostat, OECD, National Bank of the country, local Ministry of Finance*
Inflation rate	Current or latest available	N.A.	European Council, Eurostat, OECD, National Bank of the country, local Ministry of Finance*
GDP per hour worked	Current or latest available	N.A.	European Council, Eurostat, OECD, National Bank of the country, local Ministry of Finance*
Tax revenue / Tax to GDP Ratio	Current or latest available	N.A.	European Council, Eurostat, OECD, National Bank of the country, local Ministry of Finance*

**Any of the sources or any additional local official source is sufficient.*

The Table 4 provides a detailed breakdown of the healthcare data components required for the fiscal model. It includes critical data points such as mortality, incidence, and healthcare spending, categorized by years of availability and whether data is available in specified age groups. The table also highlights the importance of additional data related to paid sick leave, disability years expectancy, and caregiver data, which can significantly impact the accuracy of the fiscal modeling process. By outlining both essential and supplementary data needs, this table underscores the importance of comprehensive data collection to effectively assess the fiscal consequences of healthcare investments. This structured approach allows for better comparison across different countries and enhances the model's ability to provide actionable insights for healthcare policy.

Results

Data presented in Table 5 and Pictures 1 to 4 provide comparative analysis of the fiscal health and data availability across ten Central and Eastern European (CEE) countries. The scores assigned to countries reflect the extent to which they possess comprehensive and reliable data, which is critical for effective fiscal consequence modeling in healthcare.

The countries evaluated include Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Serbia, Slovakia, and Slovenia. Each country is assessed based on two primary dimensions: the availability of economic data and the availability of healthcare data. The economic data score is derived from key metrics such as mean and median income by age and sex, employment rate, tax revenue, and GDP per hour worked, among others. These economic indicators are essential for un-

Table 4. Structure of the datasets needed for populating the healthcare part of the model.

Component	Years	Age Groups (Y/N)	Details
Mortality	2009+	5 Years Age Groups	Man, Women, All, Total
Incidence	2009+	5 Years Age Groups	Man, Women, All, Total
Paid Sick Leave	2009+	10 Years Age Groups (nice to have)	Man/Women/Total Years/Total days/Total Costs/Cost per day/Average days on Sick Leave
Paid Disability	2009+	10 Years Age Groups (nice to have)	Man/Women/Total Under/Above 70%/Total Number/ Costs
Disability years expectancy	2009+	10 Years Age Groups (nice to have)	Man/Women/Total Years
Healthcare spending	2009+	Nice to have, but not needed.	All patients. Total spending include all reimbursed care associated with disease: medications, primary care, secondary care, diagnostics, rehabilitations, transports + any special reimbursed care.
Caregivers specifications (if any)	Current or latest available	N.A.	European Council, Eurostat, OECD, National Bank of the country, local Ministry of Finance*

**Any of the sources or any additional local official source is sufficient.*

derstanding the macroeconomic context within which healthcare investments and policies operate. A higher score in economic data indicates that the country possesses well-documented and easily accessible economic information, which is critical for fiscal planning and modeling.

In contrast, the healthcare data score evaluates the availability of clinical information such as mortality rates, disease incidence, paid sick leave, disability data, and healthcare spending. These clinical data points are crucial for understanding the direct impact of healthcare policies on public health outcomes and the broader economic implications of healthcare system performance. A high healthcare data score suggests that the country has a robust system for collecting and sharing health-related data, which allows for more accurate modeling of the fiscal consequences of healthcare interventions.

According to the analysis, Lithuania and Croatia rank the highest, both scoring 86.3%, indicating strong data availability across both economic and healthcare metrics. This high score reflects a well-developed data infrastructure, which enables these countries to effectively monitor and manage the fiscal impact of healthcare policies. Slovenia, Slovakia, and Estonia follow closely, each scoring above 84%, suggesting similarly robust data systems, though there may be slight gaps in either healthcare or economic data availability.

