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CAPITAL TAXATION AND ECONOMIC RESILIENCE: DECISION-MAKING PREDICTION THROUGH INFORMATION SYSTEMS IN THE NATIONAL SECURITY ARCHITECTURE

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Abstract: *The rapid transformation of the global economic ecosystem requires states to intelligently adapt fiscal policies, where technology becomes a strategic ally. This study explores how advanced information systems and artificial intelligence algorithms can be used to model the relationship between capital tax pressure and gross fixed capital formation (GFCF), a key indicator of economic resilience. Using longitudinal data from EUROSTAT (2010–2022) and machine learning techniques (REPTree model), the research identifies critical fiscal thresholds and relevant decision configurations for stimulating investment. The findings reveal that investment levels are not solely influenced by the absolute tax burden, but rather by strategic combinations of taxation forms and macroeconomic context. In this regard, AI-powered information systems enable not only real-time risk monitoring but also the simulation of fiscal scenarios geared toward resilience and economic autonomy. The integration of these technologies into the national security architecture provides valuable operational support for the formulation of intelligent and adaptive fiscal policies aimed at strengthening economic autonomy.*

Keywords: *information systems, adaptive decision, predictive modelling*

JEL Classification: *C35, C38, E27, G28, H25*

1. Introduction

The current global context is marked by financial instability, geopolitical fragmentation and the need to strengthen strategic autonomy, the ability of states to manage fiscal resources in a balanced manner becomes essential for supporting economic resilience. This article aims to investigate the impact of fiscal pressure exerted on capital through taxes on corporate income, self-employment income and capital stock on gross fixed capital formation, used

here as a proxy for investment and infrastructure resilience. In this approach, the emphasis is placed on the use of information systems to support economic and fiscal decisions, with the aim of supporting the overall architecture of national security. Methodologically, the research is based on a longitudinal data set, on which decision modeling techniques are applied, to highlight conditional relationships and critical fiscal thresholds. Through this approach, significant combinations of fiscal factors that positively or negatively influence the level of national investment are identified, thus providing an empirical basis for the formulation of adaptive public policies (Antikainen, Uusitalo, & Kivikytö-Reponen, 2018; Bai, Sarkis, & Dou, 2020; Dragomir-Constantin, 2025c).

The study also highlights the importance of predictive analysis information systems in monitoring fiscal risks and anticipating economic imbalances and decision-making information systems, which, integrated into fiscal analysis processes, can significantly contribute to strengthening financial autonomy and strengthening the state's capacity to respond quickly and efficiently to emerging challenges (Chen & Wang, 2024). In an era marked by persistent geopolitical tensions, systemic crises and reconfigurations of the global economic order, economic autonomy is becoming a central pillar of the national security architecture (Liu & Chen, 2024). States can no longer rely exclusively on external trade flows or globalized capital markets to support their development, but are forced to strengthen their internal resilience through self-financing mechanisms, protection of critical infrastructure and anticipation of economic vulnerabilities. In this context, the ability to effectively manage fiscal resources, especially those derived from domestic capital, acquires major strategic relevance. Taxation, beyond its traditional function as an instrument of redistribution or economic stimulation, is thus becoming an operational instrument of economic security governance. In particular, taxes on capital—whether on corporate income (CIA), self-employment income (SIE), or capital stock taxes (SST)—can directly influence the investment behavior of economic actors, affecting the level of fixed capital formation and, implicitly, the state's ability to modernize its strategic infrastructure (Dragomir-Constantin, 2025c). Excessive fiscal pressure can generate financial disintermediation, capital relocation, and a decrease in investment self-sufficiency, while a judicious balance between collection and stimulation can provide a solid basis for economic resilience. In parallel with these conceptual transformations, digital technologies and intelligent information systems are becoming an indispensable ally of the state in the process of fiscal decision-making (Lee, Kao, & Yang, 2014). The integration of predictive analysis systems, decision-making algorithms, complex fiscal databases and Business Intelligence

infrastructures allows not only the real-time monitoring of economic risks, but also the simulation of fiscal scenarios with strategic impact (Abdullah & Almaqtari, 2024). Thus, technology-assisted decision-making modeling offers an anticipatory vision of the relationship between taxation and development, facilitating a governance oriented towards stability and economic sovereignty.

