conseil d'analyse économique
French Council of Economic Analysis

Antonin Bergeaud [a], Simon Bunel [b]
Xavier Jaravel [c] et Alexandra Roulet [d]

How to Address the Productivity Shortfall?

Les notes du conseil d'analyse économique, No 94, September 2026

Productivity plays an essential role in the evolution of GDP per capita and in our ability to invest in preparation for the future. Yet productivity trends in France have been deteriorating for around thirty years. Between 1995 and 2025, labour productivity grew by 0.8% per year in France (1.1% in the euro area), compared with 1.7% in the United States. This difference accounts for the entire divergence in GDP per capita trajectories between France and the United States over this period.

Which sectors explain the deterioration in productivity in France relative to other countries? We estimate that 86% of the productivity shortfall is concentrated in sectors associated with digital technologies: primarily IT-using sectors, where diffusion takes place (64%), as well as IT-producing sectors (22%). The shortfall in digital investment contributes less and less to this gap: the challenge now lies more in firms' ability to translate digital technologies into productivity gains, particularly through employees' skills and organisational changes.

Over the coming decade, the diffusion of generative AI presents both an opportunity to boost productivity and a new risk of a productivity shortfall for France. French firms are slightly below the European average in terms of AI adoption, but far behind firms in Scandinavian countries. Barriers to adoption (concerns about technological sovereignty, a lack of knowledge and skills, and uncertainty about technological developments) justify reconsidering the scale of public support.

Unlike in other countries, France's policy of supporting adoption is not coordinated by a lead body and is not distinguished from its policy of supporting the development of innovations. We recommend expanding support for AI adoption by prioritising targeted, temporary instruments consistent with innovation support policy, bringing annual spending to 0.02% of GDP (around €600 million), matching the level observed in Singapore, a country particularly advanced in adoption.

Boosting productivity also requires strengthening the schemes that support innovative firms, such as the Programmes d'investissement d'avenir (PIA, investment programmes for the future) and France 2030, for which we present an original econometric analysis. This analysis makes it possible to quantify the socio-economic returns to support by comparing the trajectories of successful applicant firms with those of unsuccessful applicant firms.

The calls for proposals managed by Bpifrance under the PIA and France 2030 have significant effects on employment, activity, investment, R&D and the technological outcomes of the selected projects. After three years, the cumulative additional taxes and compulsory social security contributions paid by successful applicant firms even substantially exceed the support paid out. We therefore recommend strengthening this type of call for proposals within a new France 2040 programme.

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[a] HEC et CAE, [b] Insead, ENS et Farhi Innovation Lab - Collège de France, [c] London School of Economics and chairman of the CAE, [d] Insead, Farhi Innovation Lab - Collège de France and CAE

This Note examines the scale of France's productivity shortfall and the policy levers that could reverse the trend, in terms of both support for the diffusion of innovations and support for technological innovation.

France's productivity shortfall

Why focus on productivity?

Measuring the wealth generated by a country and its ability to improve its inhabitants' living standards remains a fundamental but difficult question to address. The most commonly used indicator is gross domestic product (GDP) per capita, which divides the total value added generated in the economy (goods, services, construction) by the number of inhabitants. This indicator measures an economy's productive capacity and the resources it can devote to consumption, public services or investment. In France, GDP per capita has risen continuously since the 1950s, but its growth rate has slowed since the 1990s.

To better understand the extent to which an economy generates more or less wealth per capita, GDP per capita can be broken down into two components by explicitly accounting for working time: labour input per capita, which depends on the employment rate, working hours, retirement age and demographics (the working-age population); and labour productivity, meaning the value added generated by a worker in one hour, on average.

$$\underbrace{\frac{GDP}{Pop}}_{\text{GDP per capita}} = \underbrace{\frac{GDP}{\text{Working hours}}}_{\text{Labor productivity}} \times \underbrace{\frac{\text{Working Hours}}{Pop}}_{\text{average working time per inhabitant}}$$

When considering the growth rather than the level of GDP per capita—that is, how wealth increases or decreases over time—two contributions are added together: growth in labour productivity, meaning efficiency gains with hours held constant, and growth in average hours worked per capita.

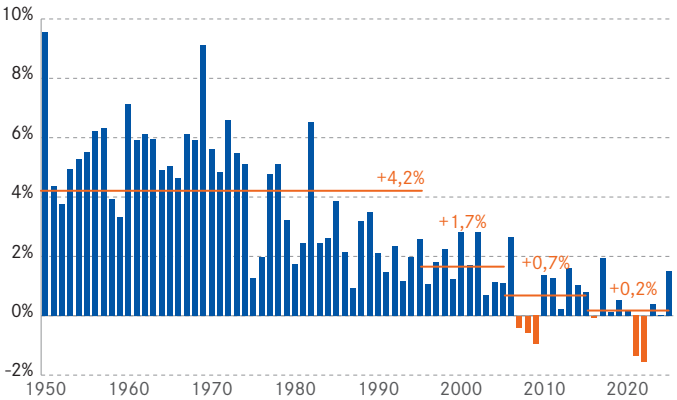
$$\underbrace{g_Y}_{\substack{\text{GDP per capita growth}\\ \sim 1.09}} = \underbrace{g_P}_{\substack{\text{Labor productivity growth}\\ \sim 0.82\%}} + \underbrace{g_L}_{\substack{\text{Growth in average working hours}\\ \sim 0.27}}$$

In France, hours worked per person in employment have fallen markedly over the long run, owing to reductions in working hours and the rise in part-time work. This decline has, however, been offset by the increase in the employment rate, first among women and then among older people, so that total hours worked relative to the population have remained broadly stable. The slowdown in GDP per capita growth since 1995 therefore primarily reflects changes in labour productivity gains. This does not mean that labour input is unimportant: people in France and elsewhere in Europe work fewer hours than Americans as a result of collective choices embedded in institutions governing retirement age, leave and labour taxation. Increasing labour input can support GDP per capita. However, this policy lever faces clear social and demographic limits. This is why this Note focuses on labour productivity, which represents the ability to create more value per hour worked and whose gains have more lasting effects on growth.

