

The Costs of Conditionality

IPCEIs and the Constrained Politics of EU Industrial Policy

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Abstract

With the global return of industrial policy, most literature examines *why* states increasingly resort to market activism. Much less is known about *how* industrial policy works ‘on the ground’. In this paper, we address this how-question through an in-depth case study on the poster child of the EU’s new industrial policy: the Important Projects of Common European Interest (IPCEI). We argue that while the literature has rightly pointed out that attaching conditionalities to public money is key to steering markets effectively and equitably, conditionalities also come with costs. Moreover, they are not the reflection of policy design principles but reflect political, institutional, and ideational constraints that shape *which* and *how* conditionalities are applied. We show how IPCEI funding is conditional on meeting demanding eligibility and compatibility criteria, which leads to perverse outcomes, adverse selection, and workarounds. We make concrete suggestions as to how to mitigate IPCEI’s cost-conditionality trade-offs.

Keywords: Industrial policy, IPCEI, conditionality, state aid, EU

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[T]he problem of industrial policies is above all a problem of instruments.'

Jacques (Lesourne, 1984, 36)

1 Introduction¹

Industrial policy long had an air of antiquatedness to it. Discredited and even stigmatized throughout the Western world, it 'went undercover' over the course of the last decades of the 20th century (Andreoni and Chang, 2019, 136; cf. Bulfone, 2023). In Europe in particular, market-directing industrial policy came to be viewed as a 'Colberist delusion' (Warlouzet, 2019, 86) and was gradually relegated to and redefined as an 'open, competition-oriented industrial policy (...) oriented towards world markets' (Bangemann, 1992, 17).

Recently, however, industrial policy has made a comeback, including in Europe (Juhász et al., 2023). McNamara, for example, observes the rise of a new 'market activism' in the EU: long 'centered on neoliberal precepts of competition and openness', EU industrial policy is increasingly willing to use 'public powers to actively shape markets for the interests and values of a bounded political community' (McNamara, 2023, 2). Di Carlo and Schmitz argue that the EU increasingly operates as a European 'developmental network state', that is, 'as an agent of market-shaping integration, proactively trying to correct, shape and protect the EU single market for the fulfillment of politically-decided public policy goals' (Di Carlo and Schmitz, 2023, 24). And Seidl and Schmitz (2024) document a 'geo-dirigiste turn' in EU industrial policy, with the EU increasingly embracing market-directing rhetoric and policy to steer economic activity into geostrategically important sectors.

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While this literature has made important inroads into understanding the drivers and changing nature of EU industrial policy, we know relatively little about how it works on the ground. Yet, the litmus test for the EU's new-found 'market activism' will be whether it has the capacity to effectively and equitably steer markets in publicly defined directions. This capacity, according to a growing literature on the political economy of industrial policy, is an 'essential constraint to getting industrial policy right' (Juhász and Lane, 2024, 12–13). It can be understood as the capacity of public actors to introduce and enforce *conditionality* vis-à-vis private actors, that is, on making public support conditional on the 'fulfillment of broad public policy goals beyond profit maximization' (Bulfone et al., 2024).

Conditionality, in other words, is what's 'making sure that directionality of growth (less inequality, more sustainability) is embedded in the tools [of industrial policy]' (Mazzucato and Rodrik, 2023, 4). Without it, industrial policy risks becoming 'corporate welfare' (Bulfone et al., 2023). And yet conditionality also comes at a cost, for conditionality begets bureaucracy. Attaching strings to subsidies requires a non-trivial amount of administrative 'spinning' and 'weaving': conditionalities need to be made concrete and legally enforceable, and compliance needs to be both demonstrated and diligently assessed. These costs are often downplayed by the literature and yet may undermine the broader industrial policy goals that have informed these conditionalities in the first place. What is more, conditionalities are not created in a political vacuum but are shaped by the political, institutional, and ideational constraints in which they are introduced and enforced.

In this paper, we look at the constrained politics of conditionalities through an in-depth case study of the poster child of the EU's new industrial policy: the Important Projects of Common European Interest or IPCEIs. IPCEIs derive their peculiar name from Article 107(3)(b) TFEU, which provides an exception to the general prohibition on state aid for aid used to 'promote the execution an important project of common European interest' (Cattrysse, 2016). While dating back to the Treaty of Rome, it was only in 2014 that the Commission consolidated, formalized, and replaced existing guidance on the interpretation of Article 107(3)(b), effectively introducing IPCEIs as an industrial policy instrument with a defined scope of application as well as eligibility and compatibility criteria (for a detailed historical reconstruction, see Lopes-Valença and Seidl,

2024). Since then, 10 IPCEIs have been approved in areas ranging from microelectronics and batteries to hydrogen and cloud computing, unlocking 37.2€bn in state aid and an additional 66€bn in expected private investments, distributed across 247 companies and 22 member states.

IPCEIs are emblematic of the complexities of the EU's new industrial policy. While most of the funding comes from member states, most of the rules come from the Commission. While undoubtedly market-directing, they also remain wedded to the principles of an efficiency-oriented industrial policy. And while exceedingly popular, they have also received ample criticism. In this paper, we look at how the constrained politics of EU industrial policy has shaped both the creation and application of the conditionalities that govern IPCEIs, and how these conditionalities have created costs that limit how effectively and equitably the EU can direct markets. We show that the criticism that IPCEIs lack 'strict governance' (Poiters and Weil, 2022) and 'extend subsidies with no transparent, well-defined criteria or governance mechanisms' (Gabor, 2023, 76) is highly misleading if not downright preposterous. IPCEI funding is conditional on meeting demanding eligibility and compatibility criteria, and companies, member states, and the Commission expend considerable resources on demonstrating or assessing compliance.

These conditionalities create costs in the form of what we call perverse outcomes, adverse selection, and workarounds. Among other things, these costs limit how effectively the EU can reach its industrial policy goals, exacerbate existing financial inequities between member states as well as between companies, and increase demand for laxer funding instruments. To be clear, ours is not a blanket criticism of conditionalities. Rather, we argue that the benefits of conditionalities need to be balanced against their costs, and the task for industrial policymakers is to carefully navigate such cost-conditionality trade-offs. We also argue that conditionalities need to be understood not as a reflection of policy design principles but of a particular constellation of interests, institutions, and ideas (Bulfone et al., 2024). This can explain, for example, IPCEIs' focus on efficiency-oriented criteria while conditionalities to involve social partners are missing (see also Munta et al., 2023), despite their potential benefits for innovation-based competition (Ornston, 2013).

Empirically, we draw on 18 interviews with policy officials and firms, analysis of dozens of official documents as well as descriptive statistics to empirically reconstruct the costs of conditionality

and the constrained politics of EU industrial policy for the case of IPCEIs.² In doing so, we qualify a sentiment common even among those who welcome the EU's 'neo-industrial turn', namely that 'because the entire European edifice was built on the premise that competition is sufficient to guarantee economic efficiency, there is close to zero technical-administrative capability to enforce industrial policy' (Durand, 2023). It is true that the EU is still learning the ropes of how to identify strategic areas and the emergence of IPCEIs has only gradually become more systematic and inclusive (for details, see Seidl et al., 2024). Yet, the central problem of IPCEIs is not the lack of administrative capacity, although more of it may help at the margins. The central problem is twofold: first, the unwillingness to provide common European funding for projects of common European interest (e.g., Eisl, 2022); second, and perhaps more easily addressed, the unwillingness to more carefully reflect on both the substance and the costs of conditionalities.

