

Louvain School of Management

**“ To what extent do France’s
current fiscal and macro-financial
fundamentals indicate a
vulnerability to a sovereign debt
crisis over the next two years? ”**

Author(s): James Oswald
Supervisor(s): Bertrand Candelon
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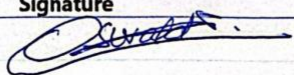
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1. Introduction

Over the past decades, sovereign debt crises have recurrently challenged the stability of both advanced and emerging economies. From the Latin American defaults of the 1980s to the Eurozone turmoil of the early 2010s, these episodes have revealed how fiscal imbalances, macro-financial vulnerabilities and institutional weaknesses can interact to trigger sudden losses of market confidence. While sovereign crises were once perceived as phenomena confined to emerging markets, the global financial crisis of 2008 and the subsequent European sovereign debt crisis profoundly reshaped this view. They demonstrated that even highly developed economies can face severe funding stress when debt dynamics, investor expectations and global financial conditions deteriorate simultaneously.

In this broader context, France has increasingly attracted attention in recent years. Long considered as one of the most stable and creditworthy economies in the Eurozone, France is now confronted with a combination of factors that question the sustainability of its fiscal trajectory. Public debt has exceeded 110% of GDP and persistent deficits, consistently above 3-4% of GDP, indicate structural fiscal imbalances rather than temporary deviations. At the same time, the country faces weak potential growth, rising interest expenditures and an erosion of fiscal space. These pressures have been reflected in the successive downgrades of France's sovereign credit rating and in growing concerns expressed by international institutions regarding the long-term trajectory of debt and deficits.

Beyond fiscal fundamentals, France's situation must also be understood through the lens of its macro-financial environment. As a member of the Eurozone, France borrows in a currency it does not individually control and its sovereign bonds are priced within a monetary union marked by incomplete fiscal integration and ongoing risks of financial fragmentation. This architecture exposes member states to confidence shocks and self-fulfilling dynamics, as liquidity crises cannot be countered by national central banks. At the same time, the crisis-management toolkit has evolved substantially since 2010-2012: ECB instruments such as OMT, PEPP and the Transmission Protection Instrument, together with steps toward banking union and temporary fiscal risk-sharing, now provide a stronger backstop against disorderly market dynamics. Moreover, France hosts one of the largest systemic banking sectors in the world, but recent assessments indicate that French banks remain well capitalised and resilient to severe stress scenarios. Thus, it must be analysed within a broader institutional, financial and market-based framework that accounts for both vulnerabilities and stabilising factors.

These evolving concerns have motivated the renewed interest in early-warning systems and empirical models aimed at quantifying sovereign crisis risk. The academic literature highlights that crises are rarely caused by a single driver, instead, they emerge from interactions between excessive debt accumulation, slow growth, tightening financial conditions and shifts in global risk appetite. Importantly, this research also shows that sovereign risk often displays non-linear behavior: once certain thresholds are crossed, whether in terms of debt levels, fiscal fatigue or market sentiment, the probability of crisis can increase abruptly. In this context, assessing France's vulnerability requires an empirical approach capable of capturing both fundamental deterioration and the broader financial conditions under which crises tend to materialize.

Against this backdrop, this thesis addresses the following research question:

« To what extent do France's current fiscal and macro-financial fundamentals indicate a vulnerability to a sovereign debt crisis over the next two years? »

This question is both timely and policy-relevant. On the one hand, France's high public spending, structurally weak primary balances and rising interest burden raise concerns about the trajectory of its debt and justify a careful assessment of sovereign risk. On the other hand, the resilience of the Eurozone, the presence of the ECB as a backstop, the depth and liquidity of French financial markets may help mitigate the immediate risk of a crisis and help contain stress at moderate levels. The goal of this research is therefore not to predict default, nor to argue that a crisis is inevitable, but rather to measure France's relative vulnerability based on historical patterns observed across economies.

To answer this question, the thesis draws on the theoretical and empirical literature on sovereign debt sustainability, crisis mechanisms and early-warning models. It constructs an econometric framework based on a panel of the EU member states to estimate the probability of sovereign debt stress as a function of fiscal indicators, macroeconomic conditions, financial market variables, global factors and institutional characteristics. This empirical model is then used to generate crisis probability estimates for France under several macroeconomic scenarios, including official projections, historical trend plans and adverse shock scenarios. By comparing France's predicted vulnerability with historical crisis episodes, the analysis provides a quantitative assessment of whether France's current trajectory places it within zones historically associated with elevated crisis risk.

The structure of the thesis is as follows. Section 2 develops the theoretical framework, discussing the concepts of debt sustainability, fiscal space, multiple equilibria, rollover risk and the institutional specificities of the Eurozone. Section 3 presents a detailed review of the academic and institutional literature on sovereign debt crises, early-warning models and the determinants of crisis vulnerability. Section 4 describes the data and variables used in the empirical study, while section 5 outlines the econometric methodology and modeling strategy. Section 6 presents the empirical results and scenario analysis for France. Finally, section 7 discusses the implications of these findings for fiscal policy, sovereign risk management and European economic governance and section 8 critically examines the limitations of the empirical framework and data. The thesis concludes with final remarks in section 9.

2. Theoretical framework

This section develops the conceptual tools used in the thesis to analyse sovereign risk, drawing on the theoretical literature and on the specific features that shape crisis dynamics in advanced economies and monetary unions. While these mechanisms highlight potential sources of fragility, they also point to important stabilising forces, particularly relevant for high-income countries such as France, ensuring that crisis risk must be understood as probabilistic rather than deterministic. Together, these elements form the analytical base upon which the empirical part of this thesis is constructed.

2.1. Debt dynamics and the intertemporal budget constraint

Sovereign debt sustainability fundamentally rests on the intertemporal budget constraint of the government. In a frictionless world with rational agents and full commitment, a government can issue debt today as long as the present discounted value of future primary surpluses equals the existing debt stock. In such models, solvency is a matter of simple arithmetic: as long as expected surpluses match obligations, sovereign debt is sustainable.

Thus, debt evolves according to the familiar equation:

$$\Delta d_t = (r_t - g_t)d_{t-1} - pb_t,$$

where d_t is the debt-to-GDP ratio, pb_t the primary balance and $r_t - g_t$ the interest-growth differential.

A central determinant of sustainability is the interest-growth differential ($r - g$). When the real interest rate is below the growth rate, debt tends to stabilize or even decline for a given primary balance. Conversely, when r exceeds g , debt dynamics become explosive unless the government generates sufficiently large primary surpluses. Recent debates emphasize that prolonged periods of low interest rates can create the appearance of sustainable high debt levels. However, the sustainability of such a regime depends critically on risk premia: if market perceptions shift, the interest rate may increase abruptly, pushing the country into an unsustainable trajectory. Thus, the condition $r < g$ is neither permanent nor guaranteed. But in reality governments do not possess perfect commitment. Policies can change following elections, economic shocks or political pressures. This introduces a wedge between the theoretical intertemporal budget constraint and practical debt sustainability. Modern sovereign debt theory shows that governments may accumulate excessive debt even without shocks, because future policymakers may have incentives to deviate from planned fiscal paths. Debt sustainability therefore depends not only on mechanical fiscal arithmetic but also on credibility, commitment and expectation formation.

2.2. Fiscal space, fiscal fatigue, debt limits and debt overhang

Beyond the intertemporal budget constraint, a broader conceptual framework centers around fiscal space, the room available to a government to raise primary surpluses before debt becomes unsustainable. Fiscal space is not a fixed number, it depends on the economic structure, institutions, credibility and market expectations. Empirical research finds that the ability to generate primary surpluses diminishes once debt reaches high levels, a phenomenon known as fiscal fatigue. In such cases, the government struggles to increase revenues or reduce expenditures in response to rising debt, implying that the marginal fiscal effort weakens as debt climbs.

Related to fiscal fatigue is the concept of debt limits, the maximum level of debt that remains with long-term solvency. These limits vary across countries: those with strong institutions, large domestic investor bases or high credibility can sustain higher levels of debt, while countries with weak institutions or volatile revenue streams face stricter limits.

A third key concept is the debt overhang, defined as a situation where debt is so high that it depresses investment, reduces growth and creates a self-reinforcing cycle. Historical evidence shows that countries trapped in long-lasting high-debt episodes tend to experience subdued growth, reduced fiscal flexibility and a heightened risk of market re-pricing. Thus, not only high debt, but persistent high debt can significantly affect crisis vulnerability.

2.3. Multiple equilibria, rollover risk and self-fulfilling crises

A fundamental question in sovereign debt theory is whether crises originate primarily from deteriorating fiscal fundamentals or from shifts in investor expectations. As shown by Cole and Kehoe (2000), both forces interact and expectations can play an independent causal role, especially when debt levels are high and refinancing needs are large.

Sovereign debt markets may exhibit multiple equilibria. In these environments, investor beliefs determine which equilibrium prevails. A central ingredient in this mechanism is rollover risk. Although sovereign debt is often long term, governments refinance a sizable share of it each year. For this reason, they remain continuously exposed to market sentiment.

When investors expect the sovereign to remain solvent, they accept low yields and refinancing proceeds smoothly but when they doubt its capacity or willingness to repay, risk premia rise sharply, potentially pushing the debt onto an unsustainable path. A temporary liquidity shock can therefore escalate into a self-fulfilling crisis, even if the country is fundamentally solvent. Expectations become reality. Liquidity crises (due to temporary difficulties in refinancing) may thus transform into solvency crises simply because the government is unable to refinance at reasonable rates before confidence is restored. This mechanism differs fundamentally from corporate finance. Private firms can be liquidated and creditors can recover residual value. Sovereigns cannot be wound down and their ability to repay depends heavily on future fiscal capacity and the willingness of markets to continue financing them. As a result, expectations and coordination among investors play a disproportionate role in sovereign debt markets.

The implication is that the distinction between sustainable and unsustainable debt is not determined solely by indicators such as the debt-to-GDP ratio or the deficit. It also depends on the expectations that investors form about the government's future ability and willingness to repay. Sovereign debt sustainability is therefore partly a coordination problem: if investors collectively adopt a pessimistic view, yields can rise abruptly, pushing the country into the "bad" equilibrium and causing a crisis even when fundamentals alone would not justify it.

2.4. The role of global financial conditions and market sentiment

Sovereign debt crises in the modern era often result from a combination of domestic vulnerabilities and global financial cycle forces. These include changes in global risk appetite, shifts in liquidity preferences and fluctuations in international capital flows.

During periods of heightened uncertainty, investors typically exhibit flight-to-quality and flight-to-liquidity behavior. This means reallocating portfolios toward the safest and most liquid sovereign assets, typically U.S. Treasuries or German Bunds. As a result, yields on riskier sovereign bonds can increase sharply, even without any change in domestic fundamentals.

Global factors matter because sovereign bond markets are increasingly integrated. Risk premia now reflect not only local fiscal conditions but also:

- global monetary policy,
- global financial stress indicators,
- cross-border banking exposure,
- liquidity conditions in international markets,
- rating agency assessments.

These dynamics imply that even fiscally sound countries may face sudden increases in spreads if global conditions deteriorate. Conversely, high-debt countries may avoid stress as long as global financial conditions remain favorable. Therefore, sovereign risk is partially endogenous to global markets, blurring the distinction between domestic and external sources of vulnerability.

2.5. The banking–sovereign nexus (“Doom Loop”)

A distinctive feature of modern sovereign debt crises is the bidirectional link between sovereign and banking sector risks. Banks typically hold substantial amounts of domestic sovereign debt as part of their liquidity buffers and regulatory requirements. This tight interdependence creates two mechanisms of contagion:

From sovereign to banks:

If the sovereign becomes riskier, the value of sovereign bonds on banks' balance sheets declines. This weakens bank capital, increases funding costs and can trigger broader financial stress. Banks may respond by reducing lending, which harms the economy and the fiscal balance, further destabilizing the sovereign.

From banks to sovereign:

When banks face distress, governments often intervene through recapitalizations, guarantees or asset protection schemes. These interventions increase public debt and may trigger uncertainty about long-term solvency. If banking rescues are large, the sovereign can itself enter a crisis.

This feedback loop is known as the doom loop and was central to the Eurozone crisis.

2.6. Institutional foundations of sovereign risk in the Eurozone

The Eurozone possesses unique institutional features that fundamentally shape sovereign risk dynamics. Unlike countries with their own currencies (e.g. United States, United Kingdom or Japan), Eurozone members do not control monetary policy individually, issue debt in a currency they cannot unilaterally create and operate under fiscal and financial structures that remain only partially integrated. These characteristics create structural vulnerabilities that influence how markets price sovereign risk, especially during periods of stress.

