



Subjective Determinants of Attitudes Towards Euro Adoption in Non-Euro Countries. A Machine Learning Approach

Ana-Maria Giurgi^{*}, Carmen Pintilescu^{**}, Ciprian Ionel Turturean^{***}

Abstract: The adoption of the euro is a sensitive topic in the European Union (EU) member states that are not yet part of the Euro Area. Public perceptions and attitudes are influenced not only by objective economic factors, but also by subjective factors, such as the level of trust in institutions, perceptions of prices changes or the mixed feelings about EU. This paper investigates the subjective determinants of attitudes towards euro adoption among EU member states before euro adoption, using an approach based on machine learning algorithms. The analysis is based on Flash Eurobarometer data for 2011–2024 and includes only observations from countries in years before they adopted the euro. The results show that price-related perceptions consistently emerge as the most important predictor of attitudes towards euro adoption, while concerns related to national identity and economic control are also strongly associated with lower levels of support. In addition, self-perceived knowledge about the euro appears to be linked to more favourable attitudes. The study contributes methodologically through the comparative application of machine learning techniques and empirically by identifying the main subjective factors associated with public support for euro adoption in the EU.

Keywords: Euro; machine learning; Eurobarometer; Euro adoption.

JEL classification: E42; E52; E65.

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1. INTRODUCTION

The process of economic integration within the European Union (EU), initiated in 1957, was strengthened by the creation of the Economic and Monetary Union (EMU), which aims to coordinate economic and fiscal policies, implement a common monetary policy, and introduce a single currency, the euro. EMU contributes to macroeconomic stability, fosters sustained economic growth, and generates positive effects on the well-being of European citizens. The Maastricht Treaty (1992) established the convergence criteria necessary for the transition to monetary integration. Since 1999, the euro area has gradually expanded, reaching 21 member states following Croatia's accession in 2023 and Bulgaria's adoption of the euro in 2026.

After the first 11 countries introduced the euro, a substantial amount of literature examined the effects of the euro changeover and highlighted the persistence of public concerns about price increases after adoption. Numerous studies have documented a discrepancy between perceived post-changeover price increases and actual price developments, often labelled the "euro illusion", showing that citizens tend to overestimate price increases after the transition to the euro even when official price indicators show more moderate developments (Gamble *et al.*, 2002; Angelini and Lippi, 2006; Gamble, 2006; Lunn and Duffy, 2010). Given the central role of public perceptions in shaping support for monetary integration, research has increasingly focused on the determinants of perceived post-adoption price increases, trust in institutions, and symbolic concerns such as economic control and national identity.

For countries that have not yet adopted the euro, understanding public attitudes towards euro adoption is particularly relevant in the current context, marked by the COVID-19 crisis, the war in Ukraine, rising prices, and declining purchasing power in Europe. These developments have amplified feelings of uncertainty and contributed to the resurgence of Euroscepticism (Roth *et al.*, 2023). In addition, recent geopolitical developments, including ongoing conflicts in the Middle East and increased global uncertainty regarding energy supply and international security, have further contributed to a volatile economic environment (Zhou, 2024), which may influence public perceptions regarding euro adoption. Identifying the main concerns associated with the adoption of the euro is therefore essential for policymakers, as it can support the design of communication and transition strategies that address citizens' concerns and facilitate the completion of the integration process.

In this study, we analyse citizens' attitudes and perceptions regarding euro adoption in non-euro EU member states. The analysis is based on Flash Eurobarometer surveys covering the period 2011–2024 and includes nine EU countries observed during their non-euro period: Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania and Sweden. We include Croatia, Latvia and Lithuania, countries that adopted the euro during the analysed period, to capture the dynamics of perceptions prior to adoption. In the empirical analysis, only observations corresponding to the pre-adoption period are considered, ensuring that all data points reflect non-euro contexts. Bulgaria is also included because, during the 2011 - 2024 survey period analysed in this study, it had not yet adopted the euro. Its subsequent accession to the euro area in 2026 makes its pre-adoption experience particularly relevant for understanding attitudes in a late pre-adoption context. Denmark is excluded because it negotiated an opt-out from the obligation to adopt the euro under the Maastricht Treaty (1992), making its public attitudes structurally different from those of countries under mandatory convergence.

As a methodological approach, in the first stage of the analysis we apply two machine learning algorithms, Random Forest and logistic regression, in order to identify and rank the subjective factors associated with attitudes towards euro adoption. The analysis includes five perception-based variables reflecting several dimensions: self-perceived knowledge about the euro, perceptions of price change, concerns about loss of national identity, concerns about loss of control over economic policy, and concerns about price abuses. In the second step of the analysis, we applied the CART algorithm in order to identify the profile of the respondents according to the subjective factors at two points in time, 2016 and 2020. The year 2016 was chosen as representative for the post-crisis recovery period and the year 2020 was chosen as representative for a period of economic uncertainty, following the pandemic crisis. To assess the performance of the models estimated, we used the following indicators: accuracy, balanced accuracy, sensitivity, specificity and AUC.

The paper is structured as follows: in [Section 2](#), we present a survey of the literature on the main economic and institutional framework of euro adoption and the public perception concerning this process. [Section 3](#) describes the data and methodology used to assess the main subjective determinants of attitudes towards euro adoption. [Section 4](#) presents the empirical analysis for non-euro EU member states, while the [final section](#) concludes.

2. LITERATURE REVIEW

2.1. The economic and institutional framework of euro adoption

Economic and Monetary Union (EMU) is one of the most important integration projects of the European Union, aiming to strengthen economic convergence and macroeconomic stability. The Maastricht Treaty (1992) established convergence criteria relating to inflation, the budget deficit, public debt, exchange rate and interest rates, intended to ensure the compatibility of the participating economies (Proctor, 2023). The implementation of a common monetary policy, coordinated by the European Central Bank, marked an important stage of economic integration, but also implied a partial loss of national autonomy in economic policymaking. The theoretical foundations of EMU are based on the Optimum Currency Area theory (Mundell, 1961), which emphasizes the advantages of reducing transaction costs, increasing price transparency, and facilitating trade, as well as the costs associated with the loss of monetary and exchange rate flexibility. The efficiency of a monetary union thus depends on the degree of economic convergence and the ability of states to adapt to asymmetric shocks through fiscal policies and labour mobility (Verdun, 2005).

Recent global crises have influenced attitudes toward the euro. The global financial crisis of 2008 - 2009 and the sovereign debt crisis raised questions about the resilience of the euro area (Roth *et al.*, 2015). The COVID-19 pandemic and high inflation in 2020 have renewed concerns about monetary stability and purchasing power (Roth *et al.*, 2024). These events have highlighted that public support for the euro does not depend only on economic indicators, but also on perceptions of security and economic control. For non-euro states in Central and Eastern Europe (CEE), such as Romania, Bulgaria, Poland, Hungary, the Czech Republic or Sweden, adopting the single currency remains a complex political and social decision, even though they are formally expected to adopt the euro, as they do not have an opt-out clause. While Romania and Bulgaria maintain relatively high levels of public support, in countries such as Hungary and Poland concerns related to sovereignty and loss of economic control

appear more prominent ([Dandashly and Verdun, 2018](#)). Croatia's recent experience provides a useful example of how institutional readiness and social perceptions condition the success of the euro accession process. Bulgaria's accession to the euro area on January 1, 2026, also makes its pre-adoption experience relevant.

2.2. Public attitudes towards the euro, main determinants identified in the literature

Public attitudes towards the adoption of the euro are a central topic in research on European integration, being influenced by a complex combination of economic, political, identity and informational factors. The literature highlights that support for the euro is not only shaped by rational assessments of economic benefits, but also by symbolic perceptions and trust in the institutions managing the integration process ([Jonung and Conflitti, 2008](#); [Hobolt and Wratil, 2015](#)).

In the economic framework, support for the euro can be interpreted through the lens of economic voting theory, according to which individuals evaluate economic performance both at a personal level (pocketbook effects) and at a national level (sociotropic effects). For example, research on Greece during the economic crisis highlights that, despite severe austerity measures and economic recessions, support for the euro remained strong due to both personal economic considerations and broader national economic evaluations, with sociotropic evaluations often taking precedence as uncertainty about policy outcomes diminished ([Jurado *et al.*, 2020](#)). Positive perceptions of economic growth, income prospects, and price stability favour pro-euro attitudes, while economic uncertainty and high inflation can increase hesitancy. Research based on the Eurobarometer has shown that individuals who perceive the single currency as a guarantee of price stability and economic integration tend to support it more strongly ([Jonung and Conflitti, 2008](#)), while those who fear losing control over prices adopt a negative position ([Banducci *et al.*, 2009](#)).

The adoption of the euro in CEE countries is associated with issues of national identity and symbolic frameworks. The euro, as a symbol of European integration, challenges traditional national symbols and can be perceived as a threat to national identity and economic sovereignty. This is particularly pronounced in CEE countries, where the process of building a post-transition national identity is recent and fragile. The perception that the adoption of the euro could lead to a "loss of country identity" and a "loss of control over economic policy" reflects concerns about diminishing national autonomy ([Parizek, 2011](#)). In these regions, the euro is not just a currency, but an indicator of European identity, which can unify or divide public opinion depending on historical legacies and the success of economic transitions ([Allam and Goerres, 2011](#)).

Another important determinant is trust in national and European institutions. Studies suggest that support for the euro tends to be higher among individuals with greater levels of trust in the European Union, the European Central Bank and, to a lesser extent, in the national government ([Bergbauer *et al.*, 2020](#)). Trust can act as a mediating factor, so individuals who perceive European institutions as competent and stability-oriented are more likely to support the adoption of the euro. Conversely, where domestic institutions are perceived as corrupt or inefficient, support for monetary integration may be weakened by the fear of losing domestic control over economic decisions ([Hobolt and Wratil, 2015](#); [Roth and Jonung, 2022](#)).

