UCL IIPP Institute for Innovation and Public Purpose

REIMAGINING THE ECONOMY
MALCOLM WIENER CENTER FOR SOCIAL POLICY

Industrial Policy with Conditionalities:

A Taxonomy and Sample Cases

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1. Introduction

Industrial policy is experiencing a global resurgence. The governments of Brazil, the European Union, South Africa, and the United States are just a few of those advancing significant investments and policy measures aimed at fostering more competitive domestic industries and catalyzing economic growth. Many of these governments recognize the need for a different type of industrial strategy to those pursued in previous decades – one that not only catalyzes but also directs growth to shape economies that are greener, more inclusive, and more resilient.

It is increasingly clear that growth is not neutral, and that a new approach to economic policy is needed if it is to be good for people and the planet (Juhász et al., 2023; Mazzucato et al., 2019, Mazzucato, 2021). Labor's share of global income is almost at an all-time low, with growth in real wages lagging productivity growth, while the capital share of global income has risen (Jacobs and Mazzucato, 2016; Autor et al., 2022). Increasing financialization has meant that profits are not being reinvested into the economy but to a large extent are going to shareholders – increasing the divide between those who own capital and those who do not (Lazonick, 2014). Meanwhile, the Intergovernmental Panel on Climate Change (IPCC) continues to highlight the widespread, adverse impacts of climate change resulting from unsustainable patterns of consumption and production, land and energy use, and lifestyles. The COVID-19 pandemic has also underlined the relationship between economic vulnerability and health. A new approach to industrial strategy must recognize that decisions about how to foster growth and shape economies cannot be separated from social, environmental, and health priorities.

Thus, 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, 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, 2022).

The idea of "conditionality" (or reciprocity) 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 and co-creates markets (Mazzucato, 2016). 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, as long as intellectual property rights are structured to not be too strong or wide (Mazzoleni and Nelson, 1994).

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. Today, conditionalities are being incorporated into key policies around the world (the U.S. CHIPS and Science Act, for example) to place limits on shareholder buybacks, use of energy efficient supply chains, and the requirement of certain labor standards to be met.

From the successful experience of East Asia, the concepts of reciprocity, long-termism, and accountability, i.e., conditionality, soon had their logical appeal. Pack and Westphal (1986) were amongst the first to emphasize the characteristics of conditionality (in this case, assessing export outcomes as a measure of progress) as necessary for the South Korean success. On the similar experience, Amsden (1989) specifies that conditionalities (in the form of state discipline over private companies or reciprocity in the relationship between public and private sector) were required for industrial policies to succeed. It is generally acknowledged that conditionalities are important to the design of industrial policies and that their absence could hamper success (see Fishlow, 1989, and Aiginger, 2007, on the Latin American experience and Studwell, 2013, on Southeast Asia) or lead to parasitic relationships, or capture, whereby businesses simply get handouts and subsidies from lobbying (Mazzucato, 2022).

Nevertheless, the idea of conditionality 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 (Mazzucato, 2022). 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.

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. This has led to the reduction of public investments in many countries, often self-defeating when those investments are required for long-term growth (Alesina and Reich 2018). Conditionality also occurs in the context of social

and welfare 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) (Mukherjee et al. 2020).

In the present context, we are interested in conditions designed by governments to maximize the value of public supports 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 towards 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 as 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 incur 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) so as 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?

Effective conditionality requires that the state exhibit a difficult combination of "autonomy" and "embeddedness" in its relationship with firms and other private interests. On the one hand, government authorities need to be autonomous enough that they can act to further public goals and discipline private firms as needed, without being co-opted by the firms themselves. On the other hand, they need to be sufficiently embedded in the private sector's decision-making processes with respect to investment, production, and technological innovation that they have access to the information they need to formulate their goals and policies appropriately and revise them over time in light of new knowledge and changing circumstances.

The design of conditions is a delicate task, as too much micromanaging with a shopping list of conditions can of course stifle innovation. A clear direction (goal) that needs to be met (e.g. achieving net zero) but leaving open the 'how' it is met is an important design challenge. During the Apollo program, the 'mission' was to get to the moon and back in a short amount of time, but the 'how' was left open, leading to many different solutions to the hundreds of homework problems. This was designed through outcomes-oriented procurement (fixed price, with incentives for quality improvement and innovation), which itself is a type of conditionality (e.g. you get a procurement contract for a solution to an innovation problem) (see Mazzucato, 2021 for a discussion of fixed price procurement and how it was used for the moon landing).

Economists might worry that close relationships with private firms would make governments prone to capture. On the other hand, one could argue that 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 Peter 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 manner in which this cooperative relation was managed dynamically over time.

Evans's discussion highlights that embeddedness can be as important as autonomy to successful industrial policy. Following Wright (1996), Juhasz et al. (2023) summarize the argument in the form of a 2x2 matrix where state characteristics can vary along both dimensions, as shown in the figure below. The Weberian ideal of a regulatory state – represented in economists' principal-agent models of regulation – consists of an autonomous, competent state engaged in top-down regulation. This is the outcome in the upper right cell, with a high degree of state autonomy and

low embeddedness. The clientelist state, where the state is merely the instrument of powerful private interests, is the mirror opposite. This is shown in the lower left cell, with low autonomy but high embeddedness. The predatory state has neither autonomy nor embeddedness (upper left cell). The case we are most interested in, which we can call the developmental entrepreneurial state, is in the lower right cell and combines both attributes.

FIGURE 1. Embeddedness, autonomy, and the developmental state (adapted from Juhasz et al. [2023] and Wright [1996])

Embeddedness	Autonomy: low	Autonomy: high
low	predatory state	Weberian regulatory state
high	clientelist state	developmental entrepreneurial state

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. Future work and research will be needed to consider the applicability (i.e., desirability and feasibility) of different types of conditionality in varying geopolitical contexts.

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 towards 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. such as 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 under-performs or fails? On the upside, how are the excess profits shared, if at all?

D. Measurable performance criteria & 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 into 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.

