MOBILIZING EUROPE'S ECONOMY: STRATEGIC INVESTMENT SCHEMES TO CLOSE THE INNOVATION GAP IN TIMES OF CRISIS

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As Europe faces renewed recessionary risks and rising global trade tensions, mobilizing public and private investment has become urgent. This paper examines how fiscal stimulus, and regulatory reform can help close the EU's investment gap with the United States and China. Through case studies of ARRA (US), EFSI (EU), and China's RMB 4 trillion plan, it shows how scale, speed, and design shape outcomes. Europe's responses have been institutionally innovative but lacked sufficient efficacy. The paper argues for combining strategic public investment with risk-sharing tools and innovation-friendly regulation – such as the more proportionate and flexible application of the precautionary principle – to unlock capital and strengthen Europe's resilience in times of crisis.

The ability to respond to economic crises is one of the defining tests of resilient societies. Each downturn uncovers underlying economic weaknesses. Be it gaps in investment, sluggish innovation, or institutional inertia. Also, every recession demands bold but strategic action by the affected authorities. The Great Recession in 2008 and following, the Eurozone crisis some five years later, and more recent disruptions such as the Covid pandemic or the global tariff disputes have made it clear: without effective intervention, recessions can leave deep, lasting scars on an economy's innovative capacity. Yet history also shows that recessions can be transformed into opportunities for renewal, if governments are willing to mobilize capital at scale and adapt the regulatory environment to reward innovation rather than restrain it.

ECONOMIES IN DISTRESS

Today, Europe faces another critical moment. The continent is slipping into a recessionary environment marked by stagnant growth, tightening credit conditions, and weakening private investment. At the same time, intensifying global tariff disputes, particularly between the three leading power blocs, the United States, China, and the European Union threaten to fragment international trade flows and disrupt investment decisions further. Strategic sectors such as independent clean energy, semiconductors, defense, and digital infrastructure are becoming increasingly tied up in protectionist measures, raising the stakes for Europe's competitiveness. In this context, ensuring that investment does not collapse, but instead pivots towards inno-

vation and future growth, is more urgent than ever. Simply relying on market forces will not be sufficient; public policy must intervene actively and intelligently to mobilize resources at the necessary scale.

This paper examines how fiscal stimulus packages can mobilize private capital for investment and how regulation can be redesigned to sustain and accelerate innovation in Europe and beyond. Drawing on empirical insights into firm behavior, the role of public support, and the impact of regulation, as well as comparative case studies from the United States, China, and the European Union, it traces the conditions under which investment drives not just recovery but long-term competitiveness.

The findings suggest that Europe's success will depend not only on injecting financial resources but also on ensuring that regulation enables technological progress rather than inadvertently constraining it. In doing so, the paper outlines a roadmap for closing the innovation gap in times of crisis. It provides a roadmap that builds on past lessons but requires sharper, more deliberate action for the future.

The paper proceeds as follows. Chapter 2 provides an in-depth examinations of policy impact on economic growth in times of crises, focusing on governmental action in terms of fiscal stimuli and the role of regulation for innovation. Chapter 3 consists of three comparative case studies that discuss fiscal stimulus packages in the US, the EU, and China. Chapter 4 provides comprehensive policy recommendations to sustain growth, Chapter 5 concludes.

BACKGROUND: POLICY IMPACT ON ECONOMIC GROWTH IN TIMES OF CRISES

Understanding how firms respond to economic downturns, public policy interventions, and regulatory environments is crucial for designing effective strategies that support investment and innovation during economically uncertain times. The following sections explore key factors shaping firm behavior: the impact of recessions on private investment and innovation activities; the role of government interventions, particularly direct support for corporate research and development (R&D) activities; and the influence of regulatory frameworks on innovation dynamics.

Drawing on recent empirical research, this literature review highlights the complex interplay between financial conditions, public support measures, and regulatory constraints, illustrating how these factors can both hinder and stimulate private sector innovation depending on their design and implementation. Overall, the insights offered provide important lessons for policymakers aiming to foster resilient and innovation-driven economies in the face of economic disruptions yet to come.