Productivity developments since 1995

Between 1950 and 1995, labour productivity per hour worked in France grew at a rate of around 4.3% per year. Since 1995, the average has been 0.8% per year, and the trajectory of labour productivity per hour worked in France can be divided into 10-year phases. Between 1995 and 2005, labour productivity per hour worked grew at a rate of 1.7% per year, driven by the diffusion of the first digital technologies and the resulting efficiency gains. Between 2005 and 2015, this rate halved to 0.7% per year as successive crises weighed on investment. Finally, between 2015 and 2025, labour productivity per hour worked grew at an average annual rate of just 0.2%. In terms of levels, each hour worked generated an average of €56.70 in 2015, compared with €57.60 in 2025 (in constant euros). Such a productivity slowdown is unprecedented in the data available since 1950 (Figure 1).

Figure 1. Annual growth rate of labour productivity per hour worked in France between 1950 and 2025, in %



Source: Insee

Reading note: In 1995, the growth rate of labour productivity was 2.58%.

Looking at productivity trends across the different sectors of the economy, it appears that the post-2015 productivity shortfall is entirely attributable to declines in productivity within sectors themselves, rather than to a change in the composition of the economy. To demonstrate this, two effects can be distinguished[1]. The first is the within-sector

* The authors would like to thank Arthur Poirier (Scientific Advisor), Alice Lapeyre (Economist), Antoine Lopes (Research Officer), and Matis Aubin and Philipa Seilles (Research Assistants) at the French Council of Economic Analysis (Conseil d'analyse économique), as well as Florian El Gourdou (a doctoral student affiliated with the Farhi Innovation Lab at the Collège de France), for their contributions to the development of this note. They also extend their thanks to the Farhi Innovation Lab at the Collège de France for the resources provided to support the content presented in this note, as well as to Gauthier Jacquemin of the IGF.

[1] This is a "shift-share" decomposition conducted across 37 sectors. For further details, see Bergeaud A. (2026): "Productivité et adoption des technologies en France" [Productivity and technology adoption in France], *Focus du CAE*, No. 141, September.

effect: productivity gains achieved within each industry, for example when a farmer produces more thanks to better equipment, or an accountant handles more files thanks to new software. The second is the reallocation effect: when workers move from a low-productivity sector to a more productive one, average productivity in the economy increases mechanically, even without any efficiency gains within individual sectors. This second effect, which was important in the post-war decades, has become marginal in the recent period: it is therefore productivity within sectors themselves that has deteriorated on average[2].

This assessment is confirmed when France is viewed in a European context. Apart from Italy, where productivity is stagnating (−0.01% per year on average), France is the only major country where labour productivity per hour worked has grown at a rate below 0.25% since 2015. Over the same period, Spain recorded growth of 0.49% per year, Germany 0.64% and the euro area as a whole 0.74%.

Growth in hours worked per capita in France since 2015 (+0.7% per year), resulting from falling unemployment and policies encouraging employment, may have mechanically depressed apparent labour productivity per hour worked if it was accompanied by the entry into the labour force of workers who were, on average, less skilled or employed in jobs with lower value added. Empirical studies make it possible to quantify this phenomenon[3]: for every 1 percentage point increase in the annual growth of hours worked, productivity is estimated to fall by an average of 0.17 percentage points in the short run. Applying this adjustment, France's adjusted labour productivity per hour worked stands at +0.36% per year over 2015–2025, compared with +0.86% for the euro area. The gap therefore remains virtually unchanged.

Once this adjustment is made, the productivity growth gap between France and the EU27 since 2015 is concentrated primarily in wholesale and retail trade (30% of the gap), manufacturing (24%) and professional and scientific services (18%).

> **Finding 1**. Since 2015, labour productivity per hour worked has grown very little in France, including relative to other European countries. This gap is explained neither by employment growth in France nor by the inclusion of workers who are, on average, less productive.

The comparison with the United States extends this assessment. Although comparing US productivity levels with those in European countries is more difficult because of differences in purchasing power parity[4], comparing growth rates very clearly reveals Europe's productivity shortfall relative to the United States, and France's in particular.

> **Finding 2**. Between 1995 and 2025, average annual growth in labour productivity per hour worked was around 0.8% in France, 1.7% in the United States and 1.1% in the European Union. These trends explain most of the difference in GDP per capita trajectories between the different regions.

Productivity and digital technologies

To understand the origins of this productivity shortfall, we need to turn to digital technologies (IT), which have been an important driver of productivity since the mid-1990s. The third industrial revolution, marked by the rise of computing, communications and, in particular, the Internet, has profoundly transformed advanced economies over the past three decades. The United States was a pioneer, both in producing these technologies and in their adoption by firms, and benefited from a wave of productivity growth as a result.

To identify the precise channels behind the productivity shortfall, it is useful to distinguish three groups of sectors in the economy according to their use of digital capital. The first comprises IT producers (electronics, digital media, IT services): these are the sectors behind the production side of the digital revolution, but they account for less than 5% of employment in France and the United States. The second comprises IT-intensive sectors, those that use digital capital intensively, such as wholesale and retail trade, finance and electrical equipment manufacturing: it is in these sectors that technology diffusion takes place. The third, comprising sectors such as transport and real estate, accounts for more than half of employment and is characterised by limited use of digital capital.

A country that excels in producing digital technologies derives productivity gains from them, but these may be limited, since IT-producing sectors account for a relatively small share of employment and total value added. It is the diffusion of these technologies across IT-using sectors, which account for the bulk of economic activity, that determines the scale of aggregate gains. When a major retailer adopts inventory management systems or when public administration becomes digital, the resulting gains spread throughout the economy. Figure 2 presents the average annual contributions of these three groups to aggregate productivity in France and the United States. It shows that most of the gap stems from IT-intensive

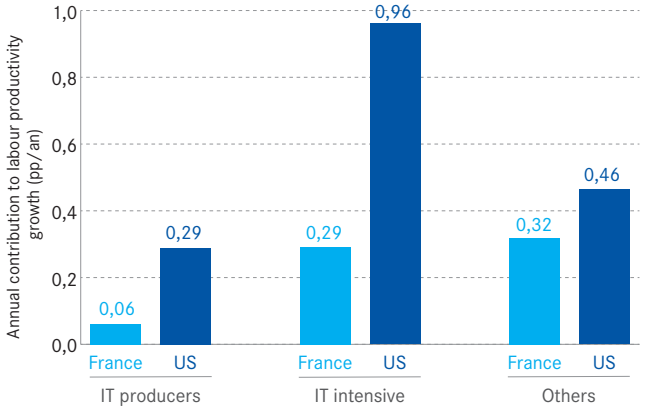
[2] The information and communication sector and food and beverage service activities have nevertheless experienced an improvement in labour productivity per hour worked since 2015, without offsetting the negative contributions of wholesale and retail trade and transport to the total.