Czechia and Hungary, with scores of 78.4% and 76.5%, respectively, show a somewhat lower level of healthcare data availability, although their economic data is well-represented. This indicates potential challenges in using clinical data to model the fiscal consequences of healthcare decisions, which may impact the accuracy and effectiveness of fiscal planning in these countries.

At the lower end of the spectrum, Bulgaria and Serbia exhibit the most significant challenges, scoring 72.5% and 66.7%, respectively. This lower score primarily reflects gaps in healthcare data availability, suggesting that these countries may struggle with integrating comprehensive clinical data into their fiscal models. Serbia, in particular, ranks the lowest due to substantial limitations in both economic and healthcare data availability. This raises concerns about the country's capacity to effectively model the fiscal impacts of healthcare investments and to inform policy development through data-driven decision-making.

The data also highlight an overall discrepancy between economic and healthcare data availability across the CEE region. While economic data in most countries is relatively complete, the availability of healthcare data often lags behind. This discrepancy can hinder the development of accurate fiscal models, as incomplete healthcare data may obscure the true costs and benefits of healthcare investments. It also underscores the need for targeted efforts to improve healthcare data collection and sharing systems, particularly in countries with lower healthcare data scores.

The broader implications of this analysis suggest that countries with stronger data systems, such as Lithuania and Croatia, are better positioned to make informed healthcare policy decisions that account for both short-term costs and long-term fiscal sustainability. Conversely, countries with significant data gaps, like Serbia and Bulgaria, face greater uncertainty in evaluating the economic impact of healthcare interventions, which may lead to suboptimal policy outcomes. Addressing these data gaps through investments in healthcare data infrastructure and harmonization efforts could enhance the overall capacity of the CEE region to model the fiscal consequences of healthcare decisions, leading to more efficient resource allocation and improved public health outcomes.

Table 5. Overall scores and results.

Country / Score / Rating	Economic Score	Healthcare Score	Total Score	Rating in % (higher is better)
Bulgaria	30	7	37	72,5
Croatia	29	15	44	86,3
Czechia	30	10	40	78,4
Estonia	30	13	43	84,3
Hungary	30	9	39	76,5
Latvia	30	12,5	42,5	83,3
Lithuania	30	14	44	86,3
Serbia	27	7	34	66,7
Slovakia	30	13	43	84,3
Slovenia	30	13	43	84,3

