

Governing Debt in the Age of Technology

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(Halil Sağırkaya - Anadolu Agency)

This policy outlook examines the growing role of technology as a central stabilising factor in macroeconomic governance amid weakening monetary policy effectiveness. It argues that high public debt, adverse demographic trends, and political constraints on fiscal and monetary tools are pushing governments to rely increasingly on productivity gains, strategic innovation, and financial infrastructure upgrades to manage refinancing pressures and sustain economic resilience. Drawing on comparative cases and forward-looking scenarios, the paper assesses how technological capacity is reshaping debt sustainability, sovereign risk perceptions, and policy autonomy, with implications for states navigating prolonged fiscal and geopolitical stress.

Introduction: The End of Monetary Dominance

For over 30 years, the mechanisms of macroeconomic governance in advanced economies were well known. The toolkit included changes to interest rates and balance sheets by central banks, while inflation targets functioned as anchors for expectations. When crises struck, as they inevitably do, monetary policy safety nets functioned as the first and possibly only line of defence. This framework worked for a while, but the world has evolved beyond that.

The current macroeconomic circumstances are characterised by structural conditions that cannot be addressed through traditional monetary policies. Public debt is high both in absolute terms and, importantly, in terms of the debt maturities countries face in a constant cycle of refinancing. Ageing demographics are leading to lower organic economic growth and tax bases in developed countries. Political tolerance for austerity, aggressive tightening, or repeated rounds of unconventional monetary stimulus has eroded. Moreover, geopolitical stress and polarisation have accentuated the strategic value of industrial strength and technological innovation.

In this context, technology is no longer a background variable influencing long-run growth. It is increasingly becoming a de facto macroeconomic stabiliser, driving how countries refinance their debt, grow and maintain political legitimacy during times of fiscal distress. Countries are increasingly trading off productivity-enhancing technologies and dual-use innovation, as well as financial infrastructure upgrades, to improve competitiveness and refinance, stabilise, and maintain confidence, without necessarily expanding the traditional role of monetary policy. Understanding this shift is essential for policymakers, investors, and analysts navigating the near-term horizon.

Debt, Demographics and Policy Fatigue

The typical macro-level story tends to concentrate on headline levels of debt as a share of GDP. Over the next several years, advanced economies face unprecedented rollover cycles as low-rate debt issued during the post-2008 and pandemic eras matures into a higher-rate environment. The United States (US), along with leading European economies and Japan, must roll over trillions of dollars in public debt each year. This puts persistent pressure on interest costs, even if primary deficits are stabilised. Traditional responses such as fiscal consolidation and tax rises are very unpopular politically as they risk derailing even strong growth trends, and can completely crush fragile ones. Inflation tolerance

has increased implicitly, not because it was desired, but because it became a political imperative.

Within this context, what lawmakers seek to achieve is no longer debt reduction but debt sustainability. Debt sustainability does not mean debt reduction; it means being able to refinance at scale without crisis, emergency intervention, or any form of forced austerity. This requires maintaining investor confidence, preserving nominal growth, and preventing sharp spikes in funding costs. Globally, monetary tools alone do not seem to be effective instruments any longer.

Demographic ageing compounds the debt challenge. A shrinking working-age population in developed countries translates into lower potential economic growth, making it harder to compound revenues. Expenses related to providing medical care and pension entitlements escalate just when it is harder to rely on workers. This is because, without productivity increases, a mathematical problem arises regarding debt sustainability. Technology then no longer remains just a variable to consider in economic expansion, but is instead potentially the only scalable offset to demographic constraints, enabling governments to generate taxes without increasing labour input.

As noted above, the repeated use of unconventional monetary policy has also created political fatigue. Measures such as quantitative easing, yield curve management, or even emergency loans are increasingly being seen as instruments of asset price inflation. The line between monetary and fiscal policy has become increasingly blurred. While central banks retain formal independence, their room for aggressive experimentation has effectively narrowed. Small adjustments have outsized political consequences but limited actual macro-level impact. This creates a vacuum that technology is increasingly filling.