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[1]	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, independent expert verifiers
CfD Funding Program ("Förderprogramm Klimaschutzverträge") (Germany)	2023 onwards (expected for 15 years)	Heavy industries including steel, cement, glass, paper, 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, local universities
ScotWind (Scotland, UK)	2021–Present	Renewable energy	Support the development of offshore wind industry in Scotland	Lease agreements, public bank loans	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 Regional Selective Assistance (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, national laboratories
U.S. CHIPS Act (USA)	2022–Present	Manufacturing (semi-conductor industry)	Support domestic investments on advanced manufacturing, with a focus on semi-conductors	Grants, concessional loans, tax credits	Government, private companies, public banks, local consortia, research institutes

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

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 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 writeups for each case that follow in the next section. In these writeups, we will also discuss the evidence on the outcomes and impact of the incentive schemes.

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 constructions 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 C02 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 the 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[2]. 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, 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 200mil, Israeli professionals employed >200, R&D budget in Israel >USD 20mil.
ScotWind (Scotland, UK)	Directionality: Firms need to submit their Supply Chain Development Statements (SCDS) stating the investment impact and job creation in local communities.	Conditions are up for interpretation and commitment by applicants. Pre-lease, SCDS can be updated.	Risks: For businesses, de-risked investment with financial support from Scottish National 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 Supply Chain Development Statement (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 will not be granted.

2 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 07th, 2023.

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
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, and future revenues and business opportunities. For government, social health, international reputation for science and medicine, possible diplomatic advantages.	UK Government and AstraZeneca both had Project Managers working closely in 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.
UK Regional Selective Assistance (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.

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
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, 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.

5. Case studies

5.1 KfW's energy efficient refurbishment and construction programs

Context

This is a case study of conditionality attached to loans, designed to shape investment and reinvestment behaviors by borrowers, particularly for green infrastructure. The German government has set forth ambitious goals to combat climate change, targeting a 55% reduction in greenhouse-gas (GHG) emissions by 2030 and aiming for carbon neutrality by 2050. A significant emphasis is placed on the building sector, given its contribution to approximately 30% of Germany's GHG emissions and accounting for 40% of the country's final energy consumption. As a backdrop to these initiatives, it is noteworthy that a majority of German buildings, about two-thirds, were erected before the 1977 Thermal Insulation Ordinance (WSVO). This means they predate any legal mandates on energy-saving measures. Subsequent regulations, such as the Energy Saving Ordinance (EnEV) introduced in 2002, brought combined guidelines for construction and heating. This was further refined, especially in 2014, to align with the EU Directive on the Energy Performance of Buildings 2010 (EPBD 2010) in a bid to stabilize the global climate.

Kreditanstalt für Wiederaufbau, popularly known as KfW bank, stands as the Federal Government of Germany's promotional and second-largest bank[3]. KfW champions the EU's leading initiative in this realm: the energy efficient refurbishment and construction programs[4]. These programs aimed to usher in a paradigm shift, motivating both residences and businesses to adhere to advanced energy-efficient standards and promote thermally enhanced construction and renovation. This endeavor was further facilitated by KfW's substantial support for Small and Medium Enterprises (SMEs), local communities, and households. Recipients benefited from attractive financial packages during this transition, including low-interest loans, and a structured debt relief system.

In a collaborative stride, KfW, in conjunction with the German Energy Agency GmBH and the Federal Ministry of Transport, Building and Urban Affairs, introduced the 'KfW Efficiency House' classification. This categorization denotes the percentage of a building's annual primary energy consumption compared to a reference new build, based on the German Energy Saving Ordinance (EnEV) standards. For instance, a KfW Efficiency House 55 implied a building that utilized merely 55% of the energy of its contemporary counterpart. While this standard stood as the pinnacle for new residential constructions, the KfW Efficiency House certification for renovations spanned a range, with 115 being the lowest standard and 55 the highest[5].

3 As of 2022, it had assets worth EUR 551.0 billion.

4 We use "KfW energy efficient refurbishment and construction programs" as an umbrella for a number of 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.

5 Under this the program offers differential and progressive debt relief based on energy consumption. All the housing groups are charged 0.75% interest rate per annum. 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%. Only applicable before 2023.

Conditionalities

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 constructions, KfW augmented its loan offering to EUR 100,000, up from the prior EUR 50,000. These loans came with a preferential interest rate of 0.75% p.a., notably lower than the long-term rate of 2.68%. Accompanying these loans were extended maturities and flexible repayment terms, such as potential extensions and early repayment options. Upon the completion and subsequent certification of the building, demonstrating adherence to the requisite energy standards, debt could be relieved up to 25%: the higher the energy efficiency, the greater the relief (KfW, 2022; KfW, 2020).

The offerings for retrofitting existing buildings were even more enticing. Recognizing the typically higher costs associated with retrofit activities compared to new constructions, the interest rate on the concessional loans, along with the step-up bonus, was made more attractive. As of 2020, retrofitting a building to the highest energy efficiency category, KfW-55, qualified for a generous 40% repayment bonus.

Outcomes

KfW allocated approximately EUR 100 billion to recipients in the form of loans. This generous financial backing incentivized the construction of buildings to the highest standards, as they promised greater repayment rates. The majority of these loans was taken up by private firms, predominantly channeling about three-quarters of these funds into the erection of new administrative and office buildings. KfW's financial contributions for building construction or retrofitting were restricted to a set amount per dwelling. Consequently, the cumulative investments in construction and modernization surpassed KfW's commitments by about threefold. Moreover, these activities generate substantial returned for the Government. From the Value Added Tax (VAT) alone, with a current rate at 19%, the revenues eclipsed the government's budgetary allocation for KfW programs. Factoring in indirect taxes, social contributions, and the reduced unemployment-related expenditures, an external analysis deduced that the Government garners an approximate return of 4 Euros for every Euro allocated from the budget to the Energy Efficient Construction and Retrofit Program (Evaluation of KfW, 2018).