[3] For further details, see *Focus du CAE* No. 141, ibid.

[4] See *Focus du CAE* No. 141, ibid.

sectors, even though the United States is more dynamic in each group[5].

Figure 2. Annual contribution to labour productivity growth by sector group, France and the United States, 1995–2025



Note: The "IT-producers" group comprises C26, J58–J60 and J62–J63; the "IT-intensive" group comprises manufacturing (C16–C18, C19, C27, C28, C29–C30, C31–C33) and service industries (G, K, M, N, R, S) with high IT intensity; "Others" comprises the sixteen remaining industries (agriculture, construction, transport, real estate, non-market services, etc.).

Source: EU-KLEMS, BEA, BLS and Insee.

Finding 3. 86% of the productivity shortfall is concentrated in sectors associated with digital technologies: 64% in IT-using sectors, where diffusion takes place, and 22% in sectors producing these technologies.

Revisiting the earlier decomposition into three periods since 1995 shows how France's shortfall developed through the different stages of the digital revolution[6].

In the first period, 1995–2005, the productivity shortfall originated in "IT-intensive" sectors, which alone accounted for 61% of the productivity gap with the United States. The United States was then undergoing a profound transformation of its economy during the "first wave" of the IT shock: retail trade combined data from checkout systems and barcodes with tools for inventory management, demand forecasting and integrated logistics, while financial services automated data processing and integrated banking information systems. Labour productivity per hour worked in US wholesale and retail trade thus grew by 5.5% per year, compared with 1.7% in France, supported by investment in digital capital that was around 1.6 times as intensive (2.9% of value added, compared with 1.8% in France). This was the period of the "retail productivity revolution", with France lagging in adoption in the sectors that use digital technologies most intensively.

In the second period, 2005–2015, the gap widened, but at a much slower pace: the growth gap fell to 0.25 percentage points per year, compared with 1.6 percentage points in the previous decade. Productivity slowed as the previous wave lost momentum, while successive crises held back investment on both sides of the Atlantic. The US sectors that had driven productivity (wholesale and retail trade, finance) stalled: labour productivity per hour worked in wholesale and retail trade grew by just 1.4% per year in the United States, compared with 1.2% in France.

From 2015 onwards, the situation deteriorates again: the growth gap rises back to 1.5 percentage points per year and, this time, spreads across the whole economy, including sectors that had previously been spared. The share of "other sectors" in the gap thus rises from 17% to 28%, and French aggregate productivity grows very little (+0.2% per year, compared with +1.7% in the United States). The shortfall in equipment is no longer the fundamental factor: in wholesale and retail trade, for example, French digital investment accelerates sharply (nearly 3% of value added, compared with 1.8% at the start of the period), to a rate now close to that of the United States (3.5%). Yet labour productivity per hour worked in the sector deteriorates (−0.9% per year, compared with +1.9% in the United States). Similarly, in scientific and technical services, the United States records productivity growth of 2.8% per year, while France stagnates (−0.5% per year), despite faster digital capital accumulation in France than in the United States (6.7% of value added invested in digital technologies, compared with 4.3% across the Atlantic). A new digital wave (cloud computing, data infrastructure, artificial intelligence) is spreading in the United States, but the gains it generates seem to depend less on the digital capital invested than on complementary assets that are difficult to measure: data, team organisation, digital skills and the ability to transform production processes.

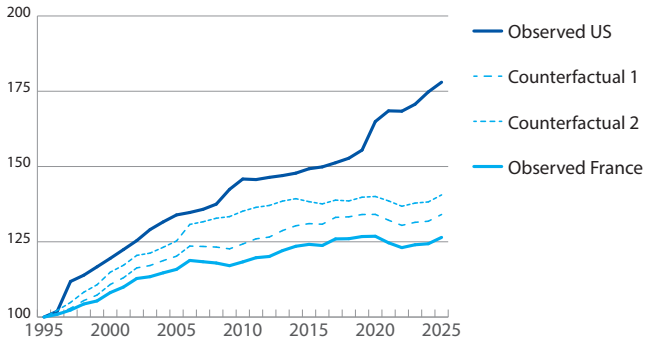
Would France have caught up if it had invested as much as the United States in digital capital? As Figure 3 shows, the answer depends on the period considered. In 2005, such a catch-up in investment would have made it possible to eliminate between 25% and 50% of Franco-American productivity gap. In 2025, only between 15% and 30%. In other words, France has partly corrected its shortfall in digital equipment over time, without reducing its productivity shortfall. This result points to an important conclusion: the problem is no longer, or no longer solely, one of investment. It is a problem of the ability to derive efficiency gains from the digital tools

[5] National statistical institutes use different methods of quality adjustment in measuring prices. While these methods are broadly (in theory) harmonised in Europe, this is not necessarily the case between the BLS and Insee, which may raise questions about the validity of the measured productivity growth gap (1.7% compared with 0.8%). Although it is difficult to eliminate the potential bias completely, several factors suggest that it is not sufficient to explain the observed gap. First, as Figure 2 shows, the largest share of the productivity shortfall stems from IT-intensive sectors, which include manufacturing sectors and wholesale and retail trade, where there is greater consensus on price measurement. Second, various exercises can be carried out: excluding the IT-producing sector, restricting the analysis to the market sector, or evenusing the same price index for both economies, without significantly changing the measured gap.

[6] For a detailed decomposition of productivity developments by period and sector, see Bergeaud A. (2026): *Focus du CAE* No. 141, op. cit.

already in place. The gap with the United States now hinges on other factors, such as employees' skills, work organisation and data governance within firms.

Figure 3. Observed and counterfactual labour productivity, France and the United States, 1995–2025 (index 100 = 1995)



Note: The counterfactual paths apply to observed French productivity the additional growth it would have experienced if each sector had invested the same amount in IT capital each year as its US counterpart (using short-run and long-run elasticities, respectively).

Sources: EU-KLEMS 2025 release for 1995–2021; INSEE national accounts (2020 base) and BLS for 2022–2025; Eurostat nama_10_nfa_st and BEA Fixed Assets for 2022–2025.

Finding 4. If France had followed the US investment path, it would have closed between 25% and 50% of its productivity gap with the United States in 2005, compared with only 15% to 30% in 2025. Since the mid-2000s, France's productivity shortfall has therefore no longer stemmed solely from a shortfall in digital investment, but also from a lower return on that investment in terms of productivity gains.

