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Industrial policy with conditionalities: a taxonomy and sample cases

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This paper looks at how industrial strategy can use conditionalities to make sure that public-private partnerships are goal-oriented with conditionalities that serve public purpose. Conditionality can be a key tool to shape markets and foster inclusive and sustainable economic growth. We develop a taxonomy to understand the range of conditionalities that governments and policymakers can consider when structuring calls for proposals, funding agreements, partnership contracts, tax incentives, regulatory frameworks, and other policies aimed at shaping the economy for the common good. The paper first provides an analytical framework for exploring the role that conditionality can play in modern industrial strategies. It then highlights a range of global case studies (lessons learned, both positive and negative) to explore the different dimensions of conditionalities and what they can achieve in practice.

JEL Classification: O25, O31, O33, O38

1. Introduction

Industrial policy is experiencing a global resurgence. Increasingly, governments recognize the need for a different industrial strategy—one that not only catalyzes but also directs growth to shape economies that are greener, more inclusive, and more resilient (Mazzucato *et al*., 2019; Rodrik and Sabel, 2019; Mazzucato, 2021, 2023; Juhász *et al*., 2023).

Key to a new approach to industrial policy is making sure that directionality of growth (less inequality, more sustainability) is embedded in the tools that lie at the interface of public-private partnerships—subsidies, loans, grants, public inputs, and intellectual property rights. Industrial policies can be designed ex ante to enhance public value, including through conditions that maximize public benefits. Conditionalities that grant equitable access and sharing rewards are a central component of shaping the economy for the common good (Mazzucato, 2023). The idea of "conditionality" arises especially in the context of considering the state not just as a market fixer, but also as an "entrepreneurial state" (Mazzucato, 2013) that shapes markets, for example through mission-oriented policies (Mazzucato, 2016, 2018). When public institutions don't only de-risk but take risks through high-risk investments (both direct and indirect), it is inevitable that some investments will be successful, while some will not. Thus, considering ways for the state to not just cover the downside but also get a share in the upside (socializing both risks and rewards) becomes pertinent (Laplane and Mazzucato, 2020). Spillovers themselves can be seen

as a return to society, so long as intellectual property rights are structured to not be too strong or wide (Mazzoleni and Nelson, 1998).

Some measure of conditionality is inherent in the idea of industrial policy. In principle, public support is provided in return for the recipients undertaking specific actions. But the extent to which conditionality has been explicit and part of a coherent, self-conscious strategy for generating public value has varied. The creation of public value requires the public sector to establish a clear vision and a public purpose that guides the collaboration and innovation of both private and public actors in addressing societal challenges. For example, credit subsidies and tax incentives in South Korea and Taiwan during the early take-off years of the 1960s were conditioned on firms meeting explicit export targets. In many other instances, however, such as the classic import-substitution strategies of Latin America, conditionalities have been at best implicit. More recently, conditionalities have been explicitly incorporated into key policies around the world (e.g. the U.S. CHIPS and Science Act) to place limits on shareholder buybacks, the use of energy-efficient supply chains, and the requirement of certain labor standards to be met.

Conditionality has received considerable attention in the literature (Pack and Westphal, 1986; Amsden, 1989; Fishlow, 1989; Aiginger, 2007; Studwell, 2013; Mazzucato, 2022). Nevertheless, the concept remains hazy, understudied, and underutilized. In this paper, we develop a taxonomy to understand the range of conditionalities that governments can consider when structuring calls for proposals, funding agreements, partnership contracts, tax incentives, regulatory frameworks, and other policies aimed at shaping the economy for the common good. Using a variety of case studies from around the world and drawn from different domains, we explore the different dimensions of conditionalities and what they can achieve in practice. Our aim is to provide a clear, analytical framework for understanding the concept of conditionality, for exploring the role that conditionality can play in modern industrial strategies oriented around fostering inclusive and sustainable economic growth, and for guiding policymakers in considering how best to maximize the public value of public investments.

We caution that industrial policy, important as it is, is only one tool to achieve important public goals such as green innovation or job creation. It needs to be complemented with supporting policies—realistic carbon pricing and public investment in skills, for example—and can benefit from new framings (such as missions) to bring these various tools into alignment. Our focus in this paper is on elements of conditionality that can make industrial policy more effective in practice.

2. Conditionality as way to create "deals" between public and private sectors

Conditionality takes place most prominently—and often problematically—in the context of interactions between multilateral or bilateral donors and international financial institutions, and the governments of low and middle-income countries. The donor or lender requests recipient governments to undertake specific policy changes—limits on fiscal expenditures, changes in regulations, etc.—in return for financial assistance. Conditionality also occurs in the context of social policies, where it has referred to conditioning transfers to low-income households or individuals on job-seeking, school attendance, periodic health checkups, etc. (such as the Bolsa Familia program in Brazil).

In the present context, we are interested in conditions designed by governments to maximize the value of public support provided to private firms. Importantly, this is about empowering governments, rather than constraining them. It also focuses on conditions applied to firms'—and not to individual or household—behavior.

We focus on interactions between a public agency ("the government") and a private-sector entity ("the firm") where the government provides a benefit to the firm (a grant, loans or equity investments, procurement contracts, tax incentives, training, infrastructure, technological support, regulatory forbearance, etc.) in return for the firm undertaking behavioral changes toward meeting certain public objectives. Conditionality refers to the framework specifying the responsibilities, commitments, or undertakings of the firm.

Firms receiving a benefit from the government will typically respond by engaging (or expanding) the activity that is linked to the incentive. For example, an export subsidy will produce an increase in exports, and a capital subsidy will bring forth an increase in investment. These would

not be considered instances of conditionality. Conditionality would exist if, say, in return to these responses, firms were asked to increase employment, upgrade wages, invest in training, engage in greening their production processes, address gender imbalances, etc.—behavioral responses that are not directly incentivized by the government and which the firms may normally consider as an additional cost.

Some programs are conditional on behavior that can be certified or observed ex ante; others require behavioral changes that will unfold over time and in conjunction with or following the provision of benefits. Under ex-ante selection, business proposals are appraised upon application, and firms must meet certain selection criteria to qualify for the incentive. Behavioral changes are expected to occur as a result of or in anticipation of receiving the incentive. For example, a firm makes a particular investment or technology adoption decision to qualify for the incentive. Under ex-post behavior, the government sets criteria or requirements for desirable outcomes, and the benefits provided through the program, or future eligibility, are conditional upon fulfillment of these requirements.

It may be difficult sometimes to make a clear distinction between pure eligibility criteria and ex-ante conditionality. Certain selection requirements—such as restricting the benefit to firms that are smaller than a certain number of employees—are not intended to alter behavior and therefore should not be thought of as conditionality. But in other cases, eligibility criteria can work like conditionality when they induce firms to undertake behavior that would not have taken place otherwise (i.e. entry into a particular sector, adoption of clean technologies) to qualify for benefits.

The success of conditionality can be evaluated in two different ways. The first relates to the narrow question of effectiveness and additionality. Did conditionality succeed in getting the firm to do something it would not have done otherwise? In econometric terms, this is the causal impact question. The second, much tougher question to answer is whether the incentive-cum-conditionality passes a broad public value test. In other words, was the public value of the program impact worth the (direct and indirect) investment?

The design of conditions is a delicate task, as too much micromanaging with a shopping list of conditions can, of course, stifle innovation. Moreover, close relationships with private firms could make governments prone to capture. On the other hand, when a state is not entrepreneurial and market shaping, it is more likely to be captured, as its relationship with the private sector will tend to be more subservient to the needs of business rather than public objectives. Indeed, conditions create a healthy tension between public and private so that subsidies are part of a "deal" rather than a blanket handout (Mazzucato, 2022). As sociologist Evans (1995), who coined the term "embedded autonomy" to describe effective industrial policy, argued, these links may be essential to ensure governments have the information needed to design workable policies, adjust to changing circumstances, and prod firms along new technological trajectories in the most effective ways possible. The difference between South Korea, on the one hand, and other less successful cases that Evans analyzed, such as India and Brazil, was less in the formal instruments and more in the way this cooperative relation was managed dynamically over time. Successful conditionality is likely to exhibit high levels of both embeddedness and autonomy.

While the broad capabilities required for effective industrial policy may be common across countries, the design of actual conditionalities must consider the specific opportunities and constraints presented by local contexts. Indeed, they take many different forms in the cases we consider below. Our focus in this paper is on describing this variety in an analytically useful manner, rather than on ascertaining their causal impacts or overall contribution to public value.

3. A taxonomy of conditionalities

With these general considerations in mind, we provide an analytical taxonomy of different types of conditionality, based on distinctions along four dimensions (A-D).