2.6.1. Evolution of the sovereign lender of last resort function

Before 2012, the ECB did not explicitly commit to preventing self-fulfilling liquidity crises in sovereign bond markets. This absence of a sovereign lender of last resort made member states highly vulnerable to shifts in investor sentiment, as even moderate changes in expectations could trigger rapid increases in spreads.

The introduction of Outright Monetary Transactions (OMT) in 2012 fundamentally improved the Eurozone's crisis-management framework. Although never activated, OMT served as a powerful signal that the ECB could intervene to counter disorderly market dynamics under strict conditionality. During the COVID-19 shock, the Pandemic Emergency Purchase Programme (PEPP) further reinforced the ECB's backstop by allowing flexible and large-scale sovereign bond purchases.

Despite these advances, the ECB's support remains discretionary and conditional and therefore differs from the unconditional backstops available in countries issuing debt in their own currency (e.g. the US Federal Reserve or the Bank of England). As a result, Eurozone sovereigns continue to face higher sensitivity to confidence shocks, especially when fiscal trajectories appear uncertain.

2.6.2. Fragmentation of financial markets

Eurozone sovereign bond markets remain segmented along national lines. Unlike in a fully integrated capital market, risk-free assets are not perfectly substitutable across countries and investors frequently differentiate between member states based on fiscal strength, political stability and perceived redenomination risk. Fragmentation intensifies in periods of financial stress, as cross-border capital flows retrench, banks reduce their exposure to sovereigns outside their home jurisdiction, interbank lending becomes increasingly domestically concentrated and sovereign spreads diverge even when underlying fundamentals remain comparable.

Although the ECB has attempted to counter these dynamics through instruments such as OMT, the PEPP and the more recent Transmission Protection Instrument (TPI), these interventions remain discretionary and conditional. Financial fragmentation thus persists as a structural characteristic of the monetary union, shaping both sovereign risk pricing and the transmission of financial shocks.

2.6.3. Procyclical fiscal rules

The Eurozone's fiscal framework, centred on the Stability and Growth Pact and the Fiscal Compact, has been widely criticised for its procyclical nature. These rules can constrain member states' ability to conduct countercyclical fiscal policy, particularly during downturns,

when the need for fiscal support is greatest. In practice, countries may be compelled to implement fiscal consolidation prematurely in order to comply with deficit and debt targets, thereby deepening recessions, weakening growth and worsening debt dynamics. Recent reforms adopted in 2023-2024 have sought to increase flexibility by introducing medium-term expenditure paths and more country-specific adjustment plans. Nevertheless, implementation remains politically complex and the underlying tension between fiscal discipline and macroeconomic stabilisation persists. As a result, high-debt countries such as France, Italy or Spain continue to operate under rules that may limit their capacity to respond adequately to adverse shocks.

2.6.4. Limited risk-sharing mechanisms

Unlike federal systems such as the United States, the Eurozone lacks large-scale automatic stabilisers capable of absorbing asymmetric shocks across regions. The absence of a permanent central fiscal capacity, the temporary nature of instruments such as NextGenerationEU and the lack of a common safe asset restrict the scope for collective macroeconomic stabilisation. Moreover, the banking union remains incomplete, particularly in the absence of a European Deposit Insurance Scheme (EDIS), while the capital markets union progresses slowly, limiting private risk-sharing across borders.

These institutional gaps mean that economic shocks are predominantly absorbed at the national rather than supranational level, placing greater pressure on domestic fiscal balances. Countries with weak growth prospects, high debt burdens or limited fiscal space, such as France, are therefore more exposed to market pressure, as investors recognise that the Eurozone architecture provides only partial mechanisms for risk-sharing.

2.7. Conclusion

The mechanisms discussed in this section highlight why sovereign crises arise and under which conditions vulnerabilities may escalate. They also show that crisis risk is inherently non-linear and shaped by both fundamentals and expectations, especially in a monetary union. This motivates the use of empirical early-warning models capable of capturing these non-linear dynamics, incorporating global financial variables and distinguishing between high-debt countries that remain stable and those that enter distress.

3. Literature review

The literature on sovereign debt crises is vast and interdisciplinary, spanning macroeconomics, international finance, political economy and economic history. This review synthesizes the main strands relevant to assessing the crisis vulnerability of advanced economies, with a particular focus on France. It is organized into five thematic blocks: (1) determinants of sovereign debt crises, (2) empirical early-warning indicators, (3) lessons from historical crises, (4) insights from the Eurozone sovereign debt crisis and (5) France-specific assessments. Together, these bodies of work build a comprehensive understanding of the mechanisms by which sovereign debt can become unsustainable and how these mechanisms apply to the French case.

3.1. Determinants of sovereign debt crises

3.1.1. Fiscal fundamentals and debt sustainability

A central strand of the literature argues that sovereign debt crises arise when fiscal fundamentals (debt, deficits and growth prospects) become inconsistent with long-term solvency. The foundational view emphasizes that governments must satisfy an intertemporal budget constraint in which future primary surpluses offset current debt accumulation. When

debt grows faster than the economy or when governments systematically fail to generate primary surpluses, the probability of crisis increases.

Manasse and Roubini (2009) identify a set of fiscal indicators most associated with crisis episodes. High public debt relative to GDP is consistently correlated with higher crisis risk, although the precise threshold varies by country and institutional setting. Deficit persistence, weak primary balance reaction functions and an unfavorable interest-growth differential ($r - g$) further exacerbate vulnerabilities. Growth prospects play a critical role: low growth both reduces fiscal revenues and increases the debt-to-GDP ratio mechanically, making sustainability more fragile.

However, Blanchard (2019) challenges the traditional idea that high public debt is always dangerous, demonstrating that when interest rates are consistently lower than the nominal growth rate, debt can be sustainable even without primary surpluses because $r < g$ observed in advanced economies creates fiscal space and reduces the economic cost of debt. This does not mean that all debt is risk-free: Blanchard points out that interest rate shocks, demographic aging and political uncertainty can quickly erode this structural advantage.

Beyond static measures, a growing body of evidence stresses the importance of debt trajectories rather than levels. Countries with rapidly rising debt, even from moderate starting points, tend to experience market pressure earlier than those with stable but high debt. This supports the idea that sovereign risk is influenced by the expected path of debt accumulation and the credibility of future fiscal consolidation.

3.1.2. Non-linearities, fiscal limits and sustainability thresholds

Empirical research has shown that the relationship between debt accumulation and sovereign risk is strongly non-linear. Rather than increasing smoothly with higher debt, crisis probability accelerates once specific thresholds are reached, as documented by Ghosh et al. (2013), Ostry et al. (2010) and Reinhart and Rogoff (2012). These contributions demonstrate that countries with debt levels between roughly 80% and 110% of GDP face a disproportionately higher likelihood of market stress, especially when fiscal policy does not respond sufficiently to rising debt. It is important to note that these thresholds are not universal and depend heavily on interest-growth dynamics, institutional credibility and market expectations.

This empirical evidence has given rise to the notions of fiscal space and debt limits, understood as the maximum debt level a government can sustain without triggering increases in risk premia or losing market access. Fiscal space varies widely across countries, depending on institutional strength, growth potential and credibility. Importantly, high-debt economies often exhibit fiscal fatigue, a weakening of the fiscal reaction function at elevated debt levels, implying that governments become less able to deliver the primary surpluses required to stabilise debt.

Taken together, these findings highlight that sovereign risk cannot be assessed solely through the current level of debt but must account for how debt responds to macroeconomic conditions, political constraints and market expectations. The empirical literature therefore reinforces the idea that advanced economies with large and persistent deficits are particularly exposed to regime shifts once debt approaches its effective limit.

3.1.3. Crisis mechanisms: fundamentals versus expectations

Another strand of the empirical literature identifies the interaction between fundamentals and expectations as a key driver of crisis dynamics. Building on the theoretical insights of Cole and Kehoe (2000), several empirical studies show that sovereign stress can arise even without major changes in fundamentals when investors simultaneously revise their expectations (e.g. De Grauwe & Ji, 2013). Liquidity shortages may quickly evolve into solvency concerns when a large share of debt must be rolled over, as documented by Reinhart and Rogoff (2009), who highlight the role of confidence shocks and market coordination failures. These findings

suggest that sovereign spreads embed both structural fiscal conditions and shifts in market sentiment and that countries with high refinancing needs are particularly exposed to expectation-driven dynamics.

3.2. Early-warning indicators and empirical prediction models

3.2.1. Indicators preceding crises

Empirical studies such as Kaminsky, Lizondo and Reinhart (1998) have attempted to identify patterns that systematically precede currency crises (but their work provides a methodological framework that can be applicable to sovereign crises). Early-warning indicator models, pioneered for currency crises and later adapted to sovereign debt, examine macroeconomic, fiscal and financial variables that exhibit abnormal behavior before crisis episodes. Typical indicators include:

- rapid increases in public debt,
- large and persistent primary deficits,
- rising external imbalances,
- excessive credit growth,
- exchange rate misalignments,
- sudden increases in spreads.

These indicators are usually interpreted through threshold models: if a variable crosses a certain critical limit, the probability of crisis rises.

3.2.2. Early-Warning models in the sovereign debt literature

Many empirical models employ binary response models such as logit or probit to estimate crisis probabilities as a function of explanatory variables. These models have shown that fiscal indicators, external imbalances and global financial conditions are statistically significant predictors of sovereign stress. Nonlinearities are central: the marginal effect of debt on crisis probability is much larger when debt is already high or when growth is weak. Panel models with country fixed effects are widely used to control for unobserved heterogeneity, while interaction terms capture how combinations of variables (e.g. high debt and low growth) are particularly dangerous.

3.2.3. Machine learning and hybrid predictors

More recent contributions, particularly Fuertes, Kalotychou and Saka (2015), incorporate machine-learning techniques such as random forests or gradient boosting. These tools can capture complex nonlinear patterns and interactions among variables that traditional models underestimate. Hybrid models that combine macro fundamentals and market-based indicators (e.g. spreads, implied volatility, CDS prices) perform significantly better than purely fundamental-based models. Market indicators are especially useful for capturing real-time changes in investor sentiment and contagion effects.

3.2.4. Global risk factors

A growing body of empirical work emphasises the central role of global financial conditions in shaping sovereign spreads. Studies by Longstaff et al. (2011), Ang and Longstaff (2013) and González-Rozada & Levy Yeyati (2008) show that fluctuations in global risk aversion, typically proxied by the Volatility Index, explain a large share of the variation in sovereign borrowing costs, often independently of domestic fundamentals. They also demonstrate that a significant portion of sovereign risk actually corresponds to a risk premium linked to the probability of extreme events (fat tails). These findings confirm that sovereign risk in advanced economies is increasingly driven by the global financial cycle: during periods of

heightened uncertainty, investors engage in flight-to-quality and flight-to-liquidity behavior, amplifying pressures on highly indebted states.

3.3. Lessons from historical sovereign debt crises

3.3.1. Common patterns across centuries

As shown by Reinhart & Rogoff (2009), historical analyses of sovereign debt crises reveal that the same mechanisms tend to reappear across time and geography. Crises often occur following periods of optimism, easy credit and high leverage followed by a sudden reversal in market conditions. This cyclical nature underscores the role of behavioral dynamics, investor sentiment and liquidity shortages.

Classic studies emphasize the role of manias and panics, showing that financial systems are prone to overextension and abrupt corrections. Historical episodes, ranging from 19th-century defaults to the 1980s Latin American debt crisis, illustrate that sovereign crises rarely result solely from mechanical fiscal deterioration. According to Eichengreen and Portes (1989), sovereign debt crises do not arise in isolation, rather, they result from the interaction between structural weaknesses (deficits, external debt, fragile banking systems) and external shocks (rising global interest rates, falling commodity prices), as illustrated by the crises of the 1980s.

3.3.2. Costs of defaults and restructuring

Trebesch and Zabel (2017) show that sovereign default is extremely costly. Hard defaults, characterized by large haircuts or unilateral actions, lead to sharp contractions in output, credit freezes and capital flight. Soft defaults often entail lower short-term costs but can create long-term distortions and credibility problems.

These findings explain why governments often try to avoid explicit default through fiscal consolidation, financial repression or seeking international assistance.

3.3.3. Role of external shocks

Historical crises also reveal the importance of external shocks, such as sudden increases in global interest rates, commodity price collapses or international financial turmoil. Even fiscally prudent countries may experience distress when exposed to adverse global conditions. These insights contribute to understanding why high-debt advanced economies today, particularly those reliant on foreign investors, remain sensitive to global volatility.

