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Income, sovereignty, and cohesion: The political economy of Europe's first mover innovation deficit

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The London School of Economics and Political Science

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Abstract

Europe's economic stagnation and declining global position stem from its failure to lead in first mover innovation, as the United States and, increasingly, China have produced the new breakthrough technologies of the latest industrial revolution. In this paper, we consider the causes of this innovation problem: interrelated issues in the structure of innovation institutions, education, geography, finance and markets, all of which have deep political roots. We build on a game theory model of strategic complementarities and mutual commitments to suggest a path forward which would allow a 'coalition of the willing' of advanced European states to develop US style institutions of innovation while combining them with Europe's social model. Using this, we chart a feasible transition path for Europe which builds on strengths in incremental innovation while creating first mover capacities through integrated capital markets, venture ecosystems, and focused regional cluster development. Only by overcoming its first mover innovation gap, while not abandoning the goals of its social model, can Europe achieve growth, global relevance, and social stability in an era of intensified geopolitical and technological competition.

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1 Introduction: Europe's prosperity and sovereignty problem is caused by an innovation deficit

Europe's relative economic decline is now well documented. A series of recent reports, most notably Draghi (2024) and Letta (2024), have shown the problems faced by the continent – here broadly defined to include continental Europe and the United Kingdom – since the millennium. The summary result of these weaknesses is that, following a long period of convergence catch-up with the US of its average incomes, per capita incomes in major high-income European countries have now fallen as much as nearly one-third behind those of the US (Eichengreen, 1996; Draghi, 2024). This gap in per capita income appears now at risk of becoming durable.

There are many reasons for Europe's divergence from the US. Some of these relate to European preferences for different work-leisure trade-offs, reflected in different working times, in spite of almost identical hourly productivity between the US and the major western European economies. Thus, the divergence in real income (or 'equivalent welfare') is substantially lower than one-third (due to different mixtures of public goods, leisure equivalents, and prices for health care, transportation and housing). But this is no comfort to Europe, because the capacity to save and invest and attain strategic autonomy in an interdependent world depends on nominal income. And the principal reason for the large gap in nominal income is Europe's failure to be a first mover in the ICT revolution (or 'Third Industrial Revolution'), which began in the 1970s and has become the core source of American productivity growth in recent years. The US income and growth gap to Europe is now almost entirely explained by the difference in the size and nature of their tech sectors (Draghi, 2024; Bergeaud, 2024).

Europe's technological weakness leaves the continent exposed to risks on multiple fronts; dependence on the US for access to fundamental technologies; to import competition in advanced manufacturing from superior Chinese goods; and, to an underperforming military sector that depends on US technologies for certain advanced operations. At the same time,

weak economic growth feeds internally into populism and political fragmentation and threatens the ability to pay for European welfare states, especially faced with ageing and shrinking populations. How can Europe maintain liberal democracy when real income growth of perhaps half the population is zero, and social services are chronically underfunded? In turn this weakens national governments (Hooghe and Marks, 2003; King and Le Galès, 2017). And in turn this in part explains the current weakness of the EU, which depends on powerful nation states with the capacity to make long-term commitments[1]. These problems cannot be solved without increasing European output and income growth well beyond what is currently possible. The unique key and precondition to that is a much stronger innovation economy: this would allow more people to work in high skilled, high wage occupations, increase total factor productivity (TFP) and wages for others through technology use, and provide incentives for more work, thus increasing per capita incomes.

Europe is not weak in applying or refining basic innovations to increase hourly productivity. It is weak in generating first mover (or 'breakthrough,' 'frontier', 'leading edge') innovations, which are those that underlie the US's giant tech sector and its world leading companies and clusters. first mover innovation generally occurs in newer firms and industries; the incremental or second-mover innovations, or innovation diffusion, occur in mature or 'legacy' firms and industries. First mover or Schumpeterian innovations have a propulsive growth potential that is exceptional (Aghion and Howitt, 1992; Mokyr, 1990). In particular, they generate technological/entrepreneurial rents, that can then be circled back into capital formation to fund additional leading-edge innovation. This is exactly what the US tech sector, with its huge companies and leading clusters, does for the American economy.

European institutions are poorly suited to generate such innovations, and especially their constituent companies and clusters. Draghi (2024) emphasised that Europe is dependent on

[1]This is echoed in the two further challenges of geopolitical insecurity from the Russian threat, and the ageing of the population as birth rates decline and mortality falls, together with a populist-induced hostility to immigration. To that can be added the equally existential questions of coping with climate change.

legacy firms and industries but does not explicitly argue that the key reason for this is Europe's failure to be a first mover innovator, and specifically its insufficient creation of entirely new technologies, processes and products, rather than the refinement and diffusion of innovations across its economy, a task which Europe does relatively well.

In this paper, we describe Europe's lag in first mover innovation; detail its consequences; and then try to chart a pathway forward to break the institutional logjam that has prevented policy after policy from succeeding in making Europe a world-dynamic innovation region in the past few decades.

There are three steps in our analysis. In section 2, we diagnose features of the problem and key consequences. In section 3, we dive into the institutionalised features of European economies that have led to this situation, and that hence require policy reform. In section 4, which is the core of our original contribution, we propose a way out of Europe's trap, building a game theory policy approach, centred on strategic complementarities and mutual commitments between nation-states, as a way of creating new incentives to break the log-jam. We propose commitments among coalitions of the willing European states that could allow the EU and UK to escape the constraints that have shackled it thus far. The reason that we propose this solution and not the default of going through the EU is that the EU moves too slowly and has too much divergence of capacities and interests to undertake the radical reforms required with the required urgency. The UK can also play an important and constructive role, both as a participant in and a catalyst for such coalitions. The time is late, and the as-yet tepid reforms undertaken in the wake of the Draghi Report are alarming. New approaches are required, as we propose in this paper.

To conclude, in section 5 we address some common arguments from sceptics about the need for Europe to change. The key one is about the linkage between first mover economics and two types of inequality: inter-personal and spatial, issues that are at the core of the European social model and distinctive culture. These links are real for the US economy, where the tech sector is responsible for substantial shares of that country's increase in inter-

personal and spatial income inequality. But there are ways that Europe can better manage these trade-offs that we discuss.

2 Diagnosis: why innovation deficits are the key to Europe's growth and income deficits

Section 2.1 shows Europe is now a second mover; section 2.2 explains how missing first mover innovation has weakened growth; and section 2.3 highlights the political and demographic pressures this innovation gap creates.

2.1 Europe is a second-mover innovator

Historically, Europe was a first mover, producing radical and disruptive innovations[2]: Britain led the First Industrial Revolution in the late 18th to mid-19th century, which was based on iron, steam and coal, while Germany - alongside the US - drove the early Second Industrial Revolution from the late 19th to early 20th century, developing giant firms focused on chemicals and auto-mobiles (Allen, 2011; Mokyr, 1990). In contrast, Europe has created none of the major new firms in the computer and digital economy and lags the US and China in critical new technologies such as AI, quantum computing, space, semiconductors, and biotechnology (Dietrich et al., 2024; Rosenbach et al., 2025). The absence of first mover firms has been a critical factor in Europe's weaker productivity growth compared to the US (Bergeaud, 2024). Europe has chosen to provide support for older industries, but these compete with new industries for labour and capital, creating a mis-allocation problem

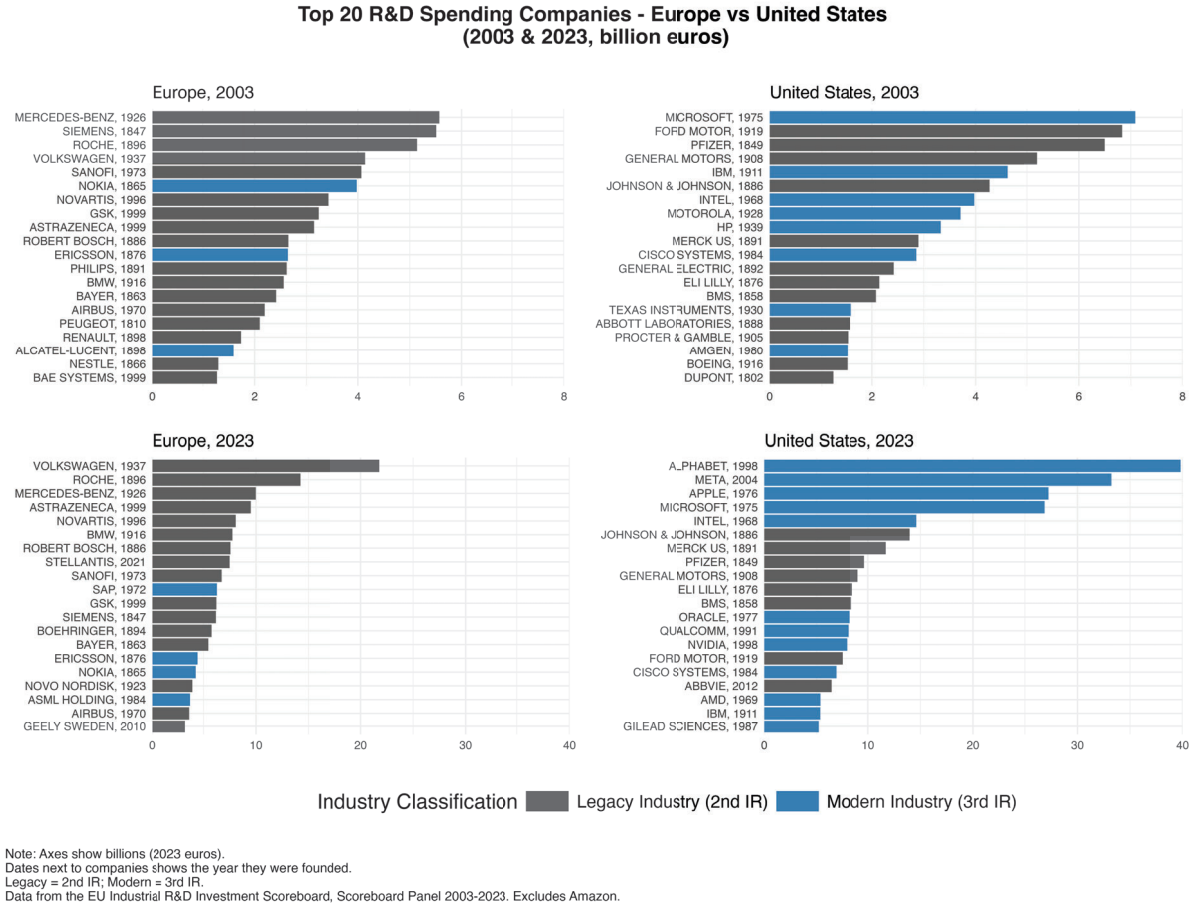
[2]There is a wide of terminologies used to try and capture a certain kind of cutting edge innovation. A review of these terms can be found in Kemeny et al. (2025). They include: disruptive, radical, general purpose, unconventional, breakthrough, and complex, inter alia. We consider that, though there may be fine distinctions between what these terms capture in various measurement literatures, for our purposes they are getting at the same broad concern of this paper. We choose to use the term 'first mover' to cover the technologies broadly described by all these terms and do so because we are trying to capture how the mastery of such technologies affects the economic development position of Europe.