A) Type of firm behavior targeted

The question here relates to the specific sphere of firm behavior to which conditions are attached. Some of the more common of these spheres can be listed as follows (see Laplane and Mazzucato, 2020 for a discussion of each):

1) **Access**: ensuring equitable and affordable access to the resulting products and services (dependent on areas like pricing and intellectual property rights);
2) **Directionality**: directing firms' activities toward socially desirable goals (e.g. net zero);
3) **Profit-sharing**: requiring profitable firms to share returns (e.g. via royalties or equity with government);
4) **Reinvestment**: requiring reinvestment of profits into productive activities (e.g. R&D or worker training).

B) Fixed versus negotiable/iterative conditions

This criterion refers to the distinction between program requirements that are fixed, apply uniformly, or have a clear schedule of incentives/conditions determined by firm characteristics, versus those that are variable, negotiable, or are determined in a process of iteration and consultation with potential recipients of benefits.

C) Risks/rewards sharing mechanism

This question relates to the extent to which the risks and rewards of the program are shared between the public and private sectors. On the downside, what are the arrangements for cost-sharing, if any at all, when the program underperforms or fails? On the upside, how are the excess profits shared, if at all?

D) Measurable performance criteria and monitoring, and evaluation

This question relates to the presence of explicit, quantitative, or measurable criteria used to ascertain compliance with conditionality. Is there a plan in place to monitor and evaluate, and/or audit the extent to which conditions are met? How is this assessment made and by whom?

4. The case studies: an overview

We will apply this taxonomy to a sample of nine case studies drawn from different types of industrial policies across the globe. Each case aims to demonstrate how governments have attached conditionalities to contracts with the private sector, benefiting from public investment. For each case, we will provide some background context, a description of the specific conditionalities, and a brief discussion of apparent outcomes. The cases are meant to illustrate for the range of situations, policy domains, and tools at the government's disposal to strengthen public value through public investment.

The following table provides a quick summary of these cases. The table lists the names of each of the programs, the time period during which they operated, their respective sectors/policy domains, the objectives sought by the government under each program, a brief overview of the incentives/benefits provided to firms as part of the programs, and a list of program partners and actors involved. Our cases cover mostly advanced countries, in view of the availability of detailed information. They cover incentive programs for renewables, hi-tech, pharma, heavy industries, semiconductors, declining regions, and R&D.

In Table 2, we provide an overview of how each of these cases breaks down according to the taxonomy we described above.

We note at the outset a few key points that emerge. The case studies show that conditionalities are both widespread and take a wide variety of forms. The application of conditionality is typically dynamic, requiring follow-up—ongoing and iterative collaboration with recipients of incentives. While public goals are quite broad (innovation, green transition, jobs in declining sectors), programs often have clear, monitorable targets. At times, firms must satisfy explicit criteria or meet specific objectives set out by the government (e.g. the KfW's energy efficiency programs). At other times, government objectives are set out more loosely, and potential beneficiaries present their own plans and proposals (as in Israeli R&D incentives, ScotWind, of the U.S. CHIPS Act). There is sometimes an explicit process of ranking firms according to the degree to which they

Table 1. Summary of case studies

Case study	Time period	Policy domain	Policy objectives	Nature of government incentives	Actors involved
KfW energy-efficient refurbishment and construction programs (Germany)	2009–2021[a]	Environment, construction	Support energy-efficient new constructions and improve the energy efficiency of existing buildings	Public Bank concessional loans, progressive debt relief	Government, Public Bank, private companies, homeowners, municipalities, municipally owned companies, and independent expert verifiers
CfD Funding Program ('Förderprogramm Klimaschutzverträge') (Germany)	2023 onwards (expected for 15 years)	Heavy industries, including steel, cement, glass, paper, and chemicals	Provide investment security for companies' transition to carbon-neutral production by 2045.	Subsidies	Government, companies
Israel high-tech R&D investment incentives (Israel)	1980-Present	Technology- innovation	Support for research and product development in the technology sector	R&D grants	Government, local government, private companies, and local universities
ScotWind (Scotland, UK)	2021-Present	Renewable energy	Support the development of offshore wind industry in Scotland	Lease agreements, public bank loans, subsidies	Government, local government, public banks, private companies, local communities, state-created business development corporation
Oxford/AstraZeneca (UK)	2010–2018: R&D technology support 2020–2021: pandemic response	Public health (vaccine development)	Create a vaccine response to COVID-19 for the UK	Grants, purchase guarantee	Government, universities, private companies
Italy's Law 488/92 Regional Investment Subsidies (Italy)	1996–2007	Manufacturing, tourism, transportation	Stimulate economic growth and job creation in lagging regions	Subsidies	Government, regional government, private companies, local communities
UK RSA (UK)	1997–2020	Manufacturing	Create and safeguard employment in areas with low economic growth	Discretionary grants	Government, regional government, private companies, local communities
South Korean HIC Incentive (South Korea)	1970s	Structural transformation/export promotion (heavy industries)	Export promotion in six strategic sectors: steel, nonferrous metals, shipbuilding, machinery, electronics, and petrochemicals	Subsidies, low-interest loans, export credit, tax exemption, depreciation allowances, wastage allowances, tariff exemptions, and concessional credits	Government, private companies, public banks, commercial banks, trade promotion corporation
ARPA-E (USA)	2007-Present	Technology, innovation, energy	Support lab-to-market research in new technologies for the energy sector	Grants, contracts, cash prizes, and other transactions	Government, private companies, independent advisors, universities, and national laboratories
U.S. CHIPS Act (USA)	2022-Present	Manufacturing (semiconductor industry)	Support domestic investments on advanced manufacturing, with a focus on semiconductors	Grants, concessional loans, tax credits	Government, private companies, public banks, local consortia, research institutes

[a]The program, which ended in 2021, is expected to be replaced by the "Federal Funding for Efficient Buildings" (BEG) program in 2024.

Table 2. Taxonomy of conditionalities in the case studies

Case study	A- Type of behavior targeted	B- Fixed versus negotiable/iterative conditions	C- Risks/rewards sharing mechanisms	D- Measurable criteria & planned monitoring and evaluation
KfW energy-efficient refurbishment and construction programs (Germany)	Directionality: Buildings must meet the energy efficiency standards. The higher the standards, the greater the debt relief issued on loans.	Building standards, interest rates are fixed. Loan contract terms can be flexible.	Risks: For businesses, de-risked higher costs of construction with starting low interest costs. For government, low risk to start a project and only have to relieve debt upon project completion. Rewards: For businesses, debt relief and long-term lower costs of operation. For government, increase building standards, environmental, and social returns.	Repayment Bonus for the standard KfW Efficiency House 40 (the highest energy efficiency category) is 25% of the loan amount (for new building). For refurbishment, 40% for Standard 55 (highest). Inbuilt quality management with sampling check and supervision. To qualify for debt relief, buildings must be technically certified to meet the standards, and on-site visits must be completed.
CfD Funding Program ('Förderprogramm Klimaschutzverträge') (Germany)	Directionality: To win the contract, eligible firms must place the lowest bid for required funding per avoided ton of $C0_2$ when undertaking a new transitional technology.	Variable subsidy for 15-year contract.	Risks: For businesses, lowered investment risks in conversion to new green technologies with government funding for the excessive costs. For government, low risk as more efficient and committed companies are more likely to adopt low-carbon production. Rewards: when new production becomes cheaper than conventional methods, subsidies are repaid to government. Both are rewarded for increased standards and social returns.	Companies emitting more than 10 kilotons of C02 a year can bid via an auction system.[a] Annual report and verification of GHG savings to be submitted for continuous payments.
Israel high-tech R&D Investment Incentives (Israel)	Profit-sharing and reinvestment: The R&D project must be executed by the applicant firm itself; the product must be manufactured in Israel and know-how acquired during the R&D may not be transferred to third parties.	Applicants choose suitable programs with fixed eligibility criteria. Not clear to what extent royalties are negotiable.	Risks: For businesses, de-risked in setting up R&D facilities, only pay royalties when profitable. For government, bearing high risk in giving grants for R&D projects, which may not guarantee innovation outcome. Rewards: For businesses, supported innovation can spur new business opportunities. For government, local development, and royalty-sharing.	Magnet Program: set up consortia (industries + academia). The consortia must pledge to make the products or services resulting from the joint project available to any interested local party, at prices that do not reflect the exercise of monopoly power. Generic Program: sales >USD 200 mil, Israeli professionals employed > 200, R&D budget in Israel >USD 20 mil.

(Continued)

Table 2. Continued.