Firm behavior, innovation, and public policy responses during recessions

The global financial crisis began with the collapse of the U.S. housing market. Many homeowners defaulted on their monthly mortgage payments, triggering a wave of real estate sales that caused the housing price bubble to burst. As many mortgages had been securitized and sold around the globe, the fire spread rapidly. But not only the housing market contracted. The sharp decrease in private nonresidential investment during the Great Recession has been partly attributed to a severe tightening of credit conditions and supply following the financial crisis. In addition, rising uncertainty surrounding future economic policy, driven by heightened partisan conflict, has been identified as a significant factor contributing to the observed decline in investment over the past decade (Gomes, 2018). Limited or no access to financial resources due to exogenous factors, such as banks hoarding liquidity, is a major impediment to investment, innovation, and growth of firms.

Industries that are more dependent on external funding resources have been particularly hard hit during recessions, especially in countries where financial contracts are less enforceable. These industries not

only experience deeper contractions during downturns but also tend to grow more slowly during recoveries from financial crises, underscoring the role of financial frictions in shaping investment behavior (Kannan, 2012; Braun & Larrain, 2005). With respect to the structure of firms, conglomerates have shown greater investment efficiency during recessions compared to stand-alone firms, indicating a heightened reliance on internal capital to finance investment decisions during downturns (Wang, 2023).

Investment behavior during the Great Recession also became increasingly diverse across firms. As highlighted by Arrighetti and Landini (2023), plenty of firms significantly cut back investments, while a small group of firms scaled it up – mostly fast-growing new entrants and those already highly innovative before the crisis (Archibugi et al., 2013). This polarization of firm behavior resulted in an aggregate flattening of investment activity, as opposing trends largely offset one another. According to Arrighetti and Landini (2023), this asymmetry in firms' responses can be attributed to two key factors: first, the heterogeneity of corporate strategies developed prior to the crisis; and second, the role of managerial discretion, which critically shapes firms' investment or divestment paths when navigating recessions.

In parallel, evidence from several countries points to a common countercyclical pattern in R&D investment, with firms often increasing their innovation efforts during prolonged economic downturns. This trend highlights the potential of private investment, particularly in research and development, to support long-term growth even amidst recessionary pressures (Censolo & Colombo, 2019) and opens a window of opportunity for targeted and precise policy actions. Notably, Barajas and coauthors (2021) find that selective loans aimed at financing firms' R&D projects during downturns bolster the resources devoted to innovation, illustrating the positive impact of targeted governmental aid during periods of economic contraction.

The effectiveness of direct public support for business investment in R&D and innovation varies across the business cycle. Evidence shows that public support tends to have positive effects on firms' allocation of resources to R&D activities, particularly during recessions (Busom & Vélez-Ospina, 2021). More broadly, the impact of public support on monetary investment in innovation appears to be pro-cyclical, i.e., rising during economic boom phases but counter-cyclical when it comes to the allocation of employee time to innovation activities. This suggests that firms adapt their innovation strategies depending on the phase of the economic cycle (Busom & Vélez-Ospina, 2021).

Even more striking, there appears to be an endogenous component to R&D spending during recessions: firms that maintain or expand innovation activities during downturns build a resilience that improves their ability to innovate during subsequent crises. Amore (2015) finds that innovation during recessions enhances firms' future innovation capabilities, indicating the value of accumulated learning and strategic agility in navigating financial constraints.

Furthermore, cooperation in innovation has proven to be particularly valuable during recessions. Collaborative innovation activities show a stronger relationship with radical innovation outcomes during downturns compared to periods of economic stability, highlighting the importance of partnerships in fostering breakthrough innovations during times of economic stress (D'Agostino et al., 2018). Public support measures, such as selective R&D loans, not only increase firms' commitment of resources to innovation but also raise the likelihood of achieving product innovations during recessions (Barajas et al., 2021). This underscores the potential of well-targeted public interventions to mitigate the erosion of firms' knowledge capital during downturns.

Taken together, these findings suggest that private investment during recessions is shaped by a complex interplay of credit conditions, government policy, industry-specific characteristics, and firm-level heterogeneity. Public policies that support R&D and investment activities thus play a crucial role in influencing private sector

behavior during and after economic downturns. Furthermore, differences across industries, particularly regarding exposure to financial frictions and commitment to R&D, underscore the highly nuanced nature of private investment dynamics during recessions.