(Bianchi and Labory, 2019; Veugelers, 2018). This deprives Europe of the dynamic reallocation, notably of labour, to highly innovative, leading-edge activities. In turn, this weakens startups and spin-offs, R&D spillovers, weakens experience effects that make innovators even more innovative, and hinders rapid scaling up. In part because of these blockages, the venture capital market is weak. All of these weaknesses can be seen in Europe's lower ability than the US to cultivate home-grown AI firms (Wolff et al., 2020).

To show Europe's weakness in first mover ICT, Figure 1 compares the top US and European firms by R&D spending, categorising them broadly by industrial revolution, or what we term legacy industries versus modern industries. In 2003, Europe had two leading ICT firms, Nokia and Ericsson. These, along with other legacy firms, were spending comparable amounts on R&D to their US counterparts; yet even then the United States had almost twice as many ICT firms among its top R&D investors. By 2023, this imbalance had become entrenched. The ICT sector developed significantly in the US, where leading firms now invest several times more in R&D than Europe's top companies. Europe, by contrast, remains concentrated in legacy sectors such as auto-mobiles and pharmaceuticals. Figure 2 shows how this divergence has deepened over the past two decades. American ICT firms have significantly expanded their R&D intensity and cumulative spending, partly in response to the developing Fourth Industrial Revolution, while European legacy firms have seen far lower growth from a similar spending position. In short, the Third Industrial Revolution has largely left Europe behind. The geography and sectoral composition of frontier R&D have shifted decisively toward the United States and its modern industry champions.

Europe's specialisation in legacy sectors and the dominance of legacy companies leads to the second challenge: the type of innovation it engages in. A long-standing defence of the European innovation model has been that its specialisation in legacy manufacturing industries leads to a comparative advantage in incremental 'quality' improvements and hourly labour productivity through diffusion, rather than first mover innovation (Blanchard, 2004; Veugelers, 2017). Many European legacy firms, in mechanical engineering and luxury goods,

for example, have succeeded by offering high quality product diversity. Yet the capital allocated to these firms may have crowded out the use of cutting-edge talent to generate first mover innovations. Consequently, Europe has been stuck in a middle-technology trap (Dietrich et al., 2024). Figure 3 uses patent data to distinguish between first mover and incremental inventions in Europe and the US. The left-hand panel shows a steep rise in first mover inventions in the US, far outpacing Europe. But the more striking finding is that Europe is also falling behind in incremental innovation: the number of incremental patents has surged in the US since 2000, while Europe's output has stagnated. This is also reflected in Europe's exports, which are concentrated in high quality product varieties rather than new types of products, the reverse of the US (Hsieh et al., 2019).



Note: Axes show billions (2023 euros).
Dates next to companies shows the year they were founded.
Legacy = 2nd IR; Modern = 3rd IR.
Data from the EU Industrial R&D Investment Scoreboard, Scoreboard Panel 2003-2023. Excludes Amazon.

Figure 1: Top R&D spending companies - Europe vs the US, by industry classification

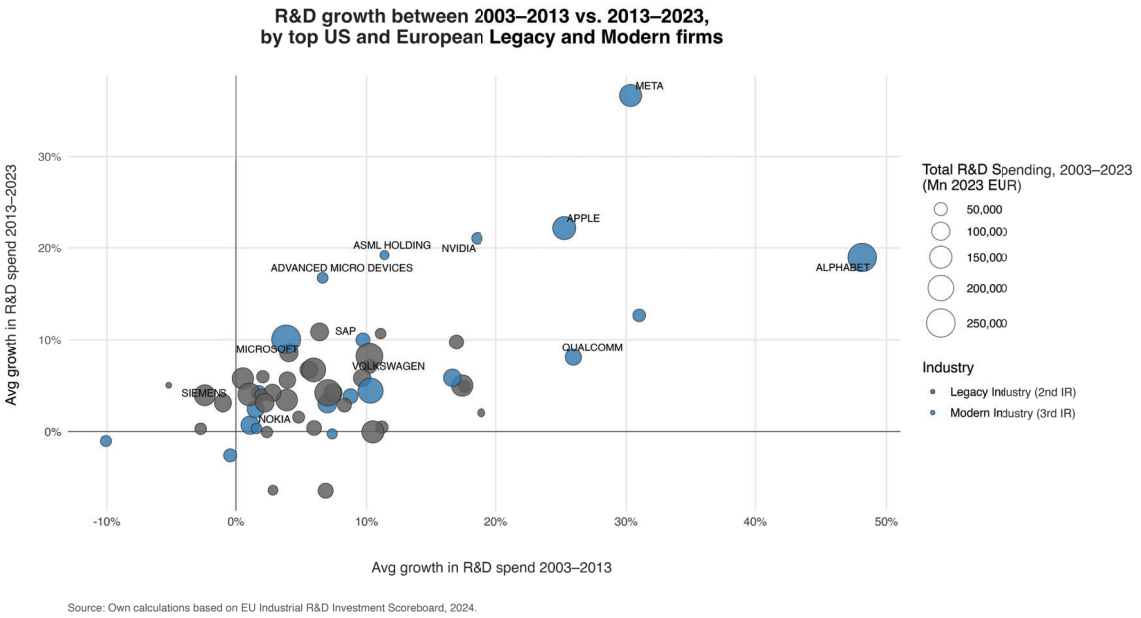


Figure 2: R&D growth between 2003-2013 vs 2013-2023 by top R&D firms

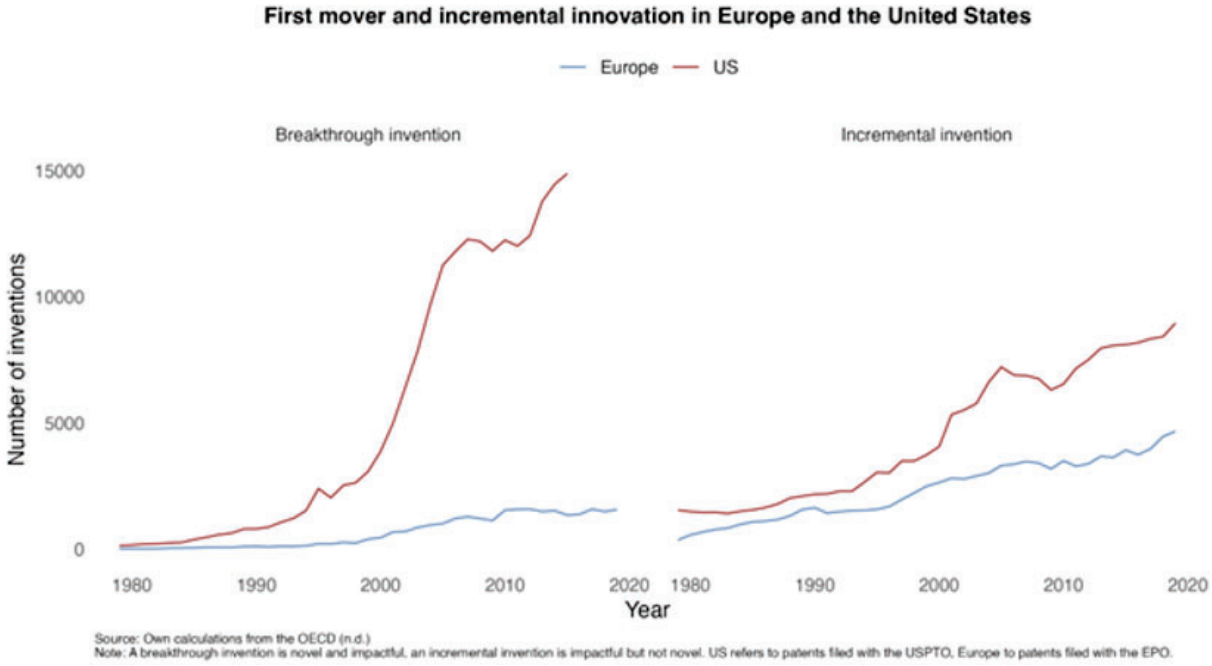


Figure 3: First mover and incremental innovation in Europe and the Unites States

The US's disruptive innovation sector is dominated by newer and bigger very large firms than in Europe. The scale of their R&D efforts is unmatched anywhere in the world. In 2024, compared to $172 billion in federal R&D spending, the 'big tech' sector invests about $350 billion per year, of which the five big tech firms account for about two thirds. Rough comparisons to the $350 billion in private company R&D tech investments, German companies invest about $250 billion, French about $50 billion (National Science Board, 2025). But the American system is not a story of now-ageing giants monopolizing tech creation. In the early years of the Third Industrial Revolution, startup firms emerged that became America's tech giants. That story of scaling up is important in and of itself. But the system for sourcing major new ideas has become more diverse in recent years. Some new disruptive technologies emerge from startups who then may do IPOs; but more than half of the external sourcing of major new ideas by the giants comes from acquisitions, often where seed money has supported many such idea entrepreneurs in the first place, combining scale with diversity and flexibility. This now gives the big companies a double advantage, as they are able to generate huge efforts at high risk, both through internally and by creating large external supply chains of R&D and ideas. It is safe to say that nothing even remotely equivalent can be found in most of Europe.