2. Theoretical framework

The present paper aims to analyze this complex interdependence, by assessing how the fiscal pressure on capital influences the level of national investments and, implicitly, economic resilience. To this end, decision-making modeling techniques are used applied to a data set provided by EUROSTAT, and the dependent variable is represented by gross fixed capital formation, considered a relevant indicator for the investment capacity of states (Marković & Jemović, 2024).

Starting from this analytical framework, the research aims to answer three fundamental questions:

- What is the relationship between capital taxation and investments in the economy?
- Can financial resilience be anticipated through decision-making modeling?
- What role do information systems play in supporting fiscal decisions and strengthening economic security?

By addressing these questions, the study contributes to the outline of a theoretical-applicative framework in which fiscal policies, supported by advanced information infrastructures, become integrated components of the national security architecture, offering states a strategic self-regulation tool in the face of emerging challenges.

2.1. Dataset and source

The study uses a dataset collected from the official EUROSTAT platform, covering the period 2010–2022 for 27 European Union member states. The data are structured on the following relevant indicators for the analysis of the relationship between capital taxation and public investment:

- TKC – Capital taxes from corporate income,
- TKE – Capital taxes from self-employed activities,
- TKS – Taxes applied to the capital stock,

• GFK – Gross fixed capital formation (million euros), used as a dependent variable.

All indicators were expressed in absolute values (million euros), without initial logarithmic transformations, precisely in order to preserve the readability of the interpretation of the decision-making models. The variables year (year) and country (country) were used as segmentation attributes, being integrated into the decision-making model to capture spatial-temporal variations.

3. Methodology

3.1. Data Exploration

The descriptive statistical analysis of the dependent variable GFK shows a highly skewed distribution to the left (positively skewed), with a mean of approximately 193,391 million euros and a significant standard deviation of over 514,000. The maximum value reaches 35,550,504 million euros (EU27 case), while the minimum values are below 2,000 million euros in small states (e.g. Malta, Cyprus). This wide variation justifies the use of decision-making models capable of capturing non-linear relationships and identifying conditional logical ramifications. This image provides a detailed statistical analysis of the dependent variable GFK (Gross Fixed Capital Formation), used in the model to assess the investment capacity and, implicitly, the economic resilience of the analyzed states. The analyzed variable, representing gross fixed capital formation (GFK), is of continuous numerical type and constitutes the dependent component of the decision-making prediction model. It is composed of a total of 362 observations, each of them having a unique value, attesting to a high degree of granularity and specificity of the collected data, respectively, an increased fidelity of the records at the national and annual level. The absence of missing values strengthens the robustness of the dataset and eliminates the need for interventions through imputation or estimation. The range of values covered by this variable is extremely wide, with an absolute minimum of 1,264 million euros, most likely corresponding to a small economy such as Malta, and an impressive maximum of 35,550,504 million euros, most likely attributed to the aggregate value of the European Union as a single economic entity. The arithmetic mean of these values is around the threshold of 193,391 million euros, suggesting a high overall level of investment. However, this mean is insufficiently representative of the central tendency, as it is significantly influenced by the existence of extreme values at the top of the distribution.