3.4. Lessons from the Eurozone sovereign debt crisis

3.4.1. Institutional fragility of the Eurozone

A key lesson from the Eurozone sovereign debt crisis is that the institutional architecture of the monetary union can amplify, rather than mitigate, sovereign stress. Empirical studies show that, because member states issue debt in a currency they do not control, markets perceived them as inherently more vulnerable to liquidity shocks (De Grauwe & Ji, 2013). During 2010–2012, the absence of a credible sovereign lender of last resort allowed self-fulfilling dynamics to emerge, with spreads increasing sharply even in countries where fundamentals had not deteriorated significantly.

Another important lesson is that institutional responses can reshape market expectations. The announcement of the ECB's Outright Monetary Transactions (OMT) programme in 2012 dramatically reduced fragmentation pressures despite no purchases eventually taking place, demonstrating that credible backstops matter as much as actual interventions. Later instruments such as the PEPP further reinforced the ECB's capacity to prevent disorderly market dynamics. However, the literature emphasises that these tools remain conditional and

discretionary, implying that the monetary union still lacks an unconditional backstop comparable to that of fully sovereign monetary systems.

Overall, the crisis revealed that institutional fragility, rooted in incomplete fiscal integration and the initial absence of a sovereign lender of last resort, remains a structural feature of the Eurozone. This fragility continues to shape how markets price sovereign risk, particularly for high-debt countries.

3.4.2. Divergence of sovereign spreads

A defining feature of the Eurozone sovereign debt crisis was the pronounced divergence of sovereign spreads across member states, despite relatively similar fiscal fundamentals at the onset of the turmoil. As highlighted by Wyplosz (2019), this divergence reflected not only market reactions to country-specific vulnerabilities but also deeper structural flaws in the governance of the monetary union. In the absence of a genuine fiscal union, with procyclical and often ineffective fiscal rules, investors reassessed sovereign risk heterogeneously, leading to asymmetric increases in borrowing costs even when differences in debt or deficits did not fully justify such repricing. The uncertainty surrounding the euro's irreversibility, combined with the limited stabilisation capacity of the European budget, amplified these movements and made spreads highly sensitive to changes in confidence.

Allegret and Raymond (2023) further demonstrate that spread divergence cannot be explained by public debt metrics alone. Using a Self-Organizing Map (SOM) approach, they show that countries clustered into distinct risk groups during the crisis based on a combination of macroeconomic, financial and institutional indicators. Their findings reveal that vulnerabilities stemmed from the interaction between structural imbalances, financial fragilities and weaknesses in European economic governance. As a result, spreads widened disproportionately in countries where liquidity conditions deteriorated, market sentiment weakened and institutional anchors appeared fragile, even when initial debt levels were moderate, as in Spain or Ireland.

3.4.3. Banking-sovereign loop in Europe

Empirical evidence from the Eurozone crisis highlights the strength of the banking-sovereign nexus. Research by Acharya, Drechsler and Schnabl (2014) shows that banks with large exposures to domestic sovereign bonds experienced severe balance-sheet deterioration as spreads increased, which in turn reduced credit supply and deepened recessions. At the same time, governments were forced to intervene to stabilise distressed financial institutions, increasing public debt and reinforcing the feedback loop. Studies such as Alter & Schüller (2012) empirically document how sovereign stress and banking fragility reinforced one another in countries like Ireland, Spain and Italy.

3.4.4. Trajectories and structural divergences

Bhimjee and Kilic (2023) show that crisis countries followed unsustainable debt trajectories, where debt rose faster than growth and primary surpluses were insufficient. Structural factors, such as low productivity growth, rigid labor markets and inefficient public spending, played a key role in shaping these trajectories. This explains why some countries have fallen into a sovereign crisis while others have escaped it.

3.5. France in the sovereign debt literature

France occupies a distinctive position in the literature on sovereign risk. On the one hand, it displays several long-standing fiscal and macro-financial vulnerabilities that are typically associated with elevated crisis probability. On the other hand, it benefits from strong institutional, financial and market-based stabilisers that significantly reduce the likelihood of abrupt sovereign stress. This subsection synthesizes the academic and institutional literature,

combining empirical findings, theoretical insights and the IMF's 2025 Article IV assessment to provide a comprehensive view of France's sovereign risk profile.

3.5.1. Fiscal and macroeconomic weaknesses

Institutional assessments underline that France exhibits persistent structural weaknesses that limit its fiscal space.

First, France has recorded uninterrupted primary deficits since 2007, with the primary balance estimated at -3.8% of GDP in 2024 and projected to remain negative at around -3.5% in 2027. Sustained primary deficits constrain the country's ability to stabilise its debt ratio, particularly in an environment where interest-growth differentials have turned positive.

Second, public debt is high and rising. General government debt reached 113.1% of GDP in 2024 and the IMF projects a further increase from 116% to nearly 121.5% between 2025 and 2027 under current policies. It shows no sign of stabilisation without additional measures. The IMF's debt sustainability analysis stresses that France's upward debt trajectory makes its public finances increasingly sensitive to changes in interest rates and growth.

Third, potential growth remains modest, estimated between 0.8% and 1% annually through 2027, below the Eurozone average and insufficient to offset persistent deficits. Weak productivity growth, demographic pressures and structural rigidities in labour and product markets weigh on long-term growth prospects.

Fourth, public expenditure is structurally high, representing 57.2% of GDP in 2024. We can note that France has the highest ratio in the OECD in 2023 with 56.87% of GDP. The Cour des comptes (2024) highlights that more than 80% of spending is non-cyclical and difficult to adjust, which limits France's capacity to undertake rapid fiscal consolidation.

Finally, France relies substantially on foreign investors, who hold close to 60% of its sovereign debt according to the IMF. This reliance increases exposure to global market sentiment, volatility in risk premia and sudden-stop dynamics.

Taken together, these factors reduce France's fiscal room for manoeuvre and increase its vulnerability to adverse shocks. Yet vulnerabilities alone do not imply imminent distress, they must be understood within the broader euro-area institutional environment and the behavior of financial markets.

3.5.2. Market discipline and investor behaviors

A large body of empirical research shows that financial markets play a central role in shaping sovereign risk by enforcing fiscal discipline and pricing changes in economic fundamentals, political credibility and global financial conditions. Studies such as Bernoth, von Hagen and Schuknecht (2012) and De Grauwe and Ji (2013) emphasise that Eurozone sovereigns with high debt and persistent fiscal imbalances, such as France, are particularly sensitive to shifts in market sentiment. Because France has substantial refinancing needs, even small doubts regarding medium-term consolidation or political reform capacity can trigger rapid adjustments in yields.

Historical evidence supports this view: during the Eurozone sovereign debt crisis, French spreads widened despite stable fundamentals, suggesting that expectations-driven dynamics and contagion effects played a meaningful role in market pricing. Moreover, movements in French yields frequently reflect global factors: increases in international risk aversion, proxied by spikes in the Volatility Index (VIX), tend to raise French sovereign spreads disproportionately, as foreign investors adjust their portfolios.

Liquidity considerations reinforce these patterns. While France benefits from one of the deepest sovereign bond markets in the Eurozone, investors during stress episodes reallocate toward the safest and most liquid assets, primarily German Bunds. As a result, French spreads tend to rise more sharply when concerns about fiscal slippage intensify, consistent with the findings of Beber, Brandt and Kavajecz (2009).

The literature therefore highlights that France's sovereign risk is shaped not only by fiscal aggregates but also by market perceptions, refinancing needs, global financial cycles and the credibility of fiscal policy.

3.5.3. Market perception and rating agencies

Recent rating downgrades reflect growing concerns about France's fiscal trajectory. In September 2025, Fitch downgraded France from AA- to A+, pointing to high and rising debt, persistent deficits and political instability undermining the credibility of any medium-term fiscal consolidation plan. A month later, S&P Global followed suit, lowering the sovereign rating to A+ and warning that public debt could reach 121% of GDP by 2028. These agency actions triggered an immediate rise in yields and widening spreads on French government bonds, confirming that market sentiment amplifies the effects of negative rating actions. These developments mirror the academic literature, which emphasises credibility, political constraints and investor coordination failures as critical determinants of sovereign stress. When doubts arise regarding the government's commitment or ability to stabilise public finances, spreads may adjust quickly, regardless of short-term solvency conditions.

3.5.4. Structural stabilisers

Despite these vulnerabilities, France benefits from several structural strengths that mitigate sovereign risk.

First, France has one of the deepest and most liquid sovereign bond markets in the Eurozone, characterised by strong demand from institutional investors. The IMF highlights that this liquidity reduces rollover risk and supports stable market access even in periods of global stress.

Second, the French banking system is resilient. The IMF concludes that French banks are well capitalised and able to withstand severe adverse scenarios. This reduces the likelihood of amplification through the sovereign-bank feedback loop documented in the literature.

Third, macroeconomic resilience remains a key stabiliser. The IMF notes that labour market conditions are robust, inflation is well anchored and real GDP growth, although modest, has exceeded expectations in recent years. These factors support fiscal revenues and mitigate crisis dynamics.

Fourth, France benefits from the ECB's expanded stabilisation toolkit. Instruments such as OMT, PEPP reinvestments and the Transmission Protection Instrument (TPI) reduce fragmentation risk and diminish self-fulfilling liquidity crises, even when not activated.

Finally, France remains a core Eurozone issuer, benefiting from structural safe-asset demand and a diversified investor base.

These strengths explain why the IMF assesses France's short-term sovereign risk as low and its medium-term risk as moderate, despite its deteriorating fiscal trajectory.

3.5.5. Conclusion

Thus, France exemplifies a case where fiscal fundamentals, institutional constraints and market expectations interact to shape sovereign risk in a probabilistic rather than deterministic manner. The theoretical and empirical literature, alongside IMF assessments, indicates that France's sovereign risk is present but manageable, with outcomes depending critically on fiscal consolidation credibility and macro-financial conditions.

4. Data and variables

This section presents the dataset used in the empirical analysis, describes the construction of the sovereign debt crisis indicator, details the definition and transformation of explanatory

variables and outlines the country sample and time period. The objective is to provide a transparent overview of the empirical foundation on which the econometric model of the next section is built.

4.1. Data sources

The dataset combines macroeconomic, fiscal, financial, external and institutional indicators drawn from internationally recognised statistical institutions in order to ensure data reliability, transparency and cross-country comparability. For each variable, priority is given to the original source commonly used in the sovereign risk and early-warning literature. When possible, series are cross-checked across databases to verify consistency. The primary data sources are the following:

- Laeven and Valencia (2018):

Sovereign debt crisis classifications used as a benchmark indicator in the initial construction of the database. While not retained as the final dependent variable due to limited variation within the EU sample, this source provides a widely accepted reference for sovereign crisis episodes in the literature.

- International Monetary Fund (IMF):

Fiscal and macroeconomic fundamentals, including general government debt, primary balance, overall fiscal balance, interest paid on public debt, government expenditure, real GDP growth, inflation rate, current account balance and Fiscal Rule Index. Data are primarily drawn from the *World Economic Outlook (WEO)* and complementary IMF databases.

- Federal Reserve Bank of St. Louis (FRED):

Long-term government bond yields for individual countries, the German long-term benchmark yield and the U.S. 10-year Treasury yield. These financial variables constitute the basis for the construction of sovereign bond spreads and the market-based sovereign stress indicator.

- Standard & Poor's (S&P) Global Ratings:

Sovereign credit ratings, subsequently transformed into a numerical scale (AAA = 1, AA+ = 2, etc.) to allow for their inclusion in the econometric analysis.

- World Bank – Worldwide Governance Indicators (WGI):

Institutional indicators measuring Rule of Law, Government Effectiveness and Political Stability, capturing the quality of governance and institutional credibility relevant for sovereign risk assessment. In addition to their use as primary institutional indicators, World Bank data are also employed for cross-checking purposes to ensure consistency with other international databases.

- European Central Bank (ECB):

Supplementary fiscal and financial data retrieved from the ECB Data Portal, particularly within the Government Finance Statistics (GFS) framework. These data are used to fill specific gaps in the IMF database (e.g., government expenditure for Lithuania or interest paid on public debt for Malta), ensuring completeness and consistency of the dataset.

- Organisation for Economic Co-operation and Development (OECD):
Selected macroeconomic, fiscal and financial indicators used for cross-validation purposes and to complement missing or less transparent series in the primary databases.

- Eurostat:
Harmonised fiscal accounts and government debt data for EU member states, used primarily for consistency checks and verification of national accounts across countries.

Monthly financial variables (long-term government bond yields and the U.S. 10-year Treasury yield) are converted to annual frequency by computing the arithmetic average of the twelve monthly observations within each calendar year.