In addition, individual information levels and political competence also influence attitudes towards the euro. People who declare themselves informed or who have a higher educational level tend to better understand the economic mechanisms of the single currency and to display pro-European attitudes (Fernández *et al.*, 2023). Media exposure and the quality of public discourse also have an effect; in times of disinformation or excessive politicization, perceptions can be divided, and limited information may increase the likelihood of “Don’t know” responses or fear-based opposition (Conflitti, 2011).

Overall, the literature suggests that attitudes towards the euro are the result of an interaction between economic evaluations, identity attachments, trust in institutions and the level of information. These dimensions do not act in isolation, but form a complex framework in which support for the single currency reflects both material interests and symbolic values related to European membership. The factors influencing attitudes towards the euro found in the literature will be presented in more detail below.

Perceptions of price increases after euro adoption are one of the most sensitive dimensions of the public debate on the adoption of the euro, being directly linked to citizens’ perceived well-being and trust in national economic policies. Numerous studies have highlighted the existence of a phenomenon known as the “euro illusion”, according to which citizens tend to perceive sharper price increases immediately after the introduction of the euro, even when official price indicators show more moderate developments (Gamble *et al.*, 2002; Angelini and Lippi, 2006; Gamble, 2006). This phenomenon is explained by psychological and behavioural effects, the initial difficulty of converting monetary values (Lunn and Duffy, 2010), the rounding up of prices to facilitate payments, and the tendency of consumers to pay disproportionate attention to frequently purchased consumer goods, where visible changes are more common (Cornille and Stragier, 2007). Thus, citizens’ perceptions of post-adoption price increases often become more negative than suggested by official price statistics, which affects attitudes towards the single currency and trust in European institutions.

2.3. Conceptualizing subjective determinants of euro adoption

In the literature on public attitudes toward the euro, subjective determinants refer to individual-level perceptions, beliefs, and evaluations that shape preferences beyond of objective economic conditions. These factors are rooted in behavioural and political economy approaches, which emphasize that individuals do not respond only to measurable macroeconomic indicators, but also to perceived realities and cognitive interpretations of economic processes (Hobolt and Wratil, 2015; Roth and Jonung, 2022).

Subjective determinants typically include perceptions of price developments, concerns about economic control and national sovereignty, trust in institutions, and the level of individual information or awareness. These variables are frequently operationalized using survey-based measures, particularly within Eurobarometer datasets, where attitudes are captured through self-reported evaluations rather than objective indicators (Banducci *et al.*, 2009; Fernández *et al.*, 2023).

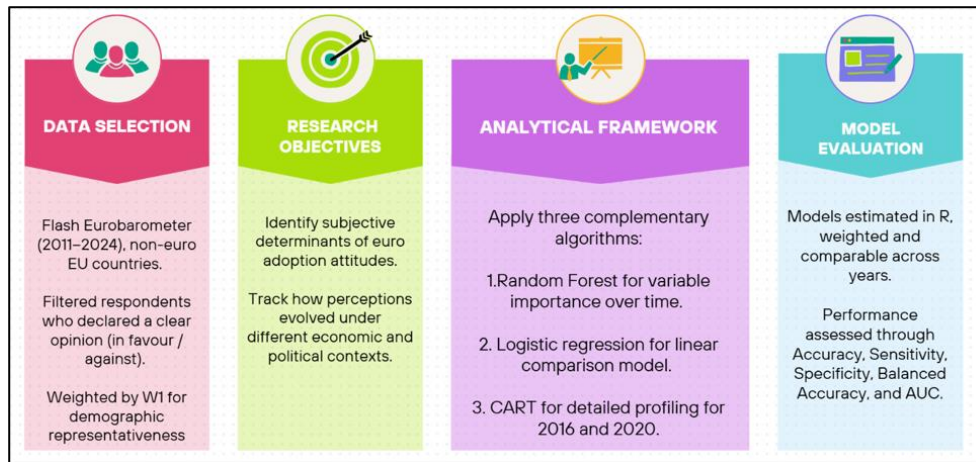
From a theoretical perspective, these factors can be grouped into three broad dimensions. First, the economic perception dimension captures individuals’ expectations regarding price rise, purchasing power, and overall economic stability. Second, the symbolic and identity dimension reflects concerns related to national identity and sovereignty. Third, the cognitive dimension relates to the level of information and understanding of the euro, which may

influence the way individuals interpret both economic and symbolic aspects of monetary integration.

This framework supports the selection of the variables used in the empirical analysis, namely price change perceptions, concerns about loss of country identity and economic control, perceived price abuses, and self-reported knowledge about the euro. These variables capture the key subjective dimensions identified in the literature and allow for a structured analysis of how perceptions shape attitudes toward euro adoption.

3. METHODOLOGY

The methodological approach applied in the paper is presented in [Figure no. 1](#).



Source: authors' analysis in Canva

Figure no. 1 – Scheme of the methodology used

To assess the main determinants of public perceptions regarding the adoption of euro, we use the data from the Flash Eurobarometer surveys corresponding to the period 2011–2024. In this study, we perform two analyses. The first focuses on the analysis of variable importance for each year of the analysed period using Random Forest and Logistic Regression algorithms. The second analysis uses the CART algorithm to profile the classes of respondents according to the subjective factors. The analysis is conducted at the country-year level and focuses on observations corresponding to periods in which countries had not yet adopted the euro. For countries that joined the euro area during the analysed period (e.g., Croatia, Latvia, Lithuania), only pre-adoption observations are included in the empirical models.

3.1. Research Hypothesis

Drawing on the literature on public support for the euro and the specific design of the Flash Eurobarometer questionnaires, this study proposes four hypotheses regarding the role of subjective determinants in shaping attitudes towards euro adoption in non-Eurozone countries. All hypotheses refer to expected relationships between self-reported perceptions and the likelihood of supporting euro adoption.

H1: Price perceptions dominate euro adoption attitudes.

In line with the literature on the “euro illusion” and the central role of concerns about price increases after euro adoption in public debates, we expect the Price change variable to be strongly associated with support for the euro. Empirically, H1 is assessed by examining whether this variable occupies the top positions in the importance rankings of variables in the Random Forest and logistic regression models and whether it appears as a primary splitting variable in the CART trees. A consistently higher importance weight for price-related variables, compared to identity or information factors, is interpreted as evidence consistent with H1.

H2: Identity and sovereignty concerns reduce support for euro adoption.

The literature on euro symbolism suggests that concerns about national identity and sovereignty can generate resistance to monetary integration. Therefore, we expect stronger agreement with statements about the loss of country identity and the loss of control over economic policy to be associated with lower support for euro adoption. The two variables are analysed separately in the empirical models in order to distinguish between symbolic identity concerns and economic-sovereignty concerns.

H3: Self-perceived knowledge of the euro has a strong influence.

Previous studies indicate that better-informed individuals tend to have more stable and pro-European attitudes. We therefore hypothesize that higher values of the variable “euro informed” are associated with a higher likelihood of supporting the euro and that information may mitigate the negative impact of fears about prices, loss of identity or loss of control. H3 is tested by examining whether “euro informed” has an effect in the first two models and whether CART splits show that better-informed respondents are more supportive at comparable levels of perceived risks.

H4: Subjective determinants become more discriminative in periods of heightened uncertainty.

We expect that subjective perceptions related to prices, identity, and economic control differentiate supporters and opponents of euro adoption more clearly in periods marked by heightened economic and political uncertainty. Given the repeated cross-sectional design, the changing country composition across survey waves, and possible differences in questionnaire wording, H4 is treated as an exploratory expectation rather than a direct causal hypothesis. It is assessed descriptively by comparing variable importance, CART profiles, and classification performance across selected years.

3.2. Data used

To identify the subjective factors influencing perceptions regarding the adoption of the euro, two machine-learning methods were applied to data from the Flash Eurobarometer surveys corresponding to the period 2011–2024. The dataset includes only country-year observations corresponding to periods before euro adoption. Therefore, for countries that joined the euro area during or after the broader period considered, only observations from their pre-adoption years are retained. The analysis is conducted separately for each year, in order to observe the temporal variations in the importance of the explanatory variables. To ensure the national representativeness of each sample included, the weighting variable W1 was used to adjust the sample structure according to demographic distributions (sex, age, NUTS II region and size of the locality) and the size of the population of each country. The comparison of the two methods made it possible to assess the robustness and consistency of the determinants. The codes of the datasets used and the countries included in the analysis, as well as the codes from the target variable questionnaire, can be seen in [Table no. A1](#).

In our analysis, we removed “Don’t know” responses and missing values (NA) from the target variable to maintain consistency in the interpretation of the results. These responses do not reflect a clear position on the adoption of the euro and could have introduced ambiguity into the classification algorithms. By excluding them, the analysis focuses only on respondents who expressed an explicit opinion, which allows for a more precise estimate of the true distribution of attitudes and a higher accuracy of the predictive models. The target variable was coded as binary, with 0 indicating opposition to euro adoption and 1 indicating support. After this filtering, the final sample includes 87,669 valid observations out of the initial total of 97,944.

In the first analysis, the data set was not divided into training and test subsets, as the main objective was not to estimate the predictive performance of the models, but to identify and rank the explanatory variables relevant to the attitude towards the adoption of the euro. In both algorithms, the aim was to assess the importance of the variables and to select the factors that contribute to the differentiation of the respondents' attitudes. In this context, using the entire sample ensures a more stable estimate of the relative importance of the predictors and minimizes the loss of information. The Random Forest models were evaluated by the OOB (Out-of-Bag) error, which provides a robust measure of performance without requiring an explicit separation of the data. Similarly, in the LASSO-penalized logistic regression analysis, validation was performed through the cross-validation penalty procedure, which allows for optimal selection of variables. Model performance was evaluated using accuracy, sensitivity, specificity, balanced accuracy, and area under the curve (AUC).