The effect of regulation on R&D and investment

The relationship between regulation and innovation is multidimensional, with both positive and negative effects depending largely on the type and implementation of regulation. On the positive side, regulation can create predictability and stability, enabling markets to function more effectively and thus supporting innovation. For instance, digital regulations that safeguard market operations can foster an environment conducive to investment and technological development, as argued by Litina and co-authors (2021).

However, the major downside of regulation lies in its potential to stifle innovation when regulatory frameworks become overly restrictive. Compliance with regulatory requirements often increases operational costs, which can divert resources away from R&D and other innovative activities. Additionally, restrictive regulations may limit the range of available technological components, thereby dampening firms' incentives to invest in innovation (Park et al., 2025; Litina et al., 2021). The compliance burden is particularly evident in the context of stringent environmental regulations, which, in certain cases, have been found to negatively impact innovation by reallocating firm resources toward regulatory compliance rather than technological advancement (Yu & Zhang, 2022).

Given that a world entirely devoid of regulation is neither realistic nor desirable, the extent of regulatory burden becomes crucial. Wang and Dai (2020) have identified an inverted U-shaped relationship between regulation and innovation: moderate levels of regulation appear to encourage innovation, while excessive regulation acts as a barrier. This finding suggests the existence of an optimal regulatory threshold that maximizes innovative activity. Furthermore, regulation itself is not a monolithic concept. Different types of regulation, economic, social, or institutional, impact innovation in varied ways, and even within a single regulatory category, effects may differ depending on the specifics of implementation (Blind, 2012).

One particularly influential example of restrictive regulation is the precautionary principle. It is a regulatory approach applied in situations of scientific uncertainty, in which potential risks to health, safety, or the environment cannot be conclusively ruled out. Even though not necessary, it may come with a reversal of the burden of proof (Bourguignon, 2016; Grandjean et al., 2004): Rather than requiring regulators to demonstrate harm, such a reversal obliges innovators, producers, or investors to prove the absence of risk before a new product, technology, or activity is permitted. This high evidentiary threshold makes the principle particularly restrictive, as it can delay or block innovation even in the absence of concrete evidence of harm.

From an epistemological standpoint, this is much more challenging and often impossible, even though many consumers, e.g., patients suffering from rare diseases, would potentially benefit a lot from the chance to get a novel treatment that has proven reliable and safe in clinical studies but not for the total entirety of theoretically conceivable cases. As a result, widespread application of the precautionary principle can significantly alter firm behavior, particularly in relation to research, development, and investment activities.

Hence, the precautionary principle tends to increase regulatory scrutiny and compliance demands, which may deter firms from pursuing certain R&D projects due to heightened perceived risks and uncertainties. Consequently, firms might avoid investing in new technologies or products that could be subjected to stringent regulatory reviews. In this way, the precautionary principle can shift firms' investment strategies, encouraging a preference for areas perceived as carrying lower regulatory risk (De Smedt & Vos, 2022; Dark & Burgin, 2017).

CASE STUDIES: RECESSION RESPONSES AROUND THE GLOBE

Understanding how different economies mobilized investment during past crises offers critical lessons for Europe's current challenges. This section examines three major responses: The United States' American Recovery and Reinvestment Act (ARRA), the European Union's European Fund for Strategic Investments (EFSI), and China's RMB 4 trillion stimulus packages. While the American and the Chinese recession stimulus packages were a response to the global financial crisis in 2008/2009, the European EFSI project was a response to the European currency crisis five years later. Each case highlights distinct strategies for channeling public and private resources, the role of regulatory environments, and the broader political and economic trade-offs involved. Taken together, they provide valuable insights into how investment frameworks can be structured to foster innovation, accelerate recovery, and strengthen long-term economic resilience.

United States: American Recovery and Reinvestment Act (ARRA)

In response to the severe economic contraction triggered by the 2008/2009 global financial crisis, the United States enacted the American Recovery and Reinvestment Act (ARRA) in February 2009. With an initial budget of $288 billion for tax cuts and $499 billion in direct spending (Conley & Dupor, 2013), and an estimated sum of $832 billion spent in the end until 2019 (Council of Economic Advisors, 2014), ARRA remains one of the most substantial counter-cyclical fiscal stimulus programs in U.S. history. There is wide consensus that ARRA contributed 2-3% of additional growth in 2009 (Council of Economic Advisors, 2009), a time in which an economic boost was desperately needed by the U.S. economy. Its twin aims were to stabilize aggregate demand and lay the foundation for long-term growth, particularly through innovation, infrastructure, and human capital development.