Case study	A- Type of behavior targeted	B- Fixed versus negotiable/iterative conditions	C- Risks/rewards sharing mechanisms	D- Measurable criteria & planned monitoring and evaluation
ScotWind (Scotland, UK)	Directionality: Firms need to submit their SCDS stating the investment impact.[b]	Conditions are up for interpretation and commitment by applicants. SCDS updated throughout development phase and ahead of lease.	Risks: For businesses, de-risked investment with financial support from Scottish National Investment Bank. Less competition when only successful bidders can sign lease. For government, bearing risks when companies undervalue what they can actually do for the local communities or when they don't fully commit to SCDS. Rewards: For businesses, the deployment of exclusive seabed for renewable energy generation, connection with local resources and businesses. For government, increase local employment, general economic development.	Applicants to provide a SCDS outlining: location, scale of the expenditure, and overarching assumptions to deploy the project's supply chain activities. SCDS can be updated by leaseholders. If less than 25% of the commitment stated in the final SCDS is spent, the final lease may not be granted.
Oxford/AstraZeneca (UK)	Access: Non-profit commitment to producing vaccines. Any royalties post-pandemic to be reinvested into medical research. Free transfer of excess of vaccine if unused by UK Government.	Fixed conditions on profit, priorities, and royalties.	Risks: For businesses, low risk when licensed to manufacture vaccines as per purchase agreement. Low risk during the pandemic because of high global demand. For government, high risk when investing in all stages from research, trials, and distribution. Rewards: For businesses, reputation, use of vaccine license, future revenues, and business opportunities. For government, social health, international reputation for science and medicine, and possible diplomatic advantages.	UK Government and AstraZeneca both had Project Managers working closely on the project. Oxford University licensed to AstraZeneca to manufacture and distribute vaccines if the trials were successful, first to the people in the UK. Advanced order made at pre-arranged price on non-refundable terms.
Italy's Law 488/92 Regional Investment Subsidies (Italy)	Directionality: Deploy the funds to develop the specific projects selected by the government, based on predetermined criteria and objectives.	Conditions are based on submitted technical report and business plan, but must comply with requirements and standards. Cannot be combined with other sources of public financing.	Risks: For businesses, lower risk investment. But subsidies are offered while funds are available so risks in excluding other forms of financing while waiting for this fund. For government, financial risks. Rewards: For businesses, financial support or start businesses. For government, local economic development.	Applications are ranked based on measurable first and second ranking criteria. Ministry of Economic Development performs several checks to determine whether subsidized firms have met their targets. Payment by installment to ensure execution of the project.

(Continued)

Table 2. Continued.

Case study	A- Type of behavior targeted	B- Fixed versus negotiable/iterative conditions	C- Risks/rewards sharing mechanisms	D- Measurable criteria & planned monitoring and evaluation
UK RSA (UK)	Directionality: Deploy the funds to develop the specific projects selected by the government, meeting expected job creation targets.	Conditions are based on submitted project with expectations to support job creation in specific regions.	Risks: For businesses, lower risk investment. For government, financial risks. Rewards: For businesses, financial support to start businesses. For government, local employment, and economic development.	Firms within an Assisted Area could apply for discretionary grants. The specific criteria for the grant disbursement: location, required capital, job creation, viability, needs, prior commitment, and other available funding. Department of Business analyzed the applications. During this process, firms and the government worked closely together to negotiate how the criteria were met and an agreed timeline. The government agency monitored the project with yearly visits, or more frequently for projects classified as risky.
South Korean HIC Incentives (South Korea)	Directionality: Firms to invest in heavy and chemical industries.	Specific conditionality is unclear.	Risks: For businesses, de-risked investment when transitioning to high sunk-cost sectors. For government, high financial risks, risks in regulating markets. Rewards: For businesses, financial support, high profitability, no shared royalties, no control over market concentration. For government, innovation, increased exports, economic growth.	The government closely monitored firms, their investments, and exports, but specific details about targets and criteria are unclear. The government stepped in to provide rescue packages for financially struggling firms.
ARPA-E (USA)	Directionality: Firms must be directly aligned with a component of the agency's mission and must meet specific targets and commercial milestones set by the program.	Co-operative and evolving conditions between agency and successful applicants.	Risks: For businesses, de-risked investment. For government, high financial risks. Rewards: For businesses, financial support to innovate, commercialize technology. For government, innovation in renewables and conservation.	Specific technical targets and commercial milestones that awardees are required to meet throughout the life of a project. Agency's Program Directors closely monitor their projects.
U.S. CHIPS Act (USA)	Directionality and Reinvestment: Firms must work in advanced manufacturing and have operations in the U.S. Each firm makes commitments to deploy advanced manufacturing, as well as develop training for the workforce engaged in this space. Childcare provision and female worker promotion are additional in cases. Companies not allowed to do a buyback or pay a dividend for 5 years	Department of Commerce works closely with applicants to refine proposals before they are funded. Unclear yet how fixed or amendable contracts are.	Risks: For businesses, de-risked investment. For government, high financial risks. Rewards: For businesses, financial support to innovate, establish supply chains. For government, innovation, and semiconductor supply chain development.	Clear criteria: extent to which the application addresses economic and national security objectives. The remaining criteria: commercial viability; financial strength; technical feasibility and readiness; and workforce development. Department of Commerce is responsible for auditing the projects that receive funds from the program, no later than four years after the first disbursement of the first financial award.

[a]Other conditions are to be confirmed as no award has been granted at the point of writing. For the first auction cycle, the deadline for submission of preliminary project information is on August 7, 2023. [b]Job creation estimates in local communities are included in some SCDSs but not specifically requested.

fulfill pre-announced criteria (as in the Italian regional subsidies). Occasionally, conditionality extends to explicit reward-sharing mechanisms (as with royalty-sharing in the Israeli program), but that is rather rare.

For further details, the reader is referred directly to the write-ups for each case that follow in the next section. In these write-ups, we will also discuss the evidence on the outcomes and impact of the incentive schemes.

5. Case studies

5.1 KfW energy-efficient refurbishment and construction programs

5.1.1 Context

This case study examines how conditionalities on loans can shape investment behaviors for green infrastructure. The building sector contributes approximately 30% of Germany's greenhouse gas (GHG) emissions and accounts for approximately 40% its final energy consumption. Notably, two-thirds of German buildings predate the 1977 Thermal Insulation Ordinance (WSVO) and thus lack the now-mandated energy-saving measures, as subsequent regulations have tightened energy efficiency requirements (Moslener *et al.*, 2018; Bach, 2020).

KfW is Germany's second-largest bank.[1] KfW has championed green construction programs that aim to motivate both residential and commercial projects to adhere to energy-efficient standard for construction and renovation projects.[2] Coupled with its support for Small and Medium Enterprises (SMEs), local communities, and households, recipients of KfW programs have benefitted from measures including low-interest loans and a structured debt relief system (KfW, n.d.-a, n.d.-b).

In conjunction with the German Energy Agency and the Federal Ministry of Transport, Building and Urban Affairs, KfW introduced the "KfW Efficiency House" classification, which denotes the percentage of a building's annual primary energy consumption relative to a reference new build (for instance, a KfW Efficiency House 55 implies a building uses merely 55% of the energy of its contemporary counterpart).[3] This system incentivizes both new construction and renovations to meet higher energy efficiency standards (KfW, 2015).

5.1.2 Conditionalities

KfW's approach aligns most closely with the Weberian regulatory state. The Bank targeted building construction using conditions that were fixed for the most part. There was no explicit risk sharing, but clear benchmarks (technical certification) for meeting the terms of the incentives.

KfW's programs strategically leveraged both ex-ante and ex-post measures to drive behavioral changes, tying together the eligibility for low-interest loans with the incentive of partial debt relief once energy efficiency standards are met. For new builds, KfW increased loan amounts to EUR 100,000 with a low interest rate of 0.7% p.a., notably lower than the standard long-term rate of 2.68%. Preferential loans also entail extended maturities and flexible repayment terms; up to 25% of the debt could be forgiven depending on the level of energy efficiency achieved (KfW, 2019, 2023). Retrofits received even stronger incentives: as of 2020, upgrading a building to the highest standard (KfW-55) qualified for a 40% repayment bonus, reflecting the higher costs of retrofitting.

5.1.3 Outcomes

Most KfW loans went to private firms, with about 75% funding new administrative and office buildings. KfW capped its financial support per dwelling, but total investments in construction and retrofitting were about three times greater than KfW's direct contributions. Moreover, these

[1] As of 2022, it had assets worth EUR 551.0 billion.

[2] We use "KfW energy efficient refurbishment and construction programs" as an umbrella for several different programs, including "Energy-efficient Construction," "Energy-efficient Refurbishment," "IKK—Energy-efficient Construction and Refurbishment," "IKU—Energy-efficient Construction and Refurbishment," and "KfW Energy-efficient Construction and Refurbishment" for commercial buildings.

[3] The KfW Efficiency House certification for renovations spanned a range from 115 (lowest standard) to 55 (highest). The program offers differential and progressive debt relief based on energy consumption. The KfW 55 class buildings get 30% debt relief, KfW Efficiency house 70 gets 25%, KfW 85 gets 20%, KfW 100 gets 17.5%, and KfW 115 gets 15% as of 2023.

activities generate substantial returns for the government: Value Added Tax (VAT) revenues (at 19%) eclipsed the government's spending on KfW programs, and overall—when factoring in indirect taxes, social contributions, and reduced unemployment-related expenditures—the state earned about 4 Euros for every Euro invested (Heinrich *et al*., 2018).