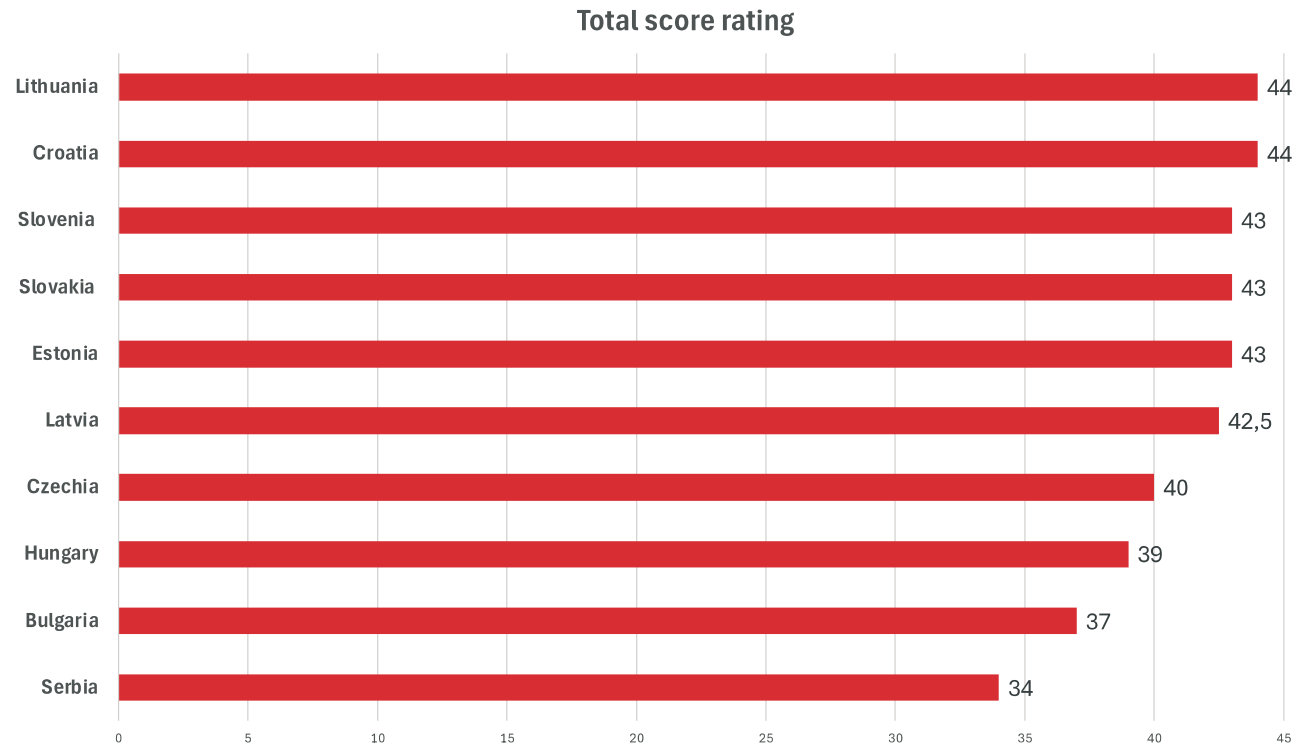
Discussion

The report emphasizes the critical challenges and opportunities for improving fiscal modeling in healthcare across Central and Eastern European (CEE) countries. A prominent issue highlighted is the discrepancy between the availability of economic and clinical data. While economic data is relatively well-documented and complete across most countries, clinical data components, such as mortality, incidence rates, and healthcare spending, are often incomplete or entirely missing. This data gap poses a significant challenge to fiscal modeling efforts, as healthcare interventions cannot be adequately assessed without a full understanding of their clinical impacts (28).

Several strategies are proposed to address this data disparity. One key step involves prioritizing data collection initiatives that focus on clinical metrics. Establishing partnerships between government agencies, healthcare providers, and international organizations can facilitate the standardization and streamlining of clinical data collection processes. The report emphasizes the need for cross-sector collaboration to develop robust data collection mechanisms capable of capturing the necessary clinical data in a consistent manner across different regions. By integrating these initiatives into a standardized framework, countries can ensure that their fiscal models

Figure 1. Overall rating from the perspective of %.

Figure 2. Overall rating from the perspective points.