The preceding analysis thus shows that the diffusion of digital technologies lies at the heart of France's productivity shortfall. With the next technological wave, that of artificial intelligence, the question now is whether France will be able to derive the productivity gains that it failed to obtain from previous waves. Should the state intervene to accelerate diffusion and, if so, which barriers need to be removed and which public policies are most effective? This should not, however, lead us to neglect the issues surrounding the development of innovations, to which we return in the final part of this Note.

Innovation diffusion in France: issues and policy levers

Why Intervene in Technology Diffusion?

The diffusion of an innovation refers to the process through which its use gradually spreads throughout the economy, beyond the initial adopters. If firms spontaneously adopted every innovation whenever it was profitable, diffusion would occur by itself, without any need for state intervention. However, the economics literature[7] identifies several market failures that may lead to suboptimal technology diffusion, meaning diffusion that is slower and/or less widespread than would be warranted by the productivity gains it delivers for the economy as a whole.

The first relates to knowledge spillovers. A firm that adopts a technology before others tests its uses and identifies the organisational arrangements that make it effective. In doing so, it produces information from which its competitors can benefit without compensating it. This may occur, for example, through employees moving between firms or through discussions about the technology outside the firm. As the firm alone bears the cost of this learning but captures only a fraction of the benefits, it has an incentive to invest less or later than would be optimal.

The second concerns information asymmetries. Faced with a technology whose returns are uncertain and vary greatly across sectors and firms, many agents may take a wait-and-see approach, preferring to observe the results achieved by early adopters before committing.

The third concerns complementarities and coordination problems. The productivity gains resulting from technology adoption materialise fully only if adoption is accompanied by complementary investments, such as improving employees' skills, developing suitable infrastructure or reorganising production processes. One difficulty is that such investments (skills, infrastructure) generally require coordination among actors beyond the individual firm facing the adoption decision.

The fourth relates to credit market imperfections. Adopting new technologies requires investments whose benefits are uncertain, delayed and sometimes intangible, all of which can make external finance difficult to obtain.

While these failures arise from different economic mechanisms, they help justify public intervention using instruments tailored to the market failure being addressed. Although this applies to any technology[8], the emergence of artificial

[7] For a more comprehensive literature review and references to academic papers, see Bunel S. (2026): "Diffusion de l'intelligence artificielle et dépendance numérique : fondements de l'intervention publique et enjeux de mesure" [Diffusion of artificial intelligence and digital dependence: Rationale for public intervention and measurement issues], *Focus du CAE* No. 142, September.

[8] The 2026 annual report of the Conseil national de la productivité, France's National Productivity Board, identifies insufficient technology diffusion as one cause of the slowdown in French productivity in recent years.

intelligence leads us to focus in what follows on the issues surrounding the diffusion of this technology.

Measuring the diffusion of AI in the economy

Many figures have been cited in recent months on AI adoption in France, some pointing to France's lag, others, by contrast, placing it among the world leaders. Some of these figures come from surveys by statistical institutes or academic papers, while others come from data provided by private organisations, often AI suppliers. In this section[9], we seek to reconcile these figures, which appear contradictory at first sight, by distinguishing three complementary metrics of AI adoption: adoption by firms, individual use at work and individual use more broadly (at work or for personal purposes).

The main reference source on AI adoption by firms is Eurostat's Survey on information and communication technologies in business[10], conducted in France by Insee, which has included an annual module on AI adoption standardised across Member States since 2021. In 2025, it shows that French firms adopted AI at the same rate as the European average, with a rate of 18% in France compared with 20% in the EU for AI broadly defined, and 8% in France compared with 9% in the EU for generative AI. Small and medium-sized enterprises (SMEs) have an AI adoption rate of 17%, compared with 58% for large firms with more than 250 employees. The same pattern holds for generative AI, with adoption rates of 7% and 39%, respectively. There are substantial differences across sectors, with an AI adoption rate of 17% in manufacturing, compared with 59% in the information and communication technology (ICT) sector. There is also considerable heterogeneity across Member States, with France 2 percentage points below the European average, far behind leading countries such as Denmark, where the adoption rate reaches 42%. Finally, although the absence of an internationally harmonised methodology makes comparisons outside the European Union difficult, an ad hoc survey by the European Investment Bank shows that Europe and the United States have comparable levels of adoption, even though the use of AI for production purposes remains lower in Europe[11].

However, although questionnaires on AI adoption are common across the EU, some survey parameters, such as whether responding is compulsory or voluntary, are left to individual Member States. This has implications for comparisons across countries. For example, responding is compulsory in France, where the response rate is 60%. In Denmark, where responding is also compulsory, the response rate is 96%. In Germany, where responding to the survey is voluntary, the response rate is only 25%, making comparisons with other countries difficult.

Beyond adoption at firm level, another way of measuring the penetration of AI in the economy is to estimate its use by employees at work. An ad hoc survey examines this dimension[12], applying the same methodology in all countries covered. This time, the results show a higher adoption rate in the United States, where 43% of economically active people report using generative AI at work, compared with 28% in France. Use is also more intensive there, involving 13% of hours worked, compared with 7% in both France and Germany. Among the European countries surveyed, France is around the average, behind Sweden (36%) and the Netherlands (36%), and close to Germany (32%). Around 55% of the gap between the European countries surveyed and the United States is explained by composition effects related to sectoral structure and firm size, while the remaining gap is attributed to management practices, meaning encouragement to use AI and access to it within the firm. Finally, French employees have a more negative perception of AI in the workplace than their European neighbours, according to the February 2025 Eurobarometer[13].

> **Finding 5**. AI adoption by French firms is close to the European average, but far behind the most advanced European countries. Employees' use of generative AI at work is substantially lower in France than in the United States (28% compared with 43%), with France occupying an intermediate position among the European countries studied.

Barriers to AI adoption by firms

To identify the barriers that might explain lower AI adoption by French firms, more than fifty representatives of business and public administration, both French and foreign, were interviewed. On the basis of these interviews and the documents provided, four main barriers were identified[14].

First, a lack of knowledge and skills concerning digital technologies in general, and AI in particular, is cited as one of the main obstacles. This barrier is not specific to France, however, and is found in most advanced economies[15]. It operates

[9] For a more detailed analysis of AI adoption figures, see Bunel S. (2026): *Focus du CAE* No. 142, op. cit.