KfW-backed projects generated nearly EUR 4.6 billion (EUR 3.6 billion effect-adjusted), with SMEs contributing about two-thirds, and led to the creation of around 64,000 full-time jobs (51,000 effect-adjusted), three-quarters of which were in SMEs. The program has achieved annual CO_2 savings of about 700,000 tons, or 0.33% of the German building sector's total emissions (Schröder *et al*., 2011). Since its inception in 2006, cumulative emissions savings from the KfW programs have surpassed 9 million tons p.a., a key part of Germany's broader climate goals.

5.2 Germany's climate protection contract for heavy industries

5.2.1 Context

In mid-2023, the Germany Ministry of Economic Affairs spearheaded a EUR 50 billion program to decarbonize energy-intensive industries, including steel. This program[4] is also a response to the US's record investment in clean energy and climate-neutral technologies via the US$300 billion Inflation Reduction Act of 2022.[5]

The Contracts for Difference (CfD) Funding Program uses the concept of Carbon Contracts for Differences (CCfDs), which were discussed as a potential "reliable basis for investment and incentives for carbon reduction targets" in *Energiewende* (Energy transition) (Federal Ministry for Economic Affairs and Climate, 2021). A similar approach has been employed by the Netherlands in the Sustainable Energy Transition Scheme (SDE++) since 2008 (Net Zero Pathfinders, n.d.). The Conditionalities direct the companies toward the overall decarbonization mission of Germany. This program also follows an auction model and includes conditionalities that share risks and rewards between companies and the government.

5.2.2 Conditionalities

The German government's behavior in this case corresponds more closely to the developmental entrepreneurial state, entailing greater interaction with private firms. The program targets directional change toward greener technology and entails variable subsidies. There is explicit risk sharing since subsidies must be repaid when green technologies become viable. There is continuous monitoring based on clear quantitative targets.

The Climate Protection Contract incentivizes companies to invest in more climate-friendly production methods, which could include green technologies and low-carbon fuel. The government selects winning bids from eligible, high-emitting companies based on their estimated funding requirement per avoided ton of $C0_2$. The selected bidders are awarded variable subsidies, with incentives based on the adoption of climate-friendly production methods.

The subsidy varies based on the estimation of excessive costs—the "differences" between the green method and the conventional method, which can arise from both construction and operation. Whilst the 15-year contracts help companies to de-risk, once such differences become negative (i.e. when the green technologies outperform the old ones), the companies must repay the subsidies. According to the current draft of CfD Program Guidelines[6], apart from the risk–reward sharing Conditionalities, the government also imposes a consistent evaluation framework, requiring the funding recipients to report annually on their progress, and verify their GHG savings achieved and, in the event of an unfulfilled target, repay the subsidies.

5.2.3 Outcomes

The first call for funding in 2024 awarded support guarantees to 15 companies across sectors such as steel, chemicals, and cement (Clean Energy Wire, 2024). The ministry expects to save about 17 million tons of CO_2 over 15 years from this first funding round, which is expected to

[4] This is a novel instrument employed by the EU's biggest economy and is a departure from its historical approach centered on initial investments and case-by-case subsidies through certain innovation schemes.

[5] As claimed by Robert Habeck, Minister of Economy and Climate Action (Kurmayer, 2023)

[6] Guidelines for the promotion of climate-neutral manufacturing in the industry sector through Carbon Contracts for Difference ("Richtlinie zur Förderung von klimaneutralen Produktionsverfahren in der Industrie durch Klimaschutzverträge"), June 6, 2023.

cost less than its allocated EUR 2.8 billion. These guarantees will compensate recipient companies for the price difference of switching to climate-neutral production; however, once climate-friendly production can be carried out more cost-effectively than conventional production, the payment obligation will be reversed, and surplus payments must be returned to the state (New Climate Institute, 2025).

The preliminary procedure for the second bidding round went ahead in July 2024, and support from the European Commission was greenlighted in March of 2025 (Clean Energy Wire, 2025). Subject to a corresponding resolution by the new German government, the second-round allocation is likely to go ahead with some minor revisions to the funding guidelines from the first round.

5.3 Israel high-tech R&D investment incentives

5.3.1 Context

Israel's high-tech sector, especially in Information and Communications Technologies (ICT), is a cornerstone of its economy. As of 2013, ICT represented 11.1% of the country's gross domestic product (GDP) and 17% of total exports (Getz and Goldberg, 2016; World Bank, 2016). The government supports R&D through the Israel Innovation Authority (IIA), which funds high-risk projects that promise substantial returns and emphasizes support for SMEs (Shalem, 2007). The IIA runs programs like the Magnet Program for collaborative research, technological incubators, and international R&D initiatives.

5.3.2 Conditionalities

This case reflects a developmental entrepreneurial approach for the state, where the government acts as a venture capitalist to invest in new technologies. The Israeli government targeted investment and innovation without explicit sectoral priorities. There were fixed eligibility criteria for private firms and explicit risk sharing as firms paid royalties to the state only if and when they became profitable. There was a mix of criteria, some more explicitly quantifiable than others.

The state established venture capital company Yozma in 1993 to help catalyze Israel's VC industry, which could invest up to 40% (maximum $8 million) of the funds raised by start-ups that met its criteria using its dedicated $100 million pot, drawing at least $150 million from the private sector (Avnimelech, 2009). The state shared the profits with the firms, according to the proportion of funds received, and allowed the firms to buy out the state capital at the same value with interest within seven years.

Currently, the IIA runs 84 programs, including the Generic Program for large firms, which can receive up to 20% of their annual R&D outlay (plus an extra 10% in priority regions) if they maintain local R&D spending and employment (Israel Innovation Authority, n.d.). These incentives aim to offset the inherent risks linked with pioneering pre-competitive innovations. The IIA also supports collaborative projects such as the BIRD program—an acronym for the Israel-U.S. Binational Industrial Research and Development Foundation—which funds joint projects up to $1.5 million each through conditional grants (BIRD Foundation, n.d). The successful fruition of a project sees BIRD reaping royalties, which can reach up to 150% of the conditional grant.

Following the realization of profits from the R&D project that received assistance, there arises an obligation to remit royalties on the sales of the evolved products and any related tech-based commodities. These royalties commence at a rate of 3% and persist until the grant's complete repayment, inclusive of interest, with higher rates if production moves abroad (Trajtenberg, 2000). Additionally, intellectual property rights are tailored to ensure companies amplify their operations domestically, and tax advantages are proportional to the annual R&D expenditure.

To foster innovation through the collaboration of academia and industry, Israel has launched programs like the Magnet Program, which funds consortia of companies and academic institutions to develop generic, pre-competitive technologies. Grants cover up to 66% of the approved R&D budget with no repayment obligations. The consortium is also bound by an obligation to offer the resultant products or services from the collaborative venture to any keen local entity, ensuring prices devoid of monopoly power leverage (Trajtenberg, 2000). Magnet aid to these consortia stops once the "pilot plant stage" is attained.[7]

[7] The additional R&D required for the actual commercialization of the products is not supported by Magnet, but the member companies may then apply for regular grants from the OCS.

5.3.3 Outcomes

By 2003, Israeli patents registered in the USA (scaled by GDP) exceeded the G7 average by 69%. By 2007, Israel had the world's highest per capita start-up concentration and was second only to Silicon Valley in absolute terms (Cohen *et al.*, 2012). Today, Israel hosts over 500 multinational R&D centers, drawn by a range of incentives like shared R&D investment risks among multinational corporations (MNCs), start-ups, and the IIA to privileged access to specific know-how and cutting-edge technologies.

Furthermore, R&D law in Israel facilitates joint intellectual property ownership or a non-exclusive license between a MNC and an Israeli firm, provided they collaboratively contributed to the IP's development. In such scenarios, while the Israeli company's rights to use the new know-how are governed by the R&D law, the MNC enjoys unrestricted, royalty-free rights to employ this know-how both domestically and internationally, as long as the Israeli company's rights remain unhampered. Over the years, these MNCs have acquired 100 Israeli firms, with giants like Intel, Microsoft, Broadcom, Cisco, IBM, and EMC each purchasing over ten local businesses during their tenure in Israel.

Research indicates a positive correlation between R&D subsidies offered by the IIA and long-term private R&D spending, with each dollar of subsidy increasing company R&D spending by 41 cents in the long run (Lach, 2002). However, some scholars have voiced concerns over the conditionality that necessitates in-country production, arguing that it could spawn certain allocative inefficiencies by diminishing the potential cost benefits firms might reap from overseas production. In its recent endeavors, the IIA has channeled efforts to stimulate R&D investments in pivotal sectors, encompassing health and medicine, energy, water, environment, and sustainability. Notably, these sectors witness a more substantial influx of government funds compared to private sector investments.