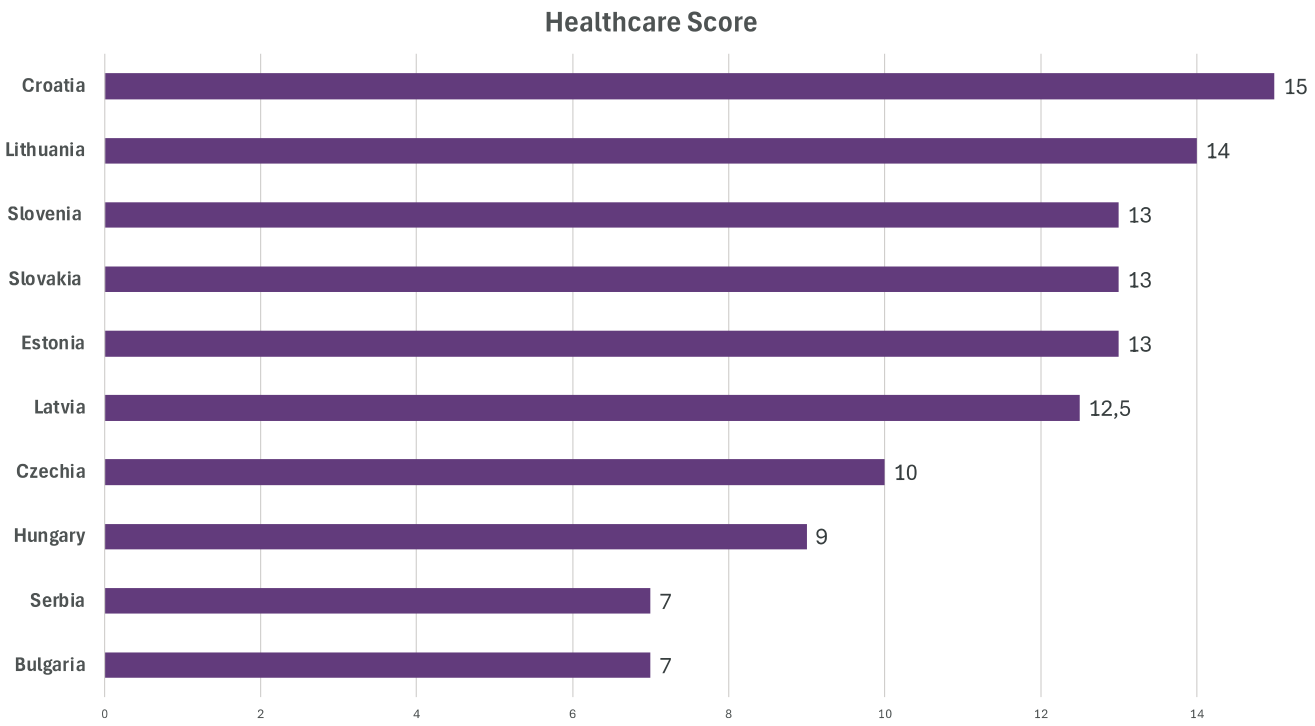


are built on accurate and comprehensive data, leading to better-informed decisions (29).

In addition to improving data availability, the report highlights the importance of developing sophisticated modeling techniques that can effectively link healthcare outcomes with economic impacts. Incorporating advanced econometric and simulation tools into the fiscal modeling process can enhance the accuracy and relia-

Figure 3. Overall rating – Economic Data availability.

Figure 4. Overall rating – Healthcare Data availability.



bility of the results, enabling policymakers to make more informed decisions.

Another critical aspect is the necessity for integrating data systems. Currently, the lack of interoperability between economic, healthcare, and social care systems creates additional barriers to data-driven decision-making. By establishing integrated information systems that combine both economic and clinical data, stakeholders can improve the accuracy and timeliness of their fiscal models. Such systems would allow for real-time data analysis, enabling fiscal models to be updated as new data becomes available. This real-time capability is cru-

cial for adapting healthcare policies to evolving economic and public health conditions (30).

The report also underscores the importance of capacity building in healthcare institutions. Investing in training programs focused on data management and analysis is necessary to improve the quality and consistency of clinical data collection. Countries with underdeveloped data systems often face challenges in maintaining the quality of the data collected, which in turn affects the accuracy of fiscal models. Providing healthcare institutions with the tools and expertise required to manage data effectively will not only close the data gap but also enhance the overall efficiency of healthcare delivery (31).

The advantages of bridging the data gap are manifold. One of the primary benefits is improved decision-making. With more comprehensive data, governments and healthcare providers can make better-informed policy decisions, ensuring that healthcare investments are aligned with both economic sustainability and public health goals. Furthermore, complete data allows for more accurate fiscal forecasting, enabling policymakers to predict the long-term fiscal consequences of healthcare interventions (32).