Five variables related to perceptions were included, capturing dimensions such as the degree of information about the euro, the perception of price change, the loss of national identity, the loss of control over economic policies, and the perception of price abuses. Items on the consequences of adopting the euro at the personal and national level are available in the data used but were excluded, as they already express a global judgment on the phenomenon and can absorb a significant proportion of the explained variance, reducing the relevance of the other explanatory factors. The variable used in the analysis, the expected effect of these variables, and the connection with the hypothesis can be seen in [Table no. 1](#).

Table no. 1 – Description of variables and connection with research hypotheses

Variable name	Price change	Loss of country identity	Loss of economic control	Price abuses	Euro informed
Concept measured	Perceived price evolution with euro adoption	Concern about losing national identity	Concern about losing control over national economic policy	Fear of unfair price rounding or manipulation during changeover	Self-perceived knowledge and awareness about the euro
Example question (Flash EB 548, 2024)	“What impact will the introduction of the euro have on prices in your country?”	“Adopting the euro will mean that this country will lose part of its identity.”	“Adopting the euro will mean that this country will lose control over its economic policy.”	“I am concerned about abusive price setting during the changeover.”	“How well informed do you feel about the euro?”
Coding / categories used in the model	Nominal variable: keep prices stable; increase prices; no impact; DK/NA. “Keep prices stable” used as reference category.	Ordinal variable: strongly disagree; rather disagree; rather agree; strongly agree; DK/NA. “Strongly agree” used as reference category.	Nominal/binary recoded variable: disagree; agree; DK/NA. “Agree” used as reference category.	Nominal/binary recoded variable: not concerned/disagree; concerned/agree; DK/NA. “Concerned/agree” used as reference category.	Ordinal variable: not at all informed; not very well informed; rather well informed; very well informed; DK/NA. “Very well informed” used as reference category.
Hypothesis link	H1 – Price perceptions dominate attitudes toward the euro	H2 – Identity and sovereignty concerns reduce support for euro adoption	H2 – Identity and sovereignty concerns reduce support for euro adoption	H4 – Subjective determinants become more discriminative in periods of heightened uncertainty	H3 – Knowledge moderates negative perceptions
Expected effect on support for euro adoption	Negative – People who expect prices to rise are less supportive	Negative – Stronger identity concern decreases support	Negative – Stronger perception of control loss decreases support	Negative – Stronger fear of abuses reduces support	Positive – Better-informed individuals show higher support

Source: authors' analysis

3.3 Random Forest and logistic regression

The Random Forest method was introduced by Leo Breiman (2001) in his article “Random Forests”, published in the journal Machine Learning. This technique is an extension of the idea of “Random Decision Forests” previously proposed by Tin Kam Ho (1995) in 1995, which introduced the random selection of subsets of variables for building decision trees. Breiman combined this approach with the bagging method (bootstrap aggregating), which he had developed in 1996 (Breiman, 1996), obtaining an ensemble learning model that reduces variance and increases the accuracy of predictions by training an ensemble of independent trees on randomly chosen samples and subsets of features. Due to its robustness, high accuracy and interpretability through the analysis of the importance of variables, Random Forest has become one of the most popular machine learning methods applied in economics, medicine and the social sciences.

The Random Forest models in this analysis were built using a standard configuration optimized for binary classification analyses, adapted to the purpose of variable selection and interpretation of their importance. Each model was composed of 1,000 decision trees (in R *num.trees* = 1000), a value chosen to ensure the stability of the results and reduce the variance between successive runs. The importance of the variables was based on the Gini index. This index expresses how much the heterogeneity of the classes (favourable/unfavourable attitudes towards the euro) decreases when a variable is used to divide the nodes in the decision tree. The higher the value of this index, the more consistently the respective variable contributes to the correct separation of observations between the two categories of the dependent variable (Kuyoro *et al.*, 2022). To facilitate within-model interpretation over time, the raw importance values were rescaled into percentages separately for each algorithm. These percentages are not interpreted as directly comparable across algorithms, but only as indicators of the relative contribution of each variable within the same modelling approach. The models were run in a weighted manner, using W1 weights, to reflect the demographic structure and population size of each country included in the sample. In addition, the probability estimation option (probability = TRUE) was enabled to allow the calculation of the area under the ROC curve (AUC), thus providing an additional assessment of the discriminatory power of the models.

The second algorithm used to examine changes in variable importance over time is LASSO-penalized logistic regression. The LASSO (Least Absolute Shrinkage and Selection Operator) method was introduced by Robert Tibshirani in 1996 (Tibshirani, 1996). LASSO is a penalty technique that combines parameter estimation with variable selection by applying an L_1 penalty to the coefficient values. This penalty constrains the sum of the absolute values of the coefficients, causing some of them to become exactly zero, which allows the automatic identification of the most relevant variables in a model. Due to this simultaneous regularization and selection capability, this penalty method has become an important tool in statistics, econometrics, and machine learning, being widely used in contexts with a large number of predictors or with collinearity problems (Mahalani and Rifai, 2022). For this study we estimated the models separately for each year from 2011–2024, using W1 weights, which adjust the sample distribution according to the population structure.

Variable importance was derived from the magnitude of the estimated coefficients after regularization. Specifically, we use the absolute value of the standardized coefficients as an indicator of the relative contribution of each predictor to the model. Variables with coefficients close to zero are considered non-informative, while larger absolute values indicate stronger associations with the dependent variable (Kuhn and Johnson, 2013). To facilitate comparison with the Random Forest results, the coefficient-based importance measures were rescaled into relative percentages, expressing each variable's contribution as a share of the total absolute importance across predictors. It should be noted that these importance measures are not directly equivalent in a strict methodological sense, as Random Forest importance reflects reductions in impurity, while LASSO importance reflects the strength of linear associations. Therefore, the comparison is intended to highlight robust patterns across methods rather than exact quantitative equivalence. The validation process was performed internally by the k-fold cross-validation procedure ($k = 5$), automatically selecting the optimal value of the penalty parameter λ that maximizes the area under the ROC curve (AUC). The performance indicators were calculated in the same way as above for Random Forest.

In addition to the variable importance results, the LASSO-penalized logistic regression models were further examined through the estimated coefficients. This additional interpretation is important because variable importance indicates the relative contribution of each predictor to the classification process, while logistic regression coefficients show how specific response categories are associated with the probability of supporting euro adoption. A synthesis of the average coefficients by variable category is presented in [Table no. A5](#). Since the predictors were categorical and introduced into the models through dummy coding, each coefficient is interpreted relative to the omitted reference category of the corresponding variable. Therefore, the signs of the coefficients should be interpreted as category-specific associations with support for euro adoption.

To compare the predictive performance of the two models over time, we calculated the annual AUC difference between logistic regression and Random Forest models ($\Delta\text{AUC} = \text{AUC Logistic Regression} - \text{AUC Random Forest}$).

3.4. CART algorithm

For the second, profiling analysis, only the years 2016 and 2020 were selected, as they capture two contrasting economic and social contexts, relevant for the analysis of perceptions regarding the adoption of the euro. The year 2016 was chosen as representative of the post-crisis recovery period, when European economies had returned to growth, inflation remained low, and trust in European institutions was being consolidated. At this stage, positive perceptions related to stability and economic convergence had a higher weight ([Roth et al., 2022](#)). By contrast, the year 2020 reflects a period of economic tension and uncertainty, marked by accelerated price increases. These conditions amplified concerns about the loss of economic control, depreciation of purchasing power, and the perceived risks of belonging to the euro area ([Carella, 2023](#)). The selection of these two moments allows the comparison of attitude profiles in a differentiated framework, between a stage of relative stability and one of inflationary crisis, providing a relevant picture of how the economic context shapes support for the euro.

For explainable profiling, we used a CART decision tree, which generates simple and interpretable classification rules. This method provides an intuitive interpretation of the determinants and allows a clear presentation of the identified segments of attitudes. For the year 2016, a calibration of the CART model was carried out, by testing several combinations of parameters (cp, maxdepth, minbucket, minsplit). The first parameter, cp (complexity parameter), controls how much the model penalises each additional split. Larger values of cp produce simpler trees, while smaller values allow the model to grow deeper and capture more detailed patterns. This parameter is used to avoid overfitting, and is typically selected through cross-validation ([Breiman, 1996](#); [Therneau et al., 2023](#)). The second parameter, maxdepth, limits the maximum number of levels the tree is allowed to grow. By restricting tree depth, the model avoids creating overly complex decision structures that memorise noise rather than general patterns. Shallow trees tend to be more stable and easier to interpret, a principle widely discussed in introductory texts on statistical learning ([James et al., 2013](#)). The minbucket parameter specifies the minimum number of observations required in a terminal node. This constraint ensures that the final leaves of the tree contain enough data to generate reliable predictions. Very small terminal nodes tend to be unstable and sensitive to noise, so increasing minbucket leads to more robust trees ([Therneau et al., 2023](#)). Finally, minsplit defines the

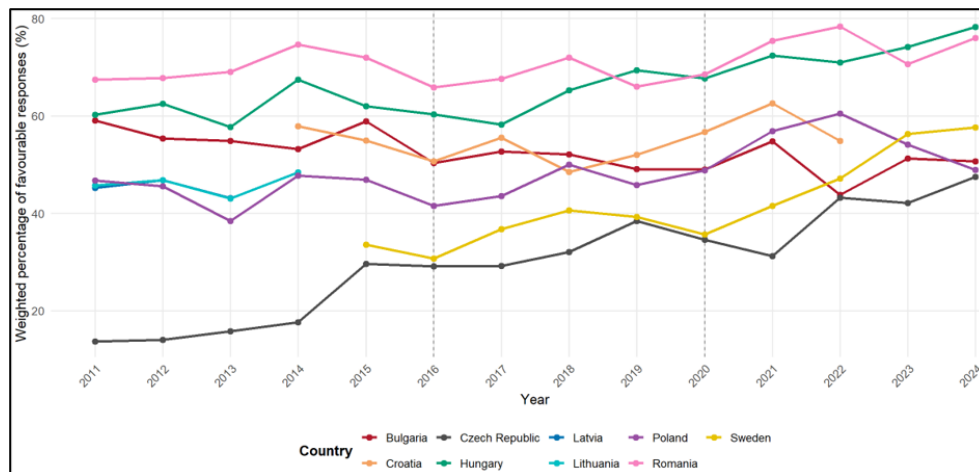
minimum number of observations needed in a node for the algorithm to attempt a new split. If a node contains fewer observations than the value of *minsplit*, no further partitioning is allowed. This prevents the model from creating unnecessary or unreliable splits based on very small subsets of data (Quinlan, 1986; Breiman *et al.*, 2017).