In this paper, we contribute to both the emerging literature on the (European) political economy of conditionality and the 'how' of industrial policy (Bulfone et al., 2023, 2024; Cooman, 2023; Mazzucato and Rodrik, 2023; Molica, 2024; Reynolds, 2024) and the fledgling literature on IPCEI (Gräf, 2024; Lopes-Valença and Seidl, 2024). While our paper is primarily empirical, we also provide concrete suggestions for how to improve the design of the IPCEI instrument. Our paper is structured as follows. In the next section, we briefly review the literature to theorize the constrained politics of conditionalities in (EU) industrial policy. Next, we describe the constrained politics of IPCEIs in more detail, situating them in the history of the EU state aid regime and discussing how this history has shaped the design of the instrument. We then describe the typical life course of an IPCEI, focusing on the design, (pre-)notification, and implementation stages, followed by a detailed empirical reconstruction of the costs of IPCEI conditionalities. We then discuss our empirics in light of the literature and conclude by making concrete suggestions as to how the governance of IPCEIs could be improved.

²For more details on the interviews and the empirical approach, see the online appendix.

2 Theorizing Conditionalities and Constraints

Europe's 'turn towards market activism' (McNamara, 2023, 2)—be it through more traditional industrial policy through direct budgetary allocations or the financial instruments preferred by the emerging 'European Investor State' (Leponet and Thiemann, 2024)—has created renewed interest in conditionality. Conditionality 'describes an incentive instrument in the relationship between two actors, in which one actor aims at changing the behavior of the other by setting up conditions for the relationship and by manipulating its cost-benefit calculation by using (positive and negative) material incentives' (Koch, 2015, 99). In this broad sense, conditionality has become 'an integral part of European governance' in areas ranging from economic governance to the rule of law (Becker, 2024, 14). However, we are less interested in conditionality between public actors than in conditionality as an incentive instrument used by public actors to 'align corporate behavior with the fulfillment of broad public policy goals beyond profit maximization' (Bulfone et al., 2024).³

At the heart of this understanding of conditionality is the idea of 'reciprocity—linking carrots to sticks' (Meckling and Strecker, 2023, 419; cf. Rodrik, 2004). Conditionality, in other words, creates 'a healthy tension between public and private so that subsidies are part of a 'deal' rather than a blanket handout' (Mazzucato and Rodrik, 2023, 7). This turns subsidies from 'gifts' to 'implicit contracts' (Chibber, 2014, 33). Conditionalities 'embed directionality in public investments' (Molica, 2024, 1657) preventing them from becoming 'corporate welfare' (Bulfone et al., 2023). Conditionalities, however, are not an unalloyed good. Like most things in life, they come with a cost. They involve, for example, breaking down abstract goals into measurable and/or legally viable indicators, demonstrating and assessing compliance, often by making informed assumptions about counterfactual scenarios, and reconciling the rigidities required by a credible instrument with the equally necessary flexibilities demanded by an uncertain and fast-changing world (Molica, 2024).

³This may occur at the 'direct interface between states and markets' as well as further down the 'investment chain' (Cooiman, 2023, 4).

Moreover, the introduction and enforcement of conditionalities do not take place in a political vacuum but against the background of specific ‘ideational, institutional and coalitional configurations’ (Bulfone et al., 2024). This makes it essential to reconstruct the thick politics of interests, institutions, and ideas that shape *which* and *how* conditionalities are applied. After all, ‘optimally designed measures are of little practical use if the political conditions for their implementation are not met’ (Bulfone et al., 2024; see also Juhász and Lane, 2024). The EU—and the Commission in particular—have been described as ‘multiply constrained’ (Akman and Kassim, 2010, 121), and the politics of its new industrial policy is shaped by such political, institutional, and ideational constraints. It is these historically evolved constraints that give IPCEIs their particular *gestalt* and shape their specific cost-conditionality-trade-off.

3 IPCEIs in the Context of the European State Aid Regime

To understand the constrained politics of IPCEIs, it is essential to understand the nature and history of the European state aid regime. This state aid regime famously prohibits state aid as a matter of principle while also providing various exceptions, with both the general prohibition and the exceptions being enshrined in Article 107 TFEU (*ex* Article 87 TEC and Article 92 EEC Treaty from 1957). However, while the constitutional basis for the European state aid framework remained ‘virtually untouched’ (Lopes-Valença, 2022, 92) since the Treaty of Rome, the state aid rules also remained ‘virtually unenforced’ (Buch-Hansen and Wigger, 2011, 69) before the 1980s. Over the first decades of European integration, member states thus retained ample room to use ‘selective and interventionist policy instruments to strengthen strategic sectors’ (Bulfone, 2023, 26).

Starting in the late 1980s, however, the Commission became ‘more assertive in monitoring state aid’ (Warlouzet, 2023, 37) and member states gradually ‘agreed to bind themselves ever more by the pro-competitive logic of deepening market integration and to abide by the ever-stricter constraints that this implies’ (Pelkmans, 2006, 45). Over the following decades, the Directorate-General for Competition (DG COMP) built an increasingly formalized and neoliberal state aid regime on the legal basis of Article 107 TFEU (Buch-Hansen and Wigger, 2011; Davies, 2013).

But while this limited member states' room for industrial policies, it also provided exceptions and criteria for 'good' and therefore admissible state aid (Blauberger, 2009). In particular, through a series of frameworks and guidelines, DG COMP has gradually (re-)defined the space for exceptions in terms of market failures (Davies, 2013, 46–50; Lopes-Valença and Seidl, 2024). Drawing on long-standing tropes (Akman and Kassim, 2010), a supranational state aid regime was viewed as a necessary bulwark against the market distortions of discretionary spending. At the same time, state aid may be justified in the face of market failures such as externalities, informational asymmetries, coordination failures, or undue market power. There is thus a 'narrow space within which the state can act, which must be *outside of the market, on behalf of the market*' (Davies, 2013, 47).

However, the striking persistence of the logic and language of market failures masks profound changes in *how market failures are understood*. Since the late 1990s, the Commission saw horizontal aid as the main remedy for market failures, meaning aid aimed at solving problems that may arise in any industry and country. However, in the late 2000s, this hard horizontalism was complemented by a soft sectorialism as the Commission began to view certain technologies—so-called key enabling technologies (KETs) such as nanotechnology, microelectronics, or advanced materials—as being 'not only of strategic importance but (...) indispensable' (European Commission, 2009). For mastering these technologies can enable innovations and value creation across entire sectors, while lagging behind can disrupt 'entire value chains with (...) consequences on the sustainability of various strategic sectors in Europe' (HLEG-KET, 2011, 26).

It is against this background that the Commission introduced IPCEIs as a standalone policy tool in a 2014 communication, which consolidated, formalized, and replaced existing guidance on the interpretation of Article 107(3)(b) (for a detailed reconstruction, see Lopes-Valença and Seidl, 2024). It is no coincidence that using IPCEIs as an instrument was first prominently suggested by the High-Level Expert Group on KETs (HLEG-KET, 2011, 38). With their greater aid intensity rates and willingness to fund projects closer to commercialization, IPCEIs are clearly meant to help cross the 'valley of death' between basic research and commercialization and to realize the positive externalities of large-scale investment in technologies with positive cross-sectoral externalities.

However, the design of the instrument remains deeply wedded to the language and logic of market failures and the concomitant principles of an efficiency-oriented industrial policy (Piechucka et al., 2023, 515). At the core of this design are a number of demanding eligibility and compatibility criteria. Fulfilling the eligibility criteria simplifies the compatibility assessment as the Commission can presume a market or systematic failure and a contribution to the common European interest. But member states and participants still need to demonstrate compatibility by showing that aid is necessary and has an incentive effect, that it is proportional and appropriate, and that its positive effects outweigh the negative effects in terms of distortions of competition. Table 1 gives an overview of the most important of these criteria, which form the heart of the IPCEI's conditionality regime.