5.4 ScotWind

5.4.1 Context

Scotland has emerged as a leader in offshore wind, which has also become one of its most cost-effective large-scale electricity generation methods (Catapult Offshore Renewable Energy, 2018; Scottish Development International, n.d.).[8] The nation's leadership in the sector is exemplified by its Hywind Scotland pilot park, the UK's inaugural floating wind farm, which not only proved the viability of floating wind farms but also hinted at the potential for developments up to tenfold the pilot's scale (Equinor, n.d.). With an expansive offshore Exclusive Economic Zone (EEZ) spanning over 462,000 km^2, Scotland is primed for further offshore wind projects (OffShore Wind Scotland, n.d.). Projections suggest that the burgeoning floating offshore wind sector could generate 17,000 jobs and contribute GBP 33.6 billion in domestic gross value added. The potential for growth is even more significant when considering energy exports (Catapult Offshore Renewable Energy, 2018; Energy and Climate Change Directorate, 2020; Mazzucato, 2022).

To harness this potential, Crown Estate Scotland—the public entity responsible for overseeing the nation's coastline and seabed—launched ScotWind, a seabed leasing initiative for establishing new offshore wind farms within the Scottish coast's EEZ. ScotWind capitalizes on devolved rights to bolster national advancement in the offshore realm. Beyond catering to sector-specific growth, the program is designed to attract expansive private investment aligned with sustainable practices and foster local development objectives (Mazzucato, 2022).

5.4.2 Conditionalities

In many respects, the program operates along the lines of a standard Weberian regulatory state; it entails contracting with private suppliers with explicit procurement requirements. The provisions for supply chain development, however, have elements of an entrepreneurial development state.

The ScotWind leasing criteria for offshore wind projects covers standard procurement endeavors such as project conception, financial blueprint, delivery timeframe, and the developer's technical proficiency (Crown Estate Scotland, 2021c). Additionally, a key requirement is the inclusion of a Supply Chain Development Statement (SCDS), where applicants outline their supply chain strategies for development, manufacturing and fabrication, installation, and operations

[8] In 2019, the Scottish government committed to ensuring that the Scottish emission accounts reach net-zero by 2045 (Scottish Parliament, 2019; Zero Waste Scotland, 2023).

(Crown Estate Scotland, n.d.-a; Mazzucato, 2022). While ScotWind's leasing mechanism does not enforce specific requirements regarding the volume or locality of the supply chain strategies detailed in the SCDS, it does comprise a part of the "Option to Lease" Agreement between the developer and the Scottish administration.

The SCDS operates as a commitment tool between the project developer and Crown Estate Scotland, ensuring the outlined expenditure within the offshore wind sector is upheld (Crown Estate Scotland, 2021c). When a bid is greenlighted, the stipulated commitment figures and associated supply chain endeavors become integral components of the leasing contract established with Crown Estate Scotland, though developers can update their SCDS as the project progresses (Crown Estate Scotland, 2021a). However, it is at Crown Estate Scotland's discretion to approve any updated SCDS submissions, especially if they diverge significantly from the previous version or affect the supply chain's evolution (Crown Estate Scotland, 2021a). Furthermore, the contract provides clauses enabling Crown Estate Scotland to invoke remedies, pegged as a percentage of the contractual value, if initial commitments are unfulfilled. A stark example is that projects may be halted if less than a quarter of the commitment noted in the finalized SCDS is disbursed (Mazzucato, 2022; Crown Estate Scotland, 2022a, 2022b).

In an endeavor to attract international developers and further fortify the Scottish economic framework, Scottish Development International (SDI) extended its support to various ScotWind leasing aspirants. As an organization committed to channeling international ventures and commerce into Scotland, SDI played a pivotal role in bridging the gap between bidding developers and native Scottish resources. This support ranged from linking developers to local contractors, suppliers, and the workforce, to imparting counsel on efficacious execution of an offshore wind supply chain within Scotland's Context (Hallan, n.d.; Mazzucato, 2022).

5.4.3 Outcomes

The initial ScotWind bidding process attracted 74 applications from major international companies, consortia, and global investment funds, with 20 applications selected for Option Agreements by August 2021. These agreements permit companies to undertake tests, surveys, and site explorations without making any permanent installations on the seabed (Crown Estate Scotland, 2021b; Mazzucato, 2022). They generated an estimated GBP 750 million in option fees, with the first 17 projects contributing GBP 699,200,000 and three NE1 projects adding another GBP 56,000,000 (Crown Estate Scotland, 2022c, 2022d). The initial SCDS submissions suggest an expected expenditure of about GBP 1.4 billion per GW of capacity, with updated SCDSs in April 2023 reflecting an average expenditure of GBP 1.5 billion per project (Crown Estate Scotland, 2023). ScotWind projects could add up to 27.6 GW of offshore wind capacity, significantly above initial estimates of 10 GW and enough to present potential export opportunities (Crown Estate Scotland, 2021a).

Despite these achievements, ScotWind has faced criticism, primarily regarding the price ceilings set during the leasing, which some have argued curtailed potential public sector revenues, as revenues from similar projects in the USA and England were up to 18 times higher (Dalzell, 2022; Williams, 2023). In defense, Crown Estate Scotland articulated that the tender was framed with a price cap of GBP 100,000 per km^2 to keep consumer costs down (Williams, 2023).

ScotWind has positioned Scotland as a leader in offshore wind, with a focus on advancing floating wind technology and workforce skills (Mazzucato, 2022; TGS, 2022). The Crown Estate is launching a similar floating offshore wind energy project in the Celtic Sea, targeting up to 20 GW of energy and anticipating sizable job creation and an influx of around GBP 20 billion in direct project investments (Welsh Affairs Committee, 2021). Building on insights from ScotWind, leasing bidders in this Welsh initiative are expected to detail potential supply chain contributions and the consequent advantages for local manufacturing and job creation. Furthermore, the Crown Estate is pressing for enforceable local content requirements in upcoming CfD auction methodologies to reinforce the potential conditions set for these future wind leasing processes. The first floating wind project in the Celtic Sea (dubbed 'Project Erebus') is expected to deliver 4GW of energy by 2026 (Welsh Government, 2023).

5.5 Oxford-AstraZeneca Partnership

5.5.1 Context

The UK government was instrumental in the creation and distribution of the Oxford/AstraZeneca vaccine (now known as Vaxzevria). Its involvement spanned from initial investments in the foundational technology (like the ChAdOx1 vaccine technology that underpins Vaxzevria) to funding research phases, establishing purchase agreements, and ensuring domestic production capabilities (UKRI, n.d.). To address health crises proactively, the UK established structures like the UK Vaccine Network and the Vaccine Taskforce. This taskforce, collaborating closely with private sector specialists, championed vaccine development both for the UK and the international community, emphasizing widespread access and fairness, and aimed to cultivate a diverse range of potential vaccine candidates to mitigate potential risks associated with any single formulation (Garrison, 2020; Bingham, 2021; Cross *et al*., 2021).

In response to the early stages of the pandemic, the government promptly allocated funds for vital clinical trials: GBP 20 million for Oxford University and GBP 22.5 million for Imperial College (UKRI, 2021). Even before Vaxzevria's safety and efficacy were confirmed, the government committed to a purchase of 100 million doses in June 2020. This pre-approval agreement served as a catalyst for Oxford/AstraZeneca to expedite the vaccine's development and manufacturing and ensured the vaccine's affordability and accessibility for countries with lower and middle incomes. Beyond this, the government buttressed local production capabilities by investing in manufacturing plants and fortifying supply chains. Such strategic actions underscore the potential of combining procurement and R&D funding conditions to introduce vital health technologies rapidly.

5.5.2 Conditionalities

The UK government acted in this case as an entrepreneurial development state, making a non-profit commitment to develop a non-profit vaccine. There were fixed conditions on profits, vaccine priorities, and royalties. Advanced orders guaranteed viability to the developers while the UK government reaped the reputational benefits and a share of the future revenues. The government closely monitored the progress toward the development of the vaccine.

In May 2020, AstraZeneca and Oxford University forged a licensing agreement in which the former agreed to develop, manufacture, and distribute the vaccine. The UK government subsequently pledged GBP 65.5 million toward Vaxzevria on the condition that AstraZeneca operate on a not-for-profit basis throughout the pandemic, only charging what was necessary to cover the costs of production and distribution (NIHR, 2020; Vaccitech, 2020; UKRI, 2022). It was anticipated that, if successful, the Oxford/AstraZeneca alliance would provide 30 million vaccine doses by September 2020 and a cumulative total of 100 million doses to the UK. This early commitment was made at a pre-determined price, with non-refundable grants even if the vaccine technology failed or failed to gain regulatory approval (Department for Business, Energy and Industrial Strategy, 2020; Health and Social Care, and Sciences and Technologies Committees, 2021; Mazzucato, 2022). Such an advanced purchasing approach aimed to mitigate the risks AstraZeneca would assume in vaccine production, irrespective of the Outcomes from the clinical trials (Douglas, 2021).