The aim of this stage was to achieve a balance between the predictive performance and the interpretability of the model. The selected configuration offered high accuracy, balanced specificity and sensitivity and, at the same time, a clear and readable structure of the tree, which allowed a coherent interpretation of the determinants of support for the adoption of the euro. The configuration was chosen for this year because the period was characterized by relative economic stability, without major shocks, which allowed a “clean” assessment of public perceptions and attitudes in relation to the adoption of the single currency. The CART models were estimated separately for 2016 and 2020, using the same set of parameters to ensure comparability across the two periods, and to assess how the model's performance changed in a different socio-economic context. This approach keeps the technical settings constant, and the variations observed in the indicator's performance differences can be interpreted as reflecting changes in respondents' behaviour and perceptions, rather than differences in model structure.

4. RESULTS AND DISCUSSION

4.1. Dataset description

Figure no. 2 illustrates the weighted evolution of public support for the adoption of the euro in the EU member countries that were not part of the euro area at the time of each survey. The dataset is presented in Table no. A2. Romania stands out as the country with the most constant and high favourable attitude towards the adoption of the euro. The values remained above 65% throughout the period and reached a peak of almost 78% in 2022.



Source: authors' analysis in Rstudio

Figure no. 2 – Weighted evolution of favourable attitudes toward euro adoption across EU member states before euro adoption (2011–2024)

This stability suggests a consolidated positive perception of monetary integration, probably associated with expectations of economic convergence and increased stability (Dragoi *et al.*, 2017). Hungary also records high levels of support, but its evolution is not strictly linear. Support was around 60% in 2011, declined in some years, including 2013 and 2017, and then increased more visibly after 2019, reaching over 78% in 2024. Therefore, Hungary should be interpreted as a case of generally high but fluctuating support, with a stronger upward movement in the most recent years rather than as a country with a constant linear increase. This pattern may be linked to changing domestic and regional economic conditions, as well as to the increased salience of monetary stability in periods of uncertainty (Roth and Jonung, 2022).

In contrast, Bulgaria shows a more volatile and generally declining pattern over the analysed period. Support decreased from approximately 59% in 2011 to a minimum of around 44% in 2022, before partially recovering to about 51% in 2024. However, this recovery did not restore support to its initial level, indicating that Bulgaria's late pre-adoption context was characterized by moderate rather than strongly consolidated public support. This pattern is particularly relevant in light of Bulgaria's subsequent accession to the euro area in 2026 and may reflect persistent uncertainty regarding economic readiness, domestic political instability, and concerns about the expected effects of euro adoption (Todorov, 2023).

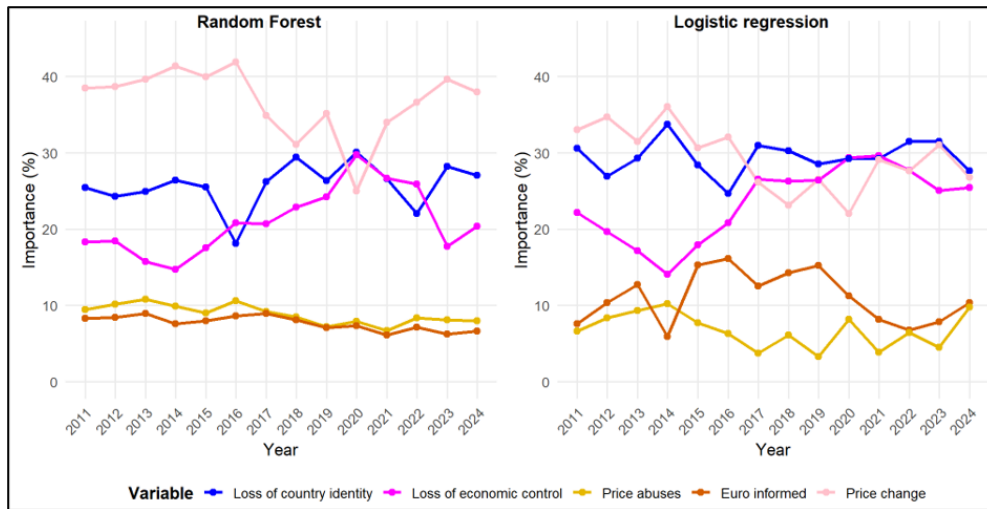
The Czech Republic remains the country with the lowest level of support, even if it gradually rises from 14% in 2011 to almost 47% in 2024, reflecting a historically reserved attitude towards monetary integration and a preference for economic policy independence (Szöcs, 2015). Poland remains in an intermediate zone, with support between 45–60%, reaching a peak in 2022, while Sweden shows a constant increase, from 33% in 2015 to almost 58% in 2024, a sign of a gradual improvement in citizens' attitudes towards the adoption of the euro.

The results indicate an increasing trend in the share of respondents declaring themselves in favour of euro adoption, with clear differences between CEE, where support is higher and more stable, and Northern Europe, where support remains more moderate, but on an upward slope.

4.2. Random Forest and Logistic regression

4.2.1. Variable importance across machine learning models

In Figure no. 3 represent the comparative analysis of the importance of variables obtained through the Random Forest and Logistic regression models for the period 2011–2024. The complete variable importance values are presented in Tables no. A3 and no. A4. The evolution shows several robust patterns and method-specific differences. In both modelling approaches, the variable capturing perceptions of price increases after euro adoption (“Price Change”) consistently emerges as the most important predictor of attitudes towards the adoption of the euro. This highlights the relevance of post-adoption price expectations, as widely discussed in the literature on the “euro illusion” (Gamble *et al.*, 2002; Gamble, 2006; Lunn and Duffy, 2010). The pronounced increase in the importance of price perceptions after 2019 - 2020 aligns with the inflationary peak documented in recent studies on the public's reaction to economic uncertainty (Roth *et al.*, 2024).



Source: authors' analysis in Rstudio

Figure no. 3 – Evolution of variable importance in machine learning algorithms

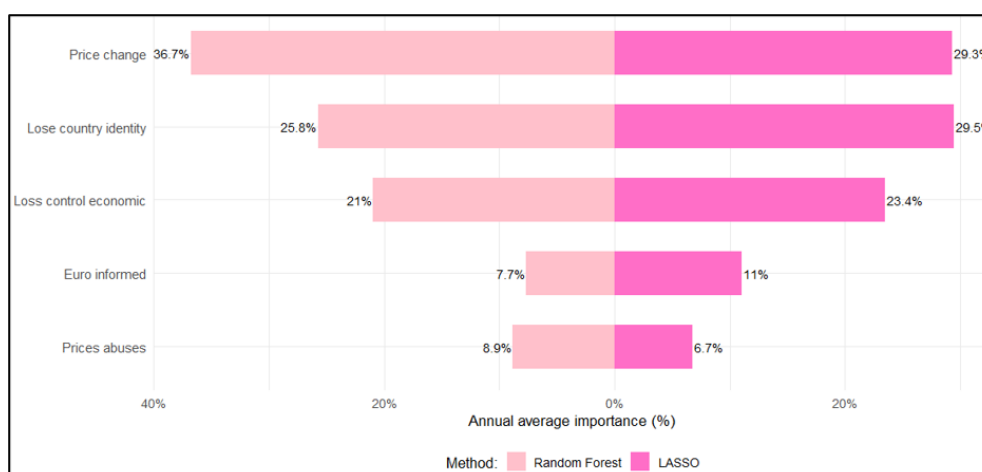
In the Random Forest models, the importance of price changes increases after 2014. Concerns about national identity and the loss of control over economic policy also gain weight, which is consistent with previous research on symbolic and sovereignty-related considerations in CEE countries (Allam and Goerres, 2011; Parizek, 2011; Dandashly and Verdun, 2018). Although these factors are not more important than price perceptions. Their consistent contribution suggests that opposition to euro adoption combines economic anxieties with identity-based considerations.

In contrast, the logistic regression models attribute a relatively stronger and more stable role to informational factors, in particular self-perceived knowledge about the euro (“Euro informed”). This is consistent with evidence that political information is associated with lower reliance on emotional or identity-based beliefs (Fernández *et al.*, 2023). The higher visibility of the “informed euro” variable in the linear model may reflect the ability of logistic regression to isolate direct effects once collinearity is penalized by regularization (Tibshirani, 1996), whereas in Random Forest these effects are often absorbed in nonlinear interactions (Breiman, 2001; Guo and Lin, 2023). In both approaches, “Price Abuse” presents the weakest and most volatile contribution, consistent with findings that concerns about unfair rounding influence attitudes but remain secondary to broader price-change expectations (Cornille and Stragier, 2007).

These results show that price perceptions consistently emerge as the most important predictors of euro support, strongly reflected in both the economic and behavioural literature, followed by concerns about sovereignty and national identity, while information levels appear to play a moderating role, especially in the linear context. Although the importance measures are not directly comparable across algorithms, both methods identify the same broad hierarchy of relevant predictors, especially the central role of price-related perceptions. This qualitative agreement supports the robustness of the substantive pattern, but not a direct numerical equivalence between the two importance measures. In addition, this aligns with previous empirical work showing that economic perceptions, symbolic attachments, and political

information jointly shape public support for monetary integration (Hobolt and Wratil, 2015; Roth and Jonung, 2022).