The composition of ARRA reflected a balance between short-term recovery and strategic investment. Roughly 37% of the package went towards public investment outlays, 29% in tax cuts, 19% to fiscal relief of the U.S. states, and 15% went to individuals directly affected by the financial crisis (Council of Economic Advisors, 2014). Importantly, the direct spending component included massive investment in transportation infrastructure, renewable energy, public health, broadband expansion, and education modernization. Federal agencies were pivotal in allocating funds to high-impact innovation-related sectors.

ARRA mobilized private capital through a variety of market-based instruments with a particular focus on green technology investments. Here, the stimulus package took a specific stand to foster investments in future key technologies. Tax incentives like the Investment Tax Credit (ITC) and Production Tax Credit (PTC) for wind and solar energy substantially reduced project costs, catalyzing a wave of private investment in U.S. clean energy infrastructure (Congressional Research Service, 2021; U.S. DOE SETO, 2022). Private companies, such as Tesla, responded with venture capital and project finance to co-invest alongside public funds, especially in emerging technology sectors.

ARRA also included investment in human capital and digital infrastructure through grants to educational institutions and job training programs. While not all components were equally effective or timely, an evaluation by the Congressional Budget Office (2015) found that ARRA significantly boosted employment and accelerated the cleantech transition. By 2012, wind and solar capacity had expanded rapidly, and the startup ecosystem, especially in energy and mobility, benefited from public-private synergy. ARRA demonstrated how a federally organized, innovation-friendly stimulus can quickly deploy capital, crowd in private finance, and build strategic capabilities during a downturn.

European Union: European Fund for Strategic Investments (EFSI)

Confronted with persistently low investment and sluggish recovery following the eurozone sovereign debt crisis, the Euro-

pean Union launched the European Fund for Strategic Investments (EFSI) in 2015 as the flagship component of the Investment Plan for Europe, widely referred to as the "Juncker Plan" as it was proposed by Jean-Claude Juncker, back in 2014 President-elect of the European Parliament (Gaitskell, 2019). Rather than relying on new public spending, politically and legally constrained by the EU's fiscal rules, EFSI adopted a guarantee-based investment model, leveraging limited EU resources to mobilize much larger flows of public and private investment. The scheme did not reach the objective of mobilizing half a trillion Euros, because of design issues and excessive bureaucracy. However, the intention of the EU was a positive one. In an evaluation report commissioned by the Committee on Budget of the European Parliament, Rinaldi and Núnez Ferrer (2017) summarize the EFSI funding scheme as follows.

With an initial guarantee of €21 billion – €16 billion from the EU budget and €5 billion from the European Investment Bank's capital –, EFSI was designed to catalyze €315 billion in investments over three years. The initiative was later extended to 2020, with a revised target of €500 billion. This leverage model relied on the European Investment Bank Group (including the European Investment Fund for SMEs) to identify and co-finance projects in infrastructure, innovation, renewable energy, education, and SME support.

EFSI's unique strength was in de-risking investments that the private sector would otherwise avoid. The fund provided partial guarantees or took junior positions in financing deals, allowing commercial lenders or institutional investors to step in behind a public buffer. This mechanism was particularly useful in financing early-stage or cross-border innovation projects that faced barriers in fragmented European capital markets. For example, water management systems in Southern Europe and mobility infrastructure in Eastern Europe were made bankable under EFSI's backing. The program also provided venture capital guarantees via the EIF to bolster start-ups and innovative SMEs (EIB, 2022).

By 2020, EFSI had mobilized €372 billion, missing the goal of fostering investment activity worth half a trillion euros across all member states, as a study by the European Court of Auditors (2025) recently demonstrated. Still, the report finds that EFSI substantially contributed to closing the investment gap from the European side. The main line of critique is centered around opaque measuring and data collection as well as methodical issues on how to capture the investment multiplier. Another line of critique was the question to which extent the EFSI funding incorporated other lines of funding, which implies a relabeling of existing programs in favor of communicating a larger impact of EFSI (Gaitskell, 2019).