The commitment to a non-profit approach was in reciprocation for the advance purchase agreement between the UK government and the AstraZeneca/Oxford consortium. Oxford, Vaccitech, and AstraZeneca agreed to forgo royalties during the pandemic (Vaccitech, 2022a), and Oxford also agreed to reinvest any future royalties back into medical research to support endeavors such as a new Pandemic Preparedness and Vaccine Research Centre (a collaboration with AstraZeneca) (Vaccitech, 2020).[9]

Although the complete contractual terms remain confidential, an edited version of the contract between the UK Vaccine Taskforce and AstraZeneca outlines the collaborative terms between the two parties and addresses topics like potential pricing alterations, intellectual property rights, and the UK government's discretion over its Vaxzevria stockpile (Gov.uk, 2020). AstraZeneca committed to a "best reasonable efforts" clause, permitting the potential for cost pass-throughs

[9] The division of potential commercial sales proceeds from Vaxzevria stood at 24% for Vaccitech and 76% for Oxford University Innovation (Vaccitech, 2022).

to the UK government and offering a safety net against potential order delays. On the intellectual property front, AstraZeneca confirmed licensing from the rightful proprietors to manufacture the vaccine, with efforts focused on retaining this license throughout the supply agreement. The contract available to the public omits mention of no-royalty charges or other IP-related conditions. Lastly, AstraZeneca granted permission for the UK government to donate or reassign surplus vaccine doses to other nations, governments, or charitable organizations without profiteering from the transactions.

5.5.3 Outcomes

The UK's Vaccine Taskforce is widely praised for its effectiveness, making the UK the first country to administer an approved COVID-19 vaccine on December 8, 2020. This success stemmed from a mission-oriented industrial policy with a long-term objective of building a strong foundation in life sciences coordinated with a short-term urgent goal from the highest level of government (Balawejder *et al.*, 2021). By April 2022, AstraZeneca and its partners had distributed over 2.6 billion doses of Vaxzevria to more than 170 countries—comprising nearly a third of all global vaccine orders—at a lower price point to the Pfizer and Moderna alternatives (Dyer, 2021; Vaccitech, 2022a). The Taskforce's approach, which prioritized cost-effectiveness and knowledge sharing, facilitated efficient production and distribution within the UK (Mazzucato, 2022).

Following its achievements during the pandemic, the Vaccine Taskforce was integrated into the UK Health Security Agency and the Office for Life Sciences in October 2022 (Department of Health and Social Care, 2022b). The initiative highlighted the importance of sustained R&D investment for public health and institutional capability for rapid medical innovation, enhanced the UK's reputation in medical research, and amplified the government's commitment to global vaccine R&D (UKRI, 2021). Inspired by the Taskforce's model, the UK government committed over GBP 113 million in November 2022 to research on cancer, obesity, mental health, and addiction, leveraging similar inter-organizational collaboration (Department for Business Energy and Industrial Strategy, 2020; Mazzucato, 2022; Department of Health and Social Care, 2022a).

Vaxzevria's commercial success benefited key stakeholders. Vaccitech went public in April 2021, raising $110.5 million on its first day of trading, and began accruing royalty payments in 2022, which contributed around $15 million to its revenues in the last quarter of the 2021 fiscal year (Vaccitech, 2021a, 2021b, 2022b). Oxford University also established the Pandemic Sciences Institute in July 2022, backed by AstraZeneca and Serum Life Science (University of Oxford, 2020, 2022; Pandemic Sciences Institute, n.d.).

5.6 Italy's Law 488/92 regional investment subsidies

5.6.1 Context

Italy has some of Europe's starkest regional wealth gaps (Cerqua and Pellegrini, 2014). To address this, the government has implemented various investment subsidies, especially targeting southern regions. This approach has historical roots—following the postwar era, the south received substantial assistance from both the Italian government and the EU (Cingano *et al.*, 2022), exemplified by the 1992 Law 488/92 introduced by the Ministry of Economic Development. The law's core objective was to promote fixed investments, especially in underdeveloped areas, prioritizing regions and sectors that promised the most substantial societal returns, notably employment. About 85% of funds went to the southern "Objective 1" regions where GDP per capita is below 75% of the EU average (Cerqua and Pellegrini, 2014; Cingano *et al.*, 2022). During its operation until the mid-2000s, the regions receiving support from Law 488/92 encompassed nearly half of Italy's population (Bronzini and De Blasio, 2006; International Trade Administration, 2008).

5.6.2 Conditionalities

The intent of the program can be characterized as developmental, though its administration has had many clientelist elements, as we discuss below. The target is regional development, especially of lagging areas. Conditions are based on submitted technical report and business plans and have to comply with requirements and standards. Applications are ranked based on measurable first and second ranking criteria. There is, in principle, monitoring as the Ministry of Economic

Development performs checks to determine whether subsidized firms are meeting their targets. Payment can be withheld if not. There is no explicit risk-sharing.

Italy's Law 488/92 was a subsidy program aimed at reducing regional disparities in economic growth by funding private investment ventures using a call for tenders' process that mirrors an auction mechanism, and targeted sectors in the underdeveloped south, like steel, pasta, and construction. Administered by the Italian Ministry of Economic Development, applications for funding were assessed on criteria such as the subsidy amount requested, job creation, and the expected return on investment. Subjective dimensions like environmental footprint and the degree of innovation were assessed by local political figures. The ranking process was further influenced by alignment with EU fund eligibility and alignment with EU objective areas, with EU-funding-aligned projects more heavily favored. Fund allocation also prioritized SMEs in Objective 1 regions. Notably, the program tended to favor entities requesting subsidies lower than the maximum permissible amount.

5.6.3 Outcomes

Between 1996 and 2007, Law 488/92 facilitated the financing of 77,000 investment projects, allocating nearly EUR 26 billion (2010 prices), much of it sourced from the European Regional Development Fund (ERDF). Despite its scale, the program's efficacy is debated, and some have argued that place-based policies like Law 488/92 have largely failed to deliver on their promises in Italy (Barone and De Blasio, 2023). Others raise concerns about Italy's institutional quality and concerns about issues like Mafia influence in fund allocation.

Research findings are mixed regarding their findings as well as the methodology, samples, and data coverage on which they are based. Some studies found only short-term investment boosts (Bronzini and de Blasio, 2006), while others identified sustained positive impacts on both investment and employment (Cerqua and Pellegrini, 2014). Recent analysis suggests that fund allocation produced the largest benefits for younger, smaller firms, but also identified political biases in determining financing eligibility (Cingano *et al.*, 2022).

5.7 UK regional selective assistance

5.7.1 Context

The UK's Regional Selective Assistance (RSA) programs, launched in the early 1970s, provide discretionary grants to firms in underprivileged areas to create and safeguard jobs. Pre-Brexit, the RSA had to align with the EU's regional development goals and restrictions on regional subsidies. The EU classified areas as "Tier 1" or "Tier 2" based on deprivation levels, assigning different grant rates to each, and established a maximum Net Grant Equivalent (NGE) to limit the percentage of a firm's investment that could receive subsidies. The RSA granted discretionary investment aids to firms in areas characterized by low GDP per capita, heightened unemployment, and frail job markets. Most grants went to the manufacturing sector, which received over 90% of allocated funds (Criscuolo *et al.*, 2019).

5.7.2 Conditionalities

This program is similar in intent and design to the Italian regional development program above. It combined elements of a Weberian regulatory state with those of a developmental state insofar as state officials had a fair amount of discretion. There was close monitoring of firms, though no explicit risk sharing.

RSA grants aimed to support a range of objectives, including: the inception of a new business; the expansion, or modernization of existing ones; the establishment of research facilities; and the innovation of new products (Criscuolo *et al.*, 2019). The grant amount that a firm could receive was contingent on its regional categorization within the "Assisted Areas" structure. Tier 1 regions—facing the most significant challenges—were eligible for a maximum investment subsidy of 35% NGE. Tier 2 regions had sub-tiers, each with varying maximum NGE levels ranging from 30% to 10%. After the 2014–2020 program update, the UK government narrowed its focus on supporting SMEs, posing stricter aid constraints on large enterprises. Additionally, aid intensities for most regions were reduced to 10%, with exceptions for certain SMEs (Department for Business Innovation and Skills, 2013).

As part of the application process to the UK's Department of Business, firms were mandated to provide details on the expected to provide details like their expected additionality, business plans, financial statements, and reasons for seeking the grant (Criscuolo *et al*., 2019). Throughout the review phase, there was significant collaboration between the firms and the government to ensure compliance with the set criteria and to finalize agreed timelines. Successful applications led to a mutually agreed disbursement schedule. Initial payments were minimal, just sufficient to jumpstart the project, with subsequent installments being contingent on the attainment of stipulated targets like job creation or capital expenditure. These projects were then subjected to regular monitoring by the government agency, with higher-risk ventures warranting more frequent evaluations.

5.7.3 Outcomes

Between 1997 and 2004, the UK government allocated over GBP 1.3 billion in RSA grants, averaging an annual payout of over GBP 160 million. Between 2013 and 2020, the program influenced areas representing approximately 30% of the UK population (Department for Business & Trade, 2021).