In addition to better decision-making, the report highlights the public health benefits of harmonizing and sharing healthcare data. With standardized data collection and integrated data systems, countries can engage in more effective public health surveillance and research. This leads to the development of targeted public health strategies aimed at improving outcomes in areas such as chronic disease management and preventive care. In turn, this reduces the overall burden on healthcare systems by focusing resources on interventions proven effective through data-driven research.

Increased efficiency is another major advantage of closing the data gap. By eliminating redundancy in data collection and enabling seamless data sharing across healthcare providers, countries can reduce administrative costs and improve patient care. Healthcare providers can avoid duplicative testing and procedures if they have access to a patient's complete medical history through a shared database. Moreover, cost savings can be realized by identifying areas where healthcare resources are being used inefficiently, allowing for better allocation of funds to areas with the highest return on investment.

The report also highlights the potential for cross-border collaboration in healthcare through the harmonization of healthcare data. In the CEE region, where many countries face similar healthcare challenges, such as aging populations and increasing healthcare costs, the ability to share data across borders can facilitate joint public health initiatives. Cross-border collaborations can also enhance the management of communicable diseases and other public health threats that transcend national borders (World Health Organization, 2021). Harmonizing data also creates opportunities for collaborative research and innovation, accelerating the development of new treatments and healthcare technologies (32).

Further, one significant aspect that warrants more attention is its potential impact on labor force participation. The report introduces the concept that labor force participation can be incentivized through innovative health impact bonds, which could serve as a powerful financial mechanism to link healthcare improvements with economic productivity. Health impact bonds are a type of social impact bond where private investors provide upfront capital for public health interventions, and the return on investment is linked to measurable health outcomes, such as reduced absenteeism or lower healthcare costs. The successful implementation of these bonds could ensure that investments in healthcare are aligned with broader economic goals, such as increasing the productive capacity of the workforce (28).

Enhancing workforce productivity through better healthcare outcomes can have long-term macroeconomic effects. Healthy populations contribute to lower absenteeism, reduced disability rates, and increased labor market participation, all of which have a direct impact on national economic performance. Investments in preventive healthcare, such as vaccination programs or chronic disease management, can thus be linked to improvements in labor force participation, providing tangible benefits to both individuals and the economy.

Another essential aspect of the discussion involves addressing challenges related to privacy and security in data harmonization. While the integration of healthcare and economic data systems offers numerous benefits, the report underscores the need for robust data protection protocols. Ensuring the privacy of patient information through encryption, anonymization, and secure access controls is crucial to maintaining public trust and compliance with legal frameworks, such as the General Data Protection Regulation (GDPR) in Europe (33). The balance between data sharing and privacy must be carefully managed to foster collaboration while respecting individuals' rights to confidentiality.

In addition to privacy concerns, the technical challenge of interoperability is another barrier that needs to be addressed. Healthcare and economic data are often collected by different agencies and in various formats, making it difficult to integrate them seamlessly. Investments in technological infrastructure are essential to overcome these challenges and enable efficient data sharing across sectors. Establishing standardized data formats and ensuring compliance with international data-sharing standards, such as those set by the European Health Data Space (EHDS), can facilitate the integration of diverse data sources (34). When such systems are implemented, they lead to more efficient healthcare management, cost savings, and improved patient outcomes.

The feasibility fiscal index also emphasizes the need for cross-sector collaboration between public and private stakeholders. Governments, healthcare providers, insurance companies, and technology firms all play a

critical role in building the infrastructure needed for data harmonization. Public-private partnerships can be leveraged to pool resources and expertise, accelerating the development of interoperable data systems. Collaborative models have been shown to bridge gaps in healthcare delivery and improve overall system efficiency (35).

In summary, the potential of innovative health impact bonds to incentivize labor force participation represents a unique opportunity to align healthcare investments with broader economic goals. Combined with efforts to bridge data gaps, ensure data privacy, improve interoperability, and foster cross-sector collaboration, the fiscal modeling framework could significantly enhance healthcare policy in Central and Eastern Europe. By addressing the current challenges in data availability and integrating innovative financing mechanisms, stakeholders can create a more sustainable and effective healthcare system that supports both public health and economic growth.