Technology as a New Economic Lever

Technology affects aggregate outcomes through a set of related yet reinforcing channels. Each of these channels, together, enables governments to manage debt dynamics, sustain growth, and absorb volatility without relying on traditional monetary expansion. The role of technology increasingly substitutes not for monetary policy per se but rather for its marginal efficacy.

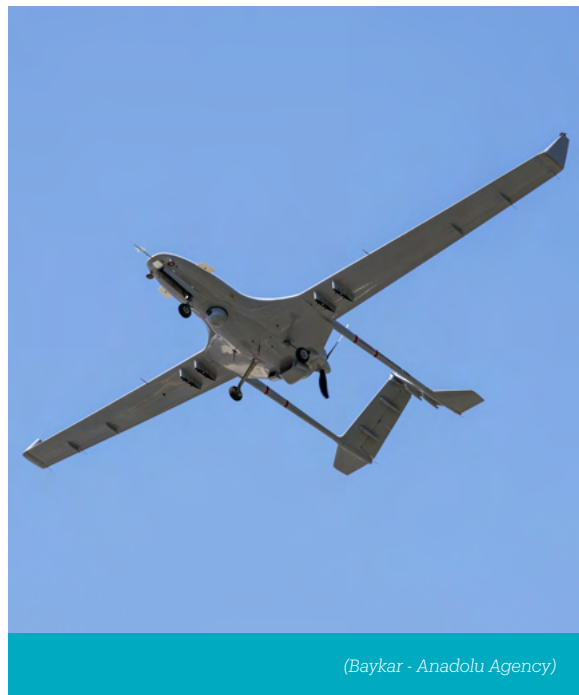
AI-enabled automation, data-driven logistics, and digital service delivery are rewriting cost structures across both the public and private sectors. Associated productivity gains lower unit labour costs and enable firms to safeguard margins even in higher-rate environments. For governments, this means higher taxable profits, better compliance, and more resilient revenue streams – without politically sensitive tax rises. Most importantly, productivity-driven disinflation is distinct from demand

suppression. This allows a state to handle inflation without triggering [socially destabilising](#) wage-price spirals. The increase in productivity indirectly contributes to the sustainability of debt. A clear case in point is [Estonia](#). Early and aggressive digitisation of public services, including tax administration, business registration, and government procurement, has massively reduced administrative costs and compliance friction in Estonia. The high level of digital integration has increased tax collection efficiency, enabling the state to be financially disciplined without tough austerity measures. While Estonia is admittedly a small economy, the mechanism can be scaled: technology-led [productivity gains](#) embedded in public administration directly strengthen fiscal capacity without visible political cost.

Defence technology, energy systems, semiconductors as well as critical minerals inhabit a special political space. Spending in these fields can be framed as [national security investment](#) rather than macroeconomic stimulus. It enables governments to finance larger deficits without facing negative repercussions, triggering immediate backlash or credibility loss. Such innovation, because it is [dual-use](#), serves both civil and military purposes including supporting domestic industrial capacity, as well as increasing employment and export competitiveness. It can effectively legitimise borrowing for strategic autonomy, and will likely carry less reputational risk in the eyes of voters and investors alike, even during periods of significant financial stress. An excellent [example](#) is Türkiye's investment in unmanned aerial systems such as the [Bayraktar TB2](#), as it illustrates how dual-use defence technologies can support export generation, industrial upgrading and civilian applications in logistics, disaster response as well as in infrastructure monitoring, while remaining politically valuable as strategic expenditure.

[Upgrading](#) financial infrastructure is one of the least discussed but most impactful macro tools. Quicker settlement systems, asset tokenisation, and digitised collateral frameworks reduce friction in capital markets. For example, the [expansion](#) of instant digital payments across the European Union shows that when settlement times are reduced from days to seconds, liquidity flows more efficiently in the economy, resulting in less idle cash required for public funding. This further leads to reduced short-term funding gaps for governments, reduced dependence on bridge financing, and reduced volatility in refinancing cycles.