2.2 The economic consequences of being a second mover innovation economy

Europe's economic performance has stagnated as a result of its persistent innovation deficit. Since 2008, GDP growth has averaged only around 0.9 percent per year, widening the continental income gap with the United States: in 2015 prices, Europe's GDP per capita was about 15 percent below the US level in 2002, but 30 percent below it by 2023 (Draghi, 2024; De Larosière and Cahen, 2025). Europe's position in the global economy has also weakened, with its share of world output falling from 33 percent to 23 percent between 2005 and 2024 (Ezell et al., 2025). These outcomes are consistent with Europe being trapped in a

middle-technology equilibrium, where it excels at incremental improvements but underperforms in generating and scaling breakthrough, first mover innovations (Dietrich et al., 2024). As (Bergeaud, 2024) shows, this is precisely the period during which Europe failed to experience the ICT-driven productivity wave that lifted the US: European TFP remained flat from the early 1990s onwards, while US TFP accelerated sharply, driven by frontier firms in semiconductors, software, and computing.

In a Schumpeterian framework, long-run growth is driven by waves of technological breakthroughs and their diffusion (Schumpeter, 1942). first mover innovations, those that establish entirely new technological paradigms, have especially powerful growth effects because they generate subsequent cascades of inventions and applications (Aghion and Howitt, 1992; Mokyr, 1990).

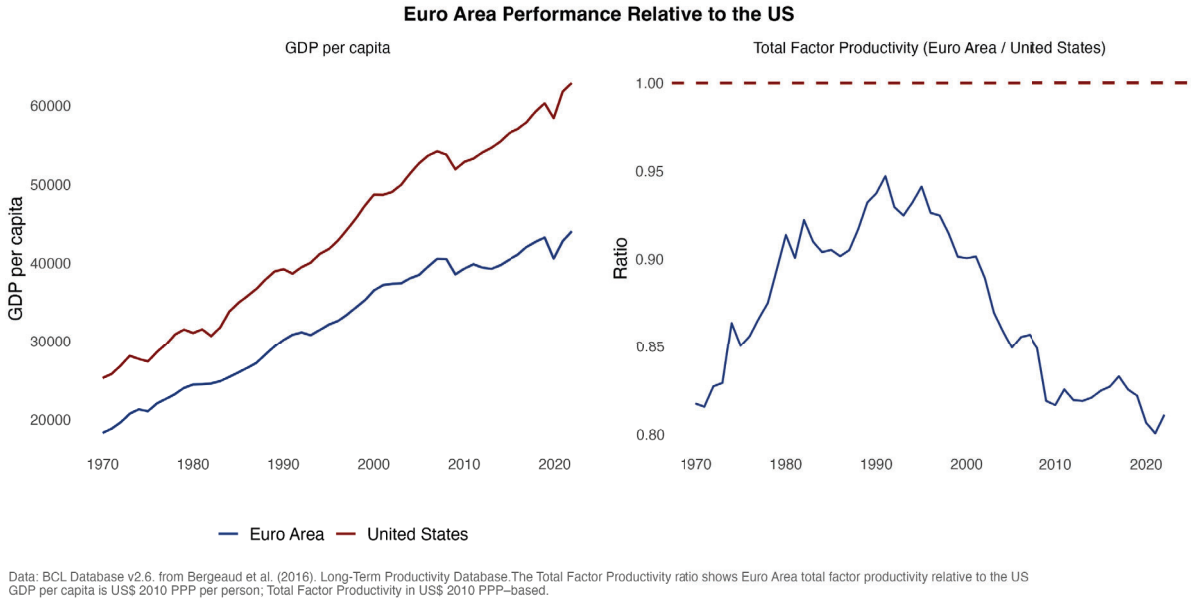


Figure 4: Europe's performance in GDP per capita and productivity relative to the US

Ultimately, these benefits are available to all, not just the early creators, as technologies mature and are diffused and their use becomes more subject to competition. However, in the meantime, it is the early developers who can accumulate important developmental advantages before other economies. These early developers generally have time advantages in

scaling up and commercialising major inventions, as they have the key skills, tacit knowledge, capital and organisational capabilities to create and commercialise the downstream products and services derived from it. These tasks are especially rich in high-skilled, high wage occupations, thus adding to the income of the economies who are first movers. Prices for technologies in their early years embody technological rents for markets defined by imperfect competition, until they are ultimately bid away by codification and rapid diffusion. During this period, there is rapid wealth accumulation by the firms who commercialize such technologies, which can be redeployed into R&D to maintain long-term advantage.

As Teece (1986) and others have observed, although codified knowledge embedded in patents can in principle be transmitted across borders, the co-specific and tacit skills of the initial developers cannot. These skill complexes, teams of engineers, researchers, designers, production specialists, are difficult to recreate elsewhere and even harder to move as a group. A version of this dynamic is at work in the geography of first mover innovation in the US. The cross sectoral super-clusters of Third Industrial Revolution innovation have powerful agglomeration economies. As a result, much of the income divergence between the US and Europe is actually divergence between the US West Coast, Texas, Massachusetts and New York, which account for most of US income growth and where the major technology companies and clusters are located. They contribute to spatial income divergence within the US.

While this concentration is an economic and policy problem for the US, there are nonetheless potential diffusion mechanisms in the highly integrated US economy, and potential policy levers for redistribution (many not exercised). But without such companies and clusters, Europe is relegated to importing the resulting high-value products from the first mover economy, sometimes for many years.

This technological lead is reinforced by powerful institutional and political mechanisms. Two are especially important. First, the US higher-education and research system, along with its leading companies, has strong incentives to continue investing in frontier technolo-

gies. Students and workers acquire the relevant skills because they can build high-return careers in innovation clusters and superstar cities where these technologies are developed and commercialised. In contrast, workers in other countries face weaker incentives to specialise in these skills, and those who do often have incentives to relocate to US hubs, reinforcing American advantages (Bergeaud, 2024). Second, technological leadership embeds actors – advanced firms, highly skilled workers, major city-regions, and associated institutions – deeply within the US political system. While there are major costs to this system, these actors mobilise to protect and promote the interests of the new technology, creating a reinforcing loop between technological leadership, economic advantage, and political influence.

2.3 The political, strategic, and demographic consequences of stagnation

Europe faces political fragmentation, polarisation and concomitant populism, in part due to its weak income growth performance. These are undermining the ability of European states to act as powerful nation states, capable of making credible long-term agreements. Just at a time when, as we shall argue in section 4, Europe needs states that can make credible mutual commitments to profound economic change, populism is narrowing the corridor for such commitments (Traber, 2025). There is a very short window to achieve major change.

The same can be said of Europe's geopolitical independence. Europe's lag at the technological frontier carries profound strategic consequences, especially for its defence, and as is widely noted, at a time when the US is becoming a less reliable ally. European R&D investment in defence remains comparatively low, amounting to just €13 billion in 2024, compared with $145 billion in the US and €21 billion in China (European Defence Agency, 2024; Office of the Under Secretary of Defense, 2023; Stockholm International Peace Research Institute, 2023). A substantial increase in its defence R&D spending is necessary to strengthen its strategic autonomy, given its low investment for a decade (Burilkov et al., 2025). This is fundamentally a geo-economic challenge developing alongside the changing world order

(Chatterji and Murray, 2025). Since 1945, despite falling behind the frontier Europe has done relatively well by adopting US technologies within a stable and open world order. But that play-book is weakening as geo-economic competition intensifies. US policy is more security-driven and less open, while adopting Chinese technology is constrained by security concerns, standards bifurcation, and supply-chain exposure. In a world of great-power technology rivalry, being a regulator-consumer rather than a leading supplier forces reliance on technologies whose design, standards and intellectual property are controlled elsewhere. Europe therefore risks being subject to 'weaponised interdependence', where states leverage control of networks and supply chains for strategic advantage, draining value creation abroad and reducing Europe's bargaining power in trade and security, and increasing its exposure to economic coercion whenever geopolitical frictions flare (Farrell and Newman, 2019; Steinberg and Wolff, 2024). Even over recent years Europe's desire to regulate has been clear, with few of its own firms falling under the scope of those rules, but it struggles to project regulations internationally or to shape the human impact of big tech[3].

The dependence spans both defence and civilian domains, from AI software and 5G equipment to quantum computing, advanced chips, and fusion energy. Draghi (2024) has already noted that cloud services and data centres are dominated by US hyper-scalers, raising concerns about data security and control. This dominance is reflected by the fact that only three major US providers, Google Cloud, Amazon Web Services and Microsoft Azure, capture more than two third of the European cloud infrastructure market share, while 92 percent of the West's data is stored by US-owned and operated infrastructure within the US (European Parliament, 2025). Beijing has tightened controls on drone components, a technology now critical to modern warfare. This context has propelled 'technological sovereignty' into European policy debate. The term does not imply autarky but the ability to secure or develop critical technologies without being subject to foreign coercion, supply cut-

[3]Brussels continues to wrestle with the gatekeeping power of US big tech through the Digital Markets and Services Acts.

off, or lack of control over deployment (Borrell, 2020). Europe's 'Open Strategic Autonomy' doctrine and initiatives such as the EU CHIPS Act, the European Battery Alliance, and the GAIA-X cloud project aim to reduce dependencies. Yet unless next-generation firms can be nurtured and scaled within Europe, the dependence will further weaken Europe's ability to align innovation with sovereign objectives and societal goals (Sheikh, 2022).