Table 1: Overview of IPCEIs' most important eligibility and compatibility criteria

Eligibility Criteria	Compatibility Criteria
<p>Importance:</p> <ul style="list-style-type: none"> • There is no minimum threshold for importance but the Commission makes clear that projects need to be 'quantitatively or qualitatively' different from run-of-the-mill projects, be it in 'size or scope' or because it involves 'a considerable level of technological or financial risk, or both' (European Commission 2021, 14). 	<p>Necessity:</p> <ul style="list-style-type: none"> • A 'counterfactual scenario' should provide evidence (e.g. from internal discussions) that 'without the aid, the realization of the project should be impossible, or should only be possible on a smaller scale, with a more narrow scope, or not with sufficient speed, or in a different manner that would significantly restrict its expected benefits' (European Commission 2021, 14). • Moreover, a 'balancing test' should ensure that the positive effects of the aid outweigh its negative effects in terms of distortion of competition.
<p>Common Interest:</p> <ul style="list-style-type: none"> • <i>General Criteria:</i> To qualify as being in the common interest, a project must meet several general criteria, notably that it addresses an 'important market or systemic failure', makes a 'concrete, clear, and identifiable contribution to the Union's objectives and strategies', involves 'at least 4 member states' while giving all member states a 'genuine opportunity to participate', and generates 'positive spillover effects' across value chains or sectors (European Commission 2021, 12). • <i>Specific criteria:</i> An R&D&I project needs to be of 'major innovative nature or constitute an important added value (...) in the light of the state of the art in the sector concerned'. An FDI project 'must allow for the development of a new product or service with high research and innovation content or the deployment of a fundamentally innovative production process [which goes beyond] regular upgrades without an innovative dimension of existing facilities and the development of newer versions of existing products'. Eligible project activities are 'the upscaling of pilot facilities, demonstration plants or of the first-in-kind equipment and facilities covering the steps subsequent to the pilot line including the testing phase and bringing batch production to scale, but not mass production or commercial activities' (European Commission 2021, 13). • <i>Positive indicators:</i> Projects which involve the Commission or other EU institutions or receive co-financing from a Union fund, for example, may be looked upon more favorably. 	<p>Proportionality:</p> <ul style="list-style-type: none"> • To ensure that a project which is of common European interest cannot be achieved with <i>less</i> aid, the Commission relies on the funding gap approach. The funding gap is calculated based on the difference between the expected positive and negative cash flows over the lifetime of a project, discounted to their present value using the Weighted Average Cost of Capital (WACC) which reflects the required rate of return and project risks. A project's net present value (NPV) is the sum of its discounted net cash flows (expected revenues minus costs). When a precise alternative project is identifiable, the Commission compares the NPVs of the aided project and the alternative. When there is no such alternative project, the Commission will verify that the aid amount does not exceed the minimum necessary for the aided project to be sufficiently profitable, based on whether it achieves an internal rate of return that meets sector-specific or firm-specific benchmarks. • The maximum permitted aid level is determined by the calculated funding gap in relation to the eligible costs⁴. It can reach up to 100% of a wide set of eligible costs for, among other things, feasibility studies, instruments and equipment, building, infrastructure and land, materials and supplies, or personnel and administrative costs. This requires companies to submit detailed funding gap analyses based on things like price quotes from suppliers, quantitative benchmarks from similar projects, or academic papers. To safeguard that aid remains 'proportionate and limited to the necessary' the updated 2021 IPCEI communication included a 'claw-back mechanism' which provides a legal basis for participants to pay back part of the aid received if a project is more profitable than forecasted in the funding gap analysis based on ex post cash flow results (European Commission 2021, 15).

While the design of the IPCEI instrument remained remarkably stable, some of the political goals associated with IPCEIs changed over time (Interview 1). Specifically, when the IPCEI communication was updated in 2021, geostrategic motives were layered on top of it, and IPCEIs turned from a tool to foster ‘economic growth, jobs and competitiveness for the Union industry and economy’ (European Commission, 2014b, 4) to one fostering ‘*sustainable* economic growth, jobs, competitiveness *and resilience* for industry and the economy in the Union and *strengthen its open strategic autonomy*’ (European Commission, 2021, 10). Underlying this was once again a stretching of the notion of market failure. For in a world rife with geostrategic conflict, markets were increasingly also seen as failing to provide the technological and economic capacities for European competitiveness and security (Seidl and Schmitz, 2024, 2152). In a recent academic paper, three DG COMP officials explicitly argue that one should be able and try to reformulate each industrial policy intervention ‘in terms of the market failures they address. Even when industrial policies are presented as aiming at political objectives, like open strategic autonomy or leading the digital transition, they can be re-formulated in terms of market failures, helping us identify the actual need for support and determine the best design for such support’ (Piechucka et al., 2023, 506).

4 From Emergence to Implementation: The Life Course of an IPCEI

Throughout their life course—from emergence to design to (pre-)notification to implementation—IPCEIs are governed by a mixture of formal rules and informal practices. The former are laid down in the official IPCEI communications, and the latter have been gradually codified based on existing experiences, most notably in DG Comp’s *Code of good practices for a transparent, inclusive, faster design and assessment of IPCEIs* (published in May 2023) but also in the Joint

⁴For example, when the total eligible costs for a project are €100,000, and the NPV of the expected net cash flows is €40,000, the funding gap is calculated as the difference between these two amounts. Suppose the project expects positive cash flows (revenues) of €60,000 and negative cash flows (costs) of €20,000, discounted to their present value to get an NPV of €40,000. The funding gap would then be: €100,000–€40,000=€60,000.

European Forum on IPCEI (JEF-IPCEI). These rules and practices shape how IPCEIs are formed, assessed, and monitored. In the next section, we argue that while they are motivated by a well-justified desire to attach conditionalities to public money, these rules and practices also limit the EU’s ability to do industrial policy, both in terms of overall effectiveness and distributive implications. However, to illustrate how IPCEIs work, we first walk readers through the typical life course of an IPCEI (see Figure 1), focusing primarily on the design, (pre-)notification, and implementation stages (for details on how strategic value chains are identified and IPCEIs emerge, see Seidl et al., 2024).

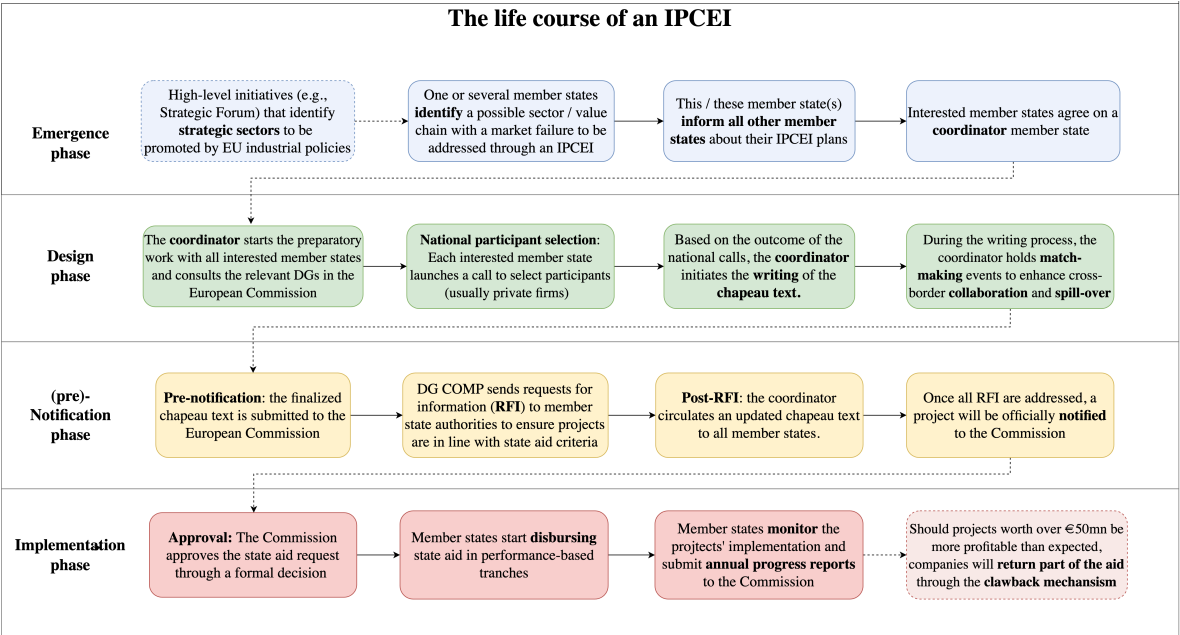


Figure 1: Flowchart documenting the life course of an IPCEI

IPCEIs emerge in a relatively bottom-up process whereby one or several member states—often reacting to demands by domestic industries—identify a potential project that is in line with the criteria set out in the IPCEI communication. For example, member states need to ask themselves if a project tackles an important market or systemic failure, is in line with the EU’s broader strategic priorities, and whether an IPCEI would be the most suitable instrument. If they believe this is the case, they should then communicate their intention to create an IPCEI and agree on a coordinator member state (‘Coordinator’). While initially done very non-transparently,

with member states only learning about an IPCEI once it was approved, this process became much more formalized and inclusive over time, especially with the creation of the JEF-IPCEI (for details, see Seidl et al. (2024)).