As an evaluation report of the European Investment Bank (2021) demonstrates, EFSI proved to be a relevant policy instrument in addressing both cyclical and structural investment gaps across the EU member countries, particularly in the period from 2018 to 2020. Its counter-cyclical function became especially visible during the COVID-19 pandemic, when investment activity slowed, and credit conditions tightened. Notably, those member states facing the largest cyclical investment shortfalls relative to GDP tended to receive a greater share of EFSI financing, underscoring its responsiveness to macroeconomic asymmetries.

Beyond its role in smoothing cyclical fluctuations, EFSI also contributed to closing longer-term structural investment gaps. Its risk-sharing mandate became even more relevant in the face of heightened uncertainty and increased private sector risk aversion during the pandemic. In this context, while it did not fully fulfill its initial aims, EFSI adapted quickly by accelerating the deployment of operations and reallocating resources toward the urgent needs of SMEs and mid-cap firms, which were particularly exposed to the economic shock.

China: RMB 4T Stimulus Package in response to the global financial crisis

Amid the global economic collapse of 2008, China launched a RMB 4 trillion stim-

ulus package, which amounted to a size of 14% of China's overall GDP in 2008 and corresponded to $586 billion. This massive relative size made it one of the most ambitious and fast-acting recovery programs of its time (Yu, 2009). Unlike the United States or the EU, which rely heavily on fiscal rules, market mechanisms, or consensus-based governance, China utilized a state-directed model, channeled through state-owned enterprises, SOEs (Wen & Wu, 2019).

The bulk of China's stimulus went to infrastructure projects, such as highways, railways, airports, public housing, education facilities, and disaster reconstruction. Approximately 75% of the funds were deployed by local governments, often in cooperation with SOEs, and executed through off-budget investment vehicles known as "Local Government Financing Vehicles." These vehicles enabled rapid deployment but also obscured fiscal transparency (Xue et al., 2020).

Crucially, China's approach to mobilizing private capital was rooted in indirect credit creation. The People's Bank of China maintained a loose monetary policy, expanding bank credit by RMB 14.6 trillion in the years 2008 to 2009 (Xue et al., 2020). This started a wave of construction, manufacturing, and real estate activity, some of it led by the private sector benefiting from spillovers and newly available financing.

Although private capital was not mobilized in a structured way through incentives or co-financing schemes, it followed the public lead, responding to increased demand and easier access to credit. Private firms in upstream industries like steel, cement, or construction materials benefitted from the infrastructure expansion. However, the absence of conditionality, limited transparency, and top-down allocation also led to wasteful duplication, environmental degradation, and the accumulation of local government debt.

While the natural critiques about the efficiency of this state intervention remain, China's stimulus succeeded in maintaining GDP growth above 8% in both 2009 and 2010, mainly due to its rapid and robust fiscal response to the global financial and economic downturn (Li et al., 2012). The plan showcased China's ability to mobilize capital and labor at scale under central coordination while illustrating the trade-offs between speed, efficiency, and sustainability. It stands as a distinct example of command-led counter-cyclical investment, where state dominance rather than market incentives drives resource allocation.

Suggestions for closing the investment gap

The attached comparison table (see Figure 1) highlights not only the different institutional approaches taken by the United States, the European Union, and China in mobilizing investment during crises but also underscores the broader policy trade-offs that accompany different models of economic intervention. Each case illustrates how the design of public investment strategies, whether through direct fiscal spending, risk-sharing guarantees, or state-led mobilization, affects the speed, flexibility, and inclusiveness of recovery efforts. However, the table also points to a deeper insight: mobilizing capital effectively is not solely a question of funding mechanisms. It critically depends on the regulatory environment in which investments are deployed.

The U.S. model demonstrates how regulatory flexibility and targeted tax incentives can accelerate private sector responses; the EU's EFSI shows how structured, criteria-bound guarantees can mobilize finance even within strict fiscal constraints; and China's approach illustrates both the strengths and risks of top-down mobilization without sufficient regulatory checks. Taken together, the experiences suggest that public investment frameworks must be complemented by regulatory reforms that enable innovation, lower compliance burdens where appropriate, and maintain sufficient flexibility to adapt to technological and economic shifts. Without such reforms, even large-scale investment efforts risk falling short of their transformational potential.