4.2. Sample composition and time period

The empirical analysis is conducted on an unbalanced annual panel of the 27 European Union member states. Restricting the sample to EU countries ensures institutional and regulatory comparability while still providing sufficient cross-country and time-series variation for econometric estimation.

The effective sample period spans from 2001 to 2024, subject to data availability across countries and variables, in order to ensure a consistent analysis covering the 21st century. This horizon covers several major episodes of sovereign stress affecting advanced economies, including the global financial crisis, the euro-area sovereign debt crisis, the COVID-19 shock and more recent periods of market stress. The sample is particularly well suited to the analysis of sovereign vulnerabilities in France within a relatively homogeneous European context.

4.3. Dependent variable: sovereign stress indicator

4.3.1. Construction of the crisis dummy

The dependent variable $Crisis_{i,t}$ is a binary indicator taking:

$$Crisis_{i,t} = \begin{cases} 1 & \text{if country } i \text{ experiences sovereign stress in year } t, \\ 0 & \text{otherwise.} \end{cases}$$

An initial specification based on the sovereign debt crisis classification of Laeven and Valencia (2018) was considered. However, within the EU sample over the 2001–2024 period, this approach yields extremely few crisis observations (notably Greece in 2012 and Cyprus in 2013), making it unsuitable for econometric analysis.

To address this limitation, the final crisis indicator is constructed using a market-based approach relying on sovereign bond spreads.

4.3.2. Market-based definition using Value-at-Risk

For each country, a sovereign spread is computed as the difference between the national long-term government bond yield and the German long-term government bond yield, which serves as the euro-area risk-free benchmark:

$$Spread_{i,t} = LTIR_{i,t} - LTIR_{DE,t}$$

A common upper-tail Value-at-Risk threshold corresponding to the 95th percentile of the pooled sovereign spread distribution is retained in order to identify episodes of sovereign market stress across the EU sample. In the empirical implementation, this threshold is equal to 4.524594792. A sovereign stress episode is identified whenever a country's spread exceeds this critical threshold. The VaR is computed exclusively on observations for which both the country-specific long-term interest rate and the German benchmark rate are available. Years with missing long-term interest rate data for country i are therefore excluded from the VaR calculation and are not used to classify stress episodes. The crisis indicator therefore captures periods of abnormally high market-based sovereign risk, reflecting sharp deteriorations in investor confidence and financing conditions.

This approach provides substantially greater variation in the dependent variable while remaining closely aligned with the concept of sovereign debt distress as perceived by financial markets.

4.4. Explanatory variables

Explanatory variables reflect the four canonical pillars of sovereign crisis determinants in the sovereign-debt literature, complemented by institutional indicators for extended robustness tests.

All variables enter the model with a one-year lag, ensuring that only information available *ex ante* is used for prediction and mitigating concerns related to reverse causality.

4.4.1. Fiscal variables

- General government debt (% of GDP):
Central measure of the government's solvency constraint.
- Primary balance (% of GDP):
Captures the structural fiscal effort and the capacity to stabilise debt dynamics.
- Overall fiscal balance (% of GDP):
Includes cyclical components and provides a broader measure of fiscal stance.
- Interest paid on public debt (% of GDP):
Indicates the fiscal burden of servicing debt and the government's vulnerability to rising financing costs.
- Government expenditure (% of GDP):
Used as a proxy for expenditure rigidity when disaggregated data are unavailable.

These measures capture solvency risks, fiscal space and the government's capacity to respond to shocks.

4.4.2. Macroeconomic variables

- Real GDP growth (%):
Low or negative growth weakens revenues and deteriorates debt sustainability.
- Inflation rate (%):
May alleviate debt burdens or, alternatively, signal macro-financial instability.

These indicators reflect cyclical conditions influencing fiscal pressure and investor confidence.

4.4.3. Financial and market variables

- Government long term interest rate:
Represents the average cost of sovereign borrowing at long maturities and reflects market pricing of default risk and inflation expectations.
- Long term sovereign bond spread vs Germany:
Measures the yield differential relative to the German benchmark, capturing country-specific risk premia within the euro area.
- US 10-year Treasury yield:
Serves as a proxy for global liquidity conditions and the international risk-free benchmark influencing capital flows and refinancing costs.
- Sovereign credit rating:
Quantifies rating agencies' assessments of sovereign creditworthiness (e.g., AAA = 1, AA+ = 2, etc.), reflecting forward-looking evaluations of default risk.

These indicators capture market-based perceptions of sovereign risk, refinancing conditions and external financial constraints affecting debt sustainability.

4.4.4. External variables

- Current account balance (% of GDP):
Indicator of external financing needs and vulnerability to sudden stops.

4.4.5. Institutional variables

- Rule of Law:
Reflects the strength of legal institutions and contract enforcement, influencing investor confidence.
- Government Effectiveness:
Measures the quality of public administration and policy implementation capacity.
- Political Stability:
Captures the risk of political disruptions that could undermine fiscal credibility.
- Fiscal Rules Index:
Assesses the strength and credibility of national fiscal frameworks constraining deficits and debt accumulation.

4.5. Data transformations

To preserve transparency and avoid artificial data smoothing, data manipulation is kept to an absolute minimum. Only one adjustment is implemented: for the institutional variables Rule of Law, Government Effectiveness and Political Stability, the 2024 observations were not yet available at the time of data collection. The 2023 values are therefore carried forward to 2024 for these specific indicators. No other interpolation or extrapolation procedure is applied to the dataset.

All variables are expressed in levels or ratios commonly used in the sovereign-risk literature, primarily as percentages of GDP when relevant, to ensure cross-country comparability. Financial variables originally available at monthly frequency are converted to annual data using simple averages. Some explanatory variables are lagged by one or two years. No mechanical winsorisation is applied ex ante; instead, the influence of extreme observations is

assessed through robustness checks. Additional transformations, such as first differences or alternative scalings, are considered only when required by the econometric specification.

Overall, these choices ensure consistency with an annual early-warning framework and maintain a clear link between the empirical model and the underlying economic mechanisms.

4.6. Descriptive statistics and preliminary evidence

Prior to econometric estimation, a descriptive analysis of the dataset is conducted in order to assess the empirical relevance and internal consistency of the variables used in the sovereign stress model. This step does not aim at establishing causal relationships, but rather at documenting stylised facts and validating the economic plausibility of the data.

First, summary statistics are computed for all variables over the full sample period and separately for stress and non-stress years, as identified by the market-based crisis indicator. This comparison allows for a preliminary assessment of whether periods classified as sovereign stress are systematically associated with weaker fiscal positions, less favourable macroeconomic conditions or tighter financial constraints.

Second, the time dynamics of key variables, such as sovereign bond spreads, public debt ratios, fiscal balances and macroeconomic indicators, are examined to verify that the identified stress episodes coincide with economically meaningful deteriorations in fundamentals or market conditions. Particular attention is paid to the behavior of sovereign spreads around major European stress episodes, including the global financial crisis and the euro-area sovereign debt crisis.

Third, France is positioned relative to other EU member states in terms of both fiscal fundamentals and market-based indicators. This cross-country comparison provides an initial benchmark for assessing whether France exhibits distinctive vulnerability patterns or whether its dynamics are broadly aligned with those observed in comparable European economies.

Finally, the descriptive analysis is used to detect potential data issues that could affect econometric estimation, such as extreme observations, highly skewed distributions or strong correlations among explanatory variables. This diagnostic step informs subsequent modelling choices and robustness checks, ensuring that the estimated early-warning models are not driven by mechanical artefacts of the data.

Overall, this preliminary evidence supports the empirical relevance of the chosen sovereign stress indicator and confirms the suitability of the dataset for dynamic binary-response modelling within an annual early-warning framework.

5. Methodology

5.1. Econometric framework

This study adopts an early-warning system (EWS) approach to assess the likelihood of sovereign stress episodes within the European Union. The dependent variable is defined as a binary indicator of sovereign stress, constructed from sovereign bond spreads, taking the value 1 when a country experiences a stress episode and 0 otherwise.

Given the binary nature of this variable, the empirical analysis relies on non-linear probability models, specifically logistic regressions. Two complementary panel specifications are

implemented. On the one hand, a pooled logit model is used to capture both cross-country and time variation. On the other hand, a conditional logit model specification is estimated to absorb time-invariant country heterogeneity through fixed effects. However, countries that never experience a sovereign stress episode are mechanically excluded from the estimation, which substantially reduces the effective sample.

This dual framework allows distinguishing between structural, long-term determinants of sovereign stress through a pooled logit and short-term within-country dynamics by a conditional logit model.

5.2. Panel structure and preliminary tests

The dataset is organised as a country-year panel covering European economies over the selected period and is declared using appropriate country and time identifiers. Prior to estimation, several preliminary econometric tests are conducted to ensure the validity of the empirical framework.

5.2.1. Stationarity

Stationarity is assessed using panel unit root tests, specifically Fisher-type augmented Dickey-Fuller tests, applied to all explanatory variables. When non-stationarity is detected, variables are transformed accordingly in order to preserve the validity of the econometric estimations. Depending on the variable considered, this involves either the use of first differences, as in the case of the current account balance, or the introduction of dynamic specifications including lagged explanatory variables. These transformations allow the empirical framework to capture both long-term relationships and short-term macro-financial adjustments while remaining consistent with the early-warning modelling approach.

5.2.2. Multicollinearity

Multicollinearity is examined through pairwise correlation matrices computed for all variables. Variables exhibiting a high degree of correlation are excluded ex ante from the model combinations in order to avoid biased estimations. A threshold of 0.8 was adopted to identify a high degree of correlation between variables, as commonly adopted in the empirical literature as an indicator of strong multicollinearity (Kennedy, 2008). This step is particularly important given the large number of candidate indicators considered in the analysis.

5.3. Model specification

The baseline specification of the pooled logit model follows a standard probabilistic framework in which the probability of a sovereign stress event depends on a vector of explanatory variables encompassing macroeconomic, fiscal, external and institutional factors.

$$P(Y_{i,t} = 1) = F(\beta X_{i,t})$$

where:

- $Y_{i,t}$ represents the sovereign stress dummy,
- $X_{i,t}$ is the vector of explanatory variables,
- $F(\cdot)$ is the logistic cumulative distribution function.

The conditional logit specification extends this framework by introducing country-specific fixed effects, thereby accounting for unobserved heterogeneity across countries (α_i).

$$P(Y_{i,t} = 1 \mid \alpha_i) = F(\alpha_i + \beta X_{i,t})$$

The initial objective of the conditional logit specification was to isolate within-country dynamics and remove structural country-specific characteristics potentially correlated with sovereign risk. However, because the conditional logit estimator only exploits within-country variation in the dependent variable, countries with no sovereign stress episodes over the sample period are automatically excluded from the estimation. Given the relatively limited number of stress episodes within the EU sample, this substantially reduces the effective sample size (from 567 to 210 observations) and may weaken predictive capacity.

5.4. Variable selection strategy

A central contribution of this study lies in the implementation of a systematic model selection procedure designed to avoid arbitrary specification choices.

5.4.1. Exhaustive combinations

All possible combinations of variables are tested within a structured framework. Each model includes exactly one variable from each category: a fiscal variable selected among five candidates, a macroeconomic variable among two possibilities, a financial/market variable among five alternatives, one external variable represented by the current account and one institutional variable among four candidates.

This approach generates a total of four sets of 200 possible specifications for both the pooled logit and conditional logit models, ensuring a comprehensive exploration of the data.

5.4.2. Selection criteria

The selection of the preferred model is based on several complementary criteria. First, the statistical significance of the estimated coefficients is considered. Second, predictive performance is evaluated using the area under the ROC curve (AUC) using the Stata post-estimation command *lroc*. Finally, economic interpretability is taken into account to ensure that the retained specification remains consistent with theoretical expectations.

5.4.3. Exclusion of financial variables

Certain financial variables are deliberately excluded from the final selection process. In particular, government long-term interest rates, Germany's long-term interest rates and the spread vs Germany are not included, as they are directly embedded in the construction of the dependent variable. Including them would therefore introduce a mechanical endogeneity bias.

In addition, other financial indicators, such as the US 10-year Treasury yield and sovereign credit ratings, are tested but ultimately excluded due to their negative impact on model performance, either through reduced predictive accuracy or lack of statistical significance.

As a result, the final model selection excludes the financial category, leading to a reduced set of 40 possible model specifications.

5.5. Static and dynamic specifications

Several model specifications are estimated in order to capture both structural relationships and short-term dynamics.