Once a potential IPCEI has been identified, it moves into the design stage. IPCEIs are designed by member states in coordination with DG COMP. Member states are tasked to organize open, transparent, and non-discriminatory national calls for expression of interest and select potential participants that fit the criteria set out in the IPCEI communications. In this process, the bulk of the administrative burden falls on the Coordinator, which acts as a *primus inter pares*. While Coordinators may have slightly more influence over the design of IPCEIs, member states are usually content if someone else takes on this role (Interviews 3, 4, and 5). After all, Coordinators must be prepared to ‘dedicate sufficient administrative capacity [and] budget’ while also having ‘in-depth knowledge of, and experience with the relevant State aid rules’ (DG COMP, 2023, 3). They are expected to actively ‘promote collaboration’ and ‘identify synergies’, for example by organizing ‘match-making’ sessions between potential participants (DG COMP, 2023, 5). Importantly, they are also meant to ‘manage the expectations of interested undertakings’ (DG COMP, 2023, 5) and explain that IPCEIs are neither the only way to get funding under EU state aid rules nor a blanket exception to them.

This is essential as IPCEI funding is reserved for specific and specifically designed projects, namely those that fulfill the eligibility and compatibility criteria set out in the IPCEI communications, which are themselves based on the broader principles of the EU’s state aid regime (see section 3). The primary mechanism through which these eligibility and compatibility criteria are transposed into the design of individual IPCEIs is the so-called Chapeau text as well as the individual project documents. The Chapeau text is meant to describe an IPCEI’s overall structure and ‘demonstrate compliance with key IPCEI requirements’ (DG COMP, 2023, 6). It is drafted by the Coordinator with the input of member states and participants. The project documents for individual sub-projects—particularly the project portfolio and funding gap projections—are prepared by the participants themselves, with national authorities and the Coordinator being tasked to ensure that this happens in a timely and precise manner.

Once the Chapeau and the project documents are finalized, an IPCEI enters the pre-notification stage during which the Commission assesses the submitted documents and sends requests for information (RFIs) to participants, although DG COMP does not directly interact with them but channels its questions to the companies via national authorities. There can be several rounds of—often detailed—RFIs during which DG COMP may also consult with experts from other DGs, for example, to assess whether a project is innovative at the global state of the art (Interview 6). One participating company recalls receiving ‘five requests for information from the EU Commission. In total, 60-70 pages of questions. All the questions are detailed questions’ (Interview 7).

The integrated nature of the IPCEIs means they are approved as a whole. Therefore, the Commission can only approve an IPCEI once all questions for each individual sub-project are sufficiently answered, and once it is assured that all companies remaining part of the IPCEI and their projects fulfill the requirements. Hence, the IPCEI is only as fast as the weakest company involved. This process is further constrained by the available manpower in DG COMP itself. When DG COMP reviews several IPCEIs at the same time, as it happened in 2022, it can take a long time to process pre-notified IPCEIs, send out RFIs, and assess the participants’ responses. According to an official from a medium-sized member state ministry participating in various IPCEIs, in extreme cases, it took 14 months between the pre-notification of the IPCEI and the first round of RFIs (Interview 3). Overall, this means it can take several months to up to 1.5 years for the pre-notification stage to be concluded (Interview 8).

Once all questions with all firms from all member states are clarified, an IPCEI can be officially notified to the Commission. After that, formal approval through a Commission decision usually takes only a few weeks. After formal adoption, additional national cost auditing may be conducted before funds are disbursed. As one implementing consultancy explains, ‘For every payment, we need to evaluate if what the company wants to do is necessary for the project [as approved by the Commission], as well as economical and efficient. (...) And therefore, we ask the companies to send us documents to prove that a certain machine is necessary and that a certain machine costs whatever they claim, etc. (...) It is daily business that we do not approve certain costs they include’ (Interview 8). The process from the emergence of an IPCEI to the final

disbursement of funds can thus take up to 4-5 years (for an illustration based on the two micro-electronics IPCEIs, see the online appendix). After an IPCEI has cleared both supranational and national hurdles, it enters the implementation stage during which progress and compliance of individual projects as well as the overall IPCEI are monitored and reported.

5 The Cost-Conditionality Trade-Off In the Governance of IPCEI

In line with the constraints imposed by the Treaties and case law as well as its own decisional practice, the Commission imposes relatively strict and restrictive conditionalities on state aid funding in the context of IPCEIs (Cattrysse, 2016). It is not shy to put candidate IPCEIs through their paces, making sure they meet demanding eligibility and compatibility criteria. To be clear, the Commission has good reasons to be concerned about competition distortions, inefficient allocations of resources, or wasteful subsidy races. And given that IPCEIs allow funding relatively close to commercialization, these concerns are even more acute. As a DG COMP official puts it, ‘in R&D, the risk of distortion is lower than in actual manufacturing support. (...) Knowledge can disseminate through the Union. Mass production facilities are usually very mobile—they can be set up anywhere, so the risk of distortion by state aid is very high’ (Interview 9). In addition to limiting competition distortions, conditionalities also help ensure that limited public resources are used efficiently. DG COMP prides itself on having saved €9bn in EU taxpayer money in the context of the first seven IPCEIs because of its thorough reviews of the state aid applications (Interview 9).

However, the potential benefits of strict conditionalities need to be balanced against their costs, just like the positive effects of aid need to be balanced against its negative effects. Sometimes, the benefits may outweigh the costs. For example, the increased communication and coordination costs of the multi-member-state requirement may well be outweighed by greater knowledge transfer, cohesion, and the mitigation of political discontent among smaller member states. The Commission thus has good economic and political reasons to tell participants the more they collaborate across borders the better their funding prospects (Interview 8). Companies receiving

state aid should also not be allowed to just keep doing what they are doing anyway (Rodrik, 2004). For example, the positive spillover requirement is interpreted by the Commission rather demandingly. While it does not tell ‘companies exactly what to do it, it has to be something else than what the companies usually do on a daily basis. It is not enough to go to conferences or write some papers or make some patents. It needs to be more. The Commission was very demanding on this point. Examples of nice spillovers are companies opening their doors to SMEs, e.g. in the case of microelectronics, foundries produce wafers for small firms, or organize a summer school for students. The spillover effects are a condition for state aid, but they are not eligible for state aid, meaning that the company needs to pay for it itself’ (Interview 8).

However, conditionalities also have costs, which come in three forms: perverse outcomes, adverse selection, and workarounds. *Perverse outcomes* occur when conditionalities lead to (unintended) consequences that run counter to the original goal of the instrument. For example, in addition to generating ‘an intrinsic tendency for peripheral underrepresentation’ (Lopes-Valença, 2024, 10), forcing companies to go beyond the global state of the art may repel those companies that are at the technological frontier. As one interviewee told us, the restrictive interpretation of this requirement would mean that ‘if TSMC were to be part of an IPCEI, its project in Europe would have to be innovative beyond what it is doing in Taiwan to be eligible for funding. This would mean, in this case, that it would have to do a project making chips at less than 2nm, say at 1nm” (Interview 6). Tesla dropped out of the battery IPCEI for similar reasons (Interview 10).