Digital asset markets, such as cryptocurrencies and tokenised financial assets, increasingly operate as [volatility displacers](#). Speculative demand that could have driven CPI-sensitive assets into bubble-mode pricing or exerted consumer price pressures is channelled into digital assets. Even though volatility in these markets is high, it is not linked to household consumption baskets or wage rates. This is the nature of a volatility displacer. This is evident in the [approval](#) of spot Bitcoin ETFs in the



US in 2024. A significant degree of risk-taking behaviour and associated institutional risk-sensitivity has been channelled into approved digital assets rather than housing, commodities, and consumer credit. Even though volatility in cryptocurrencies has increased, evidence suggests there have been no noteworthy spillovers into inflation or household balance sheets, at least in the short term. Furthermore, [researchers](#) found that post-ETF approval volatility moved less through sudden shocks and more through slower, ongoing connections between major cryptocurrencies.

Within each of the four channels mentioned above, technology does not eliminate macroeconomic constraints. Instead, it reshapes how those constraints are tackled and reduces the costs associated with debt, refinancing, and risk. Productivity replaces the need for labour expansion, strategic innovation justifies deficits, infrastructure upgrades smooth balance sheets, and digital markets absorb risk. Together, these mechanisms explain why technology has become a central, if understated, macroeconomic lever in the current policy environment.

Scenario Space: How Technology May Shape Outcomes

Over the next few years, a stack of technologies will shape inflation, debt dynamics, employment, and political stability. How societies absorb job disruption across this stack determines political, social, and economic outcomes:

Dimension	Technology-Supported Repression (Most Likely Outcome)	Volatility Displacement	Productivity-Led Soft Landing
Core Technologies	Ai And Software Automation Reduce Administrative And Service Costs; Digital Logistics And Energy Efficiency Lower Input Prices; Financial Systems Become More Efficient	Ai-Driven Trading And Financial Platforms; Automated Payments; Highly Automated Supply Chains; Speculative Tech And Digital Assets	Broad Use Of Ai, Robotics, Digital Public Services, Energy Transition Technologies, And Advanced Manufacturing
Central Economic Effect	Costs Fall And Output Is Maintained Without Major Disruption	Real Economy Remains Stable While Risk Shifts Into Markets	Economy Grows Faster Due To Broad Productivity Gains
Debt Dynamics	Debt Remains High But Is Easier To Refinance, Reducing Refinancing Stress	Debt Is Serviceable, But Refinancing Coexists With Recurring Market Volatility	Debt Ratios Stabilize As Growth Outpaces Debt Servicing Costs
Inflation Dynamics	Moderate Inflation Is Accepted; Wage Pressure Is Contained	Inflation Stays Out Of Consumer Goods; Pressure Shifts Away From Households	Inflation Is Controlled Through Productivity Gains Rather Than Demand Suppression
Employment Impact	Clerical, Administrative, And Junior White-Collar Roles Decline; Other Sectors Remain Resilient	Employment Levels Stay Relatively High, But Job Turnover And Instability Increase	Job Losses In Routine Work Are Offset By Growth In Services, Infrastructure, And Maintenance
Wages And Job Security	Wage Growth Slows; Job Security Weakens, Especially For Junior Workers	Wages And Incomes Become Uneven And Less Predictable	Wages Stabilize; Job Transitions Feel Less Disruptive
Distribution Of Adjustment	Adjustment Costs Fall Mainly On Clerical And Junior Workers; Benefits Are Broadly Spread	Risk And Stress Concentrate In Financial Markets And Tech-Heavy Sectors	Adjustment Is Spread More Evenly Across Workers And Sectors
Financial Market Behavior	Asset Markets Remain Supported With Limited Visible Stress	Sharp Swings In Crypto, Tech Stocks, And Speculative Assets	Markets Calm As Long-Term Growth Expectations Improve
Government Response	Passive Tolerance And Quiet Management; Stability Prioritized Over Reform	Targeted, Technical Interventions To Contain Market Stress	Minimal Intervention Required As Growth Stabilizes The System
Political And Social Outcome	Politically Survivable But Socially Tense; Stability Is Accepted Rather Than Celebrated	Rising Social And Political Uncertainty Despite Macro Stability	Political Pressure Eases As Employment And Growth Feel Sustainable
Overall Pattern	Stress Is Contained	Stress Is Displaced	Stress Is Absorbed