Static models, both pooled and conditional logit, are first estimated using variables expressed in levels. A pooled logit specification in first differences is then tested to account for potential non-stationarity and to capture short-term variations in the data. Finally, a pooled logit model combining both levels and first-differenced variables is estimated, retaining the most appropriate transformation for each variable based on statistical performance and economic interpretability.

Dynamic specifications for the pooled logit and the conditional logit are introduced to account for persistence and adjustment processes in sovereign stress. This is achieved through the inclusion of lagged explanatory variables, up to two periods, allowing the model to incorporate temporal dynamics.

Lagged variables were introduced sequentially to assess their impact on the statistical significance of the model. When the lag transformation of a variable led to a deterioration in statistical significance, it was excluded and the previous specification was retained.

5.6. Final model

Based on the selection procedure, the final model retains variables from four categories. Fiscal conditions are captured through general government debt, macroeconomic dynamics through the inflation rate, external imbalances through the current account expressed in differences and institutional quality through political stability. The preferred specification is estimated in both static and dynamic specifications with lag structures. Marginal effects are computed using *margins* to facilitate the economic interpretation of the results. The final model specifications are the following:

$$Y = \beta_0 + \beta_1 * GD + \beta_2 * I.GD + \beta_3 * IR + \beta_4 * d.CA + \beta_5 * I.d.CA + \beta_6 * I2.D.CA + \beta_7 * PS \text{ (pooled logit)}$$

$$Y = \beta_1 * GD + \beta_2 * I.GD + \beta_3 * IR + \beta_4 * d.CA + \beta_5 * I.d.CA + \beta_6 * I2.D.CA + \beta_7 * PS \text{ (Conditional logit)}$$

5.7. Robustness checks

Several post-estimation diagnostics are conducted to ensure the robustness of the results. Heteroskedasticity is assessed using the White test (*estat imtest*), while autocorrelation is tested through panel serial correlation tests (*xtserial*).

In addition, all final models are re-estimated with standard errors clustered at the country level, allowing for both heteroskedasticity and within-country correlation.

5.8. Forecasting strategy and scenario analysis

The preferred specification is estimated using pooled logit and conditional logit models. Once the final coefficients are obtained, the models are used to generate predicted sovereign stress probabilities for each country-year observation.

Predicted probabilities are computed using the standard logistic transformation of the estimated linear predictor:

$$\hat{P}_{it} = \frac{e^{X_{it}\hat{\beta}}}{1 + e^{X_{it}\hat{\beta}}}$$

where:

- $X_{it}\hat{\beta}$ represents the estimated linear combination of explanatory variables and coefficients,
- $\hat{P}_{it}$ is the estimated probability of sovereign stress.

The estimated models are subsequently used to generate out-of-sample sovereign stress probability forecasts for France over a two-year horizon. Since the database used in this study ends in 2024, the forecasting exercise necessarily begins with an estimation for 2025. Although 2025 is already partially observed at the time of writing, complete and harmonised annual data for all variables are not yet available across countries and international databases. Consequently, 2025 is treated as the first forecast year within the empirical framework. In order to remain consistent with the research objective of assessing France's vulnerability over a two-year horizon, sovereign stress probabilities are therefore projected for 2025, 2026 and 2027 under different macro-fiscal scenarios.

The forecasting exercise relies on projected values for the explanatory variables under several alternative macro-fiscal scenarios:

- Official forecast scenario

The official forecast scenario reflects a continuation of currently expected macroeconomic and fiscal conditions. The values for general government debt, inflation, current account dynamics and political stability are primarily derived from IMF and World Bank projections.

Under this scenario, public debt continues to increase gradually due to persistent primary deficits and moderate nominal growth, but without a sharp deterioration in financing conditions. Inflation progressively converges toward more stable levels following the post-pandemic inflationary shock, while the current account evolves in line with recent external trends. Institutional indicators are assumed to remain broadly stable over the forecast horizon.

This scenario therefore represents a “business-as-usual” trajectory in which France experiences continued fiscal pressure without entering a severe macro-financial deterioration phase.

- Historical trend scenario

The historical trend scenario assumes that France progressively restores fiscal discipline over the forecast horizon through a combination of expenditure restraint, gradual deficit reduction and improved macroeconomic credibility. Compared to the official forecast trajectory, this scenario assumes a more favourable evolution of public debt dynamics and external balances while maintaining relatively stable macroeconomic conditions.

The construction of this scenario is based on the projected values obtained under the mechanical extrapolation framework. For each explanatory variable included in the final specification, projected values for 2025–2027 are obtained by extending the historical average annual variation observed over the period 2015–2024. Formally, the projected value of each variable is computed as:

$$X_{t+1} = X_t + \Delta \bar{X}_{2015-2024}$$

This approach preserves the medium-term dynamics historically observed in France while avoiding excessively optimistic one-off adjustments.

For the debt-to-GDP ratio, the historical average annual increase observed between 2015 and 2024 is used to project a gradual and relatively contained debt trajectory. Rather than assuming an abrupt reduction in debt levels, the scenario assumes that debt accumulation progressively stabilises compared to the official forecast path. Lagged debt values are then generated mechanically from the projected debt trajectory in order to preserve the temporal consistency of the model specification.

Inflation is projected using its historical average annual variation over the same period. The resulting trajectory assumes moderate and controlled inflation dynamics, consistent with a macroeconomic environment characterised by improved policy credibility and more stable financing conditions.

The external position is modelled through the variable *D.currentaccounttogdp*, corresponding to the annual first difference of the current account balance-to-GDP ratio. Consequently, the current account balance itself is first projected using its historical average annual variation. The transformed variable included in the econometric specification is then recalculated mechanically as:

$$D.currentaccounttogdp_t = currentaccounttogdp_t - currentaccounttogdp_{t-1}$$

This procedure ensures full consistency between the projected macroeconomic trajectory and the transformed explanatory variables effectively used in the estimated model. Lagged first differences are subsequently derived automatically from the projected series.

Political stability is assumed to remain constant throughout the forecast horizon. This assumption reflects the slow-moving nature of institutional indicators and the absence of reliable short-term forecasts for governance-related variables. Maintaining institutional variables constant also allows the scenario to isolate the effects of fiscal and macroeconomic adjustments on sovereign stress probabilities.

- Adverse stress scenario

The adverse stress scenario is designed to reproduce macro-financial conditions historically associated with elevated sovereign stress episodes within the Eurozone. Unlike the historical trend scenario, this specification assumes a simultaneous deterioration in fiscal sustainability, macroeconomic stability and external financing conditions over the forecast horizon.

The adverse trajectory is constructed by applying progressive negative shocks to the official forecast values published by international institutions such as the IMF and the World Bank. The objective is not to predict a specific crisis event, but rather to evaluate whether France's projected macro-fiscal fundamentals could enter regions historically associated with elevated sovereign stress probabilities within the estimation sample.

The primary deterioration concerns the debt-to-GDP ratio. Relative to the official forecast trajectory, additional increases of respectively +5, +10 and +15 percentage points are introduced in 2025, 2026 and 2027. Percentage points refer to absolute changes in the debt ratio itself rather than proportional percentage changes. The resulting stressed debt trajectory therefore becomes substantially steeper than under the baseline scenario, reflecting the combined effects of persistent fiscal deficits, weaker growth and rising interest expenditures.

The remaining explanatory variables are adjusted using the same projection methodology as in the historical trend scenario. Lagged debt values and lagged external-balance variations are generated mechanically from the projected stressed trajectories in order to preserve full consistency with the dynamic specification of the model. Inflation is assumed to deteriorate progressively relative to the official forecast path through additional positive shocks reflecting prolonged macroeconomic instability, tighter financing conditions and weaker policy credibility.

Similarly, the external position is first deteriorated at the level of the current account balance-to-GDP ratio before recalculating the transformed variable $D.currentaccounttogdp$ included in the econometric specification. This ensures that the projected first differences and their lagged values remain fully coherent with the underlying stressed macroeconomic trajectory.

Political stability is maintained constant throughout the adverse scenario. This assumption allows the analysis to isolate the effects of fiscal and macroeconomic deterioration on sovereign stress probabilities while limiting the discretionary component of the scenario construction.

For each scenario, projected values of the explanatory variables are manually introduced into the estimated model in order to compute forecast sovereign stress probabilities for France for 2025, 2026 and 2027. The scenario analysis does not aim to predict default events with certainty. Instead, it evaluates whether France's macro-fiscal trajectory becomes statistically similar to historical sovereign stress episodes observed within the estimation sample.

The estimated probabilities should therefore be interpreted as probabilistic early-warning signals rather than deterministic forecasts. Higher predicted probabilities indicate that France's projected macro-financial conditions increasingly resemble the macroeconomic configurations historically associated with sovereign stress episodes within the European sample.

6. Empirical results

This section presents the empirical findings obtained from the estimation strategy described in the methodology. The objective is to identify the specifications that provide the strongest predictive performance and determine which variables are statistically associated with sovereign stress episodes within the European Union sample.

The section focuses exclusively on the statistical and econometric results produced by the models. The broader economic interpretation and implications of these findings are discussed separately in the following chapter.

6.1. Model estimation and specification comparison

Several pooled logit and conditional logit specifications were estimated using combinations of fiscal, macroeconomic, external and institutional variables. Variables were tested in levels, first differences and mixed transformations.

The empirical results indicate that model performance, estimated by the area under the ROC curve, varies significantly depending on the specification retained.

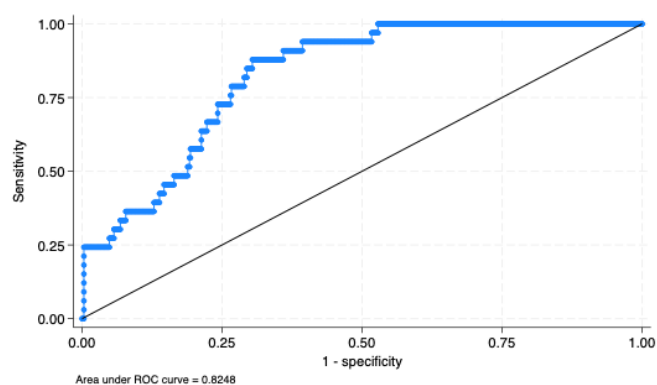


Figure 1: Pooled logit in levels ($AUROC = 0.8248$)

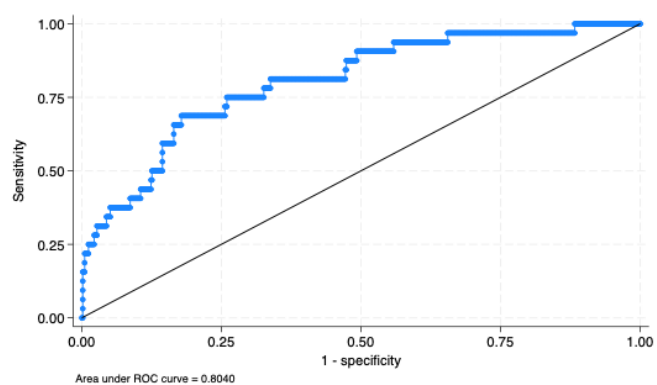


Figure 2: Pooled logit in differences ($AUROC = 0.8040$)

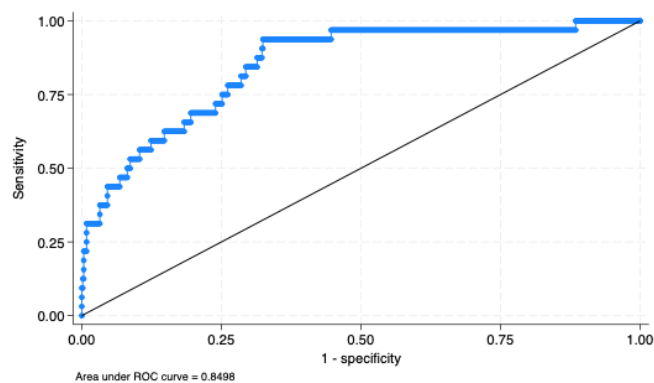


Figure 3: Pooled logit in differences and levels (AUROC = 0.8498)

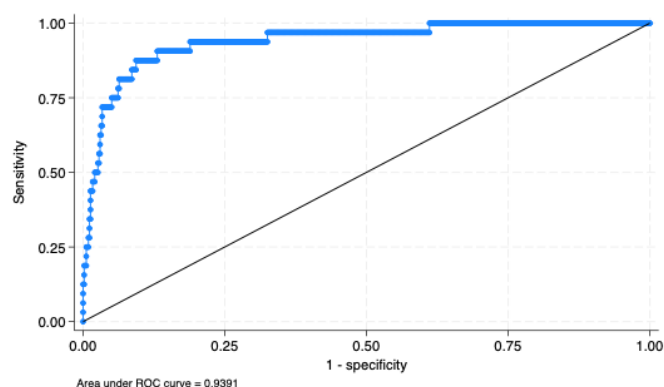


Figure 4: Pooled logit in differences and levels + lagged variables (AUROC = 0.9391)

The Wald/DeLong tests provide additional evidence regarding the predictive performance of the different specifications. The comparisons between the pooled logit model in levels (AUROC = 0.8248), the model in first differences (AUROC = 0.8040) and the mixed specification (AUROC = 0.8498) show that the observed differences in AUROC are not statistically significant (p-values of 0.6611 and 0.3718 respectively). This suggests that the inclusion of first-differenced variables alone does not significantly improve the discriminatory power of the model.