Conclusion

The CEE FISCAL Index critically examines the fiscal implications of healthcare investments across several Central and Eastern European countries. A key finding of the report is the significant disparity between the availability of economic data, which is comprehensive and well-documented, and clinical data, which is often incomplete or missing. This gap hinders the ability to fully assess the fiscal impact of healthcare systems in these countries. The report underscores the importance of addressing this discrepancy to enhance the accuracy and utility of fiscal models.

The harmonization and sharing of healthcare and social data are highlighted as essential strategies to bridge this gap. By standardizing data collection and ensuring compatibility across different systems, stakeholders can improve decision-making, public health outcomes, and efficiency in healthcare delivery. Additionally, data harmonization facilitates cross-border healthcare initiatives, supports innovation, and promotes equity in healthcare access and outcomes.

The report also stresses the need for investment in data infrastructure, collaboration between public and private sectors, and the establishment of legal frameworks that protect data privacy while encouraging data sharing. These steps are crucial for improving the accuracy of fiscal models and ensuring that healthcare investments are both economically sound and beneficial to public health across the region.*

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References

1. VERGUET S, FELDHAUS I, KWETE X, et al. Health system modelling research: towards a whole-health-system perspective for identifying good value for money investments in health system strengthening. BMJ 2019, 4 (2): e001311-e001311. https://doi.org/10.1136/bmjgh-2018-001311
2. CHRISTOPOULOS K, ELEFTHERIOU K. The fiscal impact of health care expenditure: Evidence from the OECD countries. Elsevier BV 2020, 67: 195-202. https://doi.org/10.1016/j.eap.2020.07.010
3. KHUSHALANI JS, TROGDON JG, EKWUEME DU, YABROFF KR. Economics of public health programs for underserved populations: a review of economic analysis of the National Breast and Cervical Cancer Early Detection Program. Springer Science Business Media 2019, 30 (12): 1351-1363. https://doi.org/10.1007/s10552-019-01235-6
4. WEBBER L, CHALKIDOU K, MORROW S, FERGUSON B, MCPHERSON K. What are the best societal investments for improving people's health? BMJ 2018, k3377-k3377. https://doi.org/10.1136/bmj.k3377
5. MARINO A, MORGAN D, LORENZONI L, JAMES C. Future trends in health care expenditure 2017. https://doi.org/10.1787/247995bb-en
6. BRAUN RA, JOINES DH. The implications of a graying Japan for government policy. Elsevier BV 2015, 57: 1-23. https://doi.org/10.1016/j.jedc.2015.05.005
7. MASTERS R, ANWAR E, COLLINS B, COOKSON R, CAPEWELL S. Return on investment of public health interventions: a systematic review. BMJ 2017, 71 (8): 827-834. https://doi.org/10.1136/jech-2016-208141
8. CONNOLLY MP, KOTSOPOULOS N, POSTMA MJ, BHATT A. The Fiscal Consequences Attributed to Changes in Morbidity and Mortality Linked to Investments in Health Care: A Government Perspective Analytic Framework. Elsevier BV 2017, 20 (2): 273-277. https://doi.org/10.1016/j.jval.2016.11.018
9. BURDEN G. Future and potential spending on health 2015--40: development assistance for health, and government, prepaid private, and out-of-pocket health spending in 184 countries. 2017. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5440765/
10. PIABUO SM, TIEGUHONG JC. Health expenditure and economic growth - a review of the literature and an analysis between the economic community for central African states (CEMAC) and selected African countries. BioMed Central 2017, 7 (1). https://doi.org/10.1186/s13561-017-0159-1
11. ŠIMKOVÁ I, RIEČANSKÝ I. Pulmonary hypertension - Actual problem in Slovakia (Pľúcna hypertenzia - Aktuálny problém na Slovensku). Lekarsky Obzor 2005, 54 (7-8): 323-326.
12. HENKE RM, GOETZEL RZ, MCHUGH J, ISAAC F. Recent experience in health promotion at Johnson & Johnson: lower health spending, strong return on investment. 2011. https://www.healthaffairs.org/doi/10.1377/hlthaff.2010.0806
13. BARROS FC, MATIJASEVICH A, REQUEJO J, et al. Recent Trends in Maternal, Newborn, and Child Health in Brazil: Progress Toward Millennium Development Goals 4 and 5. American Public Health