Strategic Implications for States and Markets

Tech Ecosystems as Policy Autonomy

States with deep technological ecosystems increasingly enjoy a form of [policy autonomy](#) that is not adequately captured by traditional macroeconomic indicators. The [ability](#) to generate productivity gains, sustain strategic industries, and maintain innovation momentum allows governments to operate with larger deficits and higher refinancing needs without triggering an immediate loss of confidence. In that sense, technology acts as a credibility buffer.

The [case of Türkiye](#) perhaps best illustrates this dynamic. Despite persistent headline inflation, currency volatility, as well as limited access to cheap external funding, sustained investment in dual-use technologies, including defence manufacturing, aerospace systems, energy infrastructure, and digital payments. These sectors have strengthened export capacity, reduced strategic dependence, and anchored expectations around real productive capability. While Türkiye's macroeconomic challenges persist, its technological and industrial base has helped prevent recurrent balance-of-payments crises and supported growth during periods of financial stress. Markets and partners now increasingly evaluate Türkiye not only on headline inflation or fiscal ratios, but also on its ability to translate technological capability into strategic relevance and economic resilience. This case underscores how technology can partially substitute for orthodox macro credibility in a constrained policy environment.

Vulnerability of Low-Tech States

[Countries](#) with shallow technological expertise have a [far narrower](#) and harsher set of policy tools to choose from. Without sectors that contribute to productivity and innovation, an increase in refinancing costs translates almost instantly into [fiscal trouble](#). Growth becomes unable to keep pace with rising interest rates, and inflation becomes politically troublesome rather than manageable.

A case in point is [Egypt](#). Digitalisation in fintech has grown rapidly, leading to increased speed and velocity of money, but [regulation](#) has apparently lagged far behind. This weakens policy control rather than strengthening it, as traditional levers struggle to keep pace with a more fluid digital economy. Moreover, adoption is largely in consumption and payments, rather than in production, innovation, or industrial upgrading. This leads to increased activity in the digital area, but it does not result in productivity, technological sustainability, or leadership. [Limited](#) technological diffusion and export diversification of Egypt have impeded productivity

growth. Consequently, the rise in global interest rates has posed a serious challenge to Egypt's fiscal balances and foreign exchange reserves.

Without a strong technology base, the macro adjustment process in the Egyptian economy has largely relied upon external borrowing, devaluation policies, and fiscal consolidation. Although these policies are very effective at managing short-run sustainability challenges, they are associated with high social and political costs and further limit policy autonomy. This example from the Egyptian economy effectively explains the multiplier effect [linking](#) lower technology levels and vulnerability to global liquidity cycles. In such contexts, even orthodox fiscal adjustment fails to restore credibility because growth capacity remains constrained.

Repricing Sovereign Risk

Private markets are increasingly incorporating technology and industrial capacity into sovereign risk assessments. Fiscal metrics and institutional quality, though still relevant, no longer fully explain either capital flows or risk premia. Technology has emerged as a significant macro fundamental shaping expectations for long-term solvency.