FIGURE 1
DIFFERENT INVESTMENT SCHEMES IN THE USA, EU AND CHINA

	USA	EU	China
	ARRA - American Recovery and Reinvestment Act	**EFSI** – "Juncker Plan" European Fund for Strategic Investments	**RMB 4T** Stimulus package
Type	Fiscal stimulus & grants	Guarantee-based leveraging	State-driven investment
Public Capital Source	Direct federal spending	EU budget guarantee & EIB	Central/local budgets + SOEs
Private Capital Mobilization	Tax incentives, procurement	Risk-sharing guarantees	Bank credit + procurement
Execution Speed	Fast	Medium (EIB channels)	Very fast
Flexibility	High	Medium-high (criteria-bound)	Low (broad sectoral push)
Political Trade-offs	Centralized, partisan	Decentralized, consensus-based	Centralized, top-down

Source: Own elaboration. This table shows a comparison of national investment programs.

The comparative experiences of the United States, the European Union, and China during the global economic downturns offer important lessons for Europe's current investment challenge. While each model reflects different institutional contexts, one message stands out: scale and speed of response are decisive when seeking to counteract recessionary pressures and position economies for long-term innovation leadership.

The United States' ARRA program, despite its partisan origins, demonstrated how large, direct fiscal injections, combined with targeted tax incentives and innovation-focused spending, could rapidly stimulate private investment, particularly in emerging technology sectors. In contrast, the European Union's EFSI initiative, though creative and institutionally necessary, relied heavily on leveraging private finance through guarantees. This model proved effective in mobilizing investment where financial markets were functional, but its overall scale remained modest relative to the needs of a fragmented European economy. By the end of its mandate, EFSI had mobilized approximately €372 billion. It is quite a substantial amount, but below the ambitions originally set, and modest when compared to ARRA's broader economic impact.

China's RMB 4 trillion stimulus stands out in its sheer speed and volume. By deploying capital rapidly through state-owned enterprises and local financing vehicles, China succeeded in maintaining growth above 8% even during the depths of the global downturn. However, the costs in terms of financial stability, efficiency losses, and environmental degradation also became apparent in the following decade. For Europe, China's experience underscores the risks of unchecked, top-down investment strategies without sufficient market discipline or transparency.

Taken together, these cases reveal that closing the investment gap vis-à-vis the United States and China will require the European Union to mobilize resources on a much larger scale and at a much faster pace than in the past while preserving the institutional strengths of transparency, accountability, and market orientation. Public-private investment schemes need to be designed for speed, risk tolerance, and a clear innovation focus. Without a more ambitious mobilization effort, Europe risks falling further behind in strategic sectors that will define future competitiveness.

POLICY RECOMMENDATIONS: A COMBINATION OF FISCAL AND REGULATORY RESPONSES EFFECTIVELY COMBATS RECESSIONS

The analysis presented so far underscores that fostering resilient, innovation-driven economies during and after recessions requires a two-pronged policy strategy: targeted public funding to mobilize private investment, and regulatory reforms that strike a balance between necessary risk management and innovation encouragement.

First, state support for business R&D and innovation must be actively counter-cyclical. Evidence from both the Great Recession and more recent downturns shows that public funding has the greatest positive impact when deployed during periods of heightened uncertainty and constrained private financing. Building on the experiences of successful programs like the American Recovery and Reinvestment Act in the United States and the European Fund for Strategic Investments in the European Union, future investment strategies should emphasize selective, high-leverage instruments. These include targeted loans, innovation guarantees, and co-investment platforms that not only provide immediate liquidity but also incentivize private capital to flow into critical sectors such as digital infrastructure, green technologies, and healthcare innovation.

However, expanding funding alone is not enough. The design of these programs must emphasize smart conditionality: public funds should be tied to clearly defined innovation and productivity objectives. This ensures that fiscal interventions not only stimulate short-term demand but also lay the groundwork for sustained technological progress and competitiveness. Attention must be given to ensuring that small and medium-sized enterprises (SMEs) and start-ups, which often drive radical and disruptive instead of process innovation, have equivalent access to funding instruments, counteracting the concentration effects observed during past crises.