[10] In this survey, a firm is considered to have adopted AI if some of its employees use at least one of the following technologies: text mining, automatic speech recognition, computer vision, automatic natural language generation, machine learning, deep learning, or AI-based robotic process automation software.

[11] See EIB (2025) and Bick A., Blandin A., Deming D. J., Fuchs-Schündeln N., & Jessen J. (2026): "Mind the Gap: AI Adoption in Europe and the US", National Bureau of Economic Research, No. w34995.

[12] For further details, see Bick et al. (2026): ibid.

[13] Special Eurobarometer SP554 (2025): Artificial Intelligence and the Future of Work.

[14] The main barriers mentioned overlap with those identified in Bpifrance Le Lab's study "L'IA dans les PME et ETI françaises" [AI in French SMEs and mid-sized firms] (2025).

[15] See OECD/BCG/INSEAD (2025): "The Adoption of Artificial Intelligence in Firms".

through two channels. For managers, a lack of digital literacy can make it difficult to identify relevant AI use cases within the firm. For employees, a lack of digital skills both makes learning to use the tools more difficult and increases resistance to adoption[16].

Second, a process involving AI may prove uncertain and costly for a firm, potentially holding back its investment decision. As with previous technological waves, AI-related productivity gains may not appear immediately, but materialise only later, after an initial phase of slowdown, following a "J-curve" pattern[17]. Two barriers related to this uncertainty emerged from the interviews: either the entrepreneur is unable to identify both the use cases and the gains ex ante, and chooses not to invest, or wishes to invest but lacks the financial resources to cover these investments.

Third, even where firms are aware of the use cases associated with AI, the risks associated with its use within an organisation may deter adoption. These may include errors that the use of AI could introduce into production processes, risking a deterioration in the quality of the goods and services offered, as well as cybersecurity risks, which may lead to disruptions in the production chain or data leaks. Several firms interviewed stated that they had deliberately chosen not to integrate AI, anticipating that the productivity losses associated with these risks could exceed the potential gains.

Fourth, considerations relating to sovereignty and the risk of strategic dependence emerged from the interviews. Large firms, in particular, see the adoption of non-sovereign AI as potentially leading to dependence on foreign powers.

> **Finding 6**. French firms face barriers to the adoption of new technologies, particularly AI, that may justify public intervention.

Which public policies for AI adoption?

Identifying public policies specifically concerned with AI adoption is a complex exercise: the boundary between policies supporting the development of innovations, those promoting their diffusion and broader digital policies (infrastructure, skills, cybersecurity) often remains blurred, including in the way countries themselves describe their schemes. Some databases[18] attempt to catalogue these policies, without guaranteeing comparable coverage across countries, or even within a single country. Despite these limitations, the schemes can be classified into five categories: training, financing, awareness-raising, public–private partnerships and technology transfer. Training-related schemes appear to be the most common, accounting for nearly 50% of the diffusion schemes identified. This ranking is found across all sectors of the economy and in most of the countries observed. More detailed analysis, particularly through interviews with some of the public administrations concerned, helped consolidate these initial observations.

Internationally, some countries have indeed already introduced public policies providing direct or indirect support for AI adoption:

• Direct budgetary and tax support for adoption (grants, repayable advances, guaranteed loans or tax credits), which reduces the cost of acquiring the technology. Singapore illustrates particularly extensive support for the adoption of digital technologies by SMEs, mainly through the SMEs Go Digital programme, launched as early as 2017[19]. This includes a scheme subsidising the adoption of digital tools (and, more recently, AI solutions), the Productivity Solutions Grant (PSG): targeted at SMEs, this support covers 50% of the investment, up to €20,000 per firm per year. At its launch in 2018, the programme had a budget of €75 million over three years[20]. Between 2017 and 2024, it supported more than 88,000 SMEs, equivalent to nearly 30% of the total number of Singaporean SMEs in 2024. This support has been extended to AI through the Enterprise Compute Initiative. With a budget of €100 million in 2025, this time-limited initiative aims to help Singaporean firms accelerate the adoption of advanced AI tools to develop new products or implement the associated organisational changes. To this end, eligible firms partner with one of the four US cloud service providers preselected by the programme (Google, Microsoft, Amazon Web Services and Oracle) to access tools and cloud credits. South Korea also has schemes subsidising digital and AI adoption, with support covering up to 80% of the total project cost[21]. Finally, Germany supported the digital transformation of SMEs through the federal Digital Jetzt programme (2020–2023), which provided direct grants for investment in digital technologies (software, equipment, AI applications, cloud computing, cybersecurity) and for training employees in digital skills.

The designation of a "lead body", meaning a clearly identified point of contact for firms, which also coordinates all public actors to ensure a coherent public policy across the economy. South Korea, Singapore and the United Kingdom have,

[16] Bpifrance Le Lab (2025): ibid.

[17] Brynjolfsson, E. et al. (2018): "The Productivity J-Curve: How Intangibles Complement General Purpose Technologies", *NBER Working Paper* No. 25148.

[18] See, in particular, the databases provided by the OECD: OECD.AI and the OECD Digital Policy Platform (OECD DPP).

[19] See OECD (2026), "Singapore SME digitalisation support programme", for further details. The SMEs Go Digital programme is broader and includes, in particular, digital transformation advisory services alongside adoption subsidies. The Singaporean government does not provide a breakdown of the budgets of the various agencies managing the programme, making it difficult to establish an overall annual budget dedicated to adoption.

[20] An impact evaluation of the PSG programme shows that beneficiary firms recorded an average increase of 3% in labour productivity relative to non-beneficiary firms.

[21] See OECD (2026), "Korea's AI Voucher Programme", for further details. The scheme had an annual cost of €16 million in 2025.

for example, designated a public "lead body" for AI adoption: respectively, the "National IT Industry Promotion Agency" (NIPA), the "Infocomm Media Development Authority" (IMDA) and "Digital Catapult UK".

• Support for training and advisory services for firms, enabling them to identify use cases, strengthen their digital human capital and share information with other firms. Germany has established structured innovation networks (clusters and competence centres) that explicitly offer firms, particularly SMEs, advisory, networking and training services[22].

• Direct support for adoption can operate within two different scopes, depending on its objective. On the one hand, it can be conceived as the final stage of a policy supporting innovation and the production of AI solutions. In this case, the public authorities support AI-producing firms in bringing their solutions to market. On the other hand, it can be conceived as a policy for AI adoption more broadly, independent of a policy supporting innovation. In this case, the state establishes a scheme aimed at ensuring that firms throughout the economy adopt an AI solution.