Likewise, one specific eligibility criterion for IPCEIs is that projects can only receive subsidies for activities before mass production and commercialization, but explicitly excluding the latter (see Table 1). This means, for example, that production equipment can be funded only to the extent that it is used for R&D and first industrial deployment (FID). However, the same machine can often be used for R&D, FID, or mass production. The state aid will only be granted for a share of the machine, based on how much it is used (and depreciated) for R&D and FID. A project manager involved with the administration of IPCEI applications described the problem as follows: ‘You are allowed to send samples to the customers and you will have some minor sales because samples are not for free. And then when customers like the sample and want more of these products, your sales increase. And this is where the Commission makes the cut. This

is no longer FID. Once the number of sales gets too high, this is considered mass production and this is where funding ends' (Interview 8). For one semiconductor company, this meant that they produced a test batch with perfectly fine products, but they could not sell them and had to throw them away instead because otherwise they would have jeopardized their funding eligibility (Interview 11).

Adverse selection occurs when only actors—be it governments or companies—with high administrative capacities can fulfill the IPCEI conditionalities even though these capacities are unrelated to the substantive goals behind the conditionalities. For example, the high workload associated with being a Coordinator meant that so far only Germany, France, and, in one case, the Netherlands have taken on this role. Moreover, while France has established a dedicated unit within its Ministry of Economy to deal with IPCEIs, the German BMWi outsourced the administrative coordination after the first IPCEI to VDI-VDE IT, a consultancy firm that spoke the 'language of the Commission' (Interview 11) and could thus better traverse the distinct 'social world' of EU project-based funding with its particular terms and tenets (Büttner and Leopold, 2016, 54). In other words, limited administrative capacities lead to private intermediation and create a market for specialized conditionality consulting (Büttner and Leopold, 2016, 61–62; Ducastel et al., 2024, 455; Gräf, 2024).⁵

More broadly, the administrative capacities required to manage an IPCEI—even without being the Coordinator—are unevenly distributed among member states, which reinforces regional differences in IPCEI participation that result from member states differential fiscal capacities (Büttner and Leopold, 2016; Lopes-Valença, 2024).⁶ Being a firm in a member state that can afford to be involved in many IPCEIs likely conveys considerable advantages. Spain, for example, wanted to lead a Photovoltaic IPCEI but did not understand the instrument, which meant the

⁵While some Nordic countries prefer PWC which also has extensive experience in dealing with the Commission, in Germany, VDI-VDE IT has established itself as the go-to consultancy and is, in addition to Microelectronics II, also administering a battery and the cloud IPCEI (Interview 3).

⁶Differences in fiscal capacities are of course a broader problem of EU industrial policy which is mainly financed by member states. However, member states may also have differing rules in terms of how much they can make use of the possibilities offered by the IPCEI communications. For example, Austria can only give state aid at a maximum of 30% of the eligible funding gap even though up to 100% would be allowed (Interview 4).

IPCEI never materialized (Interview 3). By contrast, Germany and therefore German companies participate in all but one of the 10 approved IPCEIs, in addition to being the sole coordinator for microelectronics 1&2, one hydrogen, one battery, and co-lead for cloud. It is therefore not surprising, as Figure 2 shows, that German companies are overrepresented even when compared to Germany’s generally higher level of state aid spending relative to its GDP (see also, Lopes-Valença, 2024).

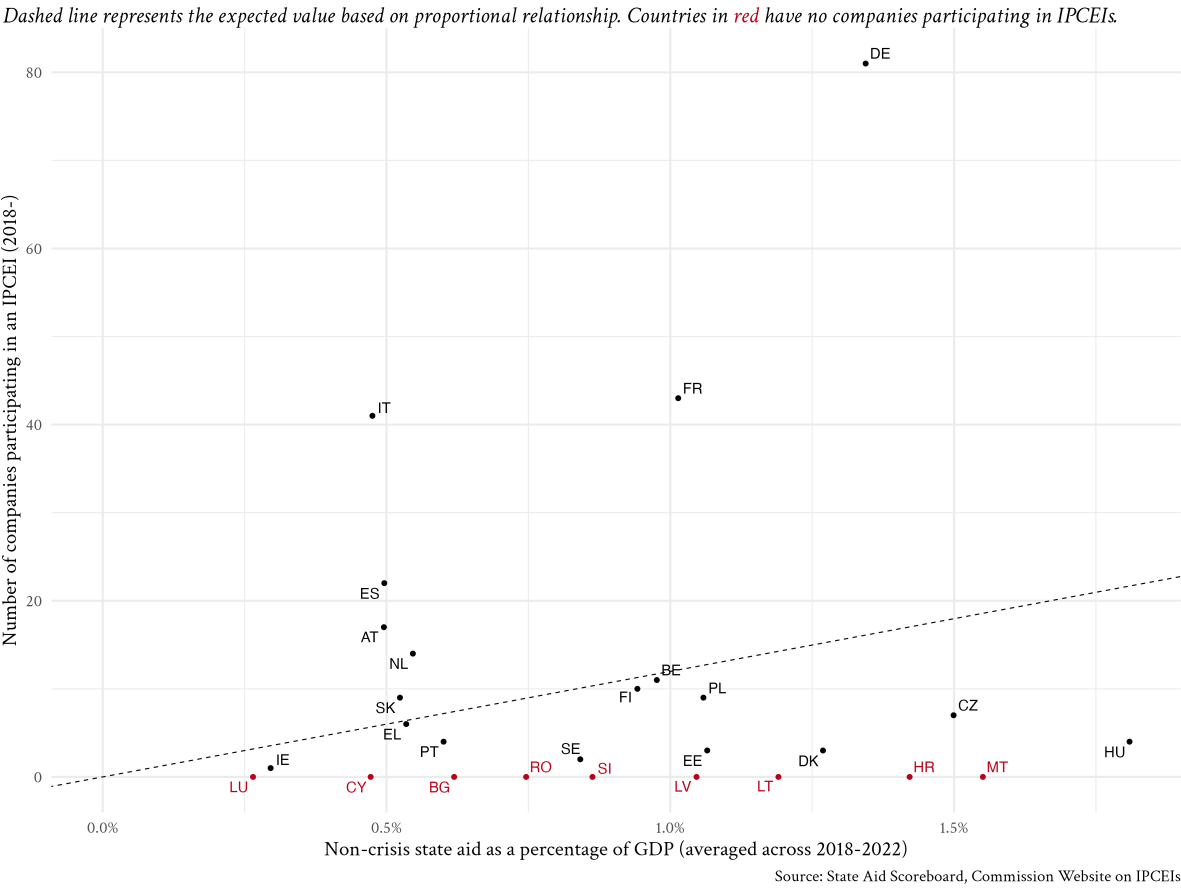


Figure 2: IPCEI and State Aid Spending

But it is not only member states that need to invest significant administrative capacity, but also firms themselves, which poses considerable challenges. To recall, firms need to write a convincing project description including a detailed funding gap analysis, contribute to the Chapeau text, participate in numerous meetings and matchmaking events, and answer RFIs from DG COMP.

They must also collaborate across countries, ensure spillovers, and manage cost-based payment requests at the national level. These requirements often lead to firms dropping out of IPCEIs during the RFI process or upon learning about the extensive reporting demands for funding approval. To illustrate the scale of the administrative load, a semiconductor company's Head of Strategy told us that from the firm's point of view an IPCEI 'costs €700,000 to €800,000. The administration is crazy, horrible. We had one person fully working on it for one and a half years. We also hired a consultancy' (Interview 7).

The administrative load is particularly challenging for smaller companies, even though both the IPCEI communications and the broader EU industrial policy discourse put particular emphasis on supporting SMEs. As one project manager involved with the administration of IPCEIs in a large EU member state noted, 'IPCEI is not the right instrument for a small enterprise. The efforts needed to be done by the company are very high. The RFI often has a lot of questions and the company only has few days to answer. Small companies cannot deal with that. They have no person who can answer such questions other than the CEO perhaps. Large companies, in contrast, have dedicated departments for funding applications' (Interview 8). The Head of the Brussels office of a semiconductor company noted that 'complexity and bureaucracy of the framework are far too high, new entrants in general (companies and member states) and especially smaller companies (SMEs, start-ups) are overwhelmed and have little motivation to participate' (Interview 12).