The projects buoyed by KfW stimulated gross value creation effects nearing EUR 4.6 billion (effect-adjusted: roughly EUR 3.6 billion). SMEs were responsible for approximately two-thirds of this figure. These value generation impacts correspond to employment ramifications, accounting for around 64,000 full-time positions (effect-adjusted: 51,000). Notably, SMEs accounted for nearly three-quarters of this employment surge. The environmental impact was also notable. The annual CO2 savings, calculated over the lifespan of the buildings financed within a single year, approximate 700,000 tons p.a., constituting 0.33% of the German building sector's total CO2 emissions annually (Schroder et al 2011). Given the durability of energy-efficient buildings (typically 30 years and beyond), the cumulative carbon savings from the program since its inception in 2006 surpassed 9 million tons p.a. Collectively, the enhancements in building

standards via the KfW Program considerably bolstered Germany's national CO2 mitigation objectives (Schröder et al., 2011).

Recent developments in 2022 revealed that KfW momentarily halted the acceptance of applications for this initiative, citing an overwhelming demand that outstripped the designated funds by over EUR 5 billion[6]. In lieu of the Energy-Efficient Construction and Retrofit Program that concluded in the summer of 2021, the Federal Funding for Efficient Buildings (BEG) initiative is set to be introduced in 2024 (KfW, 2022). Additionally, it is noteworthy that by 2025, the current pinnacle of building standards, the KfW Efficiency House 40 and 40 Plus, will be established as the baseline standard, aligning with the broader ambitions of the updated Energy Transition 2.0 strategy. From January 2023, these standards have been upgraded, and the minimum standard for new buildings is House 55, hence no longer eligible for KfW funding. No repayment subsidy is granted.

5.2 Germany's Climate Protection Contract for Heavy Industries

Context

In Mid-2023, the Federal Government officially launched a EUR50 billion program led by The German Ministry of Economic Affairs (the BMWK) to decarbonize energy-intensive industries including steel. This program[7] is also a response to the US's largest investment in clean energy and climate-neutral technologies via the U$S300 billion Inflation Reduction Act of 2022[8].

The CfD Funding Program ("Förderprogramm Klimaschutzverträge") program uses the concept of Carbon Contracts for Differences (CCfDs). This is not a new concept. CCfDs 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 but not exact approach has been employed by the Netherlands in the Sustainable Energy Transition Scheme (SDE++) since 2008 (NetZero Pathfinders, no date). The conditionalities direct the companies towards the overall decarbonisation mission of Germany, set out in Federal Climate Change Act 2021 (Bundes-Klimaschutzgesetz), Climate Action Programme 2030 and National Decarbonisation Programme. This program also follows an auction model and includes conditionalities that share risks and rewards between companies and the government.

Conditionalities

The Climate Protection Contract incentivizes companies to invest in more climate-friendly production methods which could include green technologies and low-carbon fuel. The subsidy varies based on the estimation of excessive costs – the 'differences' between the green method

6 Efficiency House /Efficiency Building 55 in new buildings (EH/EG55), Efficiency House /Efficiency Building 40 in new buildings (EH/EG40), and Energy Efficiency Rehabilitation.

7 This is a novel instrument employed by the EU's biggest economy. Historically, initial investments and case-by-case subsidies through certain innovation scheme had been favored by the EU state aid authorities. This program however takes a different approach.

8 As claimed by Robert Habeck, Minister of Economy and Climate Action (Kurmayer, 2023).

and the conventional method. The differences 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[9], 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 case of unfulfilled target, to repay the subsidies.

The government invites eligible companies (which emit more than 10 thousand tonnes of C02 per year) to submit funding proposals through an auction process, and selects winning bids based on their estimated funding requirement per avoided ton of C02. The selected bidders are awarded variable subsidies, with incentives based on the adoption of climate-friendly production methods. The lowest bidders are chosen for variable subsidies, given that they are incentivized to employ a climate-friendly production method. The first auction cycle was recently open from 06 June to 07 August 2023 with the first bidding round to happen in late 2023.

5.3 Israel High-Tech R&D Investment Incentives

Context

Israel's high-tech sector stands as a pillar of its economy, with the nation establishing a particularly robust foothold in the Information and Communications Technologies (ICT) domain. As of 2013, ICT represented 11.1% of the country's GDP, broken down into 7.5% from services and 3.6% from manufacturing, and ICT exports comprised 17% of the total exports (World Bank Development Report, 2016). The government's drive to support R&D emanates from the disparity between the public and private returns on R&D. This support is channeled through the Israel Innovation Authority (IIA), previously known as the Office of the Chief Scientist (OCS) under the Ministry of Industry, Trade, and Labor. As an autonomous public entity, the IIA is tasked with nurturing Israel's technological prowess to fuel economic expansion. This is primarily achieved by endorsing R&D projects that are high-risk but promise substantial returns. Catering to diverse entrepreneurial needs across various sectors, the IIA has a special emphasis on supporting SMEs. Its portfolio boasts a series of programs such as the Magnet Program, devised to spur pre-competitive generic research by consortia, technological incubators, and an array of initiatives centered on bilateral and multilateral international R&D cooperation.

Conditionalities

The inception of the R&D programs traces back to the 1980s. Firms aiming to qualify would tender grant applications specifying their R&D projects. Once submitted, these applications come under the scrutiny of a Research Committee. The approval rate stands at approximately 70% of all applications, with successful applicants obtaining grants that could cater for up to 50% of the earmarked R&D budget for their venture. The quantum of grants hinges on the magnitude

9 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"). Version from 6 June 2023 (GER). Available at https://www.bmwk.de/Redaktion/DE/Downloads/F/klimaschutzvertraege-foerderrichtlinie.pdf?__blob=publicationFile&v=2

of projected improvements, the targeted market, and the specific domain of the project. Of particular note is the preferential treatment for R&D ventures based in Area “A” Development Areas, which are allocated an additional grant of 10% over and above the standard provisions.

Currently, the IIA boasts a repertoire of 84 concurrent programs, all supplemented with a series of call for proposals to address various risk facets in innovation and cater to distinct company types. One of the notable initiatives is the Generic Program, crafted especially for sizable corporations. The preconditions laid down by the IIA mandate both local R&D evolution and in-country employment. Large firms, defined by either an annual sales range exceeding USD 100 million, a force of over 200 R&D professionals based in Israel, or an Israeli R&D budget surpassing USD 20 million, stand eligible for grants amounting to a maximum of 20% of their annual R&D outlay, combined with a royalty waiver. An additional 10% support is on offer for projects in preferential areas. These generous incentives aim to offset the inherent risks linked with pioneering pre-competitive innovations.