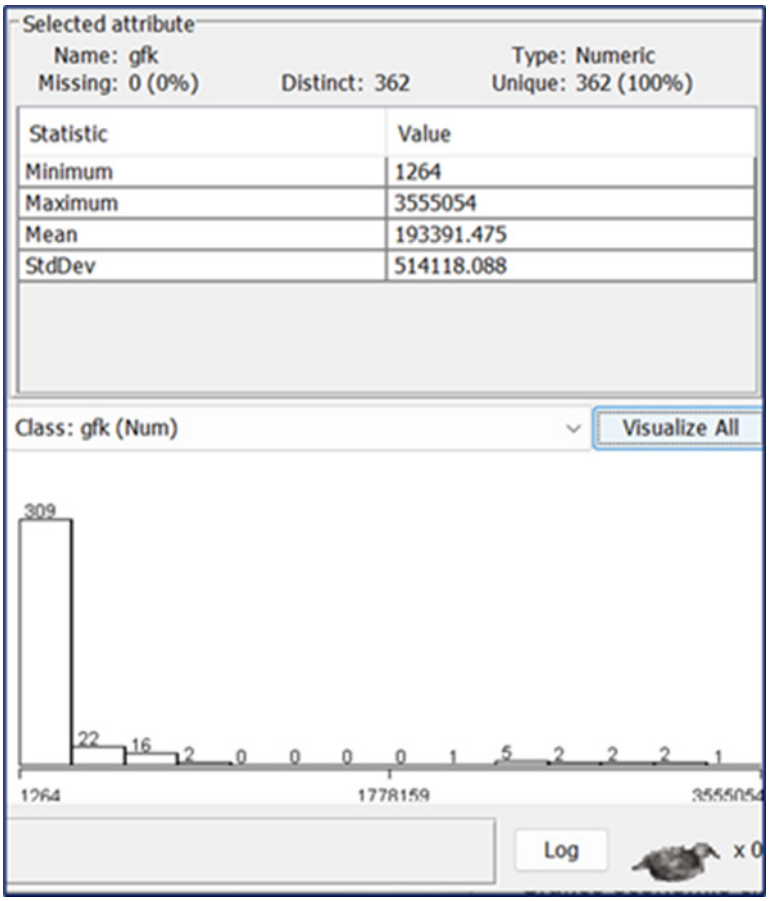

Figure 1. Data Exploration realized by the author

This observation is supported by the high value of the standard deviation, calculated at approximately 514,118 million euros, which highlights a considerable dispersion of the data from the central average and indicates the existence of significant variation between countries and years, reflecting both structural differences in economic size and fiscal and investment policy particularities. The distribution graph for the GFK variable reveals a pronounced leftward asymmetry (positive skew), with an overwhelming concentration of observations (309 out of 362) in the lower range of the scale, below the value of 177,815 million euros. Only a small number of observations – between two and five – are in the area of extreme values, corresponding to the maximum levels, which shows that massive fixed investments are characteristic of a limited number of states or economic aggregations of the size of the European Union.

This uneven distribution indicates the existence of a pronounced investment polarization at the European level, in which only a few economies have the capacity to support major investments in infrastructure and fixed capital. Consequently, the statistical average becomes an indicator with reduced interpretative value in the absence of dispersion and classification analyses, requiring the use of decision-making techniques that can effectively integrate both non-linear relationships and obvious distributional anomalies.