Although France does not currently have an adoption policy as such, its longstanding support for R&D and innovation (crédit d'impôt recherche, the French research tax credit, Programmes d'investissements d'avenir, France 2030, etc.) has recently led it to develop initiatives promoting adoption, mainly as the final stage of a policy supporting innovation, such as the "Osez l'IA" plan, Bpifrance's IA Booster scheme and research partnerships. However, in light of the instruments mentioned above, support for adoption remains very limited in France.

The only budgetary or tax support for AI adoption identified consists of loan guarantees provided by the Direction générale des entreprises (DGE, Directorate-General for Enterprise), in conjunction with Bpifrance. The loan guarantee amounts to around €25 million[23]. By comparison, the annual budgetary cost of the two schemes directly dedicated to supporting adoption in Singapore amounted to at least €125 million per year, or more than 0.02% of Singapore's annual GDP.

The DGE can be regarded as the main actor in supporting AI adoption, particularly through the "Osez l'IA" plan, whose resources currently remain limited.

Training support exists, notably within Bpifrance, but remains limited to firms previously supported. One strand of the "Osez l'IA" plan provides for a training policy, which has not been implemented to date.

Finding 7. Support for adoption is not coordinated by a fully established lead body and is not distinguished from the policy for the development of innovations.

Given this scope for improvement and the macroeconomic stakes, we recommend further expanding support for AI adoption, with statistical evaluation to identify effective schemes and scale them up.

Recommendation 1. Expand support for AI adoption in France by prioritising targeted, temporary instruments consistent with innovation support policy, bringing annual spending to 0.02% of GDP, or around €600 million per year, a scale comparable to that observed in Singapore, a country particularly advanced in adoption.

Promoting technology diffusion is, however, only one of the levers of innovation policy. The ability to produce new technologies is also crucial for productivity gains and, in the case of AI, for limiting dependence on technologies produced abroad[24]. The final part of this Note therefore examines policies supporting innovation, through an evaluation of the Programmes d'investissement d'avenir and France 2030.

Supporting the development of innovations: how effective are the PIA and France 2030?

The Programme d'investissements d'avenir (PIA) is a scheme launched in 2010 to finance innovative projects in strategic sectors: health, energy, mobility, digital technologies, sustainable cities, aeronautics and space. It can benefit both start-ups and existing firms of various sizes, financing projects involving R&D, industrial deployment, modernisation or the organisation of industrial sectors, as well as laboratories and research organisations (CNRS, Inserm, etc.), through schemes such as Labex (laboratoires d'excellence, laboratories of excellence) or Idex (Initiatives d'excellence, excellence initiatives)/I-Site (Initiatives science-innovation-territoires-économie, science–innovation–territories–economy initiatives).

The first 3 waves of the PIA took place in 2010, 2014 and 2017, with budgets ranging from €10 billion to €35 billion. In 2021, the France 2030 programme was allocated €54 billion to be deployed by 2030 (€20 billion under a PIA4 decided in January 2021, followed by €34 billion in October of the

[22] See details of German innovation policy on the German federal government's website and in the OECD report (2022), "OECD Reviews of Innovation Policy: Germany 2022".

[23] This corresponds to a leverage effect estimated by Bpifrance at €125 million.

[24] In this regard, Focus du CAE No. 142 discusses in detail the importance of establishing a reliable measure of our digital dependence.

same year). France 2030 shares the main characteristics of the PIA: exceptional, multiannual appropriations, designed to supplement ministries' ordinary budgets; selective allocation of funding through calls for proposals managed by public bodies or, sometimes, directly awarded funding. Compared with previous PIA programmes, France 2030 places greater emphasis on downstream activities and sovereignty issues, with increased support for deployment and securing value chains.

France 2030 has been the subject of annual notes (2022–2026) on budget implementation by the Cour des comptes, France's national audit office, two reports by the Comité de surveillance des investissements d'avenir (CSIA, oversight committee for investments for the future; 2023 and 2025), and an ex ante macroeconomic evaluation by the Trésor, the French Treasury[25]. The Cour des comptes deplores a lack of visibility on the financial returns and socio-economic and environmental impacts of these investments. It also notes the absence of a funding policy framework specifying which instruments to prioritise for different types of projects, particularly the choice between grants and repayable advances.

An original econometric analysis of Bpifrance support under the PIA and France 2030

We present an original econometric analysis that is essential for quantifying the socio-economic returns to support and establishing a funding policy framework based on robust empirical evidence[26].

We use a new dataset consolidating €25.8 billion in funding awarded by Bpifrance between 2010 and 2024 under the PIA and France 2030, and match it to administrative data on firms. As the main intermediary for these programmes in supporting firms, Bpifrance currently manages more than two-thirds of the measures aimed at them. To identify the causal effect of support, the analysis is restricted to calls for proposals or calls for expressions of interest for which unsuccessful applicants can be observed. This choice excludes the other implementing bodies (Ademe, ANR and Caisse des dépôts), as well as Bpifrance funding awarded outside calls, particularly directly awarded funding[27].

To track successful and unsuccessful applicant firms for up to three years after their application, the evaluation is restricted to applications submitted before 1 January 2022[28], as administrative data are generally available up to 2024. It thus covers 111 calls for proposals totalling €7.5 billion in support. France 2030 accounts for €3.6 billion, or 48% of the funding evaluated. This €3.6 billion also represents around 40% of the programme's interventions for which a comparable follow-up period is currently available.

Our main method consists of comparing successful and unsuccessful applicants for each call for proposals and each application year. Comparing them within the same call and for the same application year allows us to control for differences in timing, subject area, eligibility criteria, technological maturity, etc. Methodological details and additional analyses are presented in Focus No. 142.

We find that, on average, after three years, successful applicant firms create 10 additional jobs relative to unsuccessful applicant firms (Figure 4.a), including more than 5 high-skilled jobs and nearly 5 medium-skilled jobs, while the effect on low-skilled jobs is virtually zero. Employment in successful applicant firms is thus 8% higher than it would have been without PIA or France 2030 support. The figure shows that successful and unsuccessful applicant firms followed very similar trajectories up to the time of the call for proposals, suggesting that the subsequent divergence is indeed the causal effect of public support.