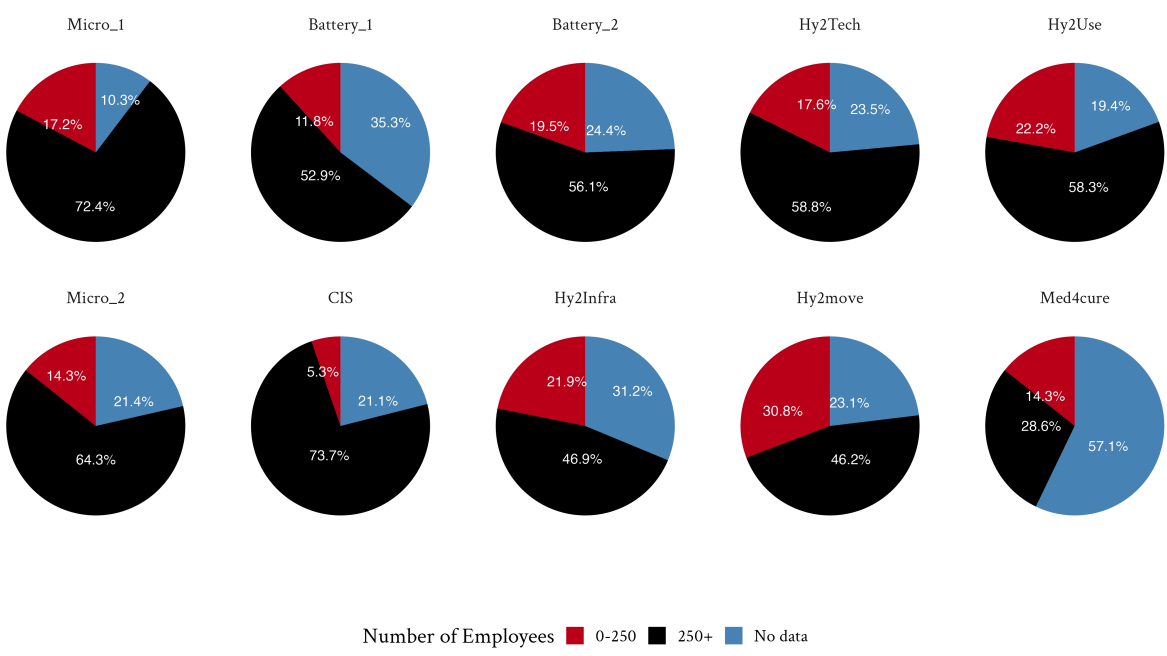
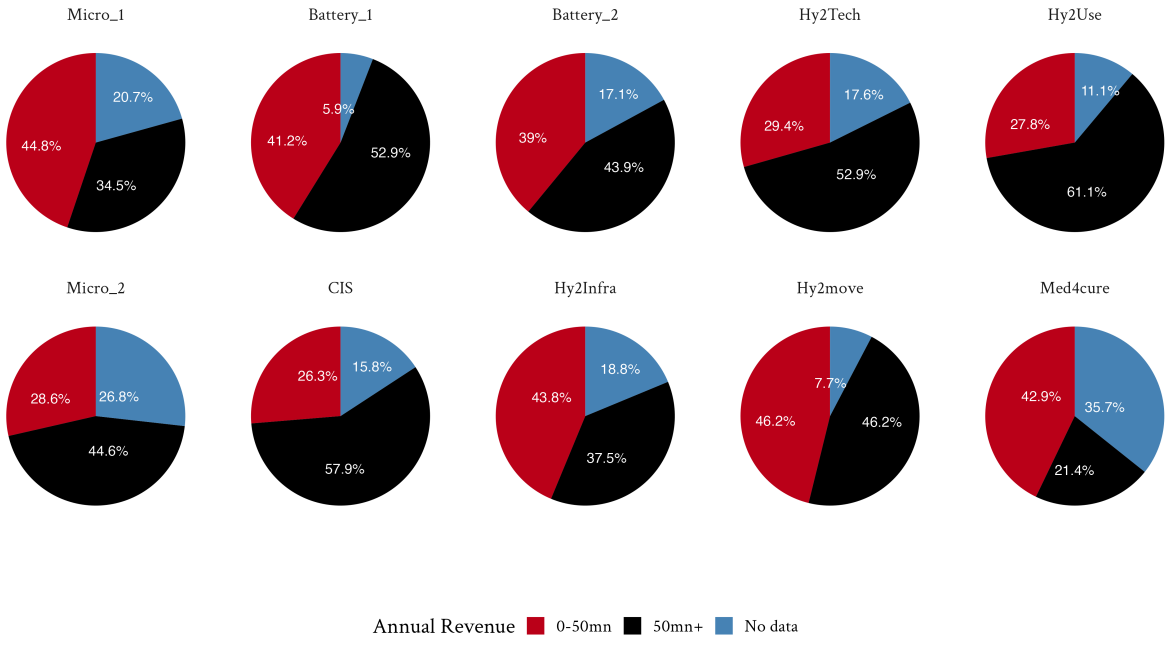
Meanwhile, the General Manager of a semiconductor supplier explained that they 'dropped out of IPCEI because of the bureaucracy. We had to do extra reports, go to meetings, make sure there are spillovers. We would have had to hire two people for all of this. Large companies can handle this, but for a small player like us it is disproportionate' (Interview 13). The Vice President of Government Affairs at another semiconductor company echoed this sentiment, stating that 'perhaps if your investment sum is huge and the potential state aid is very significant like in [a larger company's] case, you might be willing to go through this bureaucratic journey, but not for a small amount like ours' (Interview 14). Some companies also dropped out upon discovering the requirement to submit progress reports over several years post-funding: 'Companies have

to write reports during the process. And when they found this out and considered the work it meant, they no longer found it worth to remain part of IPCEI' (Interview 8).

These sentiments are also reflected in the relatively low share of SMEs—officially defined as having less €50mn in revenue and less than 250 employees—that are direct participants in different IPCEI projects (see Figure 3). Especially for some IPCEIs, large companies make up well over 50% of participants, which does not even take into account the amount of aid received, which is also generally higher for larger companies. This is in line with other findings that 'public subsidies tend to be increasingly concentrated among larger communities and companies that have the human and financial resources to capture [it]' (Ducastel et al., 2024, 455).

This is not lost on public officials themselves. A policy officer from an IPCEI-responsible ministry does not mince their words when stating that 'the companies have a point. The IPCEI notification process is insane. Those who have gone through it are damaged for life' (Interview 4). Even officials in the Commission acknowledge that IPCEIs are perhaps 'not super well suited for SMEs' and that there is a 'kind of selection implicit in the level of ambition [because] when you demand really breakthrough innovations, larger companies with very big R&D departments are more suited to provide those' (Interview 1). DG COMP even discussed relaxing the innovation requirements when it revised the IPCEI communication in 2021, but decided against being 'more lenient' and retained 'the very high ambition on innovativeness'. The Commission is also aware that to 'really facilitate work for SMEs' one may need to 'further simplify the financial assessment' (Interview 1).

However, this awareness does not translate into a more explicit balancing of the costs and benefits of IPCEI conditionalities. Instead, the Commission seems to put most emphasis on more clearly defining the rules instead of simplifying them. This has led to certain improvements. For example, the 2023 Code of Good Practices clarifies that the Chapeau text should be concise and, if possible, written in non-technical language, setting an 'indicative target' of 150 pages; for comparison, the Chapeau text for the second microelectronics IPCEI had 561 pages in total (Interview 8). As one Commission official put it, 'we used to get 300 pages of blabla' but now the quality of applications has improved (Interview 15). However, this has not made the approval process less complex. According to several of our interviewees, DG COMP now asks more ques-



Source: Orbis Europe, Capital IQ, and Zoominfo

Figure 3: Annual revenue and number of employees of firms participating in IPCEIs

tions during the request for information (RFI) stage. Because the rules are now clear, it requires more reviewing to ensure they are fulfilled.