Figure no. 4 shows the mean importance of each subjective factor over the period 2011–2024, comparing the Random Forest method and logistic regression. In both approaches, price-related perceptions consistently emerge as the most important predictors, suggesting that expectations about price increases after euro adoption play an important role in shaping attitudes toward euro adoption. This pattern is in line with the extensive literature on the “euro illusion”, which shows that citizens often tend to overestimate price increases after the euro changeover (Gamble *et al.*, 2002; Angelini and Lippi, 2006; Gamble, 2006; Lunn and Duffy, 2010). A second level of determinants is formed by the loss of country identity and the loss of economic control, the average importance of which is only slightly below price perceptions, especially in the logistic models. This pattern may reflect previous findings that concerns about sovereignty and national identity are central ingredients of scepticism towards monetary integration in CEE countries (Allam and Goerres, 2011; Parizek, 2011; Dandashly and Verdun, 2018).



Source: authors' analysis in Rstudio

Figure no. 4 – Mean of variables for the analysed period, 2011-2024

The “informed euro” variable makes a more modest but not negligible contribution, with higher average weights in logistic than in Random Forest, which is consistent with evidence that political information promotes more stable and pro-European orientations (Conflitti, 2011; Fernández *et al.*, 2023). Finally, price abuses have the lowest average importance in both approaches (non-linear and linear), suggesting that concerns about incorrect rounding or opportunistic pricing matter but are overshadowed by broader expectations regarding price increases after euro adoption and symbolic concerns, as also indicated by post-transition studies of perceived price dynamics (Cornille and Stragier, 2007). The fact that Random Forest (Breiman, 2001) and LASSO-penalized logistic regression (Tibshirani, 1996; Mahalani and Rifai, 2022) converge on this hierarchy of determinants reinforces the robustness of the empirical evidence on the stratified structure of subjective factors of support for the euro.

4.2.2. Interpretation of LASSO-penalized logistic regression coefficients

According to Table no. A5, the coefficient mean confirms that the “price change” variable has the strongest category-level association with attitudes toward euro adoption. The category indicating that euro adoption will increase prices records the highest average coefficient, followed by the category indicating no impact. Since these coefficients are estimated relative to the reference category of the Price change variable, they show that price-related expectations strongly differentiate respondents in terms of support for the single currency. This result should therefore be interpreted as evidence of the strong discriminatory role of post-adoption price expectations rather than as a direct effect of expecting prices to increase. The finding is consistent with the literature on the “euro illusion”, which shows that citizens’ evaluations of the euro are strongly shaped by expectations and concerns about price increases after the changeover (Gamble *et al.*, 2002; Angelini and Lippi, 2006; Gamble, 2006; Lunn and Duffy, 2010).

For “loss of country identity”, the positive coefficients for the disagreement categories indicate that respondents who reject the idea that euro adoption would lead to a loss of national identity are more likely to support euro adoption than respondents in the reference category. In other words, lower identity-related concern is associated with a higher probability of favourable attitudes toward the euro. This result supports the theoretical expectation that symbolic and identity-related fears reduce support for monetary integration. It also aligns with previous research showing that national identity and symbolic attachments are important determinants of euro attitudes, especially in CEE countries (Allam and Goerres, 2011; Parizek, 2011; Dandashly and Verdun, 2018).

A similar interpretation applies to “loss of economic control”. The positive coefficients for the disagreement categories show that respondents who do not perceive euro adoption as a threat to national control over economic policy are more likely to support the single currency than respondents in the reference category. This suggests that sovereignty-related concerns are associated with opposition to euro adoption, while the absence of such concerns favours support. This finding is consistent with studies emphasizing the role of economic autonomy, sovereignty, and trust in the institutions managing monetary integration (Hobolt and Wratil, 2015; Bergbauer *et al.*, 2020; Roth and Jonung, 2022).

The *Euro informed* variable shows negative coefficients for the lower information categories, especially for respondents who declare themselves not at all well informed or not very well informed. Since the coefficients are interpreted to the reference category of the variable, this indicates that lower self-perceived information is associated with a lower probability of supporting euro adoption. This result supports the hypothesis that information plays a moderating role in euro adoption attitudes. Respondents who feel better informed are more likely to express favourable views, while limited information may increase uncertainty or vulnerability to negative perceptions. This interpretation is consistent with research emphasizing the role of political knowledge, information, and education in shaping pro-European orientations (Conflitti, 2011; Fernández *et al.*, 2023).

Finally, the *Price abuses* variable has smaller and less stable coefficients compared with the other predictors. The results suggest that categories reflecting lower concern about abusive price setting are generally associated with higher support for euro adoption relative to the reference category, but the magnitude of these coefficients is weaker than in the case of broader price-change expectations, identity, or economic-control variables. This indicates that

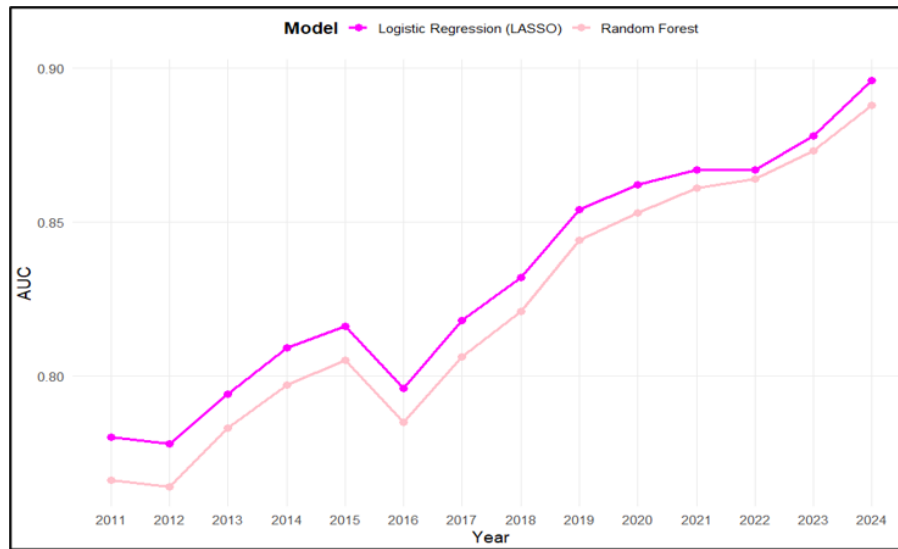
concerns about abusive price setting matter, but they play a secondary role compared with more general expectations regarding price increases after euro adoption. This finding is consistent with studies showing that fears of unfair rounding and opportunistic pricing may affect public attitudes during euro changeovers, but are often embedded in broader concerns about post-adoption price developments and purchasing power (Cornille and Stragier, 2007).

The logistic regression results complement the Random Forest findings by showing not only which subjective factors are important, but also how specific categories of these factors are associated with support for euro adoption. The results confirm the centrality of price-related expectations, while also highlighting the relevance of identity, sovereignty, and information-related dimensions in shaping attitudes toward the euro.

4.2.3. Temporal evolution of classification performance

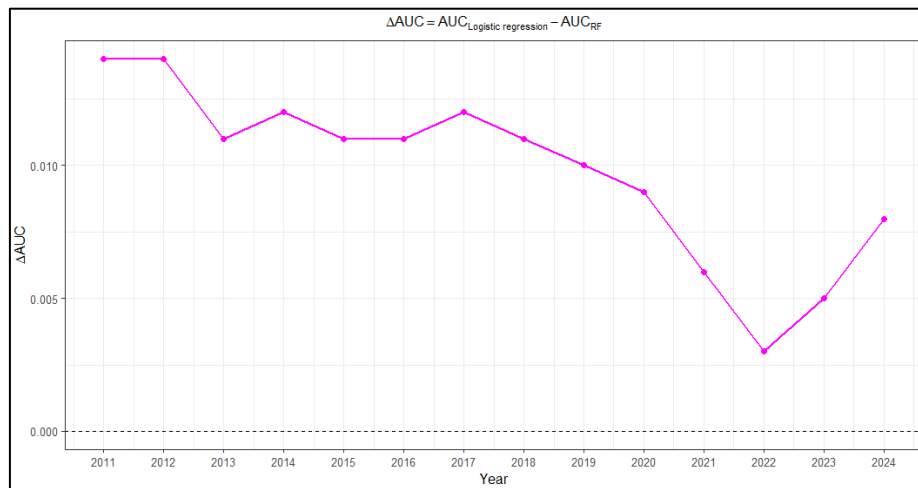
Figure no. 5 shows the evolution of model performance measured by AUC for Random Forest and LASSO-penalized logistic regression over the period 2011–2024. Both algorithms start with AUC values of approximately 0.78–0.80 and show a clear upward trend, with a temporary decrease in 2016 and a significant improvement from 2018 onwards, reaching values close to 0.90 by 2024. The advantage of logistic regression over Random Forest is small but persistent, indicating slightly higher classification performance in terms of AUC. However, this difference should not be interpreted as evidence that the underlying relationships between subjective perceptions and support for euro adoption are linear, since AUC measures classification performance rather than the functional form of associations between variables. The increase in AUC in years associated with crises and increased uncertainty, including the COVID-19 period and the subsequent rise in prices, suggests that subjective factors may become more discriminative predictors of attitudes towards the euro when macroeconomic and geopolitical conditions are turbulent (Roth *et al.*, 2015; Roth *et al.*, 2024). This pattern is consistent with H4, which suggests that subjective factors may matter more during periods of instability. Nevertheless, this interpretation should be treated with caution, as the analysis is based on repeated cross-sectional data and does not fully isolate the effect of economic instability. The observed patterns may also reflect changes in country composition over time, as well as minor variations in questionnaire structure across survey waves. The full performance values are presented in Table no. A6 and no. A7.

The performance differences between the two models (Figure no. 6) show that LASSO-penalized logistic regression consistently outperforms Random Forest over the period 2011–2024, although its advantage is relatively small, generally between 0.01 and 0.015 AUC points in most years. This suggests that, although the two models provide similar predictive results, LASSO-penalized logistic regression achieves slightly higher classification performance for the selected subjective variables in terms of AUC. This comparison refers only to model performance and does not allow conclusions about the linearity or nonlinearity of the underlying relationships between perceptions and support for euro adoption.