Finally, Europe faces the considerable challenge of population ageing. Europe's population is probably now peaking, and will face a gradual decline, unless there is an unlikely radical change in attitudes toward migration or toward having children. Many of the major economies, such as Germany, will face steeper falls. This will lead to some major shifts: if projections are to be believed, Germany will cease to be Europe's largest country in 2059 when it will be replaced by the United Kingdom. Italy's population will almost halve between its peak in 2014 (60.6m) and 2100 (35.4m), and Poland will experience similar changes (UN, 2025). This demographic challenge will be problematic for state spending and worsen Europe's problem of low working hours (Acemoglu and Restrepo, 2019). It will also starve Europe of the talent pool required to tackle major innovation problems, especially faced with the quantity and quality of talent that China (despite its population decline) will continue to be able to devote to such breakthroughs and scale them up. Even the US, with its current backlash against immigration and declining fertility, will likely find a way to keep attracting global talent and, with its culture of working longer hours and more weeks per year, will be able to mobilize labour in quantities that Europe will not.

3 The complementary institutional weaknesses that prevent Europe becoming a first mover economy

Europe has many strong regional and national economies and world-class companies. Yet even Europe's most advanced economies play limited roles in the latest industrial revolution, and they are relatively small in global terms. As Crescenzi et al. (2007) show, Europe remains

characterised by medium-sized regional innovation systems and diversified industrial bases rather than large, globally dominant technology hubs. Its leading innovators display high R&D intensity but are smaller and have less specialisation than their American or East Asian counterparts. The geography of innovation has shifted toward a few global 'super-hotspots', including California, Washington, Massachusetts, Texas, Japan's Southern Kanto, and Guangdong in China(Crescenzi et al., 2020).

In this section, we review the major barriers to European innovation. Most are familiar; our contribution is to emphasize that they are interlocked or institutionally complementary and hence cannot be fixed independently of one another. But the complementarities are positive in the US and negative in Europe. As Soskice (2020) argued, there are, by contrast to Europe, positive institutional complementarities in the US system – institutions of research and higher education, finance, the private sector, and labour market – which enabled the emergence of first mover innovation. Europe suffers from the reverse problem: institutions that are complimentary to each other, but prevent the development of significant first mover innovation, creating a medium-technology or second-mover development trap in Europe. Indeed, we observe in section 3.5 that both the EU's policies and those of most of is member states are effectively wedded to promoting only gradualist, legacy innovation, in contradiction with their abundant language about promoting world class excellence in new fields.

3.1 Finance: too little, too slow

Europe's financial system is well capitalised and supported by high household savings. Yet it lags dramatically in venture capital (VC) - the high-risk, high-reward funding model that is itself a distinct American institutional innovation and which funds much US first mover innovation. Over the decade to 2024, European VC investment averaged just 0.3 percent of GDP, less than a third of the US level (Arnold et al., 2024). In 2024 alone, US VC was estimated at around $215 billion, about 57 percent of the global total, while European VC was estimated at about $45 billion, with the average European startup raising about

half as much as its American counterpart at every funding stage (National Venture Capital Association, 2025; Atomico, 2025). Comparing the two largest VC hotspots in the US and Europe, the San Francisco Bay Area cluster by itself raised roughly $90 billion of VC in 2024 – comparable to the whole of Europe – whereas London attracted a little over ten billion dollars (Crunchbase News, 2025; London & Partners, 2025). Europe not only has fewer VC funds, but those that exist are smaller and more domestically focused. Combined with a strong home bias in asset allocation, this means that firms seeking to raise large sums quickly often need to relocate to the US. The real difference between US venture funding and Europe is probably orders of magnitude bigger than these figures, because the five major tech companies in the USA use much of their gigantic research and investment budgets to support external technological ventures, collaborative R&D with other companies and universities, and internal venturing.

This shortage of risk and VC has broader economic implications. Venture capital does not merely finance innovation; it also helps generate it. (Samila and Sorenson, 2011) show that the supply of VC capital stimulates its own demand, as entrepreneurs are more likely to start firms if they believe finance is available. Likewise, Gonzalez-Uribe and Klingler-Vidra (2025) find that the due-diligence process creates value even for firms that ultimately go unfunded, improving their capabilities and networks. These mechanisms make VC both a driver and amplifier of innovation. In their absence, European startups tend to scale more slowly than their American counterparts, often losing first mover advantages once network effects and market positions are established in the US. Even Europe's largest legacy firms cannot match the depth and risk tolerance of American capital markets.

Weaknesses in the VC ecosystem are due to three main problems. First, European stock markets are smaller and more fragmented than those in the US, limiting fund consolidation, reducing liquidity, and making European IPOs less attractive. As a result, firms list in the US to access higher valuations. Second, since the dominant acquisition opportunities for tech startups lie with US firms, Europe operates as a 'incubator economy' as firms move

to the US to scale. Third, without the early scaling of new firms, there can be no future cohort of R&D-intensive incumbents. Ten of the twelve top US R&D spenders in Figure 1 had VC funding at formative stages; none of the top R&D spenders in Europe did. Europe's failure to generate new entrants means that it lacks a pipeline of new firms building deal sizes. Europe lacks both scale and speed of finance as a result.

Discussions of reforming the European VC system overwhelmingly concentrate on the weak supply side Quas et al. (2022); Arnold et al. (2024); OECD (2025). But the problem is mainly one of demand: if Europe had dynamic first movers, it is likely that the money would come, both from Europeans and from Americans. Investors calculate that there will be too many barriers for startups or intra-corporate venturing to scale up. Thus, this is an example of institutional complementarity: if the VC system is to be reformed, it will need to address supply and demand in tandem.

3.2 European labour Markets: slow labour versus fast labour

European labour markets are often poorly adapted to the dynamics of high-growth, risky, innovation-intensive sectors. Strict employment protection laws raise the cost and lower the probability of rapid scaling; they also dramatically increase the 'cost of failure' for startups. Restructuring costs and labour-related payouts associated with economic adjustment can absorb up to six to ten times more resources than in the United States. And in many large European economies, rigid dismissal rules make it difficult to let go of workers for economic or performance-related reasons (Coatanlem and Coste, 2024).

Reflecting this, Bozkaya and Kerr (2014) show that countries relying more on labour market expenditures, such as unemployment benefits, to insure workers, develop stronger VC ecosystems than those that rely on employment protection regulation, which limits hiring and firing flexibility. The major European economies typically have employment protection legislation remains far more stringent than in the US (OECD, 2025), discouraging the labour mobility and risk-taking that underpin innovation-led growth.

Several small states have labour market rules that combine agility and labour protection well. The 'flexicurity' model used in Denmark and the Netherlands is the best example, combining elements of American hire-and-fire (hence 'flexibility') with strong social protection and active labour market policy (hence 'security') (Viebrock and Clasen, 2009). Yet flexicurity has been proposed as a labour market model since the 1990s, and larger European countries have made little progress towards it. Many countries have a political impasse that blocks such reforms.

Here, again, it is not the supply of labour market policy options that is the problem, but the political acceptance for them. Current insiders dominate politics and are prepared to defend what they have; outsiders (such as innovators and the underemployed) are weakly organized. Public opinion polls show that majorities recognize the need for reform but are distrustful of specific reforms which they are unconvinced will lead to growth. People are unwilling to give up existing advantages for unknown, diffused future gains. There are real trade-offs that we discuss below: higher real wages against higher wage inequality; widening gaps in social status; tax benefits for others, with reduction in public goods for the majority. Generating coalitions to sustain growth-focused reforms is thus difficult. It is no accident that the best functioning labour markets in Europe are in small, socially cohesive countries. This situation points the way to our overarching theme: without embedding labour market reforms in a convincing wider growth program, they will not occur; without convincing reforms, they will fail.

3.3 The European pipeline of talent to innovation is too limited

European labour markets are also less effective at attracting and assimilating skilled workers from elsewhere than the US. It has attracted fewer from abroad, produced fewer domestically, and intra-European movement of talent remains low (Baldwin and Wyplosz, 2023). This means that firms in the most promising innovation clusters find it hard to attract promising innovators from within Europe. Academic wages are often capped by labour market rules

designed to lower inequality, but that limits the ability of research institutions, universities and firms to bid for the best global and European talent. The US is the preferred location of choice of most migrants by some margin (Langella and Manning, 2021).

As in America, technological innovators in Europe have restricted social and class origins. Despite higher social mobility and lower income inequality, European studies show similar class profiles of inventors relative to the rest of the population (Aghion and Griffith, 2024). Elitism in the education and training systems create a psychological barrier to innovation for those outside (Jaravel, 2019). In many educational systems, there is a performance-selection bias that starts very early in the student's life. Students from underprivileged or minority backgrounds have much less exposure to innovators as role models, so they have lower propensity to imagine themselves as potential innovators (Aghion et al., 2017; Hoisl et al., 2023). Thus, the inventor pool would be considerably larger and research productivity could increase by 70 percent given gender parity in inventors (Jaravel, 2025). Europe faces the same problem of 'lost Einsteins' (Bell et al., 2018) as in the US. But its problem is worse: Einstein himself moved from Europe to the US, and Europe remains weak at attracting first mover inventors from elsewhere.