Appendix 1
Complete list of links with available datasets – economic data.

	Bulgaria	Croatia	Czechia	Estonia	Hungary	Latvia	Lithuania	Serbia	Slovakia	Slovenia
Mean and median income by age and sex	EuroStat									
Employment rate	EuroStat									
Average annual sick leave allowance	EuroStat									
Average annual disability pension	EuroStat									
Tax wedge	OECD	EC	OECD					Sts Office	OECD	
Value added type taxes (VAT)	EuroStat							MoF	EuroStat	
Reference and discount rates	EC									
Inflation rate	IMF									
GDP per hour worked	OECD							WBank	OECD	
Tax revenue	WBank		OECD					WBank	OECD	

Complete list of links with available datasets – healthcare data

	Bulgaria	Croatia	Czechia	Estonia	Hungary	Latvia	Lithuania	Serbia	Slovakia	Slovenia
Mortality	*	HZJZ	RMG	TAI	MRTLT	*	*	BATUT	StOffice	*
Incidence	*	HZJZ	RMG	TAI	MNSC	*	*	BATUT	NCZI	*
Paid Sick Leave	*	HZJZ	UZIS	EHIF	KSH	*	*	*	SIA	*
Paid disability	*	MRVSK	UZIS	*	ALLAM	*	*	*	SIA	*
Disability years expectancy	*	MRVSK	*	*	WHO	*	*	*	SIA	*
Healthcare spending	*	HZZO	UZIS	EHIF	*	*	*	*	NCZI	*
Caregivers data availability	EuroStat							*	EuroStat	

** Data sources could be: not available in local settings, not confirmed or specifically identified by local experts, only partially available with unconfirmed sources, or potentially available but not accessible during the study period. It's important to note that the absence of a source link does not necessarily indicate information unavailability, but rather reflects limitations in data access, verification, or completeness at the time of the study. This categorization aims to provide a nuanced understanding of data availability challenges across different regions and data types.*