Source: authors' analysis in Rstudio

Figure no. 5 – Performance evolution measured with AUC



Source: authors' analysis in Rstudio

Figure no. 6 – Performance evolution measured with AUC

The early part of the period shows the largest advantage for logistic regression, while the differences gradually decrease afterwards, reaching a minimum in 2022, when the two models almost completely converge in performance. This convergence may reflect a context marked by overlapping crises, including the pandemic, rising prices, and economic uncertainty, in which attitudes became more heterogeneous and difficult to classify. In recent years (2023–2024), the differences increase again, suggesting that logistic regression regained

a slight predictive advantage. However, these patterns should be interpreted strictly as differences in algorithmic performance over time.

These results indicate that LASSO-penalized logistic regression achieves slightly higher predictive performance than Random Forest in terms of AUC. The LASSO penalty may help stabilize the coefficient estimates and reduce the effect of collinearity between subjective perceptions. AUC evaluates the ability of the model to discriminate between respondents in favour of and against euro adoption, but it does not measure the functional form of the associations between variables. Random Forest remains useful for detecting potential nonlinear patterns and interactions, but in this case it does not lead to higher AUC values.

To complement the visual comparison of yearly AUC values, we performed a one-sample t-test on the annual performance differences ($\Delta\text{AUC} = \text{AUC Logistic Regression} - \text{AUC Random Forest}$). The aim was to assess whether the average difference in classification performance between the two models is statistically different from zero over the period 2011–2024. The results indicate that the mean difference is statistically significant ($p\text{-value} = 4.642\text{e-}08$), suggesting that logistic regression tends to achieve slightly higher AUC values on average. Although the yearly differences are relatively small, this result points to a robust pattern in which the regularized logistic model has a modest performance advantage compared to the Random Forest approach.

4.3. Analysis of attitudes profiles towards the euro adoption

Table no. 2 shows that all performance indicators of the CART models, accuracy, balanced accuracy, sensitivity, specificity and AUC, are higher in 2020 than in 2016, both in the training and test samples. This improvement suggests that the structure of subjective perceptions appears more internally consistent in 2020, a year marked by inflationary pressure and heightened economic uncertainty. In such contexts, attitudes toward the euro may be more strongly associated with perceptions related to prices, economic control, and identity, resulting in more clearly differentiated patterns that are easier to classify (Hobolt and Wratil, 2015; Roth *et al.*, 2024).

Table no. 2 – Performance of the CART models

	2016		2020	
	train	test	train	test
<i>Accuracy</i>	0.7295	0.7136	0.7751	0.7650
<i>Balanced accuracy</i>	0.7271	0.7106	0.7775	0.7661
<i>Sensitivity</i>	0.6787	0.6541	0.7392	0.7214
<i>Specificity</i>	0.7755	0.7670	0.8158	0.8108
<i>AUC</i>	0.7700	0.7598	0.8227	0.8123

Source: authors' analysis

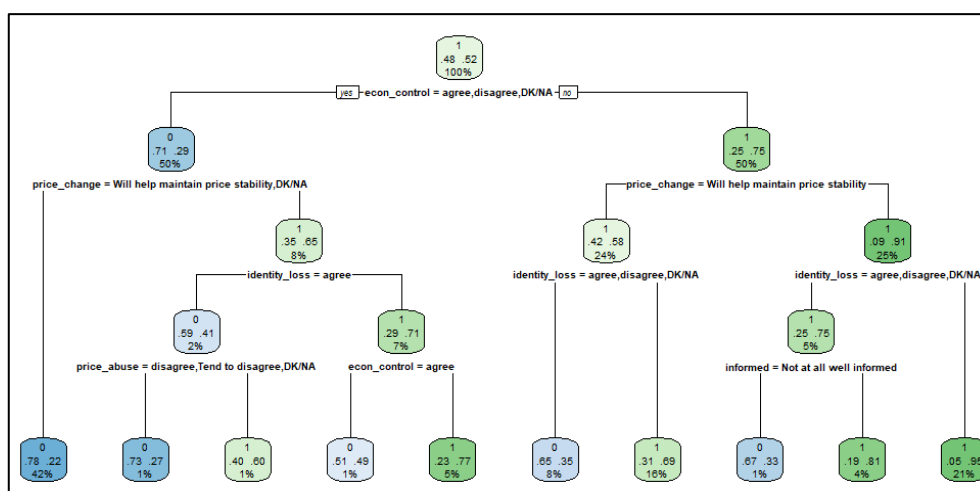
CART models, which are designed to capture perception-based segmentation, perform better when these beliefs are more polarized. The stronger discriminatory capacity in 2020, reflected in the higher AUC values in both the training and test samples, supports hypothesis H4. This may show that *subjective determinants become more discriminative in periods of heightened uncertainty*, these factors have greater explanatory power during periods of instability, when individuals depend more on affective evaluations and simplified cognitive frames. In contrast, the 2016 model, estimated in a period of relative macroeconomic calm,

reflects more diffuse attitudes and weaker separation between supportive and sceptical groups, which naturally lowers the predictive sharpness of the decision tree. The complete structure of the decision rules extracted from the CART models for the years 2016 and 2020 is presented in [Tables no. A8](#) and [no. A9](#), where both the conditions of each branch and the corresponding respondent segments can be seen.

The CART model applied for 2016 ([Figure no. 7](#)) illustrates the core mechanisms through which subjective perception's structure support or opposition to euro adoption. The central variable in the root node is Price change, indicating that expectations about prices play a key role in structuring attitudes towards euro adoption. This finding is consistent with the literature on perceived post-adoption price increases and the "euro illusion" ([Gamble *et al.*, 2002](#); [Gamble, 2006](#); [Lunn and Duffy, 2010](#)).

The left branch includes respondents who believe that euro adoption will help maintain price stability. Within this group, attitudes vary depending on perceptions of economic sovereignty. Individuals who do not associate the euro with a loss of economic control are more likely to show higher probabilities of supporting the single currency (approx. 77%). This pattern is consistent with findings suggesting that economic evaluations and confidence in institutional capacity are associated with more favourable attitudes toward the euro ([Jonung and Conflitti, 2008](#); [Banducci *et al.*, 2009](#)). When respondents perceive potential losses in economic autonomy, support tends to be lower, and this pattern is more pronounced when concerns about loss of national identity are also present, as highlighted in studies emphasizing the symbolic dimension of monetary integration in CEE countries ([Allam and Goerres, 2011](#); [Parizek, 2011](#); [Dandashly and Verdun, 2018](#)). At the same time, respondents who report higher levels of information about the euro are more likely to exhibit more favourable attitudes, a finding consistent with evidence that political information is associated with reduced reliance on identity-based concerns ([Conflitti, 2011](#); [Fernández *et al.*, 2023](#)).

The right branch of the model includes respondents who do not expect euro adoption to preserve price stability, typically corresponding to more sceptical profiles. Within this group, two main patterns can be observed. One is associated with strong concerns about the loss of economic control, corresponding to relatively low levels of support (approx. 20%). The other relates to perceptions of potential price abuses, a concern consistent with behavioural studies on post-changeover price rounding ([Cornille and Stragier, 2007](#)). Respondents who both expect price abuses and report lower levels of information tend to be less supportive overall. Conversely, those who do not expect abusive price setting and report higher levels of information are more likely to exhibit more favourable attitudes, with probabilities between 60% and 70%.



Source: authors' analysis in Rstudio

Figure no. 7 – CART tree for 2016 year

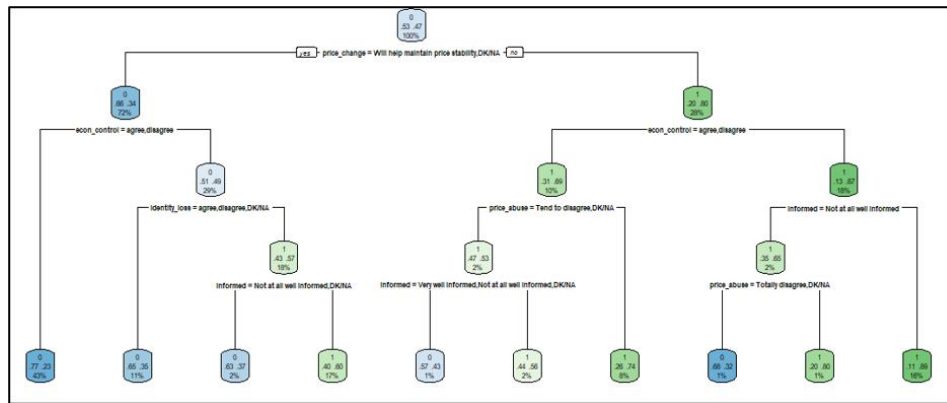
Taken together, the model highlights three interdependent dimensions associated with attitudes towards the euro in 2016. First, the economic dimension emerges as particularly important, as perceptions of price change and economic control are among the most influential predictors, reflecting the relevance of price expectations and sovereignty concerns (Hobolt and Wratil, 2015). Second, the cognitive dimension, self-perceived information, acts as a filter that moderates the impact of fears and encourages more rational evaluations of monetary integration (Fernández *et al.*, 2023). Third, the identity dimension, expressed through fears of losing national identity, systematically contributes to oppositional orientations, particularly among individuals with low information levels, confirming the long-established interplay between symbolic attachments and attitudes towards the euro (Allam and Goerres, 2011).

The CART structure highlights a clear polarization between two groups: (1) individuals with favourable economic expectations, sufficient information, and low sovereignty/identity concerns, forming the core group supportive of euro adoption; and (2) respondents marked by distrust in price change, perceived threats to economic autonomy, and low information, forming a consistently sceptical segment. These findings suggest that economic perceptions, information levels, and identity-related concerns are jointly associated with attitudes toward the euro (Roth and Jonung, 2022; Roth *et al.*, 2024), and are broadly consistent with the hypotheses derived from the literature.