4 Europe's economic geography: Most European metro areas are too small to sustain world-class clusters

first mover innovation economies have a distinctive geography: they depend on large-scale agglomerations with deep labour pools, many firms, and complex formal and informal supporting institutions. Innovators, firms, and other actors in the innovation process benefit from far better opportunities to match with scarce and complementary resources when they operate within large, diverse, and dense pools of talent, capital, and institutions. These are the well-documented super-linear effects of scale on innovation (Moretti, 2021). The vast majority of first mover innovation, and of per capita income growth greater than Europe, comes

from the five US states of New York, Massachusetts, Washington, California and Texas, all of them the sites of large innovation clusters (Chattergoon and Kerr, 2022). Unlike the specialised manufacturing clusters of the past, which typically centred on a single industry and its supply chain, today's innovation clusters are built around inter-related industries, reflecting the tight complementarities between digitalisation, life sciences, advanced engineering, marketing, and digital distribution (Delgado et al., 2014). As a result, the size premium on first mover innovation is greater now than in earlier periods, when smaller specialised clusters dotted the landscape, often outside the biggest metropolitan areas. This is central to understanding why Europe's innovation geography differs from that of the US, and how that difference is both a symptom and a cause of Europe's persistent weakness in first mover innovation.

It is vital to understand how Europe's urban system differs from that of the US. Both continents contain two mega-urban regions: London and Paris in Europe, New York and Los Angeles in the US. Yet, the European pair are smaller in absolute terms, reflecting the more fragmented markets they serve. All four function as major centres of innovation, but the real geographical foundation of American innovation lies in its second-tier cities. The US has a substantial group of metropolitan areas with between six and ten million people, which rank among the country's most innovative both scientifically and in terms of commercialisation (Crescenzi et al., 2007; Esposito, 2023). Europe lacks this entire tier. As Table 1 shows, the distribution of population across functional urban areas (FUAs) in Europe and the US, and Figure 5 shows that this distribution is far flatter in Europe: the top 20 FUAs contain 36 percent of the population and generate 36 percent of GDP, whereas in the US the top 20 account for 56 percent of the population and 65 percent of output. In Europe, GDP per capita rises by 0.1296 percentage points for each additional million inhabitants, compared to 0.2050 in the US – a size elasticity roughly 1.6 times higher in the American urban system (Storper et al., forthcoming).

Table 1: Europe versus US population in FUAs.

	FUA	County	Share	No. FUAs
EU & UK	228,281,318	400,720,730	57%	245
US	237,622,247	331,526,933	72%	162

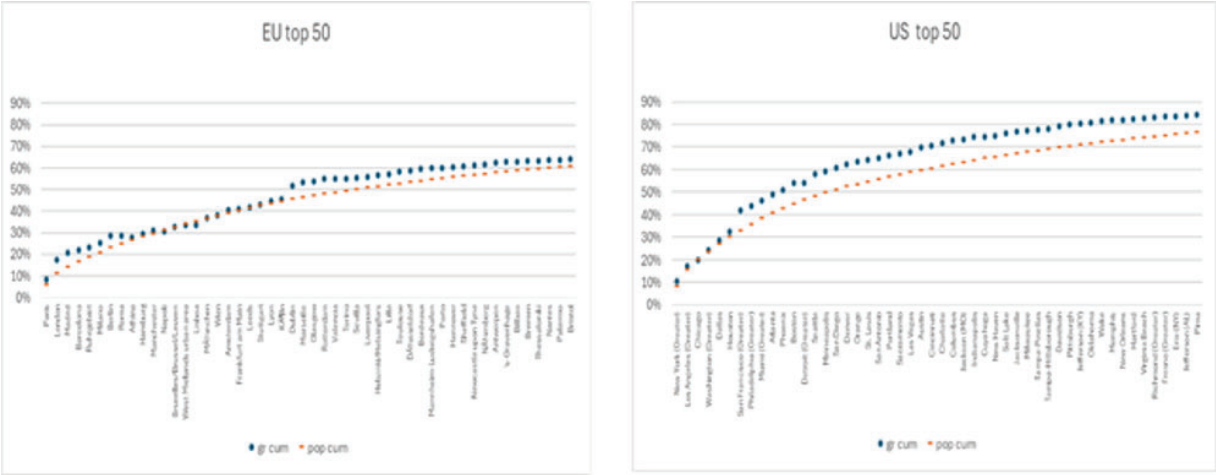


Figure 5: Top 50 regions in Europe and the US and their contribution to output

In Europe, the highest GDP per capita is found in smaller FUAs, largely those with fewer than three million people – whereas in the US the peak occurs in FUAs with between four and ten million inhabitants, the class size that is weak in Europe. There are many possible explanations for this divergence, but as we now argue, it is likely that the higher figure for the US is accounted, at least in part, by the concentration of first mover innovative activity in larger American metropolitan areas. These regions derive substantial productivity benefits from hosting first mover activities. Europe's larger cities, by contrast, often lack these leading-edge specialisations. As a result, they tend to experience congestion costs associated with scale, higher prices, longer commutes, tighter housing markets, without the compensating innovation-driven agglomeration benefits that raise productivity in similarly sized US cities.

Differences in the geography of innovation broadly mirror the differences in the geography of urbanisation. The US tech sector is more spatially concentrated in a smaller number of larger tech agglomerations that are more specialised than their European counterparts (Chattergoon and Kerr, 2022). Europe has few geographical clusters in information technology/AI, biotechnology, or defence and aerospace with the scale of America's.

This raises a key question: is Europe's small urban scale a cause of its weak first mover innovation, or a consequence of it? We have not done original research on the direction of causality, but Europe's urban and innovation geographies do not support the same depth or intensity of matching and re-matching of productive factors as the major US agglomerations. Some might be tempted to argue that several of Europe's most successful city-regions, Copenhagen, Vienna, Zurich, can compete with US innovation hubs such as Dallas, San Francisco, Boston, Seattle, New York, or Washington and so sustain a more dispersed innovation geography with lower spatial inequality. But the comparison is not straightforward. First, these European cities are highly innovative but small; they do not match the scale, depth, or global reach of second-tier American innovation centres. Second, each is a primate city within a small national system, often containing around one-third of a country's population – an already high level of concentration. As Europe moves gradually toward a more integrated single market, and if it seeks to become a first mover innovation economy, existing evidence offers little support for the view that this can occur primarily through city-regions the size of Vienna, Zurich, or Lyon. Rather, it implies that Europe would need considerably larger urban agglomerations to achieve the innovation scale effects observed in the United States.

4.1 Europe's innovation and cohesion policies: gradualism and rent-seeking displace and weaken first mover innovation and growth

As early as 1995, the European Commission identified the so-called 'European Paradox': Europe's strong scientific base but weak technological and commercial performance, especially in ICT sectors between 1980 and 1995 (European Commission, 1995). The 2000 Lisbon Strategy sought to make the EU 'the most competitive and dynamic knowledge-based economy in the world,' yet many of the structural problems it targeted - bureaucratic inertia, risk-averse governance, inefficient public sectors, and social policies that protect jobs rather than people - remain unsolved (Wyplosz, 2010). By 2004, the Sapir report had declared the Lisbon Strategy a failure, and its successor, the Europe 2020 Agenda, achieved similarly limited results: only four member states met the 3 percent R&D investment target (Becker et al., 2020). These repeated shortcomings have been attributed to weak political will, entrenched legacy-industry lobbies, and the ineffectiveness of 'peer pressure' as the mechanisms to get EU leaders to act (Wyplosz, 2010).

Alongside the political reasons underpinning failure, the structure of EU innovation policy itself is a significant shortcoming. Over time, EU innovation policy has coalesced around a two-pillar framework: the Horizon programmes, which fund 'scientific excellence,' and the Cohesion Policy instruments, which aim to diffuse innovation geographically. In practice, both have reinforced an emphasis on gradualist, second-mover innovation, rather than first mover breakthroughs. Horizon 2020 (from 2014) and its successor, Horizon Europe, are competitive, excellence-based programmes that have strengthened European science and cross-border collaboration. Yet they have struggled to translate these research gains into commercialised world-leading firms. Evaluations point to both design and ecosystem frictions: collaborative grants favour incremental, lower-risk projects; commercialisation instruments have shown mixed results; and Europe's persistent late-stage finance gap continues to

limit scale-up even when research succeeds (European Investment Bank, 2024).

Similar issues appear in the innovation dimension of Cohesion Policy, primarily channelled through the European Regional Development Fund. These programmes aim to support SMEs, build research infrastructure, and implement Smart Specialisation Strategies. However, Smart Specialisation has often been criticised as conceptually vague and prone to capture by incumbents, particularly in weaker regions (Bathelt and Storper, 2023). Studies suggest weak alignment with high-tech sectors, reliance on fashionable or overly broad sectors Di Cataldo et al. (2022), the duplication of sectoral focus, and the risk of 'lock-in' to declining industries due to the focus on relatedness (Martin and Sunley, 2022). Cohesion Policy is aimed at ensuring lagging regions can compete, it is not designed nor well suited for first mover innovation.

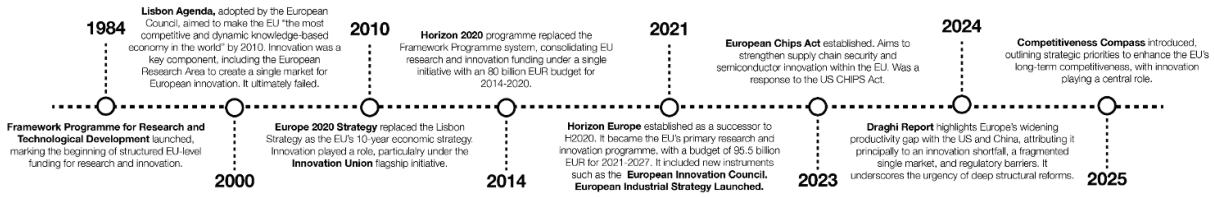


Figure 6: Key developments in the EU's innovation policy

The current policy environment in Europe – Draghi, Letta, Artus, the European CHIPS Act – responds to the failures of gradualist and 'everywhere can be innovative' policies of the past, with calls to excellence and competitiveness. However, there is temptation to try and achieve these goals through big push investment funds. They rely on examples of past successes in large-scale top-down industrial policy, from the Airbus consortium at European level, to earlier successes of French dirigiste technology policies (fast trains, nuclear power). Inadequate investment is partially due to the bank dominated and conservative financing system, and due to Europe's stagnant industrial structure. But it is also due to the structural problems we have described, which discourage capital from flowing into Europe at needed levels. Venture capitalists know that first mover innovation today is not amenable to top-

down planning as was the case in heritage large-scale engineering systems, such as Airbus or the French TGV. They will let the public funds do that, while their first mover capital will flow to American markets.