The state venture capital company Yozma was established in 1993 as a foundation for Israel’s Venture capital industry and a network catalyst for international investors and partners. Yozma leveraged the rising Nasdaq index and the expanding ICT market to attract funds for Israeli start-ups in the 1990s. Yozma 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. This pot drew at least $150 million from the private sector (Avnimelech 2019). The VC industry emerged strongly between 1996 and 1998, with a rapid growth of new start-ups. 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.

Taking a global perspective, the IIA also champions programs that necessitate collaboration with overseas partners. The BIRD program, an acronym for the Israel-U.S. Binational Industrial Research and Development Foundation, stands as a testament to this. Incepted in the early 1980s, BIRD was a product of a bilateral treaty inked by both nations, with the vision to support and promote collaborative, non-military, industrial research, and development projects that benefit the private sectors of both partners (BIRD Foundation, no date). BIRD’s modus operandi entail funding these joint ventures through conditional grants, covering up to half the project’s costs, capped at USD 1.5 million for every project. The successful fruition of a project sees BIRD reaping royalties, which are treated as pre-tax expenses for the payer and 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 (Trajtenberg, 2000). If production shifts offshore, the maximum royalty slab escalates to thrice the grant amount. This is applicable to between 90 and 100% of the overseas manufacturing segment. Intellectual property rights are tailored to ensure companies amplify their operations domestically. Tax advantages are also directly proportional to the annual R&D expenditure. Recognizing the pivotal role of synergizing academia and industry

in fostering innovation, the Israeli government has launched several instruments, including the Magnet Program, Magneton, Knowledge Import, and Applied Research in the Academia. The Magnet Program, introduced in 1993, is particularly notable for promoting collaborations between industrial entities and academic institutions to pave the way for generic, pre-competitive technologies. The consortium receives grants, covering 66% of the approved R&D budget, with no repayment obligations. They are 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[10]. Each venture within a consortium will then need to apply for different sources of fundings for later stages of product development.

Outcomes

In 2003, Israeli patents registered in the U.S., when scaled by GDP, exceeded the figure for the G7 nations by 69%. By 2007, Israel boasted the highest per capita concentration of start-ups globally, and in absolute terms, it was second only to Silicon Valley (Cohen et al, 2012). Currently, Israel hosts R&D centers for over 530 multinational companies (MNCs). The incentives for these corporations to establish R&D centers in Israel are manifold. They range from shared R&D investment risks among MNCs, start-ups, and the IIA to privileged access to specific know-how and cutting-edge technologies. MNCs also benefit from assistance in pinpointing suitable partners. Furthermore, the R&D law in Israel facilitates joint intellectual property ownership or a non-exclusive license between the 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.

Lach (2002) conducted research that reveals a positive correlation between R&D subsidies offered by the IIA and long-term R&D expenditures financed by companies. The findings suggest that an incremental dollar of R&D subsidies augments company-backed R&D by 41 cents in the long run. However, some scholars have voiced concerns over the conditionality that necessitates in-country production. They argue 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.

10 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.

5.4 ScotWind

Context

Scotland's renewable energy landscape, especially the offshore wind sector, is instrumental in achieving the nation's Climate Change targets set for 2045.[11] Offshore wind has emerged as one of the most cost-effective large-scale electricity generation methods in Scotland (Catapult Offshore Renewable Energy, 2018). The nation's prowess in the offshore wind market is undeniable, as exemplified by the UK's inaugural floating wind farm, the Hywind Scotland pilot park. This venture 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, no date). 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, no date). 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 through this technology (Catapult Offshore Renewable Energy, 2018; Mazzucato, 2022).

To harness this potential, the Scottish government introduced ScotWind, a seabed leasing initiative for establishing new offshore wind farms within the Scottish coast's Exclusive Economic Zone. Spearheaded by Crown Estate Scotland, the public entity responsible for overseeing the nation's coastline and seabed, 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, aligning with sustainable practices, and fostering local development objectives (Mazzucato, 2022).

Conditionalities

In April 2021, Crown Estate unveiled the ScotWind leasing requisites, detailing the evaluation criteria for offshore wind program applications. These criteria encompass traditional elements found in procurement endeavors such as project conception, financial blueprint, delivery timeframe, and the developer's technical proficiency (Crown Estate Scotland, April 2021). Additionally, an integral part of the application process is the inclusion of a Supply Chain Development Statement (SCDS). This document provides insights into applicants' supply chain strategies required to execute their envisioned projects. The SCDS delineates factors like location, expenditure magnitude, and overarching presumptions for the potential project's supply chain engagement, covering four essential stages: development, manufacturing, fabrication, and installation operations (Crown Estate Scotland, no date; Mazzucato, 2022). Although ScotWind's leasing mechanism does not enforce specific standards regarding the volume or locality of supply chain expenditure detailed in the SCDS, and these details are not a part of the application's evaluation procedure (Crown Estate Scotland, 2021), the SCDS represents a binding covenant

11 In 2019, the Scottish government signed the Climate Change (Emission Reduction Targets) (Scotland) Act, in which the country committed to ensuring that the Scottish emission accounts reach net-zero by 2045 (Scottish Parliament, 2019). The country also created interim targets, aiming to cut emissions by 75% by 2030, and 90% by 2040 – using 1990 as the baseline year (Zero Waste Scotland, no date).

between the developer and the Scottish administration once the leasing accords are sanctioned.

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. Within the SCDS segment of the leasing application, prospective developers delineate both concrete and aspirational expenditure figures, alongside a rationale explaining their underlying computations (Crown Estate Scotland, April 2021). 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 (Crown Estate Scotland, 2021). The agreement affords some flexibility, permitting developers to update their SCDS as the project progresses. However, it is at Crown Estate Scotland's discretion to approve any alterations, especially if they diverge significantly from the original SCDS or affect the supply chain's evolution (Crown Estate Scotland, 2021). 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 will be halted if less than a quarter of the commitment noted in the finalized SCDS is disbursed (Crown Estate Scotland, 2022; Mazzucato, 2022).

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, no date; Mazzucato, 2022).

Outcomes

The ScotWind bidding process, in its initial announcement, garnered attention with 74 applications submitted by multinationals, consortia, and global investment funds. By August 2021, in two distinct rounds, 20 of these applications had been selected for Option Agreements. These agreements permit companies to undertake tests, surveys, and site explorations without making any permanent installations on the seabed (Crown Estate Scotland, 2021; Mazzucato, 2022). The Scottish government is set to receive over 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, 2022). All 20 projects have made their SCDS publicly accessible, suggesting an expected expenditure of GBP 1.4 billion per 1 GW of capacity (Mazzucato, 2022). Furthermore, while full operations for the ScotWind offshore projects are anticipated by 2032 (Crown Estate Scotland, no date), early projections suggest that these projects could add an additional 27.6 GW to Scotland's generating capacity – a significant increase from the initially predicted 10 GW. This capacity is enough to energize over 15 million homes, presenting potential export opportunities.

While the ScotWind leasing initiative marks a significant stride for Scotland, it has not been without its critics. Regional commentaries, primarily from local newspaper entities and think

tanks, have taken issue with the perceived low prices attained during the leasing stages. The main criticism targets the price ceilings set during the leasing, which, according to some, curtailed potential public sector revenues from this venture (Williams, 2023; Dalzell, 2022). When juxtaposed with similar programs in the U.S. and England, it is noted that ScotWind, though considerable in its earnings, fell short as the latter projects yielded up to 18 times more in public revenue (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 ensure consumers benefited from manageable offshore wind expenses, as seabed leasing costs often trickle down to them (Williams, 2023).

ScotWind has positioned Scotland at the vanguard of renewable energy innovation, with its focus on advancing offshore wind engineering and technology. The government, recognizing the sector's potential, is furthering its commitments to hone the workforce skills tailored for this nascent industry and to pioneer techniques that enhance floating wind farms and energy distribution (TGS, 2022; Mazzucato, 2022). Encouraged by ScotWind's model, the Welsh Affairs Committee is venturing into a parallel program aimed at harnessing floating offshore wind energy in the Celtic Sea. This endeavor promises up to 20 GW of energy, the potential to create numerous jobs, and an influx of around GBP 20 billion in direct project investments (Welsh Affairs Committees, 2023). Drawing 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. Additionally, the Welsh Committee is pressing for enforceable local content requirements in upcoming Contracts for Difference auction methodologies to reinforce the potential conditions set for these future wind leasing processes (Sutherland et al, 2022). By early 2023, the Welsh administration greenlit the inaugural floating offshore wind projects in the Celtic Sea. Dubbed "Project Erebus" and located off the Pembrokeshire coast, it is forecasted to yield 4GW of energy by 2026, contingent on securing requisite subsidies (Welsh Government, 2023)

5.5 Oxford-AstraZeneca Partnership

Context

The UK government was instrumental in the creation and distribution of the Oxford/AstraZeneca vaccine (now known as Vaxzevria). The involvement spanned from initial investments in the foundational technology to funding research phases, and from establishing purchase agreements to ensuring domestic production capabilities. The UK's forward-thinking investments in scientific research via UK Research and Innovation (UKRI) encompassed the ChAdOx1 vaccine technology that underpins Vaxzevria. 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. It further aimed to cultivate a diverse range of potential vaccine candidates to mitigate potential risks associated with any single formulation.

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. 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. It also 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 so as to introduce vital health technologies rapidly.

Conditionalities

In May 2020, AstraZeneca and Oxford University forged a licensing agreement where AstraZeneca vowed to handle the development, global manufacturing, and distribution of the vaccine, subsequently dubbed Vaxzveria (AstraZeneca, 2020). Following this, the UK government pledged GBP 65.5 million towards Vaxzveria. The terms of the agreement, forged in April 2020, stipulated that Oxford University, its offshoot company Vaccitech, and AstraZeneca would operate on a not-for-profit basis throughout the pandemic. They would charge only what was necessary to cover the costs of production and distribution (Vaccitech, 2020). 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 (Mazzucato, 2022; Health and Social Care, and Sciences and Technologies Committees, 2021; BEIS, 2021). Such an advance 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 (BEIS, 2021). In April 2020, when announcing their exclusive licensing arrangement with AstraZeneca, Vaccitech and Oxford University – the co-owners of the platform technology underpinning the vaccine – declared they would forego any vaccine royalties during the pandemic's duration. The division of potential commercial sales proceeds from Vaxzevria stands at 24% for Vaccitech and 76% for Oxford University Innovation (Vaccitech, 2022). Furthermore, any subsequent royalties earned by the University from the vaccine would be channeled back into medical research. This reinvestment would support endeavors such as a new Pandemic Preparedness and Vaccine Research Centre, a collaborative venture with AstraZeneca (Vaccitech, 2020).

An edited version of the contract inked between the UK Vaccine Taskforce and AstraZeneca is publicly accessible, shedding light on key aspects of the purchase guarantee and some conditional terms. Although the complete contractual terms remain confidential, this document outlines the collaborative terms between the UK government and AstraZeneca, addressing topics like potential pricing alterations, intellectual property rights, and the UK government's

discretion over its Vaxzevria stockpile. Two dedicated Project Managers, one each from AstraZeneca and the UK government, were to closely collaborate, ensuring seamless order delivery. AstraZeneca also committed to a "best reasonable efforts" clause, permitting the potential for cost pass-throughs 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.

Outcomes

The UK's Vaccine Taskforce and its corresponding vaccination program are often lauded for their effectiveness, with the UK becoming the first nation globally to administer an approved COVID-19 vaccine on December 8th, 2020. This is the result of a mission-oriented industrial policy with a long-term mission to build a strong foundation in life-sciences, in combination of a clear urgent mission at the highest level of the government in policy coordination (Balawejder et al, 2021). By April 2022, AstraZeneca, in collaboration with its contract manufacturing partners, had distributed over 2.6 billion doses of Vaxzveria (Vaccitech, 2022). Remarkably, Vaxzveria comprised nearly a third of all ordered vaccine doses globally. It was distributed in over 170 countries and was available at a significantly lower price point compared to alternative vaccines developed by Pfizer and Moderna (Dyer, 2021). The vaccine's cost-effectiveness, coupled with its widespread distribution and the focus on knowledge-sharing, allowed for efficient production and timely delivery 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, 2022).

This venture underscored the significance of sustained R&D investment for public health and the need for institutional capabilities to swiftly introduce novel treatments. The successful vaccination initiative not only bolstered the UK's reputation as a pioneer in groundbreaking medical research (UKRI, 2021) but also spurred the government to amplify its commitment to global vaccine research and development. Consequently, the UK emerged as the largest national contributor to these efforts (Department for Business Energy and Industrial Strategy, 2020; Mazzucato, 2022). Drawing insights from the Vaccine Taskforce's methodologies, in November 2022, the UK government allocated over GBP 113 million to research focused on cancer, obesity, mental health, and addiction (Department of Health and Social Care, 2022). Echoing the efficient model of the Vaccine Taskforce, experts will spearhead each healthcare challenge, striving to expedite the development and incorporation of cutting-edge treatments into the NHS and fostering inter-organizational collaboration (Department of Health and Social Care, 2022).

The commercial success of Vaxzevria translated into impressive financial outcomes for key stakeholders involved in the vaccine's inception. Vaccitech transitioned into a publicly traded entity and executed its initial public offering in April 2021. The company raised a substantial USD

110.5 million on its inaugural day of trading on Nasdaq, with shares priced at USD 17.00 each (Vaccitech, 2021). By April 2022, Vaccitech began accruing royalty payments from Vaxzveria's commercial sales, marking the pandemic's conclusion. Royalties from vaccine sales in the last quarter of 2021 contributed around USD 15 million to the company's revenues (Vaccitech, 2022). In another significant move, Oxford University inaugurated the Pandemic Sciences Institute in July 2022. While specific details about the institute's financing remain undisclosed, AstraZeneca and Serum Life Science are recognized as its primary backers (Oxford University, 2022; Pandemic Sciences Institute, no date).

5.6 Italy's Law 488/92 Regional Investment Subsidies

Context

Italy has one of the most pronounced regional wealth disparities within Europe (Cerqua and Pellegrini, 2014). In an effort to address these disparities, Italy implemented various investment subsidies, especially focusing on its southern regions. This approach is not novel. Following the post-war era, the south received substantial assistance both from the Italian government and the European Union (Cingano et al., 2022). A landmark initiative in this effort was Law 488/92, introduced in 1992 by the Ministry of Economic Development. Serving as the primary tool for mitigating territorial imbalances from the mid-1990s to the mid-2000s, the law directed resources both regionally and to specific private investment ventures within these regions. Its core objective was to promote fixed investments, especially in the nation's underdeveloped areas, prioritizing regions and sectors that promised the most substantial societal returns, notably employment (Cingano et al., 2022).

To operationalize these objectives, Law 488/92 utilized open regional "calls for tenders," adhering to the EU's guidelines for regional subsidies. True to its mission, a substantial 85% of the allocated funds were channeled towards the economically lagging southern regions of Italy. These regions fall under the category of "Objective 1," which designates areas where the GDP per capita is below 75% of the EU average (Cingano et al., 2022; Cerqua and Pellegrini, 2014). It is noteworthy that, during the effective period of this legislation, the regions benefiting from these subsidies encompassed nearly half of Italy's total population (Bronzini and De Blasio, 2006).

Conditionalities

Italy's Law 488/92 is a subsidy program designed to bridge the regional disparities in economic growth. This business support initiative channels funds to a diverse array of investment ventures across multiple sectors using regional calls for tenders, mirroring an auction mechanism. Born out of Italy's longstanding tradition of industrial aid, the program gives precedence to less developed southern regions and prioritizes sectors like steel, pasta, and construction. Furthermore, the initiative sponsors a myriad of projects, ranging from the creation, expansion, and modernization of establishments to the production and distribution of energy, as well as the development of projects in the IT sector.

The administration of the subsidy program rests with the Italian Ministry of Economic Development. This ministry is tasked with the initial screening of applications, followed by a ranking process grounded in five distinct criteria. These criteria encompass three objective metrics: the subsidy rate sought, anticipated employment generation, and the expected return on investment. Additionally, two subjective dimensions, namely the environmental footprint and the degree of innovation, are determined by local political figures. The ranking process is further influenced by factors such as the size of the applying firm, its sector, potential EU fund eligibility, and alignment with EU objective areas. Such parameters can potentially override the conventional ranking, with projects eligible for EU funds sometimes receiving precedence over those ranked higher but without EU fund eligibility. Fund allocation under Law 488/92 is also contingent on the investment's geographical location and the size of the applying firm, with SMEs in Objective 1 regions (the most economically deprived) securing higher rates and other regions receiving reduced rates. Intriguingly, the program tends to favor entities requesting subsidies lower than the maximum permissible amount.

Outcomes

Between 1996 and 2007, Law 488/92 facilitated the financing of 77,000 investment projects, allocating nearly EUR 26 billion (at constant 2010 prices) through 35 open regional calls for tenders processes. A significant portion of these funds was sourced from the European Regional Development Fund (ERDF). However, the program's efficacy has been a subject of debate. Barone and De Blasio (2023) have contended that place-based policies, like this one, largely failed to deliver on their promises in Italy. Several debates revolve around the influence of Italian institutional quality on the effectiveness of the program. Particularly, concerns have been raised about the Mafia's substantial role in directing the allocation of funds within Sicilian municipalities, implying potential misuse or redirection of public finances.

Diverse studies have assessed the specific impacts of Law 488/92, often producing varied findings depending on the methodology, samples, and data coverage. For instance, an early analysis by Bronzini and de Blasio (2006) revealed that while subsidies positively influenced short-term firm investments, these benefits dwindled in the long run. They hypothesized that firms might simply expedite already scheduled investments without contributing any additional long-term investment value. A later investigation by Cerqua and Pellegrini (2014) identified sustained positive impacts on both investments and employment, although productivity remained largely unchanged. They concluded that while the subsidized capital indeed added value, it did not necessarily complement the owner-financed investment initially intended for the program. In more recent research, Cingano et al. (2022) found that the subsidies significantly bolstered investment and employment over six years, with younger, smaller firms seeing more profound benefits. Moreover, their study illuminated the influence of political biases in determining eligibility, concluding that minimizing political discretion in favor of objective metrics could substantially reduce costs. The ramifications of political discretion were most palpable in the south, which, despite receiving the most substantial funds, also bore the highest cost-per-job using the current allocation criteria.

5.7 UK Regional Selective Assistance (RSA)

Context

The UK's Regional Selective Assistance (RSA) programs, in operation since the early 1970s, are designed to foster and preserve jobs in underprivileged areas. While the UK was part of the EU, the RSA had to align with the EU's regional development goals and restrictions on regional subsidies. Consequently, the EU classified areas as "Tier 1" or "Tier 2" based on deprivation levels, assigning different grant rates to each. Additionally, a maximum Net Grant Equivalent (NGE) was established by the EU to limit the percentage of a firm's investment that could receive subsidies. Every seven years, the program underwent consultations to revise the eligibility map. The RSA granted discretionary investment aids to firms in areas characterized by low GDP per capita, heightened unemployment, and frail job markets, gauging these regions using EU metrics like GDP per capita, population density, skill sets, unemployment and employment rates, and the percentage of manufacturing employees.

Conditionalities

Once a region was identified as part of the Assisted Areas, firms were eligible to apply for discretionary grants, primarily targeting manufacturing operations with over 90% of the allocated funds. These grants aimed to support a range of objectives, from the inception of a new business, expansion, or modernization of existing ones to 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. The regions facing the most significant challenges, known as "Tier 1" following the EU's revision in the 2000s, could avail a maximum investment subsidy of 35% NGE. In contrast, "Tier 2" regions had sub-tiers, each with varying maximum NGE levels ranging from 30% to 10% (Criscuolo et al., 2019). The selection criteria retained their foundational categories in the 2014-2020 program update, but the UK government shifted its focus towards supporting SMEs. Large enterprises encountered stricter aid constraints, with funding only available for ventures associated with new economic activities, product diversification, or innovative processes. Additionally, aid intensities for most regions were reduced to 10%, although exceptions were made for certain small businesses (Department for Business Innovation & Skills, 2013).

In terms of the application process, as described by Criscuolo et al. (2019), firms were mandated to furnish details like their expected additionality, business plans, financial statements, and reasons for seeking the grant. The UK's Department of Business local office undertook the responsibility of scrutinizing these applications, with processing times varying based on the grant's size (applications for grants exceeding GBP 2 million required a more extended review period). Throughout this phase, there was significant collaboration between the firms and the government to ensure compliance with the set criteria and to finalize an agreement on 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.

Outcomes

Following the UK's formal exit from the EU in 2021, much of the publicly accessible information regarding the RSA program has been retracted due to the application of new subsidy rules in the UK (Department for Business Innovation & Skills, 2021). The continuation of the RSA program post-Brexit remains ambiguous, as the UK no longer remains bound by the EU's subsidy regulations. However, the topic of subsidy control is addressed within the UK-EU Trade and Cooperation Agreement (Department for Business & Trade, 2021). 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 within the Assisted Areas. With reference to the Assisted Areas maps discussed for the 2013-2020 duration, the program influenced approximately 30% of the UK's populace (Department for Business, Innovation & Skills, 2013).

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. Using a research design based on changing eligibility rules by the EU, which led to quasi-random variation regarding which distressed regions in the UK received more subsidy support, Criscuolo et al. (2019) found that regions eligible for elevated subsidies saw a marked increase in employment and a decrease in unemployment. Specifically, a 10-percentage point rise in the maximum investment subsidy led to a 10% surge in manufacturing employment. This effect was particularly pronounced in smaller companies, while more prominent firms received subsidies without making substantial alterations to their operations. Furthermore, the authors found no evidence to suggest that job increases were due to displacement from neighboring ineligible areas.

5.8 South Korean Heavy and Chemicals Industries (HCI)

Context

During the 1960s and 1970s, while Park Chung Hee was president, South Korea emulated the Japanese reform model to drive post-war economic growth, heavily subsidizing sectors with a particular emphasis on exports. As international aid, especially from the U.S., poured into Seoul after the Korean War, the government strategically directed special loans and financial aid to chaebols, conglomerates pivotal in resurrecting key industries including construction, chemicals, oil, and steel. Especially during the second half of the 1970s, this strategy involved promoting initially unprofitable sectors like steel production, heavy and chemical industries (HCI), and

eventually advancing into the automobile and electronics sectors. Today, South Korea boasts over 40 chaebols, with the four major players – Samsung, LG, Hyundai, and SK – representing half of the nation's stock market value. Notably, Samsung alone is responsible for a staggering one-fifth of the country's exports.

Conditionalities

In 1973, South Korea's Heavy and Chemical Industries (HCI) program prioritized six sectors: steel, nonferrous metals, shipbuilding, machinery, electronics, and petrochemicals, aligning with military modernization aims and avoiding competition with the nation's existing strengths. Prior to HCI, the country emphasized an export-centric industrial strategy, showering incentives on exporters. With the introduction of HCI, industries under its umbrella, along with exporters, were shielded from certain governmental regulations and taxes. These industries were also beneficiaries of subsidized loans and credits. To bolster foreign marketing and facilitate technology imports, the government also backed the Korea Trade-Investment Promotion Agency (KOTRA). Concurrently, South Korea's industrial strategy pivoted towards sectors with rising knowledge content. Trade regulations selectively managed imports, export incentives, and exchange rates to bolster exports. The rise of chaebols, corporate giants, was closely intertwined with the government's blueprint. These entities were enticed with monopolistic rights or financial incentives to align with state developmental agendas, making the success of governmental economic and industrial strategies heavily reliant on chaebols.

The chaebol system's inception was a significant offshoot of these policies. This system is typified by a corporate structure where the founding family's members either own or hold pivotal management roles, ensuring their unwavering influence over subsidiary entities. The conditions set by the government underwent evolution. The 1970s witnessed the nation keen on imbibing best practices from overseas. Post-1979, the regime ceased extending loans to private firms, i.e., chaebols, instead rolling out "rescue packages" for financially distressed entities. Unfortunately, smaller businesses found little solace in these measures, eventually being acquired by larger chaebols like Samsung, Hyundai, and Daewoo. South Korea's shift to democracy in the late 1980s impacted the chaebol system but only to a limited extent. The subsequent decade saw the state nudging the private sector towards heightened R&D investment. 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, exemplified by South Korea's tax framework, is skewed in favor of chaebols. The regressive corporate taxation system enables chaebol families to indulge in intricate cross-shareholdings and circular ownership designs, ensuring their dominance over minority stakeholders. This system also manifests an uneven effective tax rate; 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 (Council on Foreign Relations), thereby consolidating the formidable influence of these family-controlled conglomerates.

Outcomes

Lane (2021) underscores three major outcomes stemming from the industrial strategy South Korea adopted in the 1970s. Firstly, following the introduction of the HCI initiative, targeted sectors saw an over 100% output surge compared to non-HCI sectors. Additionally, 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, persistently 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 (Murillo and Sung, 2013). Over time, chaebols entrenched themselves deeply 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, these behemoths, leveraging their monopolistic might, often elbowed out SMEs, either replicating their innovations or annexing them outright. This hostile landscape can hamper the growth trajectory of SMEs, which are pivotal employment generators. Moreover, the intricate ties between chaebols and the government can 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, debating potential reforms spanning corporate governance shifts, enhanced reporting transparency, and robust antitrust legislations.

5.9 ARPA-E

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 report, Rising Above the Gathering Storm. The agency was modelled 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 groundbreaking scientific findings and pioneering inventions into tangible technological advancements. 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 (Assessment of ARPA-E).

ARPA-E's core mission revolves around funding audacious 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.

Conditionalities

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 U.S.-based entities such as universities, labs, companies, non-profits, teams, and consortia are eligible to apply, excluding foreign entities. 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 gauges 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 towards risk alleviation.

Outcomes

By September 2021, ARPA-E had allocated USD 3 billion to 1,294 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 teams adept at forging groundbreaking energy technologies (ARPA-E Strategic Vision). 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

Context

The 2022 CHIPS Act aims to bolster the U.S.'s domestic manufacturing of semiconductors, a sector currently dominated by East Asia, which provides 75% of the U.S. semiconductors. The U.S.'s dependency on external sources, especially with China's significant investments in the industry, presents economic and geopolitical challenges. To address these risks, 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. Additionally, it sets forth provisions to thwart the allocation of federal funds for semiconductor facilities in countries that might pose a national security threat.

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 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 U.S. Both private entities and public institutions, or 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.

Conditionalities

As of May 2023, the CHIPS Act stands as a pivotal piece of legislation in the U.S., with the Department of Commerce and the Department of Treasury diligently working through the implementation of its multifaceted provisions. Two significant components of the CHIPS Act, particularly emphasizing industrial policy with conditionalities, are the Funding for Domestic Manufacturing and the Advanced Manufacturing Tax Investment Credit.

For the Funding for Domestic Manufacturing provision, the Department of Commerce is set to distribute USD 39 billion over the next five years to semiconductor manufacturers, along with semiconductor materials and equipment producers. This allocation is aimed at the construction, expansion, or modernization of their U.S.-based semiconductor facilities. Adopting a competitive grant approach, this provision earmarks USD 2 billion for legacy chip production and designates up to USD 6 billion for direct loans and loan guarantees. However, funding for a single project is capped at USD 3 billion unless sanctioned by the President. Additionally, the funds are restricted from being used for stock buybacks or dividends. The overarching stipulation is the prevention

of fund utilization for facilities outside the U.S. or by “foreign entities of concern” – specifically entities linked to the Chinese government. Additionally, recipients are 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. The act lacks clarity on the repercussions of audit discrepancies, barring provisions related to China.

In terms of the Advanced Manufacturing Tax Investment Credit, the Department of the Treasury oversees the 48D Tax Credit introduced by the CHIPS Act. This offers a 25% investment tax credit for semiconductor manufacturing-related investments in the U.S. (U.S. Senate, 2022). Applicable taxpayers can avail these credits for investments directed towards U.S. facilities primarily engaged in semiconductor or related equipment manufacturing, encompassing the specialized tooling equipment essential for semiconductor production (U.S. Senate, 2022; Zane et al., 2022). An option exists for taxpayers to consider this credit as a direct tax payment (U.S. Senate, 2022). This credit 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 gauged by the Congressional Budget Office (Congressional Budget Office, 2022).

Outcomes

The CHIPS Act Incentive Program is slated to allocate USD 19 billion in FY22 and USD 5 billion annually from FY23 to 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 concentrates on the fabrication of leading-edge and mature-node semiconductors. Moreover, the Commerce Department plans to release two additional NOFOs, addressing semiconductor materials, manufacturing equipment facilities, as well as research and development facilities later in the year 2023.

The guidelines under the first NOFO dictate that the government’s financial support should not exceed 35% of a project’s capital expenditures. Direct funding awards within the NOFO span between 5% and 15% of an endeavor’s anticipated capital outlay. It further clarifies that the CHIPS Act Assistance cannot subsidize indirect or incremental costs surpassing the actual cost. Potential beneficiaries are 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 will be a mandate for “upside sharing” via cash payments to the Government. The CHIPS Program Office advises prospective applicants to tender a statement of interest coupled with a pre-application before presenting a comprehensive application. This detailed application must 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 have galvanized an influx of around USD 50 billion in investments within the semiconductor domain, including significant contributions from industry stalwarts like Micron, Qualcomm, and GlobalFoundries.

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 towards 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 towards 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 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 typology 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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