By contrast, the dynamic pooled logit specification significantly outperforms the mixed specification. The AUROC increases from 0.8498 to 0.9391 and the null hypothesis of equal ROC areas is rejected at the 1% significance level (p-value = 0.0038). The joint Wald test comparing all four specifications also strongly rejects the hypothesis of equal predictive performance across models (p-value = 0.0000). Overall, these results confirm that the inclusion of dynamic components and lagged variables significantly improves the model's predictive capacity.

Specifications estimated exclusively in first differences generally produce weaker predictive performance compared to models estimated in levels or mixed specifications. Although differenced variables improve the identification of short-term changes, the overall AUROC values remain lower than those obtained in the preferred models.

Models estimated entirely in levels produce more stable coefficient estimates and generally higher predictive performance. However, the best-performing specifications are obtained through mixed transformations combining variables expressed in levels and variables expressed in first differences.

The comparison between pooled logit and conditional logit models shows that both approaches produce statistically consistent results. Nevertheless, pooled logit specifications generally achieve slightly stronger predictive performance according to the ROC analysis.

The preferred specifications were selected according to three main criteria:

- statistical significance of explanatory variables;
- economic consistency of coefficient signs;
- predictive performance measured through AUROC.

In the following tables, the results of the statistical significance of explanatory variables are estimated across the four final models (static and dynamic pooled logit & static and dynamic conditional logit).

Table 1				
	(1)	(2)	(3)	(4)
VARIABLES	P (Sovereign spread)			
generalgovernmentdebt	0.001*** (0.000)	0.005*** (0.001)	0.064*** (0.017)	0.191*** (0.047)
L.generalgovernmentdebt		-0.004*** (0.001)		-0.099*** (0.037)
inflationrate	0.006*** (0.002)	0.013*** (0.002)	0.125** (0.055)	0.376*** (0.101)
D.currentaccounttogdp	0.007*** (0.002)	0.008*** (0.002)	0.142** (0.056)	0.295*** (0.092)
L.D.currentaccounttogdp		0.008*** (0.002)		0.287*** (0.081)
L2D.currentaccounttogdp		0.007*** (0.002)		0.241*** (0.081)
politicalstability	-0.002*** (0.001)	-0.001* (0.001)	-0.171*** (0.052)	-0.187*** (0.075)
Observations	621	567	230	210
Estimator	Pooled Logit	Pooled Logit	Conditional Logit	Conditional Logit
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
L. means the lagged variable				
D. means the difference of the variable				
L2. means the second lagged variable				

Table 1: Statistical significance of explanatory variables

However, these estimations rely on the assumptions of homoskedasticity and absence of autocorrelation. Another table relaxing these assumptions is presented in order to verify the robustness of the significance levels.

Table 2				
	(1)	(2)	(3)	(4)
VARIABLES	P (Sovereign spread)			
generalgovernmentdebt	0.001*** (0.000)	0.005*** (0.002)	0.064*** (0.015)	0.191*** (0.057)
L.generalgovernmentdebt		-0.004** (0.002)		-0.099*** (0.036)
inflationrate	0.006** (0.003)	0.013*** (0.004)	0.125 (0.078)	0.376*** (0.131)
D.currentaccounttogdp	0.007*** (0.002)	0.008*** (0.003)	0.142** (0.057)	0.295*** (0.090)
LD.currentaccounttogdp		0.008*** (0.003)		0.287*** (0.095)
L2D.currentaccounttogdp		0.007*** (0.002)		0.241** (0.112)
politicalstability	-0.002* (0.001)	-0.001 (0.001)	-0.171* (0.099)	-0.187 (0.129)
Observations	621	567	230	210
Estimator	Pooled Logit	Pooled Logit	Conditional Logit	Conditional Logit
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				
L. means the lagged variable				
D. means the difference of the variable				
L2. means the second lagged variable				

Table 2: Statistical significance of explanatory variables under relaxed assumptions of heteroskedasticity and autocorrelation

Overall, the preferred models display satisfactory discriminatory power between stress and non-stress observations.

Sovereign spreads	pred_final		Total
	0	1	
0	529	86	615
1	22	11	33
Total	551	97	648

Table 3: Confusion matrix

The confusion matrix indicates that the preferred specification performs particularly well in identifying non-stress periods, with a relatively low number of false positive classifications. However, the model remains less effective in detecting sovereign stress episodes, as reflected by the number of false negatives observed in the estimations. This result is consistent with the highly unbalanced nature of sovereign stress datasets, where crisis episodes remain relatively rare events. Consequently, while the model provides useful early-warning signals and strong overall predictive performance according to the AUROC metric, its ability to systematically capture all sovereign stress episodes remains more limited at the selected classification threshold.

6.2. Interpretation of the main explanatory variables

The final specifications consistently identify fiscal, macroeconomic, external and institutional variables as the main determinants of sovereign stress probabilities.

6.2.1. General government debt

Among all explanatory variables, general government debt-to-GDP emerges as one of the most robust and economically significant determinants of sovereign stress. Across most specifications, higher public debt levels are associated with a higher probability of stress episodes.

As shown by the econometric estimations reported in *Table 1*, a one-percentage-point increase in the general government debt variable increases the predicted probability of a sovereign stress event by 0.1 percentage point in the static pooled logit model, 0.5 percentage point in the dynamic pooled logit model, 6.4 percentage points in the static conditional logit model and 19.1 percentage points in the dynamic conditional logit model. By contrast, the lagged debt variable produces a marginal effect of -0.4 percentage point in the dynamic pooled logit and -9.9 percentage points in the dynamic conditional logit. Regardless of the specification retained, the general government debt variable remains statistically significant at the 1% level across all models.

The econometric results presented in *Table 2*, where the assumptions of homoskedasticity and absence of correlation are relaxed, lead to the same conclusions for this fiscal variable, confirming the robustness of the relationship between sovereign debt accumulation and sovereign stress vulnerability. The only change is that the first lag of the variable in the dynamic pooled logit is no longer significant at the 1% level but remains significant at the 5% level.

6.2.2. Inflation rate

Inflation rate also appears as a significant macroeconomic determinant of sovereign stress across several specifications. Higher inflation levels are generally associated with an increased probability of sovereign stress episodes, reflecting the deterioration of macroeconomic stability, tighter financing conditions and weaker investor confidence generated by persistent inflationary pressures.

As reported in *Table 1*, a one-unit increase in the inflation rate variable increases the predicted probability of a sovereign stress event by 0.6 percentage point in the static pooled logit model, 1.3 percentage point in the dynamic pooled logit model, 12.5 percentage points in the static conditional logit model and 37.6 percentage points in the dynamic conditional logit model.

Depending on the specification retained, the inflation variable remains statistically significant at the 1% level, confirming the relevance of inflationary dynamics in explaining sovereign stress vulnerability. Only in the static conditional logit, the inflation rate is statistically significant at the 5% level instead of 1%.

The econometric results presented in *Table 2*, where the assumptions of homoskedasticity and absence of correlation are relaxed, lead to changes for the inflation variable. The variable is still statistically significant in both dynamic models but it is now significant at the 5% level for the static pooled logit and is no longer statistically significant in the dynamic conditional logit specification, even at the 10% level.

6.2.3. Current account

The current account balance-to-GDP variable also appears as a significant determinant of sovereign stress across several specifications. More specifically, the transformed versions of the variable, expressed in first differences and lagged differences, display strong and robust statistical significance. This result suggests that sudden deteriorations in external balances are associated with a higher probability of sovereign stress episodes.

As reported in *Table 1*, a one-unit increase in the first difference of the current account balance-to-GDP ratio increases the predicted probability of a sovereign stress event by 0.7 percentage point in the static pooled logit model, 0.8 percentage point in the dynamic pooled logit model, 14.2 percentage points in the static conditional logit and 29.5 percentage points in the dynamic conditional logit model. The lagged first-difference variable also produces a positive marginal effect of 0.8 percentage point in the pooled dynamic specification and 28.7 percentage points in the dynamic conditional logit specification. Similarly, the second lag of the differenced variable increases the predicted probability of sovereign stress by 0.7 percentage point in the pooled dynamic model and 24.1 percentage points in the dynamic conditional logit model.

All transformed current account variables remain statistically significant at the 1% level across most retained specifications, with the exception of the first difference of the current account in the static conditional logit and the second lag in the dynamic conditional logit model, which remains significant at the 5% level.

The econometric results presented in *Table 2*, where the assumptions of homoskedasticity and absence of correlation are relaxed through clustered robust standard errors, lead to virtually identical conclusions for the external balance variables. The magnitude and significance of the estimated coefficients remain broadly unchanged, confirming the robustness of the relationship between deteriorating external balances and sovereign stress vulnerability.

6.2.4. Political stability

Political stability emerges as an additional determinant of sovereign stress, although its significance and magnitude vary across specifications. The estimated coefficients are consistently negative, suggesting that stronger political stability reduces the probability of sovereign stress episodes.

As reported in *Table 1*, a one-unit increase in the political stability indicator decreases the predicted probability of a sovereign stress event by 0.2 percentage point in the static pooled logit model, 0.1 percentage point in the dynamic pooled logit model, 15.8 percentage points in the static conditional logit model and 18.7 percentage points in the dynamic conditional logit model.

The political stability variable remains statistically significant at the 1% level in the static pooled logit model as well as in the static conditional logit specifications. In the dynamic conditional logit specification, the variable remains significant at the 5% level and it is only significant at 10% in the dynamic pooled logit. These results therefore suggest that institutional and political conditions play a meaningful role in explaining sovereign stress vulnerability, particularly when country-specific heterogeneity is taken into account through conditional estimators.

The econometric results presented in *Table 2*, where clustered robust standard errors are introduced in order to relax the assumptions of homoskedasticity and absence of correlation, lead to slightly weaker significance levels for the political stability variable. The coefficient remains significant at the 10% level in the static pooled logit and static conditional logit models, while it loses statistical significance in both dynamics specifications. Nevertheless, the estimated coefficients remain negative across all models, confirming the existence of a

stabilizing relationship between stronger political stability and lower sovereign stress probabilities.

6.3. Static vs dynamic specifications

The comparison between static and dynamic models provides additional insights into the persistence of sovereign stress dynamics.

Dynamic specifications incorporating lagged crisis indicators generally outperform purely static models in terms of model fit and predictive performance. The inclusion of lagged explanatory variables improves AUROC values and increases the ability of the model to identify prolonged stress periods.

Nevertheless, the improvement generated by dynamic specifications is statistically significant (AUROC rising from 0.8498 to 0.9391) but contemporaneous fiscal and macroeconomic fundamentals continue to explain a large share of sovereign stress probabilities.

The results therefore support the relevance of combining both structural fundamentals and persistence effects within the empirical framework.

6.4. Forecasting results for France

The forecasting exercise provides an assessment of France's sovereign stress vulnerability over the 2025–2027 horizon under three alternative macro-fiscal scenarios. Predictions are generated using the two best-performing econometric specifications retained throughout the empirical analysis: the pooled dynamic logit model and the dynamic conditional logit model. The three scenarios consist of an official forecast scenario based on official macroeconomic projections, a historical trend scenario assuming gradual improvements in fiscal fundamentals and an adverse scenario characterized by deteriorating fiscal and macro-financial conditions.