The problems we have outlined above are not new. So why has little been done to change the situation? The European second mover trap is a case of conventional lock-in, as defined by Lewis (1969). Behaviour is self-reinforcing, as everyone follows the same rule simply because others do, these expectations create stability, as nobody deviates from this initial situation, and – as a result – even if a better equilibrium existed, switching would require coordinated actions from many others. This is why Europe remains stuck as a second mover. Standard one-by-one policy reforms will not move Europe out of its current equilibrium. In the following section, we therefore trace out a novel approach to breaking the logjam, based on establishing a mutual commitment process ('game') of a coalition of willing states.

5 A Mutual Commitment game with Strategic Complementarities to break the logjam

Though the European Union is obviously the essential architecture of European integration and cooperation, it is widely recognised that its system of requiring consensus on major initiatives has proven problematic in many areas. But Europe, as a continent which also includes the UK, must act rapidly and work with some of its largest advanced economies. It cannot wait for EU consensus to act. Therefore, in many pressing areas, there is increasingly talk of creating coalitions of the willing – variable geometries of deep cooperation – that ultimately will become attractive examples for the entire European community.

No European country is big enough to become a world-leading first mover economy. A first mover economy in Europe will require at least several major European economies to have any hope of succeeding. The way forward between the EU's constraints and the need for scale is to bootstrap it into existence through such coalitions of the willing, or what

Draghi (2025) terms Pragmatic Federalism.

What is the structure and process of cooperation that such coalitions should adopt to generate the first mover economy? We propose an embedded game framework, in which the core players are such a coalition of the willing, which in this case would be most of the high-income nation states of advanced Europe. The coalition would make strong mutual commitments to regulatory reform and targeted investment, where the commitments are maintained and mutually enforced. While similar games have been modelled before, the focus here is on the commitments needed for innovation.

5.1 Overview of the game

In game theoretic terms, with the players the members of the coalition, there is an overall coalition of the willing game with two sub-games. The first, called the Mutual Commitment game, is between the governments in all coalition countries, involving the joint commitment to a range of key public sector innovation infrastructure investments, as well as a range of targeted regulatory reforms across all the key relevant areas in which Europe's innovation system is currently deficient (finance, labour markets including corporate governance and employee representation, product markets and competition policy, AI); in the second subgame, the Strategic Complementarities subgame, private actors (largely more advanced companies in the nation states of the coalition) are each assumed to benefit from the outcomes of the earlier Mutual Commitment game and critically and positively from each other's innovation investments.

Essentially, the game works as follows. Governments first commit to specific investments and reforms, knowing other countries are making similar commitments. This mutual commitment is key as it reduces risk for all parties. Second, seeing these credible commitments, private sector actors (investors such as venture capitalists, entrepreneurs, and firms) increase their own innovation investments, confident that the wider system needed for first mover innovation is happening. These create spillovers across Europe – innovation in Ger-

many benefits the French, the British benefit from Dutch investments and so on – these strategic complementarities break the logjam of current policy.

5.2 Coalition action and private sector response

We now turn to setting out the overall game in a more formal (and hence inevitably more simplified) way. To do this, Figure 7 illustrates the actions of members of the coalition. There are two countries, A and B, which we can think of as country A and the rest of Europe, where a and b are measures respectively of the overall investments in innovation, public and private respectively in the two games of A and B. At the initial point, there are very low levels of innovation, $\bar{a}$ and $\bar{b}$. At this point we assume there is little or no incentive for the private sector to invest. Then, the governments of A and B mutually commit to public innovation (infrastructural) investments and deregulation rules, of a and b respectively, arriving at the MC (Mutual Commitment) Equilibrium (a, b).

The second stage of the game is an embedded Strategic Complementarities game. The game is strategic as countries increase investment in expectation that they will also benefit from others' investments, a feasible assumption given the literature on knowledge spillovers (Aghion and Jaravel, 2015). The most important point to make here is that in successful innovation countries the leading innovation comes from the private sector, albeit based on a strong and effective public infrastructure. Moreover, private sector innovation across different sectors and geographically close economic areas has strong mutual complementarities, within and between countries. We capture these complementarities simplistically in the Strategic Complementarities game; and we should think of it applying within as much as between states.

The response of the private sector in national economies follows a best response function, determined by the rate of return on private sector investments in innovation. At the low levels of the initial equilibrium, there are no incentives for private sector investment. However, above a higher amount we can draw two best response (BR) functions for a and b, both

of which are increasing with investments in the other country. An example might be that French firms benefit from the innovation in software performed by firms in Germany, so they raise investments in innovation in response.

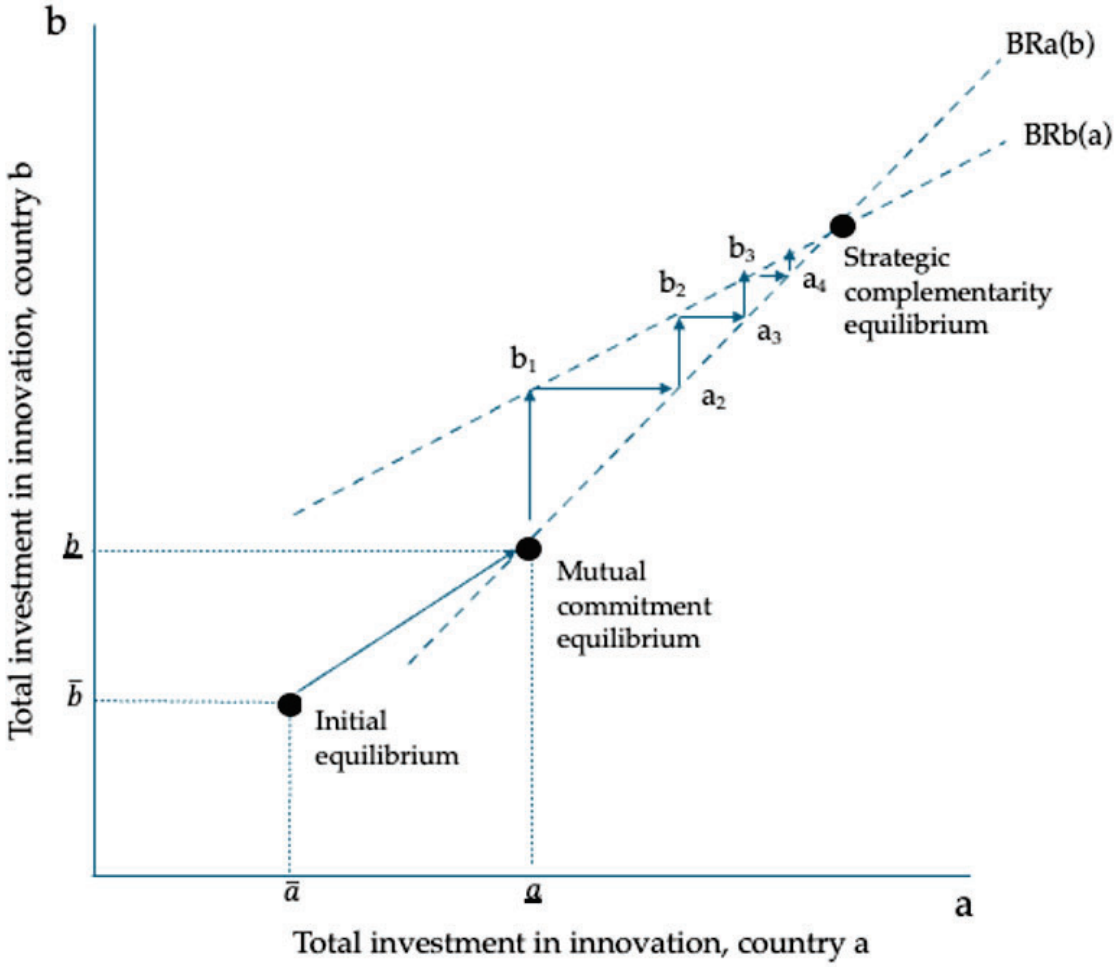


Figure 7: Mutual Commitment framework between members of the coalition of the willing

The mutual commitment equilibrium lies, for convenience, on the BR curve for country a. But at the higher level of innovation the best response for country b lies at a higher level of innovation investment. Country b invests more so we move to a_1. This then leads to a response in country a, which invests more in response. As the optimal level of investment in b is now higher, firms will make greater investments. This 'process' continues until the

strategic complementarity equilibrium is reached.

Essentially, this model shows that a state-backed surge in innovation investments could — under feasible assumptions — lead to a response from Europe's private sector. What we are envisaging then is a dynamic innovation-oriented Europe, based on an innovation-driven risk-taking private sector, underpinned by the coalition of the willing nation states.

5.3 Key components of the Mutual Commitment game

What features of Europe's innovation system might change to enable a shift to higher innovation? We can sketch out a variety of potential options.

Greatly expanding major clusters in advanced Europe. A key element in the solution, with governments constituting the coalition of the willing and the public sector playing a central role, is to create the conditions for emergence of first mover innovation clusters in Europe, and to remove barriers that stymie such emergence. World class innovation clusters have never been planned in advanced or willed into existence by any government; rather, they emerge from the creation of background conditions that enable them to emerge, coupled to ongoing removal of barriers that stymie it. For Europe to succeed, it will be up to the governments who commit to the game to show that they have enough confidence in the potential of any other country to make the commitments in such a way that other members of the coalition, and European private sector actors, are convinced of its potential. As an illustration, one could well image city-regions such as London, Paris, Munich, and Stockholm (inter alia), as potential candidates to become world-class innovation regions and hence for their respective states to make the commitments of the game. Note that these commitments do have to be made under future uncertainty, where the exact location and geography of the relatively small number of European world-class clusters cannot be known in advance. However, as we shall discuss in section 5, the growth effects of having such clusters would be Europe-wide and coupled to the right policies for cross-investment and people mobility, would have strong diffusion effects that must motivate initial commitments

under uncertainty.