Evaluation techniques for the RSA vary in their approach. Some are based on self-reported assessments from a curated group of senior managers of subsidized firms, providing insights into the hypothetical scenario had their businesses not been granted the subsidy. An example of this kind of evaluation is the survey conducted by the National Audit Office (Criscuolo *et al*., 2019). Others are more formal evaluations using modern causal inference methods. One study found that regions eligible for elevated subsidies saw a marked increase in employment; specifically, that a 10% point rise in the maximum investment subsidy led to a 10% surge in manufacturing employment (Criscuolo *et al*., 2019). This effect was particularly pronounced in smaller companies, while more prominent firms received subsidies without making substantial alterations to their operations. The studies also found no evidence to suggest that job increases were due to displacement from neighboring ineligible areas.

Following the UK's formal exit from the European Union (EU) in 2021, the continuation of the RSA program remains ambiguous (given the UK is no longer bound by EU subsidy regulations), and much of the relevant publicly available information on the program has been retracted, though the topic of subsidy control is addressed within the UK-EU Trade and Cooperation Agreement (Department for Business and Trade, 2021).

5.8 South Korean Heavy and Chemical Industries

5.8.1 Context

During the 1960s and 1970s, under President Park Chung Hee, South Korea adopted a Japanese-style reform model to drive economic growth, using heavy subsidies and targeted loans (especially from post-war US aid) to foster export-led growth. The government strategically directed support to chaebols, family-based conglomerates pivotal in resurrecting key industries including construction, chemicals, oil, and steel, to promote initially unprofitable sectors that later advanced into sizeable automobile and electronics sectors (Song-Pehamberger, 2022). Today, South Korea boasts over 40 chaebols, dominated by four major players that represent roughly half of the nation's stock market value: Samsung, LG, Hyundai, and SK. Samsung alone is responsible for one-fifth of the country's exports (Cho and Kim, 1997; Kalinowski, 2009; Lim, 2012).

5.8.2 Conditionalities

South Korea is the epitome of a developmental state, and the policies here were in line with that characterization. The government picked specific industries for promotion as part of its drive to deepen industrialization and sustain economic growth. In other respects, though, practices differed from the conventional characterization of East Asian industrial policy as top-down, hard conditionality. The incentives provided were flexible, and the government's relationship with firms collaborative and iterative.

In 1973, South Korea's Heavy and Chemical Industries (HCI) program prioritized six sectors—steel, nonferrous metals, shipbuilding, machinery, electronics, and petrochemicals—to support military modernization and economic growth. With the Introduction of HCI, these industries were shielded from certain governmental regulations and taxes and benefited from subsidized loans

and credits. The government also promoted technology imports and export marketing through the Korea Trade-Investment Promotion Agency (KOTRA), and leveraged trade regulations to selectively manage imports, export incentives, and exchange rates. The rise of chaebols was closely intertwined with the government's strategy, as they received monopolistic rights and financial incentives aligned with the state's developmental agendas.

Influenced by best practices from overseas, the government in the late 1970s shifted its support model to "rescue packages" for financially distressed entities rather than extending loans to private firms. As a result, chaebols absorbed smaller firms, resulting in the large conglomerates present today. The subsequent decade saw the state nudging the private sector toward heightened R&D investment, but left the chaebol system largely intact. By the 1990s, the private sector's devotion to R&D had soared, prompting diversification into new industrial segments and expanding into lucrative international markets (Mazzucato, 2022).

The present-day policy landscape continues to favor chaebols, demonstrated by South Korea's regressive corporate tax framework, which enables chaebol families to indulge in intricate cross-shareholdings and circular ownership designs, solidifying their dominance over minority stakeholders. Tax rates are also skewed, as large chaebols often enjoy a rate lower than the average. Notably, Samsung's effective tax on its profits stands at 12.8%, contrasting sharply with the 16.8% average across South Korean enterprises (Albert, 2018), thereby consolidating the formidable influence of these family-controlled conglomerates.

5.8.3 Outcomes

There are three key Outcomes from South Korea's industrial strategy adopted in the 1970s (Lane, 2024). Firstly, following the introduction of the HCI initiative, targeted sectors saw an over 100% output surge compared to non-HCI sectors. Economic activity within HCI sectors surpassed that of other industries, with HCI products gaining a 13% higher probability of achieving a comparative advantage globally post-1973. Furthermore, the positive ripple effects of HCI policies extended to downstream industries; such sectors, especially those tied closely to HCI industries, maintained a competitive edge in global markets.

However, some have argued that this industrial roadmap established a problematic co-dependency between the state and chaebols, bestowing disproportionate advantages upon these conglomerates (Murrillo and Sung, 2013). Over time, chaebols deeply entrenched themselves in South Korea's policy and political domains, culminating in notable economic vulnerabilities (Mazzucato, 2022). An economic crisis, ignited by strategic currency overvaluation and the towering debts of chaebols, underscored their "too big to fail" stature. Furthermore, chaebols often leveraged their monopolistic power to crowd out SMEs, either replicating their innovations or annexing them outright. Moreover, the intricate ties between chaebols and the government may erode public trust in the public sector, catalyze inefficiencies, and sporadically compel massive bailouts. Contemporary discourse actively grapples with the need for overhauling the chaebol system and is debating potential reforms spanning corporate governance shifts, enhanced reporting transparency, and robust antitrust legislation.

5.9 Advanced Research Projects Agency-Energy

5.9.1 Context

The Advanced Research Projects Agency-Energy (ARPA-E) was instituted by the America COMPETES Act of 2007 following a recommendation from the National Academies. The agency was modeled after the Defense Advanced Research Projects Agency (DARPA), a renowned initiative that funded transformative, unconventional research and engineering. The primary mandate of ARPA-E is to finance high-risk yet potentially high-yield research, with the objective of converting scientific findings and inventions into tangible technological advancements (US Department of Energy, 2022). To optimally position ARPA-E in championing such innovative research, the Act grants it exemptions from numerous federal rules and regulations. The Act's design also distinguishes ARPA-E from other Department of Energy (DOE) entities, providing it with heightened flexibility and ensuring its autonomy within the department (ARPA-E, n.d.; National Academies of Sciences, Engineering, and Medicine, 2017; Fuchs *et al.*, 2018).

ARPA-E's core mission revolves around funding new energy research endeavors that delve into technological "white spaces": areas either overlooked by other financiers or beyond existing

technological horizons. Such white spaces often represent pivotal gaps in research funding or are indicative of an urgent need for revolutionary breakthroughs. The agency employs two primary award selection models: "focused" initiatives and "open" calls. While the former is meticulously crafted by program directors to tackle specific energy challenges, the latter welcomes proposals for any concept with the potential to reshape the energy domain. Notably, the focused programs capitalize on recent scientific breakthroughs and chart a potential route to commercial realization. For instance, programs like REPAIR target the mitigation of methane emissions from antiquated pipelines; DAYS envisions pioneering long-duration energy storage solutions; and SCALEUP supports teams in elevating their technologies to commercially viable scales.

5.9.2 Conditionalities

This program runs along developmental entrepreneurial state principles. It entails close, iterative collaboration between the government agency and the private sector investors and innovators on the basis of an evolving set of "soft" conditions.

ARPA-E establishes cooperative agreements with applicants, delineating technical and commercial objectives, supervising progress, and disbursing funds in phases. The agency is versatile in its support approach, offering cash prizes, grants, contracts, and alternative transactions to cater to diverse research activities. Only US-based entities such as universities, labs, companies, non-profits, teams, and consortia are eligible to apply. The application sequence consists of three stages: submission of a concept paper, followed by a full application, and then a merit review. ARPA-E assesses applications via both quantitative and qualitative benchmarks in line with agency priorities. Each ARPA-E program stipulates clear objectives and milestones that recipients are mandated to fulfill throughout the project's duration. Notably, the GRIDS initiative set a cost projection for innovative energy storage ideas at USD 100 per kWh, aiming for a transformative impact on the electrical sector, and this cost benchmark has since become an industry norm for subsequent initiatives. These stipulated targets also ensure project alignment with the agency's overarching mission. Moreover, recipients are obligated to co-finance some project expenses, the extent of which depends on the agreement type and the funding opportunity announcement (FOA). Through its proactive project oversight, ARPA-E conducts periodic reviews, site evaluations, and provides continual feedback, ensuring projects stay on track.

ARPA-E emphasizes stringent performance expectations, and projects that fail to deliver or align with the program's goals risk having their funding withdrawn. The agency gages success by multiple metrics: patent acquisitions, scholarly publications, community integration, and the transition of projects to fresh investors or corporations for further enhancement and market introduction. The awarded funding can vary widely, spanning from USD 500,000 to a substantial USD 10 million, contingent on the project's inherent risks and potential. ARPA-E reserves its peak funding for proposals characterized by significant technological uncertainty, ambitious schedules, and meticulous management geared toward risk alleviation.