Turnover and value added in successful applicant firms increase by an additional €7 million and €2 million, respectively, relative to unsuccessful applicant firms, corresponding to increases of 12% and 11%, respectively (Figure 4.b). Supported firms also increase their net tangible fixed assets by €700,000, an additional 15%. Industrial and IT equipment together account for around 55% of this additional capital. The IT component grows twice as fast as total capital (+31% compared with +15%), and capital intensity increases.

R&D expenditure also increases by an additional €470,000 in successful applicant firms, an increase of 51% relative to unsuccessful applicant firms (Figure 4.c). This finding is all the more important given that evaluations of other public schemes financing innovation, such as the crédit d'impôt

[25] *Trésor éco* No. 393, "Évaluation macro-économique ex ante du plan France 2030" [An Ex Ante Macroeconomic Assessment of the France 2030 Investment Plan]. According to this study, France 2030 could raise the level of GDP by around 0.4 to 0.6 percentage points and create between 25,000 and 58,000 jobs by 2030.

[26] Our study analyses the economic and financial effects of PIA/France 2030 funding and its impact on our capacity to innovate, but does not take into account the effects on decarbonisation, which was another objective of France 2030. In this regard, see the Cour des comptes report: Les aides à la décarbonation de l'industrie du plan de relance et de France 2030 [French public support for industrial decarbonisation under the post-Covid recovery plan and France 2030 initiative] (March 2026).

[27] This is financial support resulting from a discretionary procedure between the state and a firm. In our dataset, it totals €9.7 billion, or 38% of funding, compared with only €0.1 billion for cohorts before 2022. This recent concentration reflects its rapid expansion and the slower roll-out of competitive procedures, so its share should decline as these are implemented. Excluding it has little effect on coverage of the cohorts studied, but the results provide no information on the effectiveness of recent directly awarded funding. An IGF report on the NANO 2022 programme (2026) suggests reservations about the effectiveness of schemes involving directly awarded funding.

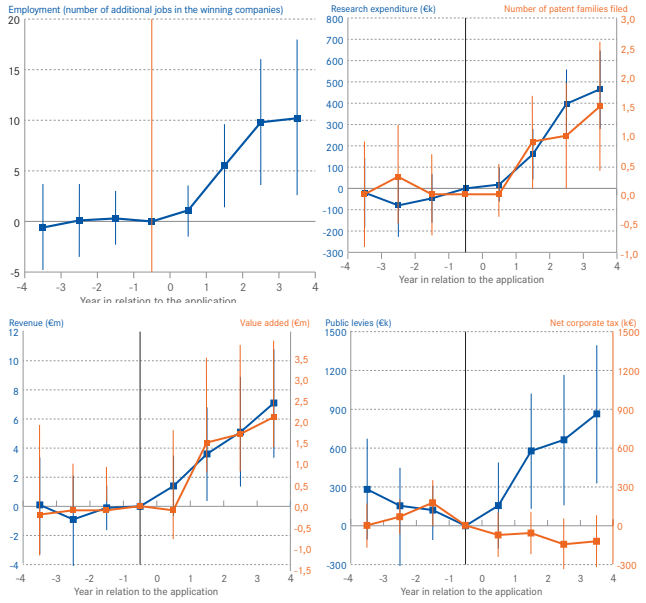
[28] When the data become available, analysis over a longer horizon will be possible. This will be particularly important for isolating the effect of France 2030 relative to previous PIA programmes.

recherche (CIR), show more limited effects on R&D expenditure (see below).

Patents are the most tangible sign of projects' technological outcomes. After three years, funded firms have filed more than 3 additional patent families cumulatively. This increase is corroborated by the rise in patent filing and defence expenditure. Prototyping expenditure also increases among SMEs, for which patenting is a less accurate measure of innovation outcomes.

Finding 8. The calls for proposals managed by Bpifrance under the PIA and France 2030 have significant effects on employment, activity, investment, R&D and the technological outcomes of projects.

Figure 4. Effect of PIA or France 2030 funding on beneficiary firms relative to unsuccessful applicant firms



Reading note: The vertical bands correspond to a 95% confidence interval. Relative to the year before application, employment (Figure 4.a) increases more in successful applicant firms than in unsuccessful applicant firms, with a gap of 5 full-time equivalents (FTEs) one year after application and 10 FTEs two or three years after application.

An analysis of the return on these investments for the public finances

To assess the positive effects mentioned above, they must be considered against the cost of the policy. If we normalise all these effects by the amount received, we can say that €100,000 in support enables the creation of around one job and, over a three-year horizon, cumulative increases since application of around €500,000 in value added and €130,000 in R&D expenditure.

Higher employment enables the public authorities to collect more social security contributions, while higher value added generates VAT receipts and taxes on production. Figure 4.d thus shows that tax payments by successful applicant firms increase after they receive funding, relative to unsuccessful applicant firms.

The effect on corporate income tax, however, is difficult to detect statistically. The effect of PIA or France 2030 funding on profits (gross operating surplus) over a three-year horizon is zero on average, which is consistent with increases of comparable magnitude in turnover and the wage bill (around 10%). However, it is estimated imprecisely, probably because of considerable heterogeneity between projects close to industrial deployment, where profitability emerges relatively quickly, and projects at earlier stages, where expenditure rises before taxable income materialises.

The effect on corporate income tax revenue received by the public authorities appears negative because of tax credits. This notably reflects a second round of public support through the CIR, covering additional R&D expenditure not covered by the initial support. Cumulatively over three years, this additional funding represents an average of €30,000 in additional public support for every €100,000 in support.

Overall, even taking into account this possible negative effect on net corporate income tax revenue, for every €100,000 in support received, successful applicant firms pay an additional €218,000 to the public authorities over three years. The positive contributions are divided between social security contributions (57%), VAT (36%) and taxes on production (7%).

Of course, the policy's total effect is not necessarily equal to its effect on successful applicant firms alone. Growth among beneficiaries may displace activity that would have occurred elsewhere. For example, a newly created job might be filled by an engineer who would have been employed in any case. In this situation, the effect on successful applicant firms overstates the policy's total effect, and the contributions estimated above overstate the return to the public finances. Conversely, growth among successful applicant firms may reflect successful innovations that stimulate the activity or capabilities of third parties: upstream, through demand for suppliers and partners; downstream or across sectors, through customers' direct and indirect use of innovations, or their adaptation or reuse by other firms.