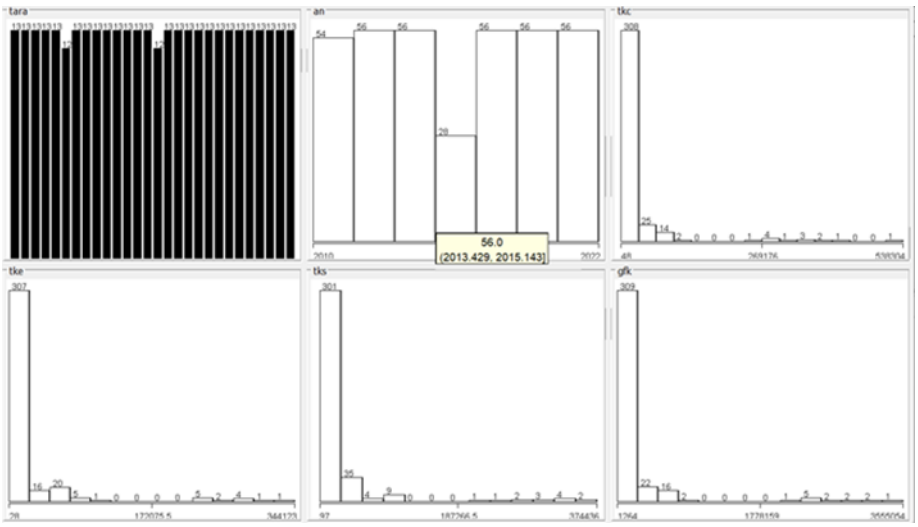

Figure 2. Data distribution realized by the author

These distributions justify the choice of robust decision models, such as REPTree or Random Forest, which handle data with extreme values and structural imbalances well. The visual distributions of the variables analyzed within the decision model reveal significant structural features, which substantiate the choice of the modeling method and provide important clues regarding the fiscal and investment behavior in the European Union member states.

First, the variable "country" (country) presents a perfectly balanced distribution, with each of the 27 states included in the sample having the same number of observations (13), most likely corresponding to each calendar year between 2010 and 2022. This symmetry of the data ensures a comparable representation across countries, eliminating possible biases induced by territorial under- or over-representation, and provides a solid framework for comparative analyses between national tax regimes. The variable "year" covers the time interval 2010–2022, with a constant frequency of observations in

almost all years, except for a notable discontinuity around 2013–2015, where the frequency drops to 28 observations. This sharp drop suggests the existence of gaps in reporting or data collection in that period, which must be taken into account in the temporal interpretation of the models, especially in the analysis of trends and decision thresholds correlated with the year.

The central fiscal indicators of the analysis, namely "TKC" (taxes on capital from corporate income), "TKE" (taxes on income of independent individuals) and "TKS" (taxes on capital stock), are characterized by a strongly asymmetric distribution to the left, highlighting an overwhelming concentration of values in the lower part of the scale. This phenomenon signals that most European states collect relatively modest revenues from these tax sources, while only a small number of economies – most likely Germany, France or the European Union at the aggregate level – record significantly higher values. This fiscal polarization may indicate structural differences in the capital taxation regime, the degree of formalization of the economy or the administrative capacity to collect. As for the dependent variable "GFK" (Gross Fixed Capital Formation), used as an indicator of investment resilience, the distribution is also highly skewed, with over 300 observations in the lower ranges and only a few very high values corresponding to developed economies. This statistical configuration suggests a disproportionate concentration of infrastructure and fixed asset investments in countries with strong tax bases and high financial capacity, while smaller economies or those with suboptimal tax regimes face a limited capacity to generate public and private capital in the long term.

4. Results

The distributional analysis supports the hypothesis that the fiscal pressure on capital, in interaction with certain structural factors, can significantly influence the level of investment and, implicitly, the economic resilience of states, justifying the integration of these variables in a predictive model based on decision trees. Also, the statistical characteristics of the data require the use of algorithms that can handle scale imbalances and non-linear relationships between variables, such as the REPTree.

The tree primarily uses the "country" variable to divide the data set into distinct nodes, which indicates that the national factor has a dominant influence in determining the level of fixed investment. This reflects structural economic realities, such as the size of the economy, fiscal policies, or the level of infrastructural development, that differ significantly from one state to another.

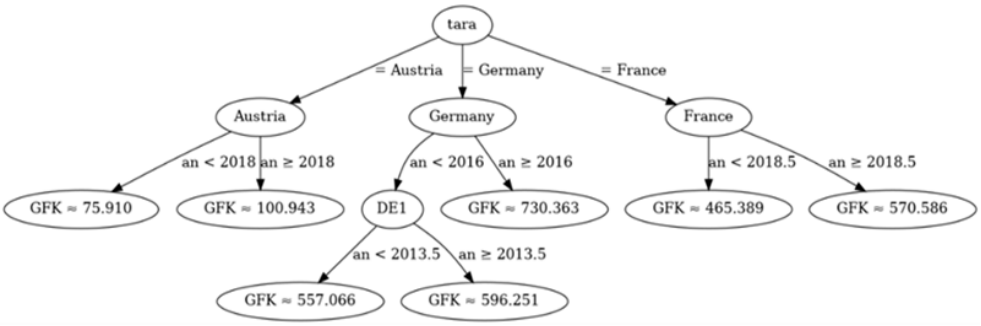

Figure 3. Relevant examples of decision segments extracted from the tree realized by the author