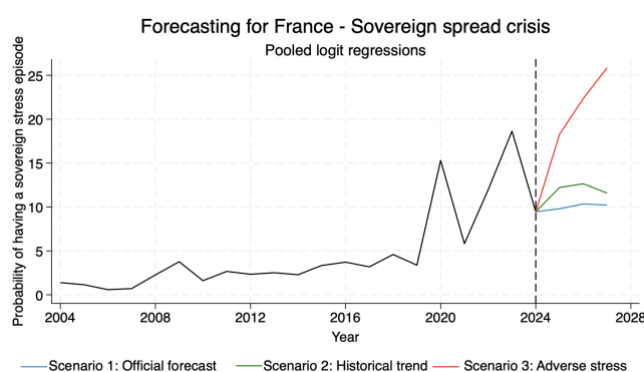


Figure 8: Forecasted probabilities of having a sovereign stress episode for France under a pooled logit regression

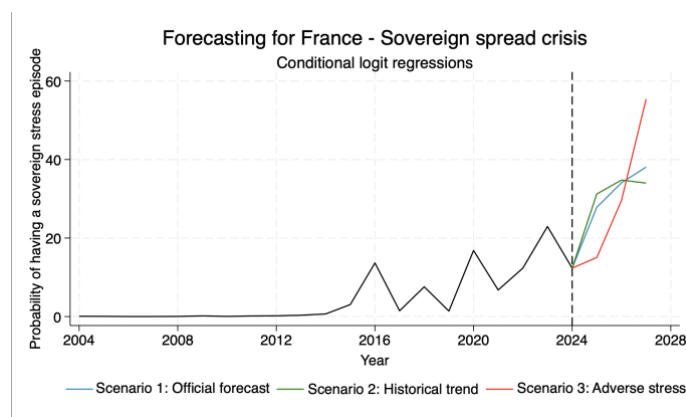


Figure 9: Forecasted probabilities of having a sovereign stress episode for France under a conditional logit regression

The forecasting results reveal a clear increase in sovereign stress vulnerability across all scenarios compared to historical levels observed during most of the sample period. However, the magnitude of the predicted probabilities differs substantially depending on both the econometric specification and the macroeconomic assumptions retained.

The pooled dynamic logit model produces relatively moderate sovereign stress probabilities under the official forecast scenario. Forecasted probabilities remain close to 10% over the entire projection horizon, suggesting that although France faces growing fiscal vulnerabilities, the model does not predict an imminent sovereign stress episode under central macroeconomic assumptions. The historical trend scenario leads to only slightly higher probabilities in the short term before stabilizing around 11.6% by 2027. This relatively limited difference reflects the lower sensitivity of the pooled logit specification to variations in the explanatory variables.

By contrast, the adverse stress scenario generates a substantial deterioration in sovereign stress probabilities within the pooled logit framework. Predicted probabilities rise rapidly from approximately 9.5% in 2024 to nearly 25.9% by 2027. This result indicates that persistent fiscal deterioration, weaker external balances and adverse macroeconomic dynamics could significantly increase sovereign stress vulnerability even within the more conservative pooled specification.

The conditional dynamic logit model produces substantially higher predicted probabilities across all scenarios. This result is consistent with the previous econometric findings showing that the conditional specification captures country-specific heterogeneity and sovereign stress persistence more strongly than the pooled estimator. Under the official forecast scenario, sovereign stress probabilities increase sharply from approximately 12.3% in 2024 to nearly 38.1% by 2027. The historical trend scenario initially follows a similar trajectory before stabilizing around 34% at the end of the forecast horizon. Although this scenario moderates the increase in sovereign stress vulnerability, it does not fully offset the impact of France's already elevated debt dynamics and macroeconomic fragilities.

The adverse stress scenario generates the strongest deterioration across all forecasting exercises. Within the conditional logit specification, sovereign stress probabilities rise continuously and exceed 55.3% by 2027. Such results suggest that a combination of persistent

fiscal deficits, rising debt dynamics, inflationary pressures and deteriorating external balances could significantly amplify sovereign risk perceptions over the medium term.

7. Discussion

The empirical results presented in the previous section provide several important insights regarding the determinants of sovereign stress within the European Union and the specific vulnerability profile of France over the coming years. While the econometric estimations identify statistically significant relationships between sovereign stress probabilities and a set of fiscal, macroeconomic, external and institutional variables, the broader economic interpretation of these results requires a more comprehensive discussion.

Overall, the findings strongly support the theoretical literature on sovereign debt sustainability, fiscal space and market-based crisis dynamics developed in previous sections. They also highlight the importance of combining structural fiscal fundamentals with macro-financial and institutional factors when assessing sovereign vulnerability within a monetary union such as the Eurozone.

7.1. Fiscal vulnerability and debt dynamics

Among all explanatory variables retained in the final specifications, general government debt-to-GDP emerges as the most robust and economically significant determinant of sovereign stress. This result is highly consistent with the sovereign debt literature emphasizing the role of debt accumulation, fiscal fatigue and debt sustainability constraints in explaining sovereign crises.

High debt levels increase sovereign vulnerability through several complementary mechanisms. First, elevated debt mechanically increases refinancing needs and exposes governments more strongly to changes in interest rates. In an environment where monetary policy has tightened significantly since 2022, higher refinancing costs progressively translate into rising interest expenditures and deteriorating fiscal balances. Second, high debt reduces fiscal flexibility and limits the government's capacity to respond to adverse macroeconomic shocks through countercyclical fiscal policy. Third, debt sustainability increasingly depends on market confidence and investor expectations once debt ratios reach historically elevated levels.

This mechanism is particularly relevant within the Eurozone framework. Unlike sovereign states issuing debt in their own currency, Eurozone governments cannot rely on a fully autonomous central bank capable of monetizing public debt in the event of severe market stress. Consequently, debt sustainability partly depends on investors' confidence in the government's ability to maintain credible medium-term fiscal trajectories. When debt levels become sufficiently elevated, even moderate deteriorations in fiscal credibility may trigger disproportionate increases in sovereign spreads through self-fulfilling market dynamics.

The empirical results appear particularly coherent when compared with historical sovereign stress episodes observed in Europe. During the Eurozone sovereign debt crisis, countries such as Italy, Spain and Portugal experienced rapid increases in sovereign spreads despite the absence of immediate default risk. In many cases, markets reacted not only to the level of debt itself but also to concerns regarding future fiscal trajectories, weak growth prospects and the political feasibility of fiscal consolidation.

The French case exhibits several similarities with these historical patterns. Public debt has exceeded 110% of GDP, primary deficits remain persistently negative and interest expenditures are progressively increasing following the normalization of monetary policy. Moreover, recent sovereign rating downgrades by Fitch and S&P illustrate the growing sensitivity of financial markets to France's fiscal trajectory. Although France continues to benefit from favorable financing conditions relative to many European peers, the econometric results suggest that the margin of fiscal safety has progressively narrowed.

7.2. Macroeconomic instability and inflation dynamics

The positive relationship identified between inflation and sovereign stress also provides important insights into the macro-financial mechanisms underlying sovereign vulnerability. While moderate inflation may temporarily alleviate debt burdens through the erosion of the real value of public debt, persistent inflationary pressures are generally associated with deteriorating macroeconomic stability and tighter financial conditions.

The post-pandemic inflationary shock observed across Europe illustrates this mechanism particularly well. Following the COVID-19 crisis and the energy shock associated with the war in Ukraine, inflation increased sharply across advanced economies. In response, the European Central Bank implemented one of the fastest monetary tightening cycles in its history. As policy rates increased, sovereign borrowing costs rose substantially across the Eurozone, particularly for highly indebted countries.

In this context, inflation acts less as an isolated macroeconomic variable than as a broader indicator of macro-financial instability. Persistent inflation may reduce investor confidence, weaken household purchasing power, slow economic activity and increase uncertainty regarding future monetary policy. Simultaneously, tighter financial conditions increase refinancing costs and worsen debt dynamics through a higher interest-growth differential.

The econometric results therefore appear consistent with a broader “financial tightening” interpretation of sovereign stress. Sovereign vulnerabilities tend to increase not simply because prices rise, but because inflation often coincides with monetary tightening, weaker growth prospects and deteriorating financing conditions.

The weaker robustness of the inflation variable in some clustered specifications may nevertheless suggest that inflation alone is not always sufficient to explain sovereign stress episodes. Rather, inflation appears to amplify existing fiscal and financial vulnerabilities when combined with elevated debt levels or deteriorating market sentiment.

7.3. External imbalances and market confidence

The current account results also provide important insights into sovereign stress dynamics within integrated financial systems such as the Eurozone. The empirical findings indicate that sudden deteriorations in external balances significantly increase sovereign stress probabilities, particularly when the variable is expressed in first differences.

This result is economically intuitive. Financial markets often react more strongly to abrupt deteriorations in macroeconomic conditions than to already persistent structural imbalances. A sudden worsening of the current account may signal declining competitiveness, weakening external demand, higher import dependence or capital outflows. Such developments can

progressively undermine investor confidence and increase sovereign refinancing vulnerabilities.

The use of first differences rather than levels appears particularly relevant in this context. While some countries may sustain persistent current account deficits over long periods without immediate stress, rapid deteriorations often coincide with broader macro-financial instability and changing market expectations. The empirical results therefore suggest that markets are especially sensitive to the speed of deterioration in external balances rather than to their absolute level alone.

This mechanism was clearly observable during the Eurozone sovereign debt crisis. Countries such as Greece, Portugal and Spain experienced substantial current account deteriorations before entering periods of severe sovereign stress. External imbalances were often associated with losses in competitiveness, excessive domestic demand and growing dependence on external financing. Once market sentiment deteriorated, these vulnerabilities contributed to rapid increases in sovereign spreads and financing pressures.

Within the Eurozone, external adjustment mechanisms are also more constrained than in economies possessing autonomous exchange rate policies. Member states cannot individually devalue their currency to restore competitiveness, implying that external adjustment frequently occurs through slower internal mechanisms such as wage moderation, fiscal consolidation or reduced domestic demand. As a result, sudden external deteriorations may have stronger and more persistent effects on sovereign risk perceptions.

7.4. Political stability and institutional credibility

The negative relationship between political stability and sovereign stress probabilities further reinforces the importance of institutional credibility within sovereign debt markets. Although political variables generally display weaker short-term predictive power than fiscal indicators, the empirical results confirm that institutional conditions remain economically meaningful determinants of sovereign vulnerability.

Financial markets do not exclusively evaluate sovereign solvency through debt and deficit metrics. They also assess governments' capacity to implement credible fiscal adjustments, maintain political cohesion and preserve macroeconomic stability during periods of stress. Political fragmentation, institutional uncertainty or repeated failures to implement fiscal reforms may therefore increase sovereign risk premia even when short-term fiscal indicators remain relatively stable.

This mechanism appears particularly relevant for France in the current political environment. Recent political fragmentation, rising social tensions and difficulties surrounding fiscal reforms have contributed to growing concerns regarding the credibility of medium-term fiscal consolidation plans. The successive sovereign rating downgrades experienced by France partly reflect these concerns. Markets increasingly evaluate not only the current fiscal trajectory but also the political feasibility of future adjustments.

Historical evidence from the Eurozone crisis also supports this interpretation. In countries such as Italy, episodes of political instability frequently coincided with sharp increases in sovereign spreads despite relatively limited changes in fiscal fundamentals. Investor

uncertainty regarding policy continuity and fiscal governance often amplified market pressures.

The weaker significance of political stability within some robust specifications likely reflects the slow-moving nature of institutional variables. Unlike macroeconomic or fiscal indicators, institutional quality evolves gradually over time and may therefore contribute more strongly to long-term structural credibility than to short-term crisis prediction. Nevertheless, the consistently negative sign of the coefficients across specifications confirms the existence of a stabilizing relationship between institutional credibility and sovereign risk.

7.5. Dynamic specifications and persistence effects

The comparison between static and dynamic specifications provides additional insights regarding the persistence of sovereign stress dynamics. Dynamic models incorporating lagged variables significantly improve predictive performance, particularly within the pooled logit framework where the AUROC increases substantially.

This result suggests that sovereign stress exhibits important persistence effects over time. Once market tensions emerge, they tend to generate self-reinforcing mechanisms through higher refinancing costs, deteriorating investor confidence and worsening macro-financial conditions. Sovereign stress therefore rarely disappears immediately following the initial shock.

These findings are strongly consistent with the theoretical literature on multiple equilibria and self-fulfilling crises. Once sovereign spreads increase significantly, debt dynamics may deteriorate mechanically through higher interest expenditures. Simultaneously, market participants may revise their expectations regarding future solvency, further amplifying refinancing pressures.

However, the empirical results also indicate that contemporaneous fiscal and macroeconomic fundamentals continue to play a dominant role in explaining sovereign stress probabilities. Crisis persistence alone does not fully explain sovereign vulnerability. Current debt dynamics, inflationary pressures and external imbalances remain essential determinants even after accounting for lagged effects.

7.6. Interpretation of the forecasting exercise

The forecasting exercise provides several important conclusions regarding France's sovereign vulnerability over the 2025–2027 horizon.