Germany serves as the case of this repricing dynamic in an advanced economy context. Notwithstanding underlying rising fiscal pressures, demographic headwinds, and energy transition challenges, Germany remains a beneficiary of largely favourable sovereign risk pricing. Markets anchor this confidence in Germany's advanced manufacturing base, engineering depth, and [applied research ecosystem](#). Germany's technological and industrial capacity underpins export resilience, supporting long-term growth expectations and dampening market reactions to cyclical slowdowns or fiscal expansion. As growth weakens, Germany's [innovation infrastructure](#) and industrial competitiveness help stabilise perceptions of sovereign risk. This illustrates how technological capacity increasingly conditions the market's interpretation of fiscal stress, eroding boundaries between industrial policy and macro credibility.

Limits and Failure Modes of Technology-Led Stabilisation

While technology increasingly shapes policy autonomy and market perceptions, its stabilising role is neither automatic nor guaranteed. There are clear limits to the pressure technological capacity can withstand, and several failure modes that can undermine the strategy if left unaddressed.

The first risk is insufficient diffusion. When productivity advances are [locked](#) within large corporations and leading

sectors, they fail to diffuse. When technological advances are not adopted by small and medium-scale businesses and public services, overall productivity stagnates. In such cases, technology deepens inequality without delivering the productivity-driven growth needed to stabilise debt. There would be reduced macroeconomic payoff, leading to rising [social costs](#).

A second risk arises when financial infrastructure amplifies rather than smooths volatility. Faster trading, algorithmic finance, and digital platforms can improve liquidity under normal conditions but [exacerbate instability](#) during stress, as they increase responsiveness to market factors. Thus, refinancing episodes can become more fragile, not less, as technology can increase sensitivity to market shocks rather than absorb them.

Third, technology-led stabilisation can fail [politically](#). Job displacement, wage stagnation, and perceived unfairness may trigger backlash against automation, digitalisation, or even globalisation more broadly. Once a certain level of societal friction passes, a government could be forced to adopt [counterproductive](#), even authoritarian, policies, such as stifling legislation, sudden and severe redistribution policies, or protectionist measures that make little sense. In such a scenario, the stabilising role of technology erodes rapidly. In addition, while technology can buy time, it cannot substitute for structural policies indefinitely. Productivity gains may plateau, or innovation cycles may slow. Moreover, if debt escalation continues and technological innovation plateaus or declines, governments would have even [less leverage](#) over time.

Finally, technology-induced stability is also vulnerable to external shocks. These could be due to geopolitical tensions, the disintegration of global supply chains, and/or energy crises, which could jeopardise efficiency gains. Technology improves resilience, but it cannot eliminate exposure to systemic shocks. With that said, these limits do not invalidate the overarching strategy. They only define its boundaries. In itself, technology as a permanent substitute for macro-level discipline will not work. In contrast, technology as a stabiliser, with conditions attached, seems more feasible. The following are suggestions for implementing that.

Policy Recommendations

Invest Strategically in Dual-Use Innovation

Governments should institutionalise dual-use investments as part of episodic industrial policy interventions and make them a regular tool for macroeconomic stabilisation. The decisive change is the way such investments are

conceptualised and administered. Rather than treating dual-use innovation as industrial subsidies or R&D grants, states should position it as core macroeconomic infrastructure, alongside transport and energy grids. Such an interpretation will regularise public deficit spending as state security rather than a periodic need of the economy. Policy mechanisms can include:

- Long-term contracts in public procurement offer certainty of demand for enterprises engaged in strategic technology development.
- Structures for co-investments that enable private capital investments while preserving state influence over critical capabilities.
- Clear pathways for civilian spillovers, categorically linking any defence or security innovation results with higher productivity in logistics, healthcare, energy, or public administration areas.

The macroeconomic payoff is twofold: first, productivity gains can be used to finance expenditures associated with reduced consumer spending due to demographic changes and increased taxation, and second, borrowing for strategic purposes enhances political support for larger deficit spending, which in turn reduces risks of sudden fiscal policy tightening during periods of debt refinancing.