The analysis of the evolution of fixed capital investments in some European Union Member States highlights significant growth trends starting with 2016 and 2017, respectively, in a context marked by stimulating economic policies and post-crisis recovery initiatives. In the case of Austria, a consistent increase in the GFK value is noted after 2018, most likely as a result of alignment with European economic recovery measures. For France, the decision-making model reveals a critical threshold located around 2018.5, which delimits a transition from an average of approximately 465,388 million euros to a higher level of 570,586 million euros, associated with the intensification of public and private investments generated by digitalization and ecological transition programs. Germany presents a stratified investment evolution, with a succession of relevant time thresholds: before 2013.5, the value of GFK was around 557,065 million euros, rising to 596,250 million euros between 2013.5 and 2016, and reaching a peak of 730,362 million euros after 2016, in a possible effort to consolidate industrial capacity in the post-Brexit context. At the aggregate level of the European Union (EU27), a marked difference is observed between the period before 2017 – with an average GFK value of approximately 2,386,444 million euros – and the period after it, when investments increase significantly to 3,070,194 million euros, an evolution correlated with the launch of the Next Generation EU instrument and the targeting of funds towards strategic priorities such as the green and digital transition.

4.1. Taxation-related decision rules

Based on the REPTree analysis, several relevant decision rules were extracted that directly link the level of capital taxation to the volume of fixed investments. These rules highlight favorable or restrictive tax configurations, as follows:

- Rule 1: if TKE > 17,000 and TKS < 100, then GFK tends to be significantly low
- Rule 2: if TKC < 200,000 and TKS > 10,000, then GFK is generally medium to high.
- Rule 3: if TKE < 5,000 and TKC > 500,000, GFK tends to reach above-average values

The decision analysis based on the REPTree model allows the extraction of significant rules that highlight how combinations of forms of capital taxation influence investment behavior. The first rule indicates that, in situations where the taxation of self-employment income (TKE) exceeds the threshold of EUR 17,000 million and the taxation of the capital stock (TKS) is kept below EUR 100 million, gross fixed capital formation (GFK) tends to be significantly reduced; this configuration suggests an inhibitory effect on investment, determined by the over-taxation of entrepreneurship in the context of a poorly taxed capital base. In contrast, the second rule reveals that a low level of corporate income taxation (TKC < EUR 200,000 million), combined with a moderate taxation of the capital stock (TKS > EUR 10,000 million), is associated with medium to high levels of investment, which reflects a fiscal balance favorable to the stimulation of fixed capital. The third rule completes this logic, showing that when the tax burden on self-employment income is low (TKE < 5,000 million euros) and the taxation of corporate profits is substantial (TKC > 500,000 million euros), the GFK level tends to exceed the average, indicating a positive correlation between the efficient taxation of large companies and the capacity to generate national investments, given that the entrepreneurial sector is fiscally encouraged.

4.2. Critical fiscal thresholds

Based on the segmentation provided by the decision tree and the visual distributions, critical fiscal thresholds can be identified that function as inflection points in the investment capacity:

• TKE > 17,000 million euros → potential inhibitor for GFK in states with a weak entrepreneurial base.

• TKC > 600,000 million euros → threshold associated with consolidated economies, which allows a high level of collection without negatively affecting investments.

• TKS < 100 million euros → identified as a risk area, where the lack of taxation on the capital stock is correlated with significant investment decreases.