The CART model for 2020 suggests that attitudes toward euro adoption are primarily associated with concerns about economic control, price expectations, and national identity. The root node of the tree is the perception that adopting the euro may lead to a loss of economic control. Respondents who do not perceive the euro as reducing national economic autonomy are more likely to be favourable toward the single currency. This pattern is consistent with previous studies indicating that sovereignty concerns are closely linked to euro-scepticism in CEE (Allam and Goerres, 2011; Parizek, 2011; Dandashly and Verdun, 2018). Within this group, support remains high when respondents also expect the euro to help maintain price stability. People who are confident that prices will remain under control have

probabilities of support above 70%. This strong effect of price expectations is consistent with the literature on the “euro illusion” and concerns about price increases after euro adoption, which suggests that people often evaluate the euro primarily through price expectations (Gamble *et al.*, 2002; Angelini and Lippi, 2006; Lunn and Duffy, 2010). Even when some respondents’ express concerns about identity or economic control, these concerns are partially mitigated when the perceived impact on prices is positive.

The model also highlights the role of national identity. Respondents who express concerns that the euro could lead to a loss of national identity are more likely to be less supportive of the single currency, even when they recognize possible economic advantages. This pattern is consistent with previous research suggesting that symbolic concerns and national identity are associated with lower support for European integration, especially in countries where sovereignty is a sensitive issue (Allam and Goerres, 2011; Dandashly and Verdun, 2018).



Source: authors' analysis in Rstudio

Figure no. 8 – CART tree for 2020 year

Another important element is the level of information. People who report being well informed about the euro tend to have more balanced attitudes and a higher likelihood of support. Information acts as a moderating factor, reducing the emotional impact of fears about price abuse or loss of identity. This is consistent with the broader literature showing that political knowledge and economic information foster more stable and rational evaluations of the euro (Conflitti, 2011; Fernández *et al.*, 2023).

The right-hand side of the tree identifies the most sceptical profile, respondents who do not expect the euro to stabilize prices and who fear losing economic control. Within this group, support for the euro falls to extremely low levels. Perceptions of price abuse further reduce support. This finding aligns with studies documenting how concerns about price abuse have shaped public reactions during previous euro changeovers (Cornille and Stragier, 2007).

One apparently counter-intuitive pattern appears in the 2020 CART model. Respondents who agree that euro adoption may involve a loss of control over economic policy, but who also expect the euro to help maintain price stability, show a very high probability of support. This result should not be interpreted as evidence that sovereignty concerns generally increase support for euro adoption. Rather, it may suggest that, for some respondents, the perceived benefit of

price stability outweighs concerns about losing national economic control. In countries where domestic economic performance or policy credibility is questioned, the transfer of monetary control to the euro area may not necessarily be perceived negatively, but rather as an acceptable trade-off associated with greater stability. Therefore, this terminal node can be interpreted as a local CART profile in which expected price stability dominates sovereignty-related concerns. However, the result should be interpreted cautiously, as decision trees may generate local patterns that do not necessarily represent general average effects.

The CART model for 2020 highlights two distinct profiles. Respondents classified as supportive of the euro are more likely to express confidence in price stability, reject the idea of losing economic autonomy, and report at least a moderate level of information. In contrast, less supportive respondents are more often associated with concerns about price stability, fears of losing economic control, and lower levels of information. The tree structure also suggests that these perception-based patterns are more clearly differentiated and easier to classify in 2020, a year marked by inflationary pressure and uncertainty. This finding is consistent with previous research indicating that subjective evaluations may become more salient in periods of crisis (Hobolt and Wratil, 2015; Roth *et al.*, 2024).

5. CONCLUSIONS

The analysis of Flash Eurobarometer data for 2011–2024 indicates a general increase in support for the euro across the EU member states observed before euro adoption, with cross-country differences. Support appears to be relatively high and stable in Romania and Hungary, while the Czech Republic and Sweden remain more cautious. This pattern is consistent with earlier evidence on heterogeneous attitudes toward the euro across Central and Eastern Europe and Northern Europe.

The empirical results are generally consistent with the proposed hypotheses. First, price expectations emerge as the main factor associated with attitudes toward euro adoption (H1, *price perceptions dominate euro adoption attitudes*) as “Price change” is the most important predictor across both Random Forest and logistic models. Second, concerns about loss of country identity and loss of economic control are systematically associated with lower support (H2, *identity and sovereignty concerns reduce support for euro adoption*), forming a second layer of relevant determinants. Third, self-perceived information about the euro appears to act as a moderating factor (H3, *self-perceived knowledge of the euro has a strong influence*), as better-informed respondents tend to be more supportive and less influenced by negative perceptions. Finally, subjective determinants appear to become more structured and predictive in periods of instability (H4, *subjective determinants become more discriminative in periods of heightened uncertainty*), as reflected in higher model performance and clearer segmentation patterns in 2020 compared to 2016. These findings should be interpreted as evidence of consistent associations rather than causal effects, given that the empirical strategy is primarily predictive and descriptive.

The results suggest three main priorities for policymakers in EU member states preparing for euro adoption. First, communication should directly target price expectations. Clear messages about actual price developments during previous monetary changes, visible consumer baskets, and transparent price monitoring can help counter the euro illusion and fears of hidden rise of prices. Second, authorities should acknowledge sovereignty and identity concerns rather than ignore them. Framing the euro as compatible with national

identity and emphasizing domestic control over key fiscal instruments can reduce resistance, particularly in CEE states, where symbolic politics around sovereignty are strong. Third, targeted information policies are important. Since better-informed respondents tend to be more supportive and less vulnerable to negative narratives, educational campaigns and accessible online tools explaining how the euro works can shape attitudes, especially among younger and less politically informed citizens. Given the heterogeneity of support across countries, these measures could be adapted to national contexts, ranging from consolidation strategies in countries with high support (e.g. Romania) to broader deliberative debates in more sceptical states (e.g. Czech Republic, Sweden).

This study has several limitations. First, it relies on repeated cross-sections rather than panel data, so the models identify associations rather than causal effects, and temporal changes may combine individual dynamics with changes in sample composition. All key variables are self-reported perceptions and may therefore be subject to bias, including the overestimation of price increases after euro adoption or of individual information levels. This is a well-known issue in research on price perceptions after euro changeovers. In addition, the modelling strategy focuses on a narrow set of subjective factors and does not model objective macroeconomic conditions or institutional trust together, even though previous work shows that these dimensions interact; this represents a direction for future research. Methodologically, Random Forest Gini importance can be influenced by the scaling of variables and the number of categories, while logistic regression imposes linear additive effects and may underrepresent complex interactions. Changes in questionnaire wording and the availability of some items only at certain stages also limit comparability over time. Future research could therefore combine the current machine learning approach with multilevel models, including economic and institutional indicators at the country level, and develop country-specific case studies to understand why similar perceptions produce different policy outcomes. This would contribute to a better understanding of how economic expectations, identity attachments, and information together shape the prospects for further euro adoption in the EU. Also, the exclusion of “Don’t know” responses from the dependent variable may introduce selection bias. These responses accounted for approximately 10.5% of the initial sample and may reflect a distinct respondent profile, characterized by lower levels of information, uncertainty, or weaker political engagement. Consequently, the findings should be interpreted as applying to respondents with a clear position on euro adoption rather than to the entire population of respondents. Future research could explicitly model “Don’t know” responses as a separate category, for example through multinomial classification, or compare the socio-demographic and informational profile of respondents with and without a definite opinion.

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ANNEX

Table no. A1 – Dataset codes used and countries included in the analysis

Flash Eurobarometer number	Data set code	Year	Countries	Target Question code
336	5771	2011		
349	5784	2012	BG, CZ, LV,	
377	5894	2013	LT, HU, PL, RO	Q14
400	5910	2014		
418	6287	2015		
440	6778	2016		
453	6859	2017		
465	6935	2018	BG, CZ, HR,	
479	7559	2019	HU, PL, RO, SE	
487	7638	2020		Q11
492	7769	2021		
508	7884	2022		
527	8758	2023	BG, CZ, HU,	
548	8824	2024	PL, RO, SE	

Source: authors' analysis

Table no. A2 – Percentages of people in favour of adopting the euro by country and year

Year	Bulgaria	Croatia	Czech Republic	Hungary	Latvia	Lithuania	Poland	Romania	Sweden
2011	59.05		13.70	60.22	45.20	45.71	46.77	67.41	
2012	55.33		14.01	62.51	46.79	46.77	45.57	67.82	
2013	54.88		15.75	57.70	43.12	43.05	38.44	69.04	
2014	53.15	57.92	17.59	67.42		48.41	47.77	74.68	
2015	58.93	54.98	29.63	62.01			46.91	71.95	33.55
2016	50.32	50.63	29.14	60.33			41.56	65.82	30.73
2017	52.71	55.50	29.21	58.21			43.54	67.58	36.76
2018	52.10	48.52	32.01	65.28			49.99	72.00	40.64
2019	49.11	52.02	38.45	69.36			45.84	65.99	39.24
2020	48.96	56.69	34.60	67.71			48.83	68.53	35.65
2021	54.78	62.59	31.17	72.40			56.91	75.39	41.50
2022	43.75	54.86	43.22	70.95			60.47	78.33	47.10
2023	51.25		42.14	74.18			54.14	70.67	56.27
2024	50.68		47.45	78.26			48.92	75.98	57.60