Lastly, *workarounds* refer to situations where actors seek alternative solutions either within or outside the IPCEI framework. In the former case, actors seek to bend the rules governing IPCEIs to at least partially avoid their costs. Recall that it can take several years until a potential IPCEI is approved. The ‘heavy process’ (Interview 1) not only strains the administrative capacity of member states and companies but also of the Commission itself. Especially, during the period of the greatest ‘enthusiasm’ for IPCEIs in late 2021 and early 2022 (check), the Commission faced a lot of criticism for how slowly it assessed applications and doubled its staff to deal with the increased load (Interviews 2 and 3). Making projects more inclusive also did not help as larger projects increased transaction costs in the form of coordination and reviewing. As one Commission official sums it up: ‘We are not many people here. And we have to deal with tons of projects’ (Interview 2).

This slowness of the approval process stands in stark contrast to the fast-moving technological landscape into which IPCEIs are meant to make a dent. Actors have thus sought internal workarounds to speed up the process, notably the early start mechanism (ESM), which the BMWi devised during the first IPCEI but which has later become common practice.⁷ Basically, the ESM means that companies receive letters from the BMWi (and later other national ministries) that allow them to go ahead with their designated projects at their own risk, although this usually only happens if the member states and the Commission are reasonably confident there are no obvious ‘red flags’ in the project descriptions (Interview 3). The letters imply that if the IPCEI does not receive Commission approval, the firms would not receive state aid; but at the same time, they were also not *foregoing* their right to state aid by starting early. The ESM is a workaround which trades off risk for speed as firms need to move fast in fast-moving sectors. It thus safeguards the usefulness of IPCEIs from the point of view of firms. As one executive puts it bluntly: ‘Without the ESM, the IPCEI investment projects would be dead’ (Interview 11).

⁷We know that this tool was used in the first and second microelectronics IPCEIs (see Table 2), and in the IPCEI on Next Generation Cloud Infrastructure and Services (Interview 16).

However, the ESM also calls into question the approval process because by conducting the investment before receiving aid the company technically signals that it does not need the aid. After all, if the investment can be conducted without state aid, there is no market failure.

In addition to such workarounds within the IPCEI framework, there are also attempts to make use of (and lobby for) alternative funding opportunities, both inside and outside the EU. For one, industrial policy is on the rise not just in the EU, and companies are not shy to arbitrage between different jurisdictions. ‘There is a subsidy race whether we like it or not’, a Commission official concedes (Interview 15). And compared to the complexity of IPCEIs, subsidies elsewhere are often much easier to come by. As the Head of Strategy of a semiconductor company puts it, ‘In the US, the support works via a simple tax refund. This is much less complicated than the IPCEI procedure’ (Interview 7). A Commission official also notes that the IRA ‘has changed the picture a lot’ and reduced ‘the pressure on IPCEIs as a tool’ as the European response has been to broaden the industrial policy toolbox, most importantly through the possibility to match aid received in other countries (Interview 1).

Hydrogen companies, for example, note that the EU, having put hydrogen ‘high on the agenda’, is ‘a bit stressed’ about the IRA’s generous tax credits. Their ‘message’ to the Commission is that ‘businesses prefer schemes like IRA (...) because then the market actually dictates which projects will be run [instead of] bureaucrats’ (Vollidal, 2022). In addition, instruments like the Chips Act often provide much easier access to funding and are therefore much preferred by semiconductor companies: In an interview with an official from an EU member states’ ministry, it was emphasized that semiconductor firms’ requests for subsidies have kept ‘flooding in since late 2023, totally going beyond our available budget. My main task at the moment is telling firms that there is no Chips Act money for them’ (Interview 17). The most recent GBER amendment also significantly increased the aid intensities and notification thresholds for environmental and R&D&I aid, providing an alternative to IPCEI funding for many smaller projects. For example, an Austrian official argued that ‘all the Austrian participations in the EuBatIn IPCEI would be under the GBER now (...). Below the thresholds.’ (Interview 4).

6 Discussion & Conclusion: Lowering the Price of Getting Things Right

In this paper, we have provided an in-depth case study on how IPCEIs work on the ground. In particular, we have shown how conditionalities—despite being rightly considered essential for maximizing ‘the value of public supports provided to private firms’ (Mazzucato and Rodrik, 2023, 6)—also create costs, specifically in terms of perverse outcomes, adverse selection, and internal and external workarounds. We now tie these theoretical and empirical discussions together to reflect more systematically on how IPCEI’s cost-conditionality trade-offs are shaped and exacerbated by the political, institutional, and ideational constraints of EU industrial policy. We then make some suggestions as to how IPCEIs could be tweaked to lower these costs without radically departing from these constraints.

Like with all industrial policies, the features of the IPCEI instrument ‘have been significantly distorted by the constraints within which they have emerged’ (Block, 2008, 171). First, there is the multi-level nature of the European polity which invests the Commission with the constitutional authority—increasingly realized since the 1980s—to both constrain and direct the industrial policies of member states, which continue to provide most aid. This creates an administratively burdensome governance architecture in which member states coordinate IPCEIs and directly interact with participating companies while the Commission assesses the eligibility and compatibility of projects. This requires the Commission and member states to coordinate their actions while marshaling the resources to effectively administer IPCEIs, despite having limited experience with or being ‘out of practice with the capacity-intensive forms of industrial policy’ (Juhász and Lane, 2024, 16). This limits how nimble IPCEIs can be and sits uneasily with the demands of a fast-changing technological landscape: In a world characterized by subsidy races in core technologies, 4-5 years between the initial idea to subsidize something and the actual pay-out of the subsidy (see Table 2) is simply too slow. Relatedly, the multi-level nature of IPCEIs creates political tensions and economic distortions as richer member states not only have more fiscal *but also* more administrative capacities to make use of the instrument.

In addition to these institutional constraints rooted in the architecture of the European polity itself, there are ideational constraints arising from the deeply-held belief that industrial policies need to be justified in terms of market failures. On the one hand, this results in demanding eligibility and compatibility assessments which strain the administrative capacities of member states and participating companies (Ducastel et al., 2024), but also of DG COMP itself, whose ‘sweeping powers have never been matched by the level of human resources available to it’ (Akman and Kassim, 2010, 121). On the other hand, it sidelines non-efficiency-based criteria, which are largely absent from the IPCEI conditionality regime. This is in striking contrast to recent industrial policies in the US such as the CHIPS and Science Act, which includes, among other things, provisions on the use of union workers and limits of stock buybacks and dividends (Reynolds, 2024).⁸

Third, the ability to enforce conditionalities depends not only on administrative capacity but also on ‘strategic state capacity’, understood as the ability of public actors ‘to mobilize or demobilize interest groups in pursuit of official policy goals’ (?, 495). There is thus an intimate relationship between conditionality and political power (Bulfone et al., 2023; Cooman, 2023). The Commission’s relative lack of power resources raises questions about whether it, if push comes to shove, has the ‘stick to discipline opportunistic action’ (Rodrik, 2004, 11), especially if recipients lobby for alternative, less demanding funding instruments. Similar political constraints may prevent the Commission from managing discontent among member states and mobilizing enough support to develop IPCEIs into a more ambitious tool of a supranational industrial policy that transcends the limits of its current network- and project-based structure (Büttner and Leopold, 2016; Di Carlo and Schmitz, 2023). The current lack of ‘strategic coherence’ between different instruments (GBER, IPCEI, Chips Act Pillar II, TCTF) creates frictions that could be avoided if they were ‘embedded in joint strategy’ (Interview 4).