Interpretation of the decision rules highlights critical fiscal thresholds, which function as predictive factors in assessing the investment capacity of states. First, exceeding the 17,000 million euro level in self-employment income taxation (TKE) proves to be a potential inhibitor of gross fixed capital formation (GFC), especially in economies characterized by a low entrepreneurial base, where a strong tax pressure on the small business segment diminishes the capacity to initiate and sustain investments. Second, reaching a corporate income tax collection threshold (TKC) of over 600,000 billion euros is specific to consolidated economies, which have the necessary infrastructure and stability to support a high level of tax collection without negatively affecting the investment climate, which suggests a correlation between economic maturity and resilience to high tax pressure. Last but not least, maintaining the capital stock taxation (TKS) below the threshold of 100 million euros is identified as an area of systemic risk, in which the absence of a fiscal instrument capable of valorizing the accumulated capital generates structural imbalances and is associated with a notable decrease in investments, reflecting a vulnerability of the fiscal model that undermines the long-term self-financing capacity.

5. Conclusions

The results obtained by applying the REPTree decision model clearly highlight the fact that the fiscal pressure exerted on capital – manifested by taxation of corporate income, self-employment and capital stock – represents a relevant and sensitive determinant of investment capacity, reflected in the level of gross fixed capital formation (GFC), used in this study as a proxy for economic resilience. In a context marked by geopolitical reconfigurations and recurrent economic tensions, this relationship becomes essential for understanding the mechanisms through which states can strengthen their economic autonomy and, implicitly, the national security architecture.

More than the absolute level of the tax burden, what seems to decisively influence investment behavior is the combination of forms of taxation and their placement in a certain temporal and structural context. The interactions between taxes on capital, whether targeting corporate profits, self-employment or patrimonial assets, generate emergent effects that cannot be understood outside an integrated framework. In this sense, the decision-making model allows the identification of optimal fiscal configurations, through which both areas of fiscal capping can be anticipated – where excessive pressure discourages investment – and the risks of fiscal regression, associated with unjustified relaxations that can destabilize the public budget without producing positive economic effects. Thus, fiscal balance appears not as a fixed value, but as a dynamic benchmark,

which must be continuously adjusted according to the particularities of each economy and its strategic objectives. In this complex equation, information systems become indispensable tools for anticipatory fiscal governance, providing analytical and decision-making support by integrating Business Intelligence, Big Data and artificial intelligence technologies. The ability of these systems to collect, process and analyze large volumes of data in real time gives the state a granular view of emerging fiscal risks, facilitating both the simulation of alternative scenarios and the assessment of the impact of legislative measures on economic behavior. Thus, they function as strategic sensors of fiscal stability and can contribute to the creation of proactive public policies, focused on autonomy, adaptability and resilience.

However, the conclusions of this study must be interpreted in light of inherent methodological limitations. The use of aggregated data at national and annual levels restricts the possibility of detailed analysis at sectoral or regional level, while structural differences between states – including in terms of the size of the economy, the legal system or administrative efficiency – can significantly influence the interpretation of the results. In addition, the absence of social variables, such as education level, inequality level or unemployment rate, limits the model's ability to fully capture the impact of taxation on socio-economic cohesion. Even under these conditions, the study validates the idea that capital taxation is a critical variable in understanding and modeling the investment capacity of the European Union Member States. The REPTree model applied to the data provided by Eurostat demonstrated the existence of tax thresholds and tax configurations that significantly influence investment dynamics, thus providing an empirical basis for the formulation of adapted public policies. Consequently, it is imperative to implement integrated tax monitoring IT systems, capable of providing real-time analysis and supporting evidence-based decision-making. It is also necessary to balance the tax pressure on capital through policies that stimulate investment, without compromising budgetary sustainability, as well as to correlate the tax regime with the objectives of economic autonomy, so that taxation becomes not only a collection tool, but also a pillar of structural stability.

By intelligently linking taxation, digital infrastructure and economic strategy, states can develop adaptive mechanisms for protection and development, in line with the new requirements of European economic security and in support of public governance oriented towards sovereignty, resilience and performance.

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