Research has never been able to identify all the conditions sufficient for creation of such clusters, but it has identified the necessary preconditions. The key is obviously highly endowed top universities and research institutions on the American model, with such universities having Europe (or world-) wide reach and excellence. Such research excellence, with a risk-taking (in scientific terms) and entrepreneurial attitude toward commercialisation, is essential. In the US, some clusters combine both basic scientific excellence and commercialisation; others are more oriented toward commercialisation. In all of them, embedded practices allow starting-up, scaling up and network formation in supply chains; financing; innovative entrants; firm coaching to grow; finance for marketing power; and host of world class legal, marketing and dealmaking intermediaries. One possible advantage is for Europe is the quality of many of its urban regions, with world class transport, public space, public health facilities, and inclusive high-quality housing. Though these do not assure innovation, they can enhance attractiveness to innovators as the core elements of innovation clusters are supported. Indeed, this may be a strength compared to the dysfunctional urban policies in most American innovative metropolitan areas, where even highly paid innovators now complain of cost and quality-of-life factors. We can also imagine less important but still major clusters, with similar characteristics and perhaps a greater focus on technological diffusion and more incremental innovation.

Targeted regulatory reform. The most critical set of policies will be the targeted regulatory reforms and massive investments in six areas of our advanced European economies:

- **Financial markets:** Regulatory reform of private lending: in particular venture capital and corporate venture, private equity and hedge funds, as well as investment banks require substantial liberty from regulation; this also true of IPOs outside established exchanges. Regulation of commercial banks should be concerned with safeguarding of deposits, but not with their ability to finance innovative startups.

- **Labour markets:** The basic principle here should be some form of Danish flexicurity;

this requires effective institutions of retraining and upskilling. But to this should be added jointly agreed forms of employee representation.

- **Open product markets and light-touch flexible competition control:** Notably allowing giant companies if the overall world market is judged competitive. Need to be agreed across Europe (including the UK and Switzerland as non-EU members).

- **AI and its developments:** One general principle is that legislation should apply to specific not general harms. The second is that rules should primarily relate to promoting 'employee-friendly' AI. This is both central to a social European approach against an American one, but also very difficult (we do not necessarily wish to discourage automation or robotisation in many circumstances). As Acemoglu et al. (2023) puts it, 'automation' is where AI is used to substitute for employees. 'Pro-worker' AI is where AI is complementary to the employee (skill-expanding). Both types of AI raise productivity, but worker-friendly AI enables the upskilled employee to participate in innovation, and arguably to expand the scope of innovation from simply employment-reducing automation to innovative new services.

- **Skilled worker mobility:** A basic principle should be free movement of skilled workers and the ability to study at certified institutions of higher education.

Loan from Financial Markets. As in Draghi's proposals in relation to the EU, but now relating to the coalition of the willing, the coalition will need to raise about €1 trillion annually, proportionately increasing the public sector debt of the coalition members. The coalition members would pay the interest on the loan proportionately. In the case of the Draghi proposals, many of the northern EU members (including Germany) objected to EU loan on the basis that this was de facto subsidising the southern and ECE member states: such an objection would not hold in this coalition of the willing case. (Note too that this mimics the use by the US of public sector debt; but now is certainly a good moment to copy the US 'exorbitant privilege'.) This loan has three major functions in our argument:

1. It is designed to pay for the (large) annual expenditures implied by the massive payments which will be needed to pay for the infrastructural public innovation-related investments called for.

2. The mutual underwriting of the loan will enable low-cost borrowing from international financial markets.

3. It will act as a powerful incentive structure for the relevant countries to join and carry through the huge investments required of the individual countries: for it gives the countries access to the major funds needed to meet the current and future challenges they are facing from the US and China as well as internally and from each other. Moreover, the potential withdrawal of such facilities will act as a powerful sanctioning instrument to keep the individual Coalition members to their obligations.

Mutual commitments to combat populism. A potential obstacle to getting the game started is right-wing populism. Right populist parties are leading in current opinion polls in many European economies. This is widely associated with a decline in the effectiveness of liberal democratic government at the national level. Much of the populism is sources from less-developed peripheral areas around (and even within unsuccessful parts of) successful clusters. It will be necessary for the Mutual Commitment game to show reluctant populist constituencies that there is something in the game for them, and that it is not just another 'reward elites and cities' policy effort. One way to do this is to build in commitments for specific types of redistribution of the benefits of the growth generated by becoming a first mover economy, to populist constituencies. This means public, credible commitments to those parts of the population (generally without higher education) and those regions ('left behind places'), as part of a commitment deal to share the benefits that come from becoming a first mover.

6 Counterargument and complexities

The Draghi Report emphasises the need for Europe to become more innovative, but unlike this paper, does not clearly distinguish between innovation in general and first mover innovation in particular. Beyond Draghi, there are sceptics about innovation as a focus. These come from degrowth constituencies, but also - and in our view more importantly - from those who emphasise that innovation can bring higher inequality, and that this is incompatible with social Europe. In this section, we respond to some of these claims.

6.1 Go green and grow slow

There is a certain view that has much public and policy currency in Europe, that weaknesses can be overcome with a strategy of green decarbonisation and changes in lifestyle that will allow Europe to live within its means with no reduction in quality of life. One version of this aligns with our case for Europe as an innovation-driven growing economy, i.e. if green technologies can be turned into a first mover sector for Europe and exported around the world. The evidence for this, especially faced with Chinese performance in this area, is weak. As the Draghi Report showed, Europe's lead is slim in these technologies.

The other version of it consists mostly of wishful thinking. This is because green technologies do not automatically raise TFP and generate growth (Acemoglu et al., 2012). They reallocate within the economy, and they can lead to many valuable benefits such as offsetting the risks and costs of climate change, but there are no convincing models that they decisively raise TFP, thus setting off a virtuous circle of income growth. And many investments in hardening against climate change or mitigation are going to be very expensive, dragging down productivity growth and potentially crowding out investment. Given the lack of international cooperation, while Europe's commitment to such technologies is principled, it exposes Europe to a moral hazard in the world economy of being the provider of virtue to the rest of the world but being vassalised in power terms.

6.2 The opposite: pump it up

Others would use military Keynesianism to make technology spending a direct instrument of macroeconomic stimulation. With the declining reliability of US defence protection, there will be of necessity an up-tick in European defence expenditures. But much of this will necessarily go into operations rather than innovation with high spillover effects to the wider economy. The technological innovation part of such an up-tick will face a strong risk of being crowded out by large-scale systems spending (big technology projects that are engineering based, but not first mover). The challenge is to push increases in European defence spending into areas in which it is not currently dominant and that involve cutting edge new technologies, such as drones, logistics, batteries, artificial intelligence, and not just into upgraded versions of legacy military technology. These are areas in which Europe is not currently a world leader. Some voices that are gathering to treat Europe's problem as simply one of creating large new special funds for innovation or military spending, are likely to fail at transforming Europe into a first mover innovation economy.

6.3 Fatalism and European social superiority: the uses and misuses of comparative analysis

In some quarters, a common reaction is fatalism, the view that either Europe cannot or should not try to become a leading world innovation economy. Another is defensive, European self-satisfaction at being more egalitarian and caring than China and America. A third current is denialism: we don't really need more growth, because Europeans are content with a different equilibrium of growth and quality of life compared to other parts of the world. Such reactions are often based on misreading the use of comparisons to other parts of the world. In this paper, we do not argue for 'making Europe into America,' nor for Europe embracing American-style inequalities as the price to pay for renewed dynamism. Rather, our use of comparison to the American (and to some extent Chinese) innovation systems is a

heuristic device that allows us to identify the kind of innovation performance that underpins economic growth and sovereignty that can be shown to be necessary for the economic and geopolitical flourishing of Europe in a realistic understanding of 21st century conditions. Whether certain features of the American or Chinese systems can or cannot be reproduced in Europe, our argument is that Europe must find its own way to redress the innovation deficit that is revealed through the heuristic comparison.

6.4 Do more, and do better, of what we are already doing

There is an ambiguity in Draghi and other reports in their discussion of the legacy economy in relation to the first mover. The term 'excellence' is used, but the ambiguity is: this could mean use European firepower to do more of the same, only bigger and better; or it could mean (as we point out above) go green; alternatively, it could mean what we are talking about, which is fix the first mover innovation deficit. We point out in section 5.6 below that the European legacy economy should not be abandoned. Indeed, it should be strengthened. It is complementary to a first mover economy, essentially a means to advanced and innovation diffusion. In addition, keeping it will have inequality tempering effects, both interpersonally and spatially. But it cannot achieve the growth and sovereignty that come from first mover innovation. If that were the case, it would already be doing so.

6.5 A coalition of the willing is politically undesirable or politically impossible

The need to create a first mover economy in Europe comes at a time when state capacities to make bold policy innovations are highly limited by the rise of populism and indebtedness. Populist parties are in general for a national turn in economic strategy, whereas we argue that a first mover Europe can only come about by making binding mutual foreign commitments. This will be anathema to populist parties who will claim that it is globalist and elitist.

Nonetheless, it is striking that coalitions of non-populist parties, broadly speaking of the political centre-left, centre and centre-right, are not even trying to advance growth strategies in most countries. Hence, they cede ground to populists of left and right and make political difficulty into impossibility. A credible mutual commitment game, such as we propose in this paper, proposes a credible new pathway to reform for growth, rather than the current conventional lock-in to austerity with little promise of growth.