Table no. A3 – Variable importance of RF models

year	variable/ importance	Lose country identity	Loss control economic	Prices abuses	Euro informed	Price change
2011	Raw importance	237.59	172.90	101.79	95.48	339.62
2012		204.24	163.85	100.75	89.90	322.99
2013		232.15	150.93	103.96	98.04	359.02
2014		264.99	151.52	103.15	87.36	396.08
2015		262.56	194.90	94.90	76.36	396.41
2016		205.56	235.55	120.08	97.41	473.98
2017		314.81	248.55	110.48	107.38	419.01
2018		376.11	292.09	108.85	103.62	397.52
2019		376.21	346.12	102.79	100.86	502.06
2020		445.72	440.93	117.09	109.15	370.87
2021		383.86	384.57	97.06	87.97	490.45
2022		317.01	372.85	120.29	102.74	527.51
2023		377.29	237.35	108.80	83.64	530.10
2024		371.29	279.87	109.85	91.01	521.52
2011	Percentage importance	18.29	13.31	7.83	7.35	26.14
2012		15.53	12.46	7.66	6.84	24.56
2013		17.77	11.55	7.96	7.50	27.48
2014		19.66	11.24	7.65	6.48	29.38
2015		17.27	12.82	6.24	5.02	26.07
2016		18.15	20.80	10.60	8.60	41.85
2017		26.23	20.71	9.20	8.95	34.91
2018		29.43	22.85	8.52	8.11	31.10
2019		26.34	24.24	7.20	7.06	35.16
2020		30.04	29.72	7.89	7.36	25.00
2021		26.58	26.63	6.72	6.09	33.97
2022		22.01	25.89	8.35	7.13	36.62
2023		28.22	17.75	8.14	6.25	39.64
2024		27.03	20.38	8.00	6.63	37.97

Table no. A4 – Variable importance of logistic regression models

Year	Variable/ Importance	Lose country identity	Loss control economic	Prices abuses	Euro informed	Price change
2011	Raw importance	0.33	0.22	0.05	0.15	0.57
2012		0.31	0.18	0.05	0.15	0.49
2013		0.36	0.18	0.07	0.25	0.53
2014		0.38	0.19	0.09	0.18	0.65
2015		0.45	0.28	0.08	0.10	0.49
2016		0.36	0.31	0.00	0.22	0.51
2017		0.48	0.33	0.08	0.31	0.47
2018		0.53	0.39	0.03	0.33	0.47
2019		0.55	0.43	0.12	0.41	0.51
2020		0.59	0.52	0.10	0.42	0.46
2021		0.58	0.49	0.09	0.29	0.86
2022		0.53	0.44	0.12	0.23	0.63
2023		0.62	0.41	0.13	0.25	0.72
2024		0.58	0.46	0.05	0.35	0.84
2011	Percentage importance	12.31	8.01	1.72	5.55	21.04
2012		11.34	6.64	1.85	5.37	17.87
2013		12.56	6.14	2.54	8.87	18.28
2014		13.10	6.44	3.10	6.19	22.15
2015		13.60	8.40	2.32	3.07	15.03

Year	Variable/ Importance	Lose country identity	Loss control economic	Prices abuses	Euro informed	Price change
2016		25.59	21.89	0.36	15.94	36.23
2017		28.92	19.60	4.66	18.70	28.11
2018		30.23	22.18	1.98	18.98	26.63
2019		27.21	21.13	6.13	20.35	25.18
2020		28.24	24.63	5.01	19.96	22.16
2021		25.02	21.14	3.94	12.48	37.41
2022		27.02	22.53	6.30	11.98	32.17
2023		28.97	19.22	6.03	11.95	33.84
2024		25.36	20.37	2.10	15.25	36.92

Table no. A5 – Yearly summary of LASSO-penalized logistic regression coefficients by variable

Variable	Category	Mean coefficient	Median coefficient
Euro informed	Not at all well informed	-0.7442936	-0.7568885
	DK/NA	-0.3607903	-0.3908045
	Not very well informed	-0.3232927	-0.2792908
	Rather well informed	-0.0714146	0
Loss of country identity	Totally disagree	1.54896022	1.55974263
	Tend to disagree	1.13495144	1.14599778
	DK/NA	0.94045295	0.96496615
	disagree	0.65008435	0.6440838
Loss of economic control	Totally disagree	1.30129096	1.33065915
	Tend to disagree	1.02271179	1.01621809
	DK/NA	0.70665996	0.66685108
	disagree	0.41415857	0.45977409
Price abuses	DK/NA	0.13146433	0.23705797
	disagree	0.28514228	0.28236941
	Totally disagree	-0.0681299	-0.064118
	Tend to disagree	0.14709625	0.17305782
Price change	Will increase prices	1.96756359	1.96913314
	No impact	1.62845504	1.73520887
	DK/NA	0.60247452	0.60627269

Note: Coefficients refer to dummy-coded categories and are interpreted relative to the omitted reference category of each variable. The dependent variable is coded as 0 = against euro adoption and 1 = in favour of euro adoption. Positive coefficients therefore indicate a higher probability of supporting euro adoption relative to the reference category, while negative coefficients indicate a lower probability. Mean coefficients were computed across the annual LASSO-penalized logistic regression models for 2011–2024.

Table no. A6 – Performance of Random Forest models

Year	Sample size	Accuracy	Sensitivity	Specificity	Balanced accuracy	AUC
2011	6591	0.701	0.639	0.758	0.699	0.766
2012	6591	0.705	0.648	0.756	0.702	0.764
2013	6156	0.718	0.611	0.809	0.710	0.783
2014	6194	0.728	0.732	0.724	0.728	0.797
2015	6320	0.742	0.715	0.771	0.743	0.805
2016	6380	0.722	0.653	0.784	0.718	0.785
2017	6321	0.732	0.699	0.765	0.732	0.806
2018	6426	0.737	0.710	0.766	0.738	0.821
2019	6345	0.773	0.757	0.790	0.774	0.844
2020	6440	0.771	0.766	0.775	0.771	0.853
2021	6358	0.785	0.800	0.766	0.783	0.861

Year	Sample size	Accuracy	Sensitivity	Specificity	Balanced accuracy	AUC
2022	6415	0.795	0.800	0.788	0.794	0.864
2023	5529	0.802	0.831	0.759	0.795	0.873
2024	5603	0.820	0.853	0.769	0.811	0.888

Table no. A7 – Performance of Logistic regression models

Year	Sample size	Accuracy	Sensitivity	Specificity	Balanced accuracy	AUC
2011	6591	0.709	0.658	0.755	0.707	0.780
2012	6591	0.712	0.641	0.776	0.709	0.778
2013	6156	0.726	0.636	0.805	0.720	0.794
2014	6194	0.731	0.714	0.750	0.732	0.809
2015	6320	0.742	0.725	0.760	0.743	0.816
2016	6380	0.729	0.653	0.797	0.725	0.796
2017	6321	0.742	0.720	0.763	0.742	0.818
2018	6426	0.751	0.755	0.745	0.750	0.832
2019	6345	0.779	0.782	0.776	0.779	0.854
2020	6440	0.773	0.791	0.754	0.772	0.862
2021	6358	0.787	0.812	0.755	0.784	0.867
2022	6415	0.790	0.827	0.739	0.783	0.867
2023	5529	0.808	0.844	0.756	0.800	0.878
2024	5603	0.822	0.861	0.763	0.812	0.896

Table no. A8 – Decision rules extracted from the 2016 CART model and their interpreted profiles

Rule	Conditions	Support Probability	Interpretation
R1	price_change = “Will help maintain price stability” AND loss_econ_control = “disagree”	~77%	Positive economic expectations and no sovereignty concerns → most supportive profile
R2	price_change = “Will help maintain price stability” AND loss_econ_control = “agree” AND loss_identity = “disagree”	~51%	Belief in price stability but moderate sovereignty concerns → mixed support
R3	price_change = “Will help maintain price stability” AND loss_econ_control = “agree” AND loss_identity = “agree” AND euro_informed = “high”	~47%	Strong identity concerns softened by high information → balanced segment
R4	price_change = “Will help maintain price stability” AND loss_econ_control = “agree” AND loss_identity = “agree” AND euro_informed = “low”	~26%	Identity threat and low information → clearly sceptical
R5	price_change = “Will NOT maintain price stability” AND loss_econ_control = “agree”	~25%	Negative price expectations and sovereignty concerns → strongly sceptical
R6	price_change = “Will NOT maintain price stability” AND loss_econ_control = “disagree” AND price_abuse = “disagree” AND euro_informed = “high”	~60–70%	Reject price-abuse fears and possess high information → unexpectedly favourable
R7	price_change = “Will NOT maintain price stability” AND loss_econ_control = “disagree” AND price_abuse = “agree” AND euro_informed = “low”	~20%	Fear of abuses and low information → most sceptical profile

Table no. A9 – Decision rules extracted from the 2020 CART model and their interpreted profiles

Rule	Conditions	Support Probability	Interpretation
R1	loss_econ_control = <i>disagree</i> AND price_change = <i>Will help maintain price stability</i>	~85%	Very confident group: no sovereignty concerns + belief in price stability → strongest support
R2	loss_econ_control = <i>disagree</i> AND price_change = <i>Will NOT help maintain price stability</i> AND identity_loss = <i>disagree</i>	~31%	Price sceptics but no identity concerns → moderate but hesitant support
R3	loss_econ_control = <i>disagree</i> AND price_change = <i>Will NOT help maintain price stability</i> AND identity_loss = <i>agree</i> AND euro_informed = <i>high</i>	~67%	Identity-concerned yet informed → information moderates scepticism
R4	loss_econ_control = <i>disagree</i> AND price_change = <i>Will NOT help maintain price stability</i> AND identity_loss = <i>agree</i> AND euro_informed = <i>low</i>	~20%	Low information and identity threat → clearly sceptical
R5	loss_econ_control = <i>agree</i> AND price_change = <i>Will help maintain price stability</i>	~95%	Believe in price stability despite sovereignty concerns → surprisingly strong support
R6	loss_econ_control = <i>agree</i> AND price_change = <i>Will NOT help maintain price stability</i> AND identity_loss = <i>disagree</i>	~42%	Price sceptics but no identity fears → divided segment
R7	loss_econ_control = <i>agree</i> AND price_change = <i>Will NOT help maintain price stability</i> AND identity_loss = <i>agree</i>	~29%	Sovereignty, identity concerns and price pessimism → stable sceptical profile