Second, regulatory frameworks must be modernized to better support innovation dynamics without abandoning essential protections. The relationship between regulation and innovation is not linear but follows an inverted U-shape. Moderate, well-calibrated regulation can foster innovation by providing stability and market confidence, whereas excessive regulatory burdens can stifle investment and new developments. Policymakers should thus seek to identify and maintain this optimal regulatory zone.

Another essential step toward enabling innovation is advancing the European Capital Markets Union. While public investment and guarantees are indispensable, Europe also needs deeper, more integrated private capital markets to channel funding into productive, high-risk ventures, particularly in early-stage innovation. Fragmented national regulations, inconsistent insolvency laws, and limited cross-border investment tools currently prevent the emergence of a genuine single capital market.

This structural weakness disproportionately affects start-ups and scale-ups in innovation-intensive sectors that depend on venture capital or equity financing. A functioning Capital Markets Union would complement public funding by unlocking private investment at scale, allowing innovative firms across the EU to access financing under conditions comparable to their counterparts in the United States. Developing the EU towards a working capital markets union would match the existing supply of financial resources with the demand of firms that need funding for their innovation paths. A unified capital market would not only increase access to finance but also enhance Europe's overall financial resilience in times of crisis.

A critical area for reform is the application of the precautionary principle. While precaution is essential in managing genuine societal risks, its blanket application, requiring innovators to prove the complete absence of risk, can disproportionately deter R&D activities, particularly in emerging technologies where scientific uncertainty is inherent. Going forward, the precautionary principle should be applied more propor-

tionally and flexibly, distinguishing between high-risk and manageable-risk innovations, and allowing experimental projects under controlled conditions. Mechanisms such as regulatory sandboxes can facilitate this approach, enabling firms to develop and test novel technologies in a supervised environment before full market deployment.

Moreover, regulatory impact assessments should routinely include innovation considerations, ensuring that new regulations do not unintentionally close off technological pathways. In fields such as digital technologies, renewable energy, and biotech, adaptive regulatory frameworks capable of evolving with technological advances, will be critical to maintaining Europe's innovation competitiveness. Finally, mobilizing capital and regulatory reform must go hand in hand. Public investment platforms can only be fully effective if firms operate in an environment that rewards, rather than penalizes, innovation risks. Vice versa, a lighter, smarter regulatory burden needs the backing of strategic public funding to ensure that innovation ecosystems are inclusive and resilient, particularly during economic downturns.

In conclusion, Europe's ability to turn future recessions into opportunities for renewal hinges on combining targeted, scalable investment programs with forward-looking regulatory reforms. Only by aligning these two levers can the EU mobilize its full economic potential and close the innovation gap with global competitors.

CONCLUSION: TOWARDS A GROWING EUROPE

The evidence assembled in this paper points to a clear lesson: recessions expose vulnerabilities, but they also create opportunities to reshape the foundations of economic growth. The experiences of the United States, the European Union, and China show that timely, well-structured public interventions can not only stabilize demand but also channel investment into future-oriented sectors. However, the effectiveness of such stimulus packages hinges on two critical factors.

First, mobilizing capital at scale requires more than just plain public spending. It demands carefully targeted instruments that leverage private investment, prioritize innovation, and support a broad base of firms, including those that have the capacity to drive disruptive growth. Selective public loans, risk-sharing guarantees, and co-investment platforms can amplify the reach of public funds and unlock private sector dynamism, especially in times of heightened uncertainty.

Second, regulatory frameworks must evolve alongside investment efforts. Overly restrictive or rigid regulations risk stifling exactly the kind of innovation needed for renewal. As the analysis has shown, there is a fine line between protecting societal interests and inadvertently closing promising technological pathways. Regulation must be proportionate, adaptive, and innovation-sensitive, applying principles like precaution thoughtfully rather than mechanically. The comparative case studies reinforce these lessons. Where regulatory flexibility and targeted investment worked hand in hand, recovery was faster and more resilient. Europe, facing an innovation gap combined with the competitive pressure of global peers, must now act decisively on these insights.

To turn future recessions into moments of renewal, Europe must deploy public capital smartly, mobilize private investment, and reform its regulatory environment to foster rather than inhibit innovation. The challenge is significant but so is the opportunity to build a more dynamic, resilient, and future-proof European economy.

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