Modernise Financial Infrastructure

Financial infrastructure modernisation should be treated as a sovereign resilience project, not a technical upgrade. Faster settlement systems, programmable money, tokenised securities, and collateralised frameworks are all directly working to mitigate refinancing risk. The following areas ought to be focused on by the government and regulatory bodies:

- Further use of tokenised public bonds and collateral in an effort to enhance market depth and international accessibility.
- Integration of digital ID, compliance, and custody requirements to enable scalable institutional participation.

These upgrades improve the absorption capacity of domestic and global markets and effectively enable smoother debt rollover by increasing the velocity and flexibility of capital flows. From a political perspective, technology infrastructure-led reforms avoid the stigma of “stimulus” or “financial engineering,” while delivering concrete macro-stabilising benefits. Behind the scenes, they remain, to date, one of the best methods for potentially substituting for conventional monetary policy.

Support Diffusion of Technology into SMEs and Public Services

Productivity gains must diffuse broadly across small and medium-sized enterprises and public-sector operations to be macro-relevant. This diffusion will ensure that technology does not widen inequality and that it improves its fiscal impact. Hence, policymakers should focus on:

- Subsidised access to AI technology, cloud computing infrastructure, as well as digital platforms for SMEs, specifically in the fields of services, manufacturing, and logistics.
- Digital transformation initiatives in the public sector: Healthcare, tax, permits, and social services.
- Retraining of the workforce should be directly related to technology implementation rather than the development of abstract skills.

The aim is to unlock outputs from technological capability. When smaller enterprises and the public sector increase productivity, this leads to an expansion of the tax base and to more efficient public expenditure. This diffusion is what converts technology from a growth story into a debt-management tool. Such broad-based economic growth helps to stabilise nominal GDP and thus lessens pressure for redistribution and austerity.

Integrate Technological Indicators into Sovereign Risk Analysis

The current frameworks for assessing sovereign risk rely excessively on fiscal ratios and insufficiently on structural capacity. This results in blind spots in a world in which technology is becoming an ever more important determinant of a country's debt-sustainability capacity. Technology-adjusted indicators should be incorporated into debt sustainability analyses by:

- National adoption rates of AI and automation in key sectors.
- Dual use of industrial ecosystems and the resilience of an ecosystem.
- Ability to quickly disseminate innovations between businesses and public services.

Integrating these indicators will provide a clearer picture of a nation's actual resilience. Countries with stronger technological capabilities can absorb more debt without disrupting markets, whereas others will have difficulty rolling over their debt, no matter how small their debt levels

are. This will also help align the rewards system. Decision-makers will be encouraged to develop productive, strategic technologies, rather than being judged solely on their fiscal performance. These recommendations reflect a pragmatic adaptation to structural constraints. As traditional monetary tools continue to lose marginal efficacy, technology becomes the primary channel through which states can preserve growth, manage debt, and maintain political legitimacy.

Conclusion : The Quiet Restructuring of Macroeconomic Governance

Macroeconomic governance is undergoing a subtle but profound transformation. Technology is no longer on the periphery of economic expansion; rather, it is integral to public and market confidence. With the erosion of the effectiveness of classical monetary policy tools, technology is increasingly the factor distinguishing countries with the capacity to maintain high levels of national debt and economic growth from those without it.

Over time, technological depth will function as a core pillar of sovereign credibility, alongside institutions and monetary frameworks. Advanced economies are already relying on productivity gains, strategic innovation, and financial infrastructure to navigate constraints that interest-rate policy alone cannot resolve. It's a global paradigm shift that's quietly taking shape but will significantly affect power and resilience in the global economy.

What is emerging cannot be characterised as disordered chaos, but rather a more discreet reordering of macroeconomic power. Governments that recognise this early will retain room to manoeuvre under fiscal and demographic pressure. Those who do not will, unfortunately, discover too late that fiscal discipline without technological capacity is no longer a strategic option for stability.