While these constraints can always change—as evidenced by the proposal by newly-reelected Commission President von der Leyen to create a ‘European Competitiveness Fund’ which would

⁸In the eyes of DG COMP, the ‘social impact of industrial policies must be incorporated in the decision-making process, but it is not per se part of the efficiency assessment of the policy choice set’ (Piechucka et al., 2023, 510).

also ‘support’ IPCEIs (von der Leyen, 2024, 12)—we take their existence for granted when thinking about how the IPCEIs’ conditionality regime could be improved. The central message is that just like the Commission balances the benefits and costs of state aid, it should also balance the costs and benefits of conditionalities more explicitly. In other words, there is a price of getting things right. In what follows, we want to make two related suggestions for how to lower this price in ways we consider net-positive and that are entirely in line with efficiency-oriented principles: to shift conditionalities from ex-ante to ex-post, and to increase the tolerance for failure.

First, conditionalities can be a precondition for receiving aid (ex-ante), or aid can be increased or reduced during the course of a project or relationship based on whether the conditionalities are met (ex-post) (Koch, 2015, 99–100). IPCEIs themselves have a mechanism, the so-called clawback-mechanism, which requires recipients of state aid in excess of €50mn to pay back part of the aid if a project is more profitable than forecasted in the funding gap analysis.⁹ This mechanism should allow DG COMP to speed up project reviews as it ‘incentivizes companies to be honest with the funding gap. Because if they lie, they will have to pay it back anyway’ (Interview 9). Projects could be further sped up when the clawback-mechanism is linked up with the early start mechanism (see previous section). Such repayable advances have been shown to work well theoretically and empirically (Meunier and Ponssard, 2024). In fact, the EU Commission in its 2014 state aid guidelines for R&D&I already recommends using them, and even flags them as ‘potentially less distortive forms of aid’ and ‘the aid instrument of choice’ for ‘activities that are close to the market’ (European Commission, 2014a, 16–17).

If credibly applied, it can function as a Sword of Damocles (Interview 12) which can limit opportunistic behavior and thus allow for further simplifying project applications and reviews. This seems all the more important given that ex-ante demonstrations of compliance and ‘over-precise work planning’ are often simply ‘unrealistic in view of the project durations of several years and generates tremendous extra work’ (Interview 12). However, the enforcement of ex-post conditionalities should be centralized in DG COMP as currently only ‘some member states [do] it

⁹According to DG COMP, this mechanism was adopted by the US based on the EU experiences: ‘The US has copied this for their Chips Act, after we explained it to them. They call it ‘upside sharing’’ (Interview 9).

properly [while] some do it less properly' (Interview 9). It may also have to be applied more comprehensively to avoid companies exploiting thresholds as described by one company: 'We deliberately stayed under €50mn per project/site for the second microelectronics IPCEI to avoid falling under the claw-back mechanism' (Interview 18).

Second, while IPCEIs follow many of the 'design principles' for good industrial policy, such as limiting incentives to 'new activities', requiring the demonstration of 'spillovers', or 'support as a corrective to specific market failures instead of generic support for this or that sector' (Rodrik, 2004, 21–23), it ignores a broader point: 'The objective should be not to minimize the chances that mistakes will occur (...) but to minimize the costs of the mistakes when they do occur. If governments make no mistakes, it only means that they are not trying hard enough' (Rodrik, 2004, 25). In other words, the perfect can be the enemy of the good and overly strict conditionalities may prevent too many false negatives (investments not made or made elsewhere) at the expense of minimizing false positives (allocating subsidies to investments that would be made anyway). This was a point already raised by the Swedish government during the consultation for the 2014 IPCEI communication, and we could not agree more with it: 'We question the need for such a deep analysis here, especially as regards R&D&I projects. "Failures" must be allowed to happen in this field, since they are common or even dominant in experimental R&D&I processes. To fully and accurately, in advance, describe the counterfactual scenario is also often a utopia. We therefore suggest that the Commission downplays the requirements of counterfactual scenarios.'

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8 Online Appendix: The Costs of Conditionality

8.1 Interviews

This paper draws on insights from 18 interviews conducted between May 2023 and March 2024. All interviews have been recorded and transcribed with prior verbal permission obtained on condition of guaranteeing the anonymity of the interviewee. We have selected our interview partners based on their knowledge, expertise, and direct involvement with IPCEI projects and/or knowledge of EU state aid procedures. The pool of interview partners comprises officials from member states and the EU Commission, as well as corporate executives from companies partaking in IPCEI-projects. Table 1 gives a complete overview of our interview partners.

Table 1: List and details of interviewees

Interview #	Date	Location	Description
Interview 1	31.01.24	Online	DG COMP case handler
Interview 2	11.10.23	Online	DG COMP policy officer
Interview 3	19.01.24	Brussels	DG COMP policy officer
Interview 4	29.01.24	Online	Ministry official, medium-sized member state
Interview 5	26.02.24	Online	Ministry officials, medium-sized member state
Interview 6	17.01.24	Brussels	DG CNECT policy officer

Interview #	Date	Location	Description
Interview 7	13.06.23	Online	Head of Strategy, semiconductor company
Interview 8	09.06.23	Online	Project manager involved with the administration of IPCEIs in large EU member state
Interview 9	17.01.24	Brussels	Director, Head of Unit, and policy officer, DG COMP
Interview 10	13.03.24	Brussels	Member of a previous German government
Interview 11	29.01.24	Online	Head of Government Affairs, semiconductor company
Interview 12	23.01.24	Brussels	Head of Brussels Office, semiconductor company
Interview 13	17.05.23	Dresden	General Manager, semiconductor supplier

Interview #	Date	Location	Description
Interview 14	11.05.23	Berlin	Vice President Government Affairs, semiconductor company
Interview 15	02.02.24	Online	DG COMP head of unit
Interview 16	01.02.24	Online	Two Heads of Unit, industry association involved with the Cloud IPCEI
Interview 17	08.02.24	(cannot be disclosed)	Ministry officials, large member state
Interview 18	17.05.23	Dresden	Innovation Program Manager, semiconductor company

8.2 Firm-level data

We have collected data on all firms are direct participants in IPCEI projects. Direct participants are that are mentioned in official Commission documentation on IPCEIs. With few exceptions, direct participants are firms that are the beneficiary of state aid. The only exceptions are CEA-Leti and Fondazione Bruno Kessler, which are both research institutes.

We have collected data on the number of employees, revenue, host country, the firm's main activity, the year they joined the IPCEI, and the name of the IPCEI. This allows us to reconstruct both the firm-level and the member-state level picture. We have used two databases: Orbis Europe (curated by Bureau Van Dijk), Capital IQ, and Zoominfo. Revenue and employee data are the most recent numbers available. At the time of compiling the database, this was 2022.

Data on unlisted (private) firms is less well represented in both databases. This skews the data somewhat to larger listed firms, for which data is legally required to be disclosed. We have accounted for this bias by including the percentage of missing firms directly in Figure 3.

For Figure 2, which plots the number of firms per country against state aid expenditures in GDP, we supplement our data with numbers from the EU Commission’s state aid scoreboard.

8.3 Timeline Microelectronics IPCEIs

Table 2 describes the timeline for the two microelectronics IPCEIs. It is based on official publications by the German government and the European Commission, interviews with high-level officials at the German Ministry responsible for the IPCEIs, representatives from companies involved in the IPCEIs, and a manager from the implementation agency for the IPCEIs in Germany.

Table 2: Timelines of the two microelectronics IPCEIs

	First IPCEI on Microelectronics	Second IPCEI on Microelectronics & Communication Technologies
Initial discussion German government & industry	2015	July 2019
Call for expression of interest in Germany	10.08.2016	25.01.2021
Call for project descriptions in Germany	Integrated with call for expression of interest	01.09.2021
Early start approval letters	January 2017	April 2022
EC approval	18.12.2018	08.06.2023
Official grant notice by the German government	2nd quarter 2019	December 2023 & January 2024