First, all scenarios generate sovereign stress probabilities that remain significantly above the levels historically associated with the most stable European economies. Even under the official forecast scenario, France exhibits a non-negligible level of sovereign vulnerability. This result suggests that current fiscal and macro-financial conditions already place France within a zone of moderate sovereign stress sensitivity.

Second, the historical trend scenario only partially stabilizes sovereign stress probabilities. Although gradual fiscal improvements reduce the pace of deterioration, they do not fundamentally reverse the upward trajectory of sovereign vulnerability. This result likely reflects the already elevated starting level of public debt and the persistence of structural

fiscal deficits. Once debt levels become sufficiently high, moderate fiscal adjustments may require prolonged periods before significantly improving sovereign risk perceptions.

Third, the adverse stress scenario generates a rapid and substantial increase in predicted sovereign stress probabilities, particularly within the conditional dynamic logit specification. This finding highlights the strong non-linearities characterizing sovereign risk dynamics. Simultaneous deteriorations in debt accumulation, inflation and external balances generate cumulative effects that significantly amplify sovereign vulnerability.

The substantially higher probabilities produced by the conditional logit specification also deserve attention. Because the conditional estimator captures country-specific heterogeneity and within-country persistence effects more strongly, it appears more sensitive to France's own fiscal trajectory and structural vulnerabilities. By contrast, the pooled specification partially smooths these effects through cross-country averaging.

Nevertheless, the forecasting results should be interpreted carefully. The estimated probabilities do not represent deterministic forecasts of sovereign default. Instead, they measure the extent to which France's projected macro-financial conditions resemble historical configurations associated with sovereign stress episodes within the estimation sample.

More broadly, the historical evolution of France's sovereign stress probabilities suggests that the country has progressively moved from a low-vulnerability environment before 2008 toward a structurally more fragile fiscal regime characterized by persistently high debt and stronger sensitivity to macro-financial shocks.

Several structural stabilizers specific to France are not fully captured by the econometric framework. France benefits from one of the deepest and most liquid sovereign bond markets in Europe, a diversified investor base, strong institutional credibility and the stabilizing role of the ECB. Instruments such as OMT, PEPP reinvestments and the Transmission Protection Instrument significantly reduce the probability of disorderly liquidity crises relative to the institutional environment prevailing during the Eurozone crisis.

8. Limitations

Despite the robustness of the empirical framework and the satisfactory predictive performance obtained by the preferred specifications, several limitations must be acknowledged regarding the construction of the dataset, the econometric methodology and the interpretation of the forecasting results.

A first limitation concerns the definition of sovereign stress episodes. Due to the very limited number of official sovereign debt crises observed within the European Union during the 21st century, the dependent variable is constructed using a market-based approach relying on sovereign bond spreads relative to Germany. While this methodology substantially increases the number of stress observations and remains consistent with the sovereign risk literature, it does not directly measure sovereign default or debt restructuring events. The estimated probabilities should therefore be interpreted as indicators of market-based sovereign stress rather than deterministic predictions of sovereign insolvency.

A second limitation relates to the relatively small number of sovereign stress episodes within the estimation sample. Although the Value-at-Risk methodology increases variation in the

dependent variable, sovereign stress events remain relatively rare observations in advanced European economies. This class imbalance may affect the stability of coefficient estimates and partially explains why some variables lose statistical significance once clustered robust standard errors are introduced.

The econometric framework itself also presents several limitations. First, pooled logit models assume a relatively homogeneous relationship between explanatory variables and sovereign stress probabilities across countries. However, sovereign debt dynamics may differ substantially depending on institutional credibility, investor base composition, financial market depth or monetary conditions. Although the conditional logit specification partially addresses this issue through country fixed effects, it also reduces the effective sample size because countries without stress episodes are automatically excluded from the estimation.

Second, the annual frequency of the dataset limits the ability of the model to capture short-term financial market dynamics. Sovereign crises often develop rapidly through abrupt changes in investor expectations, liquidity conditions or international financial shocks. Annual data smooth these high-frequency movements and may therefore underestimate sudden market reactions.

Another important limitation concerns omitted variables. Some determinants frequently emphasized in the sovereign risk literature are not explicitly included in the final specification. Global financial conditions, investor sentiment, ECB communication effects, banking-sector vulnerabilities or geopolitical shocks may all influence sovereign spreads independently of domestic fiscal fundamentals. While part of these effects may be indirectly captured through macroeconomic and financial variables, the model cannot fully isolate their individual contribution.

In addition, the forecasting exercise necessarily relies on simplifying assumptions regarding the future evolution of macroeconomic variables. The scenarios constructed for 2025–2027 do not aim to predict future economic conditions with precision but rather to evaluate how different macro-fiscal trajectories may affect sovereign stress probabilities. Consequently, the projected probabilities remain highly sensitive to the assumptions retained for debt accumulation, inflation dynamics and external balances.

The interpretation of political stability indicators also requires caution. Institutional variables evolve slowly over time and annual governance indicators may not fully capture rapid political developments, market sentiment changes or short-term uncertainty related to elections, social unrest or fiscal negotiations. This limitation is particularly relevant in the French context, where political credibility may change more rapidly than annual institutional indicators suggest.

Finally, several structural stabilisers specific to France and the Eurozone are difficult to fully integrate within a standard econometric framework. The stabilizing role of the ECB, the depth and liquidity of the French sovereign bond market, the importance of institutional investors and the international role of the euro significantly reduce the probability of disorderly sovereign crises compared with historical crisis episodes observed in other economies. As a result, the estimated sovereign stress probabilities may overstate the likelihood of extreme outcomes if interpreted outside their historical and institutional context.

Despite these limitations, the empirical framework remains useful as an early-warning tool aimed at identifying periods during which France's macro-financial conditions increasingly resemble historical sovereign stress environments. The results should therefore be interpreted as probabilistic signals of vulnerability rather than deterministic forecasts of sovereign default.

9. Conclusion

This thesis aimed to assess the extent to which France's current fiscal and macro-financial fundamentals indicate a vulnerability to a sovereign debt crisis over the next two years. More specifically, the objective was not to predict an inevitable sovereign default, but rather to evaluate whether France's current trajectory increasingly resembles the macroeconomic and financial configurations historically associated with sovereign stress episodes within the European Union during the last 24 years.

The analysis was motivated by the growing concerns surrounding France's fiscal trajectory in recent years. Persistently high public deficits, rising debt levels, weaker fiscal space and increasing interest expenditures have progressively raised questions regarding the long-term sustainability of French public finances. At the same time, the post-pandemic macroeconomic environment, characterized by higher inflation, tighter monetary conditions and slower growth prospects, has significantly altered the financial conditions under which highly indebted sovereigns operate within the Eurozone.

In order to address the research question, the thesis first developed a theoretical framework centered around debt sustainability, fiscal space, multiple equilibria, rollover risk and the institutional specificities of the Eurozone. The literature review highlighted that sovereign crises rarely result from a single factor. Instead, they generally emerge from the interaction between deteriorating fiscal fundamentals, adverse macro-financial conditions, external imbalances and shifts in investor expectations. The literature also emphasized the importance of non-linear dynamics, showing that sovereign risk may increase abruptly once debt trajectories, refinancing needs or market perceptions reach critical thresholds.

The empirical analysis relied on an annual panel dataset covering the 27 European Union member states over the 21st century. Given the very limited number of official sovereign debt crises observed within the EU during the sample period, the thesis adopted a market-based sovereign stress indicator constructed from sovereign bond spreads relative to Germany using a Value-at-Risk approach. This methodology made it possible to capture periods of abnormal market stress while remaining closely connected to the concept of sovereign vulnerability reflected in financial markets.

Several econometric specifications were estimated using pooled logit and conditional logit models. The results show that sovereign stress probabilities within the European Union are primarily explained by four major determinants: general government debt, inflation, deteriorations in the current account balance and political stability. Among these variables, public debt emerged as the most robust and economically significant determinant across all specifications. Higher debt levels consistently increased the probability of sovereign stress episodes, confirming the central role of debt accumulation and fiscal sustainability in sovereign risk dynamics.

Inflation also appeared as an important explanatory factor, particularly in the post-2022 environment characterized by rapid monetary tightening. The results suggest that inflation affects sovereign vulnerability less through the erosion of debt in real terms than through its impact on refinancing conditions, investor confidence and interest-growth differentials. Similarly, sudden deteriorations in external balances significantly increased sovereign stress probabilities, especially when the current account variable was expressed in first differences. This finding indicates that financial markets react strongly to abrupt macroeconomic deteriorations rather than to slowly evolving structural imbalances already incorporated into expectations.

Institutional and political conditions also contributed meaningfully to sovereign risk dynamics. The negative relationship identified between political stability and sovereign stress probabilities suggests that market participants evaluate not only fiscal fundamentals themselves but also governments' capacity to implement credible fiscal adjustments and preserve macroeconomic stability over time.

The empirical analysis additionally demonstrated the importance of persistence effects in sovereign stress dynamics. Dynamic specifications incorporating lagged variables significantly improved predictive performance compared to purely static models. This result is fully consistent with the theoretical literature on self-fulfilling crises and multiple equilibria, where rising spreads, deteriorating expectations and worsening debt dynamics can mutually reinforce one another over time.

The forecasting exercise provided further important insights regarding France's sovereign vulnerability over the 2025–2027 horizon. Under the official forecast scenario, sovereign stress probabilities remain moderate but significantly above the levels historically associated with the most stable European economies. Under the historical trend scenario, gradual fiscal improvements only partially stabilize sovereign vulnerability, reflecting the persistence of already elevated debt dynamics. By contrast, the adverse stress scenario generates a substantial increase in sovereign stress probabilities, particularly within the dynamic conditional logit specification, where probabilities exceed 50% by 2027.

These forecasting results do not imply that France is likely to default on its sovereign obligations in the near future. Rather, they indicate that France's macro-financial conditions increasingly resemble historical environments associated with elevated sovereign stress within the estimation sample. The distinction between sovereign stress and sovereign insolvency is therefore essential. France continues to benefit from several major structural stabilizers that substantially reduce the probability of a disorderly sovereign crisis. These stabilizers include the depth and liquidity of the French sovereign bond market, a diversified investor base, the resilience of the French banking system and, most importantly, the stabilizing role of the European Central Bank through instruments such as OMT, PEPP and the Transmission Protection Instrument.

Nevertheless, the results also suggest that the margin of fiscal safety has progressively narrowed over time. One particularly important finding of the thesis is that France's sovereign stress probabilities never fully return to their very low pre-2008 levels after the successive global financial, sovereign debt and post-pandemic crises. This result may indicate that France has progressively entered a structurally more vulnerable fiscal regime characterized by persistently high debt, reduced fiscal flexibility and stronger sensitivity to macro-financial shocks.

From a policy perspective, the findings of this thesis highlight the importance of preserving fiscal credibility over the medium term. While abrupt austerity measures could prove economically counterproductive, the results suggest that persistent deficits and continuously rising debt levels progressively increase sovereign vulnerability, particularly in an environment of structurally higher interest rates. Restoring fiscal space therefore appears essential in order to reduce sensitivity to future macro-financial shocks and preserve investor confidence.

More broadly, the thesis also reinforces the importance of the Eurozone institutional framework in shaping sovereign risk dynamics. The European sovereign debt crisis demonstrated that market perceptions, liquidity conditions and institutional credibility can become as important as fiscal fundamentals themselves during periods of stress. Although the Eurozone architecture has become significantly more resilient since 2012, important structural fragilities remain linked to incomplete fiscal integration, fragmented financial markets and limited supranational risk-sharing mechanisms.

Several limitations nevertheless remain. The market-based sovereign stress indicator does not directly measure sovereign default events, annual data may underestimate high-frequency market dynamics and the forecasting exercise necessarily relies on simplifying assumptions regarding future macroeconomic conditions. Consequently, the results should be interpreted as probabilistic early-warning signals rather than deterministic predictions.

Despite these limitations, the empirical framework developed in this thesis provides a coherent and economically grounded assessment of France's sovereign vulnerability. By combining fiscal, macroeconomic, external and institutional dimensions within a dynamic early-warning framework, the analysis contributes to a broader understanding of sovereign risk in advanced economies operating within a monetary union.

Overall, the central conclusion of this thesis is that France does not currently appear to face an imminent sovereign debt crisis, but it exhibits a progressively higher degree of fiscal and macro-financial vulnerability. The combination of persistently high debt, structural deficits, tighter financial conditions and limited fiscal space suggests that France has become more sensitive to adverse shocks than it was during the pre-2008 period. Consequently, while a disorderly sovereign crisis remains unlikely under current conditions, maintaining fiscal credibility and macro-financial stability will remain essential in limiting sovereign stress risks over the coming years.

10. References

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