The positive effects of R&D beyond its beneficiaries are very well documented in the literature[29]. Studies that jointly quantify negative displacement effects and positive spillovers tend to suggest that the latter outweigh the former: the

[29] Jaffe A. B., Trajtenberg M. & Henderson R. (1993): "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations", *The Quarterly Journal of Economics*, 108(3); Hall B. H., Mairesse J. and Mohnen P. (2010): "Measuring the Returns to R&D", in B. H. Hall and N. Rosenberg (eds), *Handbook of the Economics of Innovation*, Vol. 2. Elsevier, pp. 1033–1082.

return calculated for successful applicant firms would therefore underestimate the total effect for the economy as a whole[30]. Even assuming an unfavourable net balance owing to strong displacement effects, 54% of the direct effect calculated above would have to be deducted to eliminate self-financing over three years[31].

Finding 9. Over three years, the cumulative additional taxes and compulsory social security contributions paid by successful applicant firms substantially exceed the support paid out: the policy is therefore self-financing over this horizon.

Very few policies are self-financing, especially over such a short period. Some exist in education, but self-financing only materialises once pupils enter the labour market, so several decades must elapse[32].

What public funding policy for innovation in the future?

Our analyses show a very high return on public funding awarded through calls for proposals managed by Bpifrance. We therefore call for these to be maintained over the long term, or even strengthened, under a "France 2040" plan on the same scale as the PIA/France 2030 programmes.

Recommendation 2. Make permanent and strengthen the competitive calls for proposals used under the PIA/France 2030 programmes, which causal evaluations show to be self-financing over a relatively short horizon. Allocate at least 0.2% of GDP per year to a new “France 2040” programme, prioritising competitive calls for proposals.

Nevertheless, we believe that the allocation of funds can still be improved. Beyond the finding of effectiveness on average, the challenge now is to identify the configurations that generate the highest returns, for example according to the stage of industrial deployment, the type of project and the financial instrument used. This requires empirical analyses like those we have presented, but examining heterogeneity across different dimensions.

The reports by the Cour des comptes and the CSIA also call for a stable funding policy framework governing the share of grants and repayable advances. The Secrétariat général pour l’investissement (SGPI, General Secretariat for Investment) favours 60% grants and 40% repayable advances for projects upstream of industrial deployment, and 50/50 for downstream projects, but has never formalised this framework. The CSIA recommends using grants alone for projects below €250,000, to avoid "administrative costs", and varying the balance between grants and repayable advances according to project maturity for projects above this threshold. It seems to us that all these approaches can be tested empirically and that robust evidence is important before defining such a framework.

Recommendation 3. Continue evaluating France 2030 to identify the most effective types of projects and financing instruments, particularly the appropriate balance between grants and repayable advances (investment policy framework).

Finally, our analyses suggest that public money intended to finance innovation is better used in schemes such as France 2030 than in another scheme with a similar purpose: the crédit d’impôt recherche. In theory, this type of tax incentive should increase R&D expenditure[33]. However, several evaluations of the CIR converge on the finding that the mechanism may be useful for SMEs but primarily generates windfall gains for large corporate groups, which would have incurred some of this R&D expenditure even without the scheme[34]. The CIR thus appears to us to represent a poorer use of public money than France 2030, as it is very far from being self-financing and would benefit from tighter targeting, for example by removing incentives above 100 million, which appear to generate windfall gains for large corporate groups. Since the CIR was introduced in 2008, corporate income tax was reduced in 2018 from 33% to 25%, and taxes on production have been reduced by 10 billion per year. The CIR could be justified at the time of its introduction as a means of making French firms more attractive, but, as the context has changed, we consider it important to target it more closely and reallocate

[30] Bloom N., Schankerman M. and Van Reenen J. (2013): "Identifying Technology Spillovers and Product Market Rivalry", *Econometrica* 81.4, pp. 1347–1393.

[31] Our calculations are also conservative for several reasons. First, we do not take into account possible effects on the income tax paid by workers hired by these firms. Second, we treat all funding received as a grant, in the sense that we do not take possible repayments into account, even though repayable advances account for more than a quarter of the amounts paid out in our sample. Third, CIR tax credit entitlements can be used over 5 years, depending on firms’ circumstances, but we account for them in full in the first year, on the grounds that these entitlements will ultimately be paid in any case. The amount we subtract on this basis in our calculations is therefore an upper bound on the amount actually paid by the public authorities over the horizon considered.

[32] Using the Marginal Value of Public Funds (MVPF) employed in previous CAE Notes (*Note du CAE* No. 84, "Education: How to Better Target Public Spending", and *Note du CAE* No. 90, "Measuring the Efficiency of Unemployment Insurance"), a self-financing policy has an infinite MVPF. By comparison, the MVPFs we found for the different unemployment insurance policy levers ranged from 0.75 to 1.5.

[33] Bloom et al. (2019), " A toolkit of policies to promote innovation", *Journal of Economic Perspectives*.

[34] See, in particular, Aghion P., Chanut N. and Jaravel X. (2022): "Renforcer l’impact du Crédit d’impôt recherche" [Strengthening the impact of the French research tax credit], *Focus du CAE* No. 90, and the work of the Commission nationale d’évaluation des politiques d’innovation, the national commission for the evaluation of innovation policies.

the savings to calls for proposals such as those examined in this part of the Note.

Recommendation 4. Target the crédit d'impôt recherche more closely, particularly by removing the reduced rate applicable to R&D expenditure above €100 million, and reallocate the savings to financing calls for proposals that evaluations have found to be effective.

Conclusion

Using original empirical analyses, this Note has quantified the scale of France's productivity shortfall. The productivity slowdown explains the entire difference in GDP per capita trajectories between France and the United States since 1995. It stems primarily from sectors using information and digital technologies and, to a lesser extent, from sectors producing these technologies. To reverse the trend, we recommend ambitious public policies supporting the diffusion of innovations, particularly generative AI, and technological innovation, with the launch of a "France 2040" programme prioritising calls for proposals. ■

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Correspondents
Dominique Bureau, Benoît Mojon, Anne Perrot, Aurélien Saussay, Ludovic Subran

Les Notes du Conseil d'analyse économique
ISSN 2273-8525

Publication director Xavier Jaravel
Editorial director Augustin Vicard
Editing Hélène Spoladore
Press Contact Hélène Spoladore
helene.spoladore@cae-eco.fr
Tél. : 01 42 75 77 47 – 07 88 87 55 44

20 avenue de Ségur 75007 Paris – Téléphone : 01 42 75 76 84 – @CAEinfo www.cae-eco.fr