A mutual commitment arrangement is vulnerable to the criticisms that are made of the EU, that it is insufficiently democratic. We do not have a formula for how each country could obtain the public support to enter the credible mutual commitment game we propose. A country's participation will not survive unless initial entry is achieved via open debate and legitimate approval. Making a forward commitment to other democratic states for mutual gain will be, in the eyes of some, to give up sovereignty to foreign powers; for others, it will be a pragmatic way to advance national interests.

6.6 First mover innovation and interpersonal inequality

The most serious objection to creating a first mover economy in Europe is that it could increase inequality to unacceptable levels. In its American form, first mover innovation has been closely tied to rising income and spatial inequality. There is considerable evidence that the American first mover economy has contributed to the rise of American interpersonal income inequality since 1980 (Aghion et al., 2019). Most analysis of this increase concentrates on a phenomenon that is common to all countries, skill-biased technological change (SBTC) in the economy of the Third Industrial Revolution. SBTC is largely responsible for rewarding college graduates relative to the rest of the population, roughly the top one third compared to the rest. In addition, in many countries, there has been a growth in top one percent inequality, largely from vast family fortunes, some of them inherited from the old economy, and some from super-winners in the new economy as well as titans of finance. first mover inequality concerns roughly the incomes of the 2nd to 10th percentile, or perhaps the 15th.

Economists measure this group via a combination of being in industries that are first mover, and in occupations linked to first mover activity, as well as to investor or entrepreneurial rents related to first mover companies. Most of the income inequality difference between Europe and the US is not due to different tastes for redistribution or social protection, although the US's programs are less universal and less efficient than those in Europe. The difference is principally in 'predistribution,' meaning the occupational-wage structure in America that is more weighted toward tech-intensive, skilled work that commands high wages (Blanchet et al., 2022). Thus, American tech performance does generate more inequality there.

A generation of research has revealed several multiple and interacting channels to the success of these people in the new economy. We can call these multiple 'superstar' aspects of a first mover economy, building on the foundational insights of Rosen (1981). 45-50 years into the new economy, we now know that the first mover and top one percent contributions to inequality, as distinct from the more general phenomenon of SBTC, come from the following. First, there are superstar domains of technology, where the key innovators in these domains, which are the most disruptive, are early entrants in R&D and/or commercialisation. Second, the people associated with such domains are increasingly recruited by super star companies, who have the means to attract and retain such persons in a competitive labour market for them. Early on, some of these individuals were in early startup companies (and some of them became the super-rich of today), but today most are in the mature large leading super star companies. Third, such people are often in superstar networks of business and technology, owing to their experience as superstar scientists, entrepreneurs or commercialisers. They navigate through positions as a result of these 'colleges' of which they are a part, that allow them to accumulate experience, reputation and further superstar incomes. Fourth, such superstar persons and companies are often located in superstar spatial clusters, and are the basis for first mover clusters as well as beneficiaries of the spillovers and un-traded interdependencies that underpin their innovative prowess. This is the specific economic and spatial vortex of first mover contributions to inequality, and it is sharply in evidence in the

US.

Another reason US inequality is high compared to most European countries is that the US abandoned its legacy (mostly manufacturing) economy, and especially the quality-oriented manufacturing, more than did Europe. In the late 1970s and 1980s, debates over the 'new economy' versus 'manufacturing matters' Cohen and Zysman (1988); Berger and Piore (1980) pitted the emerging Silicon Valley model against a strategy of upgrading advanced manufacturing. US policy ultimately favoured the former at the expense of the latter, a fateful choice that helped produce today's dual structure of inequality: first, the rewards and spatial bidding wars of the first mover economy; and second, the hollowing-out of the Second Industrial Revolution core. In Europe, inequality was tempered in part by its opposite pathway: it preserved more of its legacy economy, on one hand, and did not develop much of a first mover economy. In hindsight, the best combination for economic growth would be to marry a dynamic first mover economy to a strong quality-oriented legacy/diffusion economy, while allowing for globalisation of more routine manufacturing (as has already occurred in both Europe and the US). In addition, some of the Superstar inequality could be tempered via the usual mechanisms of redistribution, public goods provision, and so on – measures which have been particularly weak and inconsistent in the US.

In the medium run, first mover inequality can be tempered by a vibrant legacy sector that perfects, incrementally adapts, and – critically – diffuses first mover technologies. In a series of seminal papers, Aghion and Howitt (1992), Aghion et al. (2019), and Aghion and Griffith (2024) demonstrate that the inequality effects of dynamic first mover (what they call Schumpeterian) economics should be rapidly eroded by policies that encourage rapid diffusion, and temper the rents that growing sectors attempt to harvest through lobbying. Thus, the challenge and opportunity Europe faces is, while perhaps accepting that some short-term increases in 'good' inequality, embedding the first mover economy within the wider economic strategy concerns outlined above. Some of the most innovative European economies – such as Switzerland and Sweden – illustrate this balance: they combine high

innovation and selective top-end inequality with strong wage floors and diffusion mechanisms that spread the benefits to non-frontier workers (Lee, 2024). As noted earlier, Europe also has a real opportunity to appeal to new innovators with a combination of excellence, materials rewards, and values. While the US has developed great strength in developing radical innovation, it has not translated into widely shared prosperity. Europe can foster innovation that produces good jobs while also spreading prosperity widely (Lee, 2024). This could be through the redirection of technological change to be more 'worker-friendly' (Acemoglu and Restrepo, 2019; Rodrik, 2023). Worker representation could play a crucial role in redirecting technological change, such as works councils or unions affecting decisions related to the adoption of technology and training; translating productivity increases into higher wages and creating decent work conditions (Acemoglu and Johnson, 2023). Similarly, increasing the inventor pool is expected to alter the direction of innovation, but also increase productivity and reduce inequality. As shown by Einiö et al. (2019) innovators are more likely to create products for consumers that are similar to them, which they refer to as 'innovator-consumer homophily'. Increasing the inventor pool could create a 'social push' through the creation of novel products for under-represented groups, reducing cost-of-living gaps for them.

6.7 First mover innovation is spatially clustered, generating spatial inequality

We noted in section 3.5 that first mover innovation dynamism seems to depend on large clusters, and that Europe does not have the urban structure to support such clusters. We also argue, in section 4.2, that facilitating the emergence of such clusters should be part of the mutual commitment game to achieve a first mover economy. Therefore, we are indeed implying that Europe may have to tolerate a higher degree of spatial inequality to become a first mover economy.

First of all, it should be remarked that spatial inequality is high and has been rising in the medium term in Europe even without a first mover economy. That is because the sources

of spatial inequality lie in the agglomeration economies of even the second mover parts of the Third Industrial Revolution, consisting of strong urban size premiums that attach to needed concentrations of firms and college-educated workers. The difference is not between a spatially egalitarian Europe and a spatially unequal US, but in the returns to spatial inequality that come from the abundance of relatively small metropolitan areas in Europe as compared to the US, and to policy preferences for spreading incremental legacy innovation and for spatial redistribution, which are more present in Europe than in the USA (Berkowitz et al., 2025).

Clusters cannot be willed into existence or planned. They must emerge from fundamentals linked to the emergence of first mover innovation. At the present time, however, both national policies and the cohesion framework of the EU actively favour territorial redistribution and spatially distributed innovation. Though the continuation of these policies may be necessary to maintain and strengthen Europe's vibrant second-mover economy, they will need to be complemented by policies that squarely face the logic of scaled-up large clusters of first mover excellence. As we noted in section 4.3, countries will need to make mutual credible commitments to make the adjustments in their spatial-innovation policy frameworks to be sure that the large new financial resources that could come from the first mover coalition do not disappear into rents and subsidies for the spatially dispersed, incremental innovation policies that dominate at the moment. Note, however, that if Europe can maintain its existing legacy excellence economy while building a first mover economy, the most severe versions of American left behind regions can be avoided. Europe has already done better at rescuing its Rustbelts than the US Gagliardi et al. (2023)). This is not a trade-off to the spatial basis of a first mover economy; they are different and complementary, part of an overall framework to generate both growth and equity in Europe.

7 Conclusion: A cultural change for a political-economic transformation

Great changes will be demanded of European society to meet the challenges of creating a first mover Europe. Only slightly over-dramatizing, the necessary transformations will be on a par with any during the post-war 1945 period. Europe has, perhaps inadvertently, become culturally resigned to becoming a second-mover. We have laid out a realistic game for breaking the policy logjam, but to conclude, we would like to insist that it is time to change the European culture of resignation. Jean Monnet famously argued that 'Europe will be forged in crisis and will be the sum of the solutions adopted for those crises'. The truth in this statement has been clear in European Union responses to the Eurozone crisis, COVID, and the invasion of Ukraine, each of which has led to changes in European institutions. But the EU and Europe more broadly are now in an economic crisis, and it needs to forge a new economic route.

The answer will be to find a feasible transitional path which takes the values of Europe but reconfigures them for the modern economy. It should be feasible, but it also needs to be radical. A more honest public debate, one that avoids wishful thinking on the one hand or fatalism on the other, is necessary to align a new political consensus on the ambitious reforms we identify above and provide European leaders with a mandate to do what is now urgently necessary.

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A Classification of breakthrough and incremental patents

To classify patents we follow a large literature that uses patent citations to determine the impact and novelty of a patent. A breakthrough patent is defined as novel and impactful, whereas incremental innovation is impactful, but not novel (Esposito, 2022). Forward citation are used to identify high-impact invention, following Ahuja and Lampert (2001) using the most highly cited patents. A patent is impactful if it is in the top 5 percent of forward citations within five years of patent grant, compared to other patents in the same year and technology field. Novelty is assessed using the originality index, which has been first put forth by Trajtenberg et al. (1997). The index captures the breadth of knowledge the patent relies on, with a high score (close to 1) referring to a diversity of technology fields in backward citations. An original invention is thus a patent that depends on a broad range of knowledge sources Squicciarini et al. (2013). If a patent has a score higher than 0.95, a patent is considered as novel. For the US, we use all patents from the USPTO, whereas for Europe we do the same for all patents from the EPO.