5.9.3 Outcomes

By September 2021, ARPA-E had allocated USD 3 billion to 1294 projects across 49 states through over 60 focused programs and five open solicitations. The funding distribution saw 30% go to small businesses, 43% to universities, 14% to large businesses, 9% to National Laboratories, and 4% to non-profits, mirroring the application inflow and the multi-disciplinary, multi-institutional team's adeptness at forging groundbreaking energy technologies (ARPA-E, n.d.). Fast forward to January 2022, 185 ARPA-E initiatives have received above USD 9.87 billion in subsequent private sector funding, with 268 projects collaborating with other government agencies for advanced development. Moreover, a considerable number of ARPA-E-funded ventures have evolved into new start-up companies (ARPA-E Strategic Vision).

5.10 U.S. CHIPS Act

5.10.1 Context

The 2022 CHIPS Act aims to bolster the US's domestic manufacturing of semiconductors. This sector is currently dominated by East Asia, which provides 75% of the world's production (Varas *et al.*, 2020). To address the risks of dependency on external trade (particularly from China), the Act seeks to diversify semiconductor manufacturing locations, reinforce the security of the

semiconductor supply chain, create jobs, drive innovation, and ensure resilience and inclusivity in vital sectors, in addition to setting provisions to thwart the allocation of federal funds for semiconductor facilities in countries that might pose a national security threat (Arcuri, 2022; Badlam *et al*., 2022; Chari *et al*., 2022; Brown *et al*., 2023).

Simultaneously, the CHIPS Act sets aside appropriations of US$1.5 billion to enact the bipartisan U.S. Telecommunication Act of 2020, a measure aimed at strengthening the global telecommunications supply chain and curbing the influence of Chinese enterprises like Huawei (The White House, 2022). The objective is to facilitate the advancement of an open-architecture model, promoting diverse vendor participation in specific network components. Furthermore, the Act offers financial aid for the creation, growth, or modernization of semiconductor fabrication units in the US Private entities, public institutions, and their consortiums can solicit a federal grant, capped at USD 3 billion unless authorized by the Secretary of Commerce in tandem with other federal entities (Kanan and Feldgoise, 2022; PWC, 2022; NIST, 2023).

5.10.2 Conditionalities

The CHIPS Act was the Biden administration's most distinctive foray into developmental entrepreneurialism. It incentivized investments in advanced semiconductors and entailed close collaboration between the Department of Commerce and individual firms. Proposals were selected based on how closely they fulfilled national security and economic requirements, though those requirements were not clearly quantified or observable. There were some provisions for profit sharing, as we discuss below.

The two significant components of the CHIPS Act were the Funding for Domestic Manufacturing and the Advanced Manufacturing Tax Investment Credit. For the former, the Department of Commerce was set to distribute USD 39 billion over five years to semiconductor manufacturers, along with semiconductor materials and equipment producers (US Department of Treasury, 2023). This allocation was aimed at the construction, expansion, or modernization of their US-based semiconductor facilities. Adopting a competitive grant approach, this provision earmarked USD 2 billion for legacy chip production. The CHIP Program Office could designate up to USD 75 billion in guaranteed loans or guaranteed principal authority; however, funding for a single project was capped at USD 3 billion unless sanctioned by the President. Funds were restricted from being used for stock buybacks or dividends. Additionally, recipients were prohibited from significant semiconductor capacity expansion in China or other concerning nations for a decade, along with certain joint research or technology licensing endeavors with these entities.

For the latter, the Department of the Treasury was to oversee the 48D Tax Credit introduced by the CHIPS Act, which offered a 25% investment tax credit for semiconductor manufacturing-related investments in the USA (U.S. Senate, 2022). Eligible taxpayers can avail these credits for investments directed toward US facilities primarily engaged in semiconductor or related equipment manufacturing, encompassing the specialized tooling equipment essential for semiconductor production (Zane *et al*., 2022). Taxpayers can consider this credit as a direct tax payment (U.S. Senate, 2022), which is applicable to properties operational after December 31, 2022, but initiated before January 1, 2027 (U.S. Senate, 2022). Financially, the implications of this tax credit amount to an estimated USD 24 billion, as gaged by the Congressional Budget Office (Congressional Budget Office, 2022).

5.10.3 Outcomes

The CHIPS Act Incentive Program allocated USD 19 billion in FY22 and USD 5 billion annually from FY23-FY26, specifically targeting semiconductor manufacturers. In late February 2023, the Department of Commerce unveiled the first Notice of Funding Opportunity (First NOFO), encompassing direct funding, loans, and loan guarantees to eligible applicants. The first NOFO concentrated on the fabrication of leading-edge and mature-node semiconductors.

The guidelines under the first NOFO dictated that the government's financial support should not exceed 35% of a project's capital expenditures. Direct funding awards within the NOFO spanned between 5%–15% of an endeavor's anticipated capital outlay. It further clarified that the CHIPS Act Assistance could not subsidize indirect or incremental costs surpassing the actual cost. Potential beneficiaries were obligated to forecast their cash flow, and for projects priced at or exceeding USD 150 million, if the actual returns notably surpass a defined threshold, there

was a mandate for "upside sharing" via cash payments to the Government. In June 2023, this funding opportunity was extended to large-scale semiconductor materials and manufacturing equipment facilities with capital investment of USD 300 million or more. Later in September, the Commerce Department released the second NOFO, addressing semiconductor materials, manufacturing equipment facilities, as well as research and development facilities with capital investment less than USD 300 million.

The CHIPS Program Office advised prospective applicants to tender a statement of interest coupled with a pre-application before presenting a comprehensive application. This detailed application had to elucidate how the venture aligns with core CHIPS Act objectives, including economic and national security goals, commercial feasibility, financial robustness, technical viability, workforce expansion, and expansive impacts, with a prime evaluative criterion being alignment with economic and national security objectives. Such incentives galvanized an influx of around USD 250 billion in investments within the semiconductor domain, including significant contributions from industry stalwarts like Micron, Qualcomm, and GlobalFoundries. Private investment commitment scattered across states, including Arizona, Oregon, and California (The White House, n.d.).

6. Conclusion

Industrial policy is back on the agenda, and it requires bold rethinking. It is not enough to guide investments in desired directions; it is also necessary to ensure the benefits are as widely shared as possible. Conditionalities are one powerful tool that governments can use to co-shape investment and co-create markets with the private sector. Indeed, with conditions, industrial policy can lead to transformation. Without conditions, it might just lead to subsidies, guarantees, and handouts for firms to stay in place. Such transformation can be at the heart of a development strategy, especially for countries that experience inertia in business investment. When companies receive public investments in the form of subsidies, guarantees, loans, bailouts, or procurement contracts, conditions can be imposed to help guide innovation and steer growth toward achieving the highest public benefit. For example, procurement can be made conditional on greener supply chains, reinvestment of profits, and better working conditions. Of course, too many conditions can also stifle innovation. Thus, the design challenge is to have conditions that set a direction, while leaving open the how-to experimentation and discovery.

The cases discussed in this paper demonstrate the range of conditions that have been deployed as well as the impacts they have brought about in changing the relationship between the government and the private sector in different countries. While the case studies described in this paper are far from exhaustive and the selection of cases certainly not random, they serve to illustrate the potential to embed conditions in the contractual relationships between the public and private sectors, to deliver on policy objectives that increase public benefit. These cases demonstrate how conditionalities can, for example, leverage publicly funded R&D to expand access to products and services at reasonable prices, as well as access to patent rights, as in the Oxford/AstraZeneca case. Conditionalities can influence the direction of innovation and economic activity, leading to socially and environmentally desirable technologies, as in the case of KfW. Government funding can also come with profit-sharing conditionalities, as seen in the case of Israel. And conditionalities can require funding recipients to reinvest their profits, in terms of magnitude, geographic localization, or type of investment, as in the cases of Italy and UK's regional development programs.

Getting conditionality right is no simple task, but it is a vital one if governments are to realize the full potential of modern industrial strategy. Our taxonomy can provide a guide to governments when thinking about the different dimensions that need to be put in place. It also highlights the flexibility governments have in designing conditionalities.

In the Context of a shift toward longer-term, public-value-oriented economic thinking, there is a real opportunity to reimagine the contracts that structure public-private relationships. Similar reasoning could also be relevant to the relationship between different public entities, such as the relationship between a country's state-owned enterprise (SOE) and the Treasury: benefits to the SOE can be structured with conditions to make sure the SOE directs its investments in

particular ways, shares knowledge, makes products/services accessible, etc. Redesigning these contracts means redesigning the direction of the economy from the ground up. To succeed, modern industrial policies must be deliberately sustainable, welfare-oriented, and innovation-led; coordinated as a holistic package; and implemented cooperatively across government agencies and with the private and third sectors. The conditionalities written into contracts are a key site for realizing these aims. This paper provides a taxonomy of the key dimensions of conditionalities and aims to illuminate how these dimensions can be applied to catalyze investment, innovation and growth that is aligned with the goal of shaping more sustainable, inclusive, and resilient economies.

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