Association 2010, 100 (10): 1877-1889. https://doi.org/10.2105/ajph.2010.196816

14. DJALALOV S, MASUCCI L, ISARANUWATCHAI W, et al. Economic evaluation of smoking cessation in Ontario›s regional cancer programs. Wiley 2018, 7 (9): 4765-4772. https://doi.org/10.1002/cam4.1495
15. FARLEY TA, DALAL MA, MOSTASHARI F, et al. Deaths Preventable in the U.S. by Improvements in Use of Clinical Preventive Services. 2010. https://www.ajpmonline.org/article/S0749-3797(10)00207-2/fulltext
16. WHEELER SB, ROCQUE GB, BASCH E. Benefits of Breast Cancer Screening and Treatment on Mortality. American Medical Association 2024, 331 (3): 199-199. https://doi.org/10.1001/jama.2023.26730
17. THOMAS C, SADLER S, BREEZE P, SQUIRES H, GILLETT MP, BRENNAN A. Assessing the potential return on investment of the proposed UK NHS diabetes prevention programme in different population subgroups: an economic evaluation. BMJ 2017, 7 (8): e014953-e014953. https://doi.org/10.1136/bmjopen-2016-014953
18. BÄRNIGHAUSEN T, BLOOM DE, CAFIERO E, O›BRIEN J. Economic evaluation of vaccination: capturing the full benefits, with an application to human papillomavirus. Elsevier BV 2012, 18: 70-76. https://doi.org/10.1111/j.1469-0691.2012.03977.x
19. BLOOM ED, FAN VY, SEVILLA J. The broad socioeconomic benefits of vaccination. American Association for the Advancement of Science 2018, 10 (441). https://doi.org/10.1126/scitranslmed.aaj2345
20. EUROPEAN CENTRAL BANK Fiscal policy and monetary policy interactions in the euro area. 2023, Available online: https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp230920~c21e96e03f.en.html
21. BRADA JC, FRENSCH R. Economic development in Central and Eastern Europe: The role of changes in the external environment. Post-Communist Economies 2021, 33 (6): 645-660. https://doi.org/10.1080/14631377.2020.1867430
22. ROLAND G. Transition and Economics: Politics, Markets, and Firms. MIT Press 2000. https://doi.org/10.7551/mitpress/6882.001.0001
23. PUTNAM BH. From phase transitions to Modern Monetary Theory: A framework for analyzing the pandemic of 2020. Elsevier BV 2020, 39 (1): 3-19. https://doi.org/10.1002/rfe.1122
24. EC: The EU's economic governance framework. European Commission, 2021, Available online: https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction_en
25. IFRIM M, LAZOREC M, PINTILESCU C. Assessing the economic resilience in central and eastern EU countries. A multidimensio-

nal approach. Published in: Conference Proceedings of 24th RSEP International Conference on Economics, Finance & Business, 24-25 February 2022, Vienna 2022: 196-208. Available at: https://mpra.ub.uni-muenchen.de/117912/
26. BLOOM DE, CANNING D, LUBET A. The economics of aging: Fiscal sustainability and public policy. Oxford Research Encyclopedia of Economics and Finance 2020. Avilable online: https://doi.org/10.1093/acrefore/9780190625979.013.575)
27. ARISTOVNIK A, RAVSELJ D, UMEK L. The impact of COVID-19 on the European Union's public finances: A cross-country analysis. Journal of International Financial Markets, Institutions and Money 2022, 76: 101460. https://doi.org/10.1016/j.intfin.2021.101460
28. CASPER T, KINDIG DA. Are Community-Level Financial Data Adequate to Assess Population Health Investments? Centers for Disease Control and Prevention 2012, 9. https://doi.org/10.5888/pcd9.120066
29. SZARFMAN A, LEVINE JG, TONNING JM, WEICHOLD F, BLOOM JC, et al. Recommendations for achieving interoperable and shareable medical data in the USA. Nature Portfolio 2022, 2 (1). https://doi.org/10.1038/s43856-022-00148-x
30. NBER WORKING PAPER SERIES the potential impact of artificial intelligence on healthcare spending. https://www.nber.org/system/files/working_papers/w30857/w30857.pdf
31. MUNDEL T. Honing the Priorities and Making the Investment Case for Global Health. Public Library of Science 2016, 14 (3): e1002376-e1002376. https://doi.org/10.1371/journal.pbio.1002376
32. MORGAN D, JAMES C. Investing in health systems to protect society and boost the economy. 2022. https://doi.org/10.1787/d0aa9188-en
33. ZICHICHI M, FERRETTI S, D'ANGELO G, RODRÍGUEZ-DONCEL V. Data governance through a multi-DLT architecture in view of the GDPR. Springer Science+Business Media 2022, 25 (6): 4515-4542. https://doi.org/10.1007/s10586-022-03691-3
34. GENOVESE S, BENGOA R, BOWIS J, et al. The European Health Data Space: a step towards digital and integrated care systems. Emerald Publishing Limited 2022, 30 (4): 363-372. https://doi.org/10.1108/jica-11-2021-0059
35. HAMMOND WE, BAILEY C, BOUCHER P, et al. Connecting Information To Improve Health. Project HOPE 2010, 29 (2): 284-288. https://doi.org/10.1377/hlthaff.2009.0903

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