POLITICS OF INNOVATION:
THE ENTREPRENEURIAL STATE AND THE MAKING OF ISRAEL'S 'START-UP NATION'

by

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Vivek Chibber

DEDICATION

To my parents,

Raya (ז"ל) and Eli Maggor

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Much like innovation, a dissertation is very much a collaborative project. Therefore, while this document only contains my name on the cover, it would not have been possible without the institutions, teachers, colleagues, friends, and family, who provided training, support, and encouragement through the many years it took to bring this project to fruition. Nothing gives me greater pleasure than the opportunity to thank them all here.

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ABSTRACT

Over the last three decades, Israel has emerged as a global leader in the development of innovative technologies. Previously a manufacturer of textiles, clothing, and processed food, it currently designs and produces computer software, information and communication technologies, electro-optical devices, and cybersecurity solutions. This dissertation examines this profound historical transformation as a structural shift from traditional industries to technological innovation. Using a historical-comparative approach, I underscore the crucial role of policymakers within Israel's Ministry of Trade and Industry and Office of the Chief Scientist in orchestrating this shift. These public officials, I show, launched a bold attempt to restructure the Israeli economy, designing and implementing a host of ambitious policy measures. These programs and institutions combined public incentives and disciplining mechanisms– *carrots and sticks* – to propel otherwise reluctant private actors towards making long term investments in technological upgrading and scaling up their operations locally. Whereas the existing scholarship emphasizes the exceptional features of the Israeli case and the role of market mechanisms, my approach stresses the vital role of targeted innovation policies advanced by an 'entrepreneurial' developmental state. I rely on state and industry archives, historical periodicals and newspapers, and in-depth interviews with government officials and business leaders. To explain why targeted innovation policies were effective, I embed policy developments and state capacity within broader political-economic and social structures. Organizing my analysis along these lines, I trace the state's efforts to renegotiate

longstanding alliances with leaders of traditional industry, both business and labor, as well as incorporate new groups from emerging sectors of industry. Once established, this "upgrading coalition" functioned as a key forum for intragroup coordination and state-business cooperation. Far from a sharp break from earlier patterns, the legacies of Israel's earlier industrialization proved vital. Here I stress, in particular, how Israeli state managers drew on the institutions and political alliances forged in the 1950s and 1960s. These earlier foundations were then redeployed in a new configuration suited for the specific challenges of innovation-led development. Finally, the emphasis on government policy allows me to identify Israel not as a stand-alone case, but as one of a small number of historically low-technology states that made similar attempts to transform their economies in the aftermath of the crisis of the 1970s. I compare Israel with Taiwan and Ireland, attending to both industrial strategies and developmental outcomes, in order to generalize my findings of the Israeli case. I examine the variation between the three cases to examine several counterfactuals and illuminate a variety of alternative pathways to state-led economic development.

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LIST OF ABBREVIATIONS

APSI	Assistance Program for Strategic Industries
BIRD	Bi-National Industrial R&D
CEPD	Council for Economic Planning and Development
EPTR	Export Profits Tax Relief
FDI	Foreign Direct Investment
FSU	Former Soviet Union
FTZ	Free-Trade Zone
GDP	Gross domestic product
IAEI	Israeli Association of Electronic Industries
ICT	Information and Communication Technologies
IDA	Industrial Development Authority
IDB	Industrial Development Bureau
IDCC	Industrial Development Consultation Committee
IP	Intellectual Property
IPO	Initial Public Offering
ISI	Import-substitution Industrialization
IT	Information Technology
ITRI	Industrial Technology Research Institute
IVA	Israel Venture Association
M&A	Merger and Acquisition
MAI	Manufactures Association of Israel

MATIMOP	The Israeli Industry Center for R&D
MNC	Multinational Corporations
MOEA	Ministry of Economic Affairs
MOF	Ministry of Finance
MOTI	Ministry of Trade and Industry
NESC	National Economic and Social Council
NSTC	National Science and Technology Conference
OCS	Office of the Chief Scientist
OECD	Organization for Economic Co-operation and Development
OEEC	Organization of European Economic Cooperation
ROI	Return on Investment
S&T	Science and Technology
SEI	Statute for Encouragement of Investment
SME	Small and Medium-Size Enterprise
STAG	Science and Technology Advisory Group
SUI	Statute for Upgrading Industries
TSMC	Taiwan Semiconductor Manufacturing Company
USPTO	US Patent and Trademark Office
VC	Venture Capital
WTO	World Trade Organization

INTRODUCTION

> "Israel is an innovation nation.…I want you to know what we're doing. Technology by itself does not do it. You can have enormously gifted people in technology. You can have the greatest scientists and you could have the greatest mathematicians and you can have the greatest physicists...technology alone does not work…This is the fundamental change that we made in Israel. *We couple technological capabilities with freer markets*."

- *Israel's Prime Minister, Benjamin Netanyahu, speaking at special economic event in Buenos Aries, September 2017*, emphasis by author[1]

> "The rapid development of [Israel's] science-based industries in the last decade was no doubt *the outcome of the involvement and incentives provided by the public sector*. This accelerated an economic process that would have taken far longer under regular market conditions…Lowering the risk and recruiting entrepreneurs to move into such sectors *necessitated government involvement*, which focused on sharing the economic costs involved with industrial research and development."

- *David Brodet, former head of Israel's Economics and Finance Planning Administration at the Ministry of Trade and Industry, January 1984* (Brodet, 1984, pp. 889, 893, emphasis by author).

Over the last three decades, Israel has emerged as a global leader in the development of computer software, information and communication technologies, electro-optics, and cybersecurity. In 1979, high-technology manufacturing represented only 14 percent of all industrial exports. However, by 1999, these products accounted for a staggering 54 percent of Israel's manufactured exports (Avnimelech & Teubal, 2008, p. 17). In 1968, civilian research and development (R&D) expenditure as share of gross domestic product (GDP) was less than 1 percent, lower than all of the OECD countries accept for Italy (Breznitz, 2007b, p. 42). By 2000,

[1] https://mfa.gov.il/MFA/PressRoom/2017/Pages/PM-Netanyahu-addresses-special-economic-event-in-Buenos-Aires.aspx [accessed: July 10st, 2020; emphasis added by authors].

R&D spending in Israel stood at 4 percent of GDP, double the average of members of the Organization for Economic Co-operation and Development (OECD) and representing the highest R&D intensity in the entire organization (see Figure 1).[2] Bloomberg's Innovative Index for 2020 recently ranked Israel as the sixth most innovative nation in the world. The country placed first in the world in R&D intensity (as percent of GDP), second in researcher concentration, and seventh in patents (both per capita).[3] Israel is also a hothouse for startup activity with the largest number of startups per capita in the world. The number of active Israeli high-tech companies[4] continues to grow steadily each year, and by the end of 2018 exceeded 6,600.[5] Employment in the high-tech sector is 9 percent of total employment, or 12 percent of employment in the business sector, which is the highest rate in the OCED and more than double the OECD-country average (Brand, 2018, p. 4).[6]

However, Israel was not always renowned for its advanced technology. In fact, until the 1980s Israel's main industrial exports were textiles, clothing, and processed food (Teubal, Halevi, & Tsiddon, 1986). Furthermore, between 1973 and 1985, the country endured a long period of economic stagnation which renowned Israeli economist Michael Bruno (1993, p. 24) famously

[2] OECD Main Science and Technology Indicators R&D Highlights in the February 2020 Publication, https://www.oecd.org/sti/msti2020.pdf [accessed: July 10th, 2020].

[3] See: https://www.bloomberg.com/news/articles/2020-01-18/germany-breaks-korea-s-six-year-streak-as-most-innovative-nation [accessed on: July 10, 2020.

[4] The high-tech sector in Israel combines the industrial sectors in the electronics, pharmaceuticals and aircraft sectors alongside services – software and research and development.

[5] Start-Up Nation Central Annual Report 2019, p. 6, 10.

[6] OECD Economic Surveys Israel March 2018, p. 18, http://www.oecd.org/economy/surveys/Israel-2018-OECD-economic-survey-overview.pdf [accessed July 10th, 2020].

referred to as a "lost decade". In those years, economic growth almost came to a halt, the balance-of-payments deficit rose to alarming proportions, and inflation soared at a staggering rate (Bruno, 1993, Chapter 2). In other words, when Israel embarked on its transition towards high-tech innovation, its future economic success was far from preordained, and its prospects for economic prosperity seemed no more promising than its chances for continued stagnation. Table 1 (below) summarizes and compares the main characteristics of Israel's high-tech economy in the 1990s to the situation that prevailed in the two decades that preceded it.

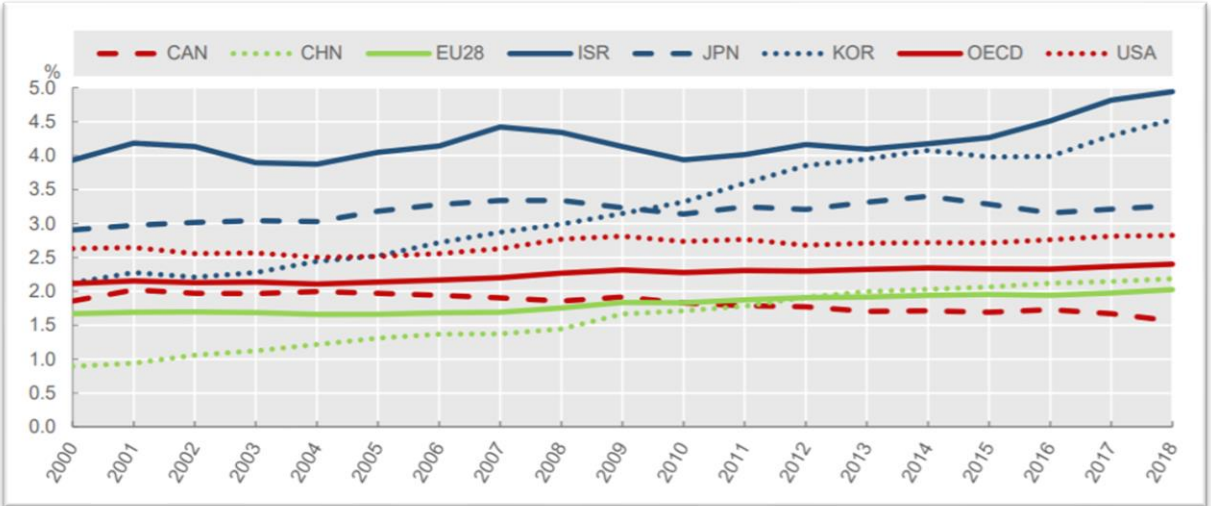

Figure 1: R&D Intensity (Gross domestic expenditure on R&D as a percentage of GDP, 2000-2018)

Source: OCED Main Science and Technology Indicators Database, February 2020.

This dissertation aims to understand how, despite the various challenges involved, Israel succeeded in advancing this profound historical transformation. How did such a small, low-technology economy carry out a structural shift from traditional industries to technological innovation?

In the existing literature, Israel's achievements in high-tech are often attributed to several exceptional factors. Geo-political analyses highlight the state's hostile environment which gave rise to its "industrial-military complex" (Katz & Bohbot, 2017; Mintz, 2013). Cultural accounts

point to the "entrepreneurial culture" that resides within Israeli society (Senor & Singer, 2009; Yair, 2019). Economic studies stress the prevalent involvement of venture capital (Avnimelech, Rosiello, & Teubal, 2010; Avnimelech & Teubal, 2006) and the configuration of Israel's 'silicon-valley-like' technological cluster (De Fontenay, 2004). Others emphasize social factors like the existence of dense social networks, both formal and informal, particularly the close links between the military and private industry (Baram & Ben-Israel, 2019; Breznitz, 2005; Drori, Ellis, & Shapira, 2013; Honig, Lerner, & Raban, 2006; Swed & Butler, 2015), and the state's high-skilled labor force and outstanding scientific infrastructure (Avnimelech & Teubal, 2004; Commander, 2005; Mani, 2001).

Table 1: Israel's high-tech sector, selected structural elements (1970s-1990s)

Accumulated during the decade	*1990s*	*1980s*	*1970s*
Number of startup creation	~2,500	~300	~150
Funds raised by VCs (in M$)	~8500	~50	0
Capital invested in Israeli startups by VCs (including foreign) (in M$)	~6650	~50	0
Accumulated number of IPOs (high tech)	126	9	1
Accumulated VC-backed IPOs:	72	3	0
Accumulated # of significant M&As by MNE	~75	0	0
Capital raised in NASDAQ in the decade (in M$)	~10,750	~50	~10
Mergers and acquisitions (M&A) (in B$)	~18,200	~0	~0
Figure for the end of the Decade	*1990s*	*1980s*	*1970s*
Number of international investment banks in Israel		1	0
Number of VC companies	~100	2	0
Share of ICT exports in manufacturing exports	54%	28%	~14%
ICT manufacturing exports M$	12,950	2,450	350
Software exports MS	2600	75	0
Civilian R&D as percentage of GDP	4.8%	2.8%	1.8%
ICT employees (thousands)	152	~80	~60
ICT skilled employees (thousands)	57	37	~26
Patents issued	969	325	140

Source: (Avnimelech & Teubal, 2008, p. 154, table 1).

Yet looking at Israel today and arguing the country's economic success was a foregone conclusion would be a clear case of reading history backwards. In fact, until the mid-1980s, there were few signs that such a radical transformation was in the cards. In that period, Israel's economy was based on traditional, labor-intensive manufacturing sectors which were geared mostly towards addressing domestic demand. This was the result of the state's import-substitution industrialization (ISI) strategy, which sought to replace imports with domestic production. Under this regime, state policies supported local manufacturers in imitating proven manufacturing knowhow, not on upgrading or innovating new technologies (Barnett, 1996; Levi-Faur, 1998). The total number of scientists and engineers at the time was not low, about 10 per 10,000 employees, but it was still half of the ratio of the U.S (25) or Sweden (22) (Breznitz, 2007b, p. 42). More importantly, until the mid-1970s, Israel's science and technology (S&T) capabilities resided almost exclusively in its public research institutions or the military, both of which avoided commercialization and produced very limited spillovers into civilian industry. In stark contrast, the number of R&D personal in the private civilian sector remained miniscule, especially in comparison to other countries (Teubal, 1993, pp. 484-485). Considering these facts, it is clear that to foster a structural transformation of industry, Israel had to first radically shift its policy framework.

Alternative accounts have attributed the emergence of Israel's dynamic high-tech sector not to the utilization of preexisting conditions, but rather to a profound rupture from its past, advanced though an intensive process of economic liberalization (e.g. Drori et al., 2013; Justman, 2002). Prime Minister Netanyahu's depiction of Israel's innovation economy as the outcome of the marriage between scientific prowess and free markets - quoted above – echoes this view, which

has become a widespread trope within Israel and beyond.[7] Indeed, since the 1980s a deep and far-reaching process of economic and political restructuring began to take shape. This shift encompassed the implementation of orthodox neoliberal formulas commonly identified with the 'Washington Consensus': deregulation of the labor market; liberalization of financial markets; lifting of restrictions on the movement of capital and goods; heightened involvement of foreign capital; privatization of public infrastructure and assets; a dramatic decline in unionization and the decentralization of wage bargaining, and restrictive fiscal and monetary policies (Bassat, 2002; Kristal, 2013; Maron & Shalev, 2017; Paz-Fuchs, Mandelkern, & Galnoor, 2018; Shalev, 1998).

Yet, the idea that Israel was able to foster a dynamic high-tech industry by implementing neo-liberal reforms should surprise anyone familiar with the effects of such policies in other parts of the world. In Latin America, for example, despite policymakers' hopes that the private sector and liberalized markets would combine to produce economic growth and development, a Washington Consensus program implemented in the 1990s completely failed to generate such results. For more than two decades following its implementation, productivity growth and per capita GDP growth rates in Latin American countries were disappointingly low, as the private sector compensated only partially for the decline in public investment. This left most of Latin America in a 'middle-income trap': with wages often too high to allow competitive production of labor-intensive commodities, and productivity too low to allow producers to compete with more industrialized countries in the production of highly skill-intensive goods. Rather than expanding knowledge-based industries and moving up the value chain, most South-American economies

[7] Although Netanyahu is the leader of the Israeli Right, this view is propagated by politicians across the political divide. For example, see: Naomi Zoref, "Yair Lapid: 'Mobileye did not succeed because of the government. If anything, it succeeded despite the government'", *Calcalist* (April 4th, 2917).

returned to a comparative advantage based on the export of primary products in agriculture and mining, while the exports of many Central American countries came to be dominated by assembled labor intensive products (Abugattas & Paus, 2010, pp. 120-121). Liberalization efforts produced similarly disappointing results in sub-Saharan Africa, the Middle East, North Africa, and South Asia. Since the 1980s, countries in these regions all witnessed their manufacturing sectors stagnate or shrink and relative average income fall behind the advanced economies (Wade, 2012, p. 224).

From this comparative perspective, the notion that, in Israel, market forces simply unleashed dormant entrepreneurial and innovative capacities that in turn energized the state's high-tech sector is far from convincing. Furthermore, while it is commonly believed that Israel's neo-liberal turn also involved the retreat of the state from its historical dominance of the economy, recent studies have shown this process did not produce the weakening of its state institutions. In fact, the capacities and relative autonomy of its state agencies, particularly the Ministry of Finance (MoF) and Israel's Central Bank, have only strengthened since the 1980s (Mandelkern, 2019; Maron & Shalev, 2017). This continuity also applied to the state's longstanding role in guiding economic development and advancing industry (Maman & Rosenhek, 2012). Further support of this view is provided in the second quote above by David Brodet– one of Israel's leading economic figures who previously served as the state's chief economist, the director general of the Israeli MoF, and as its budget director. From Brodet's point of view, rather than the *invisible* hand of market forces, it was the *visible* hand of the *public* sector which was responsible for the emergence of Israel's high-tech sector.

Instead of free markets, in this dissertation I stress that Israel's innovation-based economy was the outcome of a host of targeted policy measures – *an industrial policy* – advanced by what contemporary scholars have called a 'neo' or 'entrepreneurial' developmental state (Block, 2008;

Mazzucato, 2015). Most consequential in this regard was the role of the Office of the Chief Scientist (OCS) at the Ministry of Trade and Industry (MOTI)— a 'pilot' developmental agency Which launched a bold attempt to restructure the Israeli economy, designing and implementing a host of ambitious policy measures. These programs and institutions provided direct and indirect public funding, mobilized private investment in emerging technological fields, offered institutional support, fostered network building, opened-up export markets, and stimulated technological transfer.

Although the important contribution of Israel's OCS has been acknowledged in previous studies (e.g. Avnimelech & Teubal, 2008; Justman & Zuscovitch, 2002; Teubal, 1997; Trajtenberg, 2001), its origins has been largely taken for granted and its effectiveness assumed to be almost automatic. Industrial restructuring, however, cannot be understood simply as a process of policy development and implementation. As research on state-led development has shown, a far-reaching transformation like the one witnessed in Israel is hardly ever seamless. Most often, considerable challenges make such an accomplishment extremely improbable. These challenges play out in both the policymaking and political arenas.

Much of our knowledge on these challenges derives from the classic literature on the developmental state. Starting in the 1980s, this scholarship investigated the 'miraculous' economic success of a number of East Asian countries– first Japan, and later South Korea, Taiwan and Singapore. These accounts demonstrated that the unprecedented success of these newly industrialized countries rested not in their commitment to free market principles, but rather on their reliance on a comprehensive industrial program implemented by a developmental state. Such industrial policies generated an economic transformation by targeting investment in select industrial sectors and fostering national champions that could catch-up to, and eventually out-

compete leading international firms in established industries (H.-J. Chang, 2002; Evans, 1995; Haggard, 1990; Johnson, 1982; Rodrik, 1995; Wade, 1990; Weiss, 1998; Woo, 1991).

One of the central tasks of the traditional industrial strategy was ensuring capital is channeled in the appropriate direction and at benchmark levels of efficiency. Because in the context of a capitalist economy final investment decisions are the prerogative of the owners of capital, it required that states construct institutional mechanisms through which they could exert effective influence over private firms' investment process. One method for inducing investment was providing a myriad of publicly financial subsidies – generous tax breaks, cheap loans, export incentives and trade protection – to industrialists willing to sink new funds in targeted industries. More crucially, however, states had to guarantee firms did not view these subsidies as "gifts", but rather as "implicit contracts" (Chibber, 2014, pp. 32-33). Whereas the former runs the risk of subsidies being diverted to operations in less productive sectors, the latter obligates private enterprises to invest in specified lines and on benchmark technology or be disciplined by state managers. In other words, effective industrial policies required states gain the capacity to *condition* subsidies upon monitorable performance standards and impose *discipline* on firms that did not meet these targets.[8] This was one of the main insights of the developmental state literature, associated first and foremost with the work of heterodox economist Alice Amsden (1989, 2001; also see: Chibber, 1999; Davis, 2004; Wade, 1990). In Korea, to use a well-known example, exceeding export targets was rewarded with further licenses to expand into more lucrative sectors, while poor performers or bankrupt firms were heavily penalized, either by the refusal of

[8] Following Robert Wade (2010, p. 36), in this dissertation I define state discipline as the ability to withdraw public assistance from private firms – whether in the form of trade protection, credit subsidies, fiscal incentives, public investment in R&D or other – either when their performance is poor, or when they no longer need assistance to be internationally competitive.

government to bail them out or by the transfer of their assets to other enterprises (A. Amsden, 1989, pp. 21-23; Woo, 1991, pp. 165-174). Only in this manner, with both "carrots" *and* "sticks", were developmental states able to dislodge industrial elites away from final stage assembly, and move them into the more sophisticated and riskier, yet far more dynamic realm of high value manufacturing. This, in turn, fueled economic development that then helped these states catch-up, and sometimes even surpass, the developed economies.

Innovation-based development is no less challenging. Yet the nature of the challenge is distinct. Rather than help firms compete in already existing markets, contemporary industrial policies are mostly geared towards generating *new* markets by fostering innovative technologies and products (Breznitz & Ornston, 2013). Since the goal is to produce novel technological or scientific breakthroughs, long-term planning and targeted investment in existing industrial sectors is less applicable. Instead, effective interventions require policy measures that are far more "experimental" (Grabel, 2018) and "discovery-based" (Rodrik, 2004), along the lines of Albert Hirschman's (1987, p. 30) call for a more "open-ended, eclectic, skeptical inquiry". These interventions include the provision of funding and other public resources to groups that have promising ideas for developing cutting edge technologies.[9] Often, they also require coordinating public-private partnerships, cultivating new networks, and building bridges between innovative firms and scientists and engineers working in university, military, or government laboratories (Block, 2008; O'Riain, 2004; Samford, 2017; Schrank & Whitford, 2009; Weiss, 2014).

[9] Whereas the trade framework of the World Trade Organization (WTO) largely prohibits traditional industrial policy instruments such as export subsidies or import tariffs, it does not bar, and even encourages, the state promotion of science and technology through R&D polices, see: (A. H. Amsden & Hikino, 2000; Naqvi, Henow, & Chang, 2018; Weiss, 2005).

This changing nature of industrial policy presents policymakers with a host of very specific challenges. Making sure public subsidies are fully invested is far less of a concern. This is because, instead of channeling large sums to a handful of "national champions," innovation policy often follows the logic of "letting a hundred flowers bloom," providing a large number of small grants with the knowledge that only a small minority will actually succeed (Block, 2008, p. 173).[10]

What mostly troubles policymakers then is not the R&D process itself, but rather what happens once an R&D project is successful. This is because the broad social and economic benefits of innovation – good jobs in manufacturing, stable tax revenue, high value-added exports, advanced skills, and additional knowledge creation that paves the way for further innovation and the emergence of new economic sectors down the line – are mostly realized once innovations are commercialized. However, this is also the stage where profit-oriented firms – which in the context of a capitalist economy are nearly always the owners of new technologies – often enjoy the most leeway. Seeking to maximize their return they will repeatedly look to relocate certain business functions related to the commercialization of R&D to places where they are more economically beneficial.

Today's economic globalization makes this task even more challenging. The current "fragmentation of production" and the rise of "global value chains" have provided profit-oriented firms with far more opportunities to shift production around the world in search of lower costs and higher profitability (Gereffi, 2005). Once innovation is severed from commercialization, a race to the bottom dynamic ensues. Often, this results in most of the potential economic rewards of innovation being captured by private corporations that evade taxes, apply downward pressure on

[10] Of course, this does not mean that planners do not need to set benchmarks and withdraw funding from groups that fail to show adequate progress.

wages, and undermine environmental regulations (Breznitz & Zehavi, 2010; Mazzucato, 2018). Further complicating the matter is the fact that, in contrast to firms in traditional industrial sectors like steel or chemical manufacturing, firms operating in R&D intensive industries such as software or information technology are far more footloose, making it an even greater challenge to collect taxes or make other socially-oriented demands (Zehavi & Breznitz, 2017, p. 304). Upending these trends, therefore, represents a notable challenge for states that engage in innovation-led growth. Legislators' central task is advancing policies that, as Mariana Mazzucato (2018, p. 207) aptly puts it: "socialize both risks and rewards".

In addition to the policy challenges, industrial upgrading[11] also involves significant political barriers. First and foremost, such an agenda usually takes place against opposition from entrenched interests (Chang, 1994, 1999; Khan & Blankenburg, 2009). Sources of resistance originate from both within the state apparatus itself, for example on the part of rival state agencies who hold competing agendas (Chibber, 2002), as well as on behalf of societal forces. Particularly significant are industrial elites who are embedded in an existing accumulation regime and would stand to be on the losing end of such a far-reaching transformation (Barkey, 1989; Chibber, 2003; Hamilton, 2014; Waldner, 1999).

To champion a new developmental strategy and overcome these barriers, states must find ways to mobilize political support and foster cooperation from emerging sectors in industry that share the state's upgrading agenda. The classic literature on the developmental state has indeed stressed the crucial importance of the structured relationship between the state and a specific set of societal actors. Whether its Evan's concept of "embedded autonomy" (Evans, 1995, p. 12),

[11] By "upgrading" I refer to the production of goods and services with increasing value added, domestic linkages, and sustained productivity growth.

Wade's "governed market theory" (Wade, 1990, pp. 26-27) or Weiss's "governed interdependence" (Weiss, 1998, pp. 38-39) this approach has highlighted that effective developmental policies require states enjoy not only a certain level of autonomy (i.e. insulation from the influence of firms and other state agencies) but also a sufficient level of '*embeddedness'* (i.e. "a concrete set of social ties that binds the state to society and provides institutionalized channels for the continual negotiation and renegotiation of goals and policies") (Evans, 1995, p. 12). Only through such dense policy networks are state managers able to get a sense of firms' investment priorities, negotiate developmental goals and gauge whether these targets are being attained.

While the state's embeddedness with industry is widely recognized to serve as an "underlying structural basis for successful state involvement in industrial transformation" (Evans, 1995, p. 12) a puzzle remains: it is not clear how embeddedness yields effective policy. How do state manages guarantee their close relations with private actors produce positive outcomes rather than manipulated for predatory behavior? As others have already noted, Evans' account is limited in its ability to reveal the "specific practices that state officials use to engage effectively with […] firms" (Block & Negoita, 2016, p. 57). A more compelling account, therefore, needs to demonstrate *how* the state is able to leverage its embedded relations with societal actors to overcome the underlying structural constraints outlined above. This question has thus far been neglected in contemporary literature on innovation-led development. With some notable exceptions, such as Doner and Schneider's (2016, 2020) recent work on the political economy of development, contemporary debates on the 'neo developmental' or 'entrepreneurial state' have not paid much attention to how state action is enabled (or constrained) by its relationship with various social groups.

The critical question then is *how* did the Israeli state overcome these various policy and political challenges? How did its innovation policy-regime emerge, and how did the state develop the capacities to overcome resistance in order to implement it effectively?

In this dissertation, I provide a more complete account of the remarkable development of Israel's high-tech economy. I do so by adopting an historical-comparative analysis which moves beyond an emphasis of Israel's endowed features. This perspective also undermines the pervasive notion that the deregulation, privatization, and liberalization in the 1980s gave birth of Israel's high-tech sector. In contrast to the existing scholarship, I underscore the crucial role of state policies, programs and institutions that redirected public resources away from Israel's traditional industries and towards the development of cutting-edge technologies. I find that, rather than a growing role for market mechanisms, Israeli policymakers used a combination of public incentives and disciplining mechanisms – *carrots and sticks* – that conditioned state assistance on domestic commercialization. Such conditions included manufacturing requirements that stipulated that beneficiaries of state funding must produce certain goods domestically, as well as ownership requirements that ensure firms maintain certain key activities local. Together these worked to, on the one hand, reduce the risk associated with innovation thereby propelling otherwise reluctant private actors towards making long term investments in technological upgrading, and on the other hand, ensured that firm scale-up would take place locally.

To explain why targeted innovation policies were effective, in this dissertation I embed policy developments and state capacity within broader political-economic and social structures. Organizing my analysis along these lines, I trace the state's efforts to renegotiate longstanding alliances with leaders of traditional industry, both business and labor, as well as incorporate new social groups from emerging sectors of industry. These included sections from the financial sector,

former military elites, entrepreneurial scientists, and heads of leading academic and scientific institutions. Once established, this "upgrading coalition" functioned as a key forum for intragroup coordination and state-business cooperation. In this regard, in this dissertation I investigate the ability of states to restructure their economy around innovation with renewed attention to interests, capacities, and political resources. By incorporating an analysis of the politics of policy formation and institutional change, I highlight that politics represents a key causal factor in both the implementation and potential transformation of innovation policy.

To fully account for Israel's accomplishments, I argue, we must also look beyond the 1970s to an earlier period. Few studies on the rise of Israel's high-tech sector adopt this approach, and those that do have done so in order to stress *differences* between historical periods that are presumed to be diametrically opposed. For example, a recent book attributed the emergence and growth of Israel's high-tech sector to its so-called "*competitive economy*" a "liberal, market-oriented economy" – the polar opposite of the state's former "*cooperative economy*" in an earlier period "marked by centralized government intervention" (Drori et al., 2013, p. 9). Instead, my dissertation highlights important lines of *continuity* across the two periods. Far from a sharp break from earlier patterns, the legacies of Israel's earlier industrialization proved vital. Here I stress, in particular, how Israeli state managers drew on the institutions and political alliances forged in the 1950s and 1960s. Much like other postwar developmental states, in this period Israel established its traditional industries through 'catch-up' industrialization. As I show, Israel's industrial strategy in those years was effective in large part because of the policymaking capacities of MOTI— its central developmental agency. These capabilities, including the capacity to discipline private firms, were constructed as policymakers leveraged their embedded relations with Labor. In this regard, in their later efforts to advance technological upgrading, state managers did not need to

establish new developmental agencies or policy instruments. Rather, these earlier foundations were then redeployed in a new configuration suited for the specific challenges of innovation-led development.

The upgrading coalition that supported the state's innovation-led strategy also emerged out of this earlier historical arrangement that nurtured both private and the labor-owned industrial sectors. In other words, the conditions that allowed Israel to produce the desired developmental results in the context of innovation-led growth rested in a variety of ways on the state's previous developmental experience. Rather than a sharp break from earlier patterns, the view advanced here is one that emphasizes *continuation* and *deepening* of preexisting institutions and political alliances.

By shifting the emphasis away from Israel's exceptional features and towards government policy I also open up the Israeli case to an international comparative analysis. I identify Israel not as a stand-alone case, but as one of a small number of historically low-technology states that made similar attempts to transform their economies in the aftermath of the crisis of the 1970s. These countries, for example Ireland, Taiwan, Finland, faced similar challenges to the ones detailed above on their way to becoming technological leaders (Breznitz, 2007b; O'Riain, 2004; Ornston, 2006, 2012a). In the dissertation's final two chapters I compare Israel with Taiwan and Ireland, attending to both industrial strategies and developmental outcomes, in order to generalize my findings of the Israeli case. I examine the variation between the three cases to examine several counterfactuals and illuminate a variety of alternative pathways to state-led economic development.

DATA & METHODS

The dissertation uses a comparative historical approach. I have built my argument around two sets of comparisons. The first is an internal comparison between Israel's two historical developmental regimes: its original industrialization campaign in the decades following independence, and its technological upgrading strategy starting from the mid-1970s. With this comparison I demonstrate, first, that effective industrial policies, whether they aim to establish a traditional or an innovation-based economy, require the capacity to *condition* state assistance and *enforce discipline* when warranted. The content of the specific conditions that were set in each period, and the manner in which they were enforced varied in according to the particular goals and challenges of each developmental regime. Yet in both periods these capacities rested on state-industry cooperation and a social coalition that supported the state's developmental agenda.

The second comparison is an international one, between Israel and two additional cases: Taiwan and Ireland. Like Israel, Taiwan's developmental record was an unquestionable success. The Irish experience, on the other hand, was far more checkered. Leveraging this comparison, I am able to better generalize the dissertation's main findings regarding the Israeli case, as well as examine alternative pathways and counterfactuals. These comparisons also enable me to apply my findings from Israel to sharpen and advance the existing understanding of the Irish and Taiwanese cases.

The data I present in this dissertation is drawn from a mix of primary and secondary sources. The analysis of the Israeli cases relies mostly on original archival data, the majority of which was declassified for the purpose of this study, while the international comparisons rely mostly on secondary sources. Primary documents were gathered from Israel's State Archive, Israel's Knesset (its legislative branch) archives, The Pinhas Lavon Institute for Labour Movement

Research (the archive of the Histadrut), the National Library of Israel, and the U.S's National Archives at College Park, Maryland. To allow for triangulation, for the period of 1950-1973, I also conducted a systematic reading of publications issued by MOTI, as well as the periodicals of the representative bodies of both private industry, the Manufacturers Association of Israel, and Israel's trade union federation, the Histadrut. For the period of 1975-2016, I conducted 32 semi-structured interviews with senior civil servants from all the relevant government ministries and agencies, both current and past, as well as founders and top executives of prominent technological firms and leading venture capitalists. While the interviews were open-ended, I used an interview protocol of roughly 20 questions organized around sub-themes. Interviews lasted anywhere between 45 minutes to 3 hours. Additional materials include historical newspapers, autobiographies of key figures, published government and non-government reports, and secondary literature (see Appendix for complete details).

The dissertation is organized as follows. The first chapter explores Israel's first industrialization campaign and state building efforts in the two and a half decades following its independence. I outline how, much like paradigmatic developmental states such as Korea, Taiwan or Japan, Israel's industrial policies in this period were effective due to the state's institutional capacity to condition public subsidies upon firm performance and practice discipline when warranted. I then trace the source of this capacity – often considered to be "the most difficult of the growth-enhancing government capacities" (Wade, 2010, p. 38) – to dynamics within Israel's political economy. More specially, I show how policymakers leveraged their embedded relations with both private and labor-owned enterprises to generate discipline. In chapters two and three, I turn to an analysis of Israel's transition from traditional to high-tech manufacturing that began in the mid-1970s. In chapter two I outline efforts to reorganize Israel's developmental regime to

advance this upgrading strategy, focusing mainly on the establishment of Israel's OCS within MOTI and its various policy instruments. I emphasize, in particular, how the combination of conditions and disciplinary mechanisms addressed the main challenges of innovation-based development outlined above. In chapter 3 I return, once again, to the political sphere. I demonstrate how politics, reflected in the relations between the state's developmental agencies and key societal actors represented a key causal factor in the effective implementation of the state's innovation policy. I also show how, starting in the early 2000s, segments within the high-tech sector, led mostly by the budding venture capital (VC) industry, mobilized politically to curtail key regulations of the sector, severely dampening developmental outcomes. The fourth and fifth chapters presents the international comparison, situating Israel's development policy regime among the similar cases of Taiwan and Ireland.

CHAPTER 1:

The Origins of Israel's Developmental State

This chapter begins our investigation of the emergence of Israel's innovation economy with an analysis of the origins of the state's traditional industry in the two and a half decades that followed its independence in 1948. By extending our historical analysis all the way to this period we are able to demonstrate the historical origins of the state's developmental legacies, as well as its embedded relations with its central social partners, which were first nurtured in this period. In later chapters we will see how these aspects contributed to policy development and implementation that was responsible for the advancement of Israel's innovation-based economy.

As will be shown, much like many other late-developing nations in the postwar period, Israel's economy was established through the implementation of an Import-Substitution Industrialization (ISI) development regime. Most countries that employed this growth strategy, such as Argentina, Turkey, India and Egypt, are considered relative development failures. Israel, on the other hand, is an obvious success case that, at least in terms of economic outcomes, more resembles the highly effective East Asian Tigers.

Israel's success is even more surprising if we consider that the state's initial starting conditions were far from advantageous. In fact, early assessments made soon after Israeli independence in 1948 by a team of World Bank experts concluded the state had "little prospect of economic progress, escaping its poverty, or becoming anything more than an economic charge of the West" (quoted in: Barnett, 1996, p. 107). Nevertheless, within two decades, Israel's economic performance was being praised by leading international organizations and showcased for other Third World countries (Ibid.). Future analyses would attribute much of this unanticipated success

to the state's relatively autonomous state and its capacity to override the interests of powerful societal forces (Kalev, Shenhav, & De Vries, 2008; Levi-Faur, 1998; Migdal, 1988; Shalev, 1992). Juxtaposing the pessimistic forecast with Israel's eventual success suggests this capacity did not inhere in its state institutions prior to independence, but rather had to be produced and maintained.

The lion's share of this chapter is devoted to explaining this surprising outcome. In particular, I show that, much like in paradigmatic developmental states such as Korea, Taiwan or Japan, what determined the effectiveness of Israel's developmental strategy was its capacity to condition public subsidies upon firm performance, including but not limited to meeting predetermined export targets. I then proceed to demonstrate the sources of this crucial state capacity. I do this by shifting the analysis from policy to politics. More specifically, I find that Israeli state managers generated disciplinary capacity by leveraging their embedded relations with Israel's trade union federation - *the Histadrut* - to foster dynamic competition within the domestic market. Two preconditions proved essential in translating this relationship into effective discipline. The first was the relative autonomy of the Histadrut's industrial sector from the state, particularly as it pertained to the realm of investment. The second was the labor organization's commitment to broader social goals alongside the pursuit of economic gains.

Next, I show that once realized, this capacity empowered state managers to execute a novel industrialization strategy I call *pursuing overcapacity.* Implemented in the face of clear opposition on the part of private industry, this strategy supplied an additional layer of market discipline which allowed the state to combat the predatory and rent-seeking behavior of private firms. Whereas the East Asian developmental states allowed a full monopolization of their domestic markets and focused on export competition, Israel prioritized the creation of a competitive domestic market and viewed exports as only a secondary concern.

THE ORIGINS OF ISRAEL'S DEVELOPMENTAL STATE

Israel's economic 'miracle'

From 1950-1970, Israel's GDP and per capita income grew at extraordinary average annual rates of 9.7 percent and 5.2 percent, respectively (Syrquin, 1986, pp. 45-48). The main source of this remarkable growth was Israel's dynamic, albeit newly formed industrial sector which enjoyed an unusually high annual productivity growth of 4.7 percent and accounted for 43 percent of total output growth (Halevi, Baruh, & Havrylyshyn, 1991, pp. 24-25). While production throughout this period was largely geared towards the domestic market, Israel also produced an incredible growth in industrial exports which climbed from only 3 percent of all commodity exports in 1949 to 46 percent in 1965 (Pomfret, 1976, p. 56). The economic indicators presented in Table 2 demonstrate that Israel's economic performance in this period was virtually on par with the export-led development of Korea and Taiwan and fared much better than the growth patterns exhibited in Turkey or Mexico, considered to be two of the most successful cases of ISI-led development.[12]

What accounted for this developmental success? Many economists have attributed it to Israel's increasing factors of production: the dramatic growth in population and the large and continuous flow of foreign capital.[13] While the first was a result of mass Jewish migration, which

[12] Whereas Israel's industrial exports increased rapidly in this period, rather than "export-led", its developmental model more resembled what Albert Fishlow (1990, p. 66) described as an "export-adequate strategy" where diversifying exports regularly keeps up with product growth and earns needed foreign exchange. Even after Israel increased its encouragement of exports in the 1960s, its economy remained primarily inward-oriented. A closer look at Table 2 demonstrates that as late as 1973, Israel's manufactured exports accounted for only 15 percent of GDP, whereas in countries that implemented a clear export-led strategy like Korea and Taiwan, exports ranged from 24-38 percent of GDP.

[13] A similar argument has been advanced regarding the East Asian 'miracle', see: (Krugman, 1994; Young, 1995).

provided an expanding supply of labor and a growing source of domestic demand, investment capital arrived in the form of unilateral transfers from three main sources: U.S. Export/Import bank loans, proceeds of Israel Government bonds floated in the U.S., and from 1952 onwards, the German war reparations fund.

Table 2: Cross national indicators of structure and growth

		Average annual growth of GDP(%)	Average per capita growth (%)	Manufactured Exports Share of GDP (%)	Value-Added in Industry [a]
Korea	1955		-	0.2	13.1
	1963		1.6	1.2	16.9
	1973		8.0	24.3	29.7
	1950-70	6.8	4.5		
Taiwan	1955		-	1.4	23.6
	1963		3.0	6.2	28.6
	1973		7.4	38.3	43.8
	1950-70	8.4	5.4		
Israel	1955		-	4.9	31.6
	1963		5.2	11.2	35.5
	1973		5.2	15.1	36.7
	1950-70	9.7	5.2		
Turkey	1955		-	0.2	16.9
	1963		3.7	0.3	19.0
	1973		3.8	3.8	26.8
	1950-70	6.1	3.5		
Mexico	1955		-	3.8	26.8
	1963		2.4	1.7	27.2
	1973		3.4	3.0	31.1
	1950-70	6.4	3.1		

a. Industry includes manufacturing and construction.

Source: (Hollis B Chenery, 1980, p. 282; Syrquin, 1986, pp. 45,48)

Although these two factors undoubtedly contributed, they cannot on their own explain Israel's developmental success. First, it is important to stress that mass migration to Israel occurred mainly in the years 1948-1950, but dropped sharply after 1951 (Halevi et al., 1991, pp. 14-15). In fact, studies show the migrant population was almost completely absorbed in the labor market by 1955 (Hollis Burnley Chenery, 1979, p. 311). Thus, even if population growth did provide a boost, it is difficult to see how it alone can account for over two decades of sustained economic development. As for the inflow of capital, again this no doubt played a key role, yet aid can hardly

be taken as a sufficient condition for Israel's superior economic performance. Several other countries have received similar or even larger amounts of aid per capita and have not used it as effectively (Levi-Faur, 1998, pp. 80-83). In fact, the experience of many other developing economies has shown that large sums of foreign aim can sometimes have a negative effect on economic development (Moss, Pettersson, & Van de Walle, 2006). This is particularly true if the institutions required to oversee the allocation of capital are absent (Dollar & Levin, 2005). It is only when publicly controlled capital is coupled with the institutional capacity to ensure investment is utilized effectively that you get sustainable economic growth. Understanding Israel's developmental success, therefore, requires a closer analysis of the state's industrial strategy and the institutions in charge of monitoring it.

The origins of Israel's developmental state

The central state agency responsible for orchestrating Israel's industrialization campaign in this period was MOTI. Starting in 1955, and under the decade-long direction of Pinchas Sapir – one of the most powerful economic state managers in Israel's history – a small, Weberian state structure crystallized within the Ministry. Similar to other 'pilot' developmental agencies such as Japan's Ministry of International Trade and Industry (MITI) or Korea's Economic Planning Board (EPB), Israel's MOTI enjoyed an autonomous position within the state (Levi-Faur, 1998, pp. 69-70). Largely responsible for its dominance in the realm of industrial policy was the strong political support and cooperation it received from Israel's MOF and the Prime Minister's office (Greenberg, 2011, pp. 83-84; Levi-Faur, 1998, p. 70). This solidified MOTI's central position within the state apparatus and allowed it to withstand numerous attempts to weaken its dominant position (Greenberg, 2011, pp. 94-96; Kochav, 2006, pp. 98-103). Its authority over the realm of industry

was further cemented after Sapir was able to secure control over the German war reparations fund– one of the central sources of investment capital under state control in this period (Greenberg, 2011, pp. 125-126; Halevi & Klinov-Malul, 1968, pp. 166-167).

MOTI also maintained close connections with private industry, as members of its upper echelons maintained close relationships with leaders from both private industry and the Histadrut. Whereas the agency's embeddedness with labor predated the state, ties to leaders in the private industrial sector, many of which were organized under the Manufactures Association of Israel (MAI), were first established in this period. Throughout his tenure as Minister of Trade and Industry, Sapir went to great lengths to cultivate these relationships. He famously took weekly trips across the state in order to tour manufacturing facilities and meet with managers or potential investors. He maintained an especially close relationship with the acting President of the MAI, Arie Shenkar, whom he met with in his office on a weekly basis (Greenberg, 2011, pp. 90, 113).

Like many other emerging economies at the time, Israel's development policies were guided by industrial planning. In 1957 MOTI intensified its efforts in this direction by setting up an Industrial Planning Bureau with the object of centralizing planning and drawing up a blueprint for the development of industry.[14] Shortly after, the Bureau drew up a four year "pilot plan" for the development of industry and in 1959 published the first comprehensive five-year plan, followed by another five-year plan published in 1965. State planning in the period closely followed the tenets of ISI development— generating new manufacturing capacity by providing manufactures with generous subsidies and protection from international competition via a host of administrative trade barriers.

[14] *Israel Economic Bulletin* (hereafter *IEB*) Vol. X, 5, July 1959, p. 2.

A detailed examination of Israel's five-year plan for 1960-1965 demonstrates that the majority of its targets were met and, in some cases, surpassed (see Table 3). For example, industrial output exceeded its set target for 1965 two years earlier than originally planned (Ministry of Trade & Industry, 1964, p. 6). Similar success was attained with regards to industrial employment and total investment in industry. Efficiency and productivity also increased in excess of the forecast (Ministry of Trade & Industry, 1964, p. 10). Finally, industrial exports surpassed their projected amount in four out of the six years for which data are available (see Table 4).

Table3: Annual rates of growth: planned compared with achieved, 1958-1962

Branch	Rate of growth (%)		
	A Plan1958–1964	B Achievement1958–1962	B/A (%)
All	10.0	14.3	143
Mines & Quarries	18.6	20.0	108
Foodstuff	7.0	12.0	171
Textiles	9.9	18.0	182
Clothing	9.5	8.7	92
Wood	7.6	16.0	211
Paper & Printing	6.9	11.8	171
Leather	7.0	6.0	86
Rubber & Plastics	7.0	6.0	86
Chemicals & Petroleum	13.9	13.2	95
Non-metallic Minerals	8.9	13.7	154
Diamonds	9.2	28.8	313
Metals & Metal Products	9.6	14.4	150
Machinery and Electrical equipment	16.0	17.7	111
Transport Equipment	14.3	13.8	97
Miscellaneous	19.2	9.7	51

Source: (Ministry of Trade & Industry, 1964, p. 7)

As these data clearly show, MOTI was effective in achieving its long-term plans. As a result, local industry was vastly transformed from one that mostly carried out the final stages of production, assembling semi-processed products, to one involved in all stages of the production cycle, from the production of raw materials through intermediate goods to final products, creating

significant vertical linkages (Ministry of Trade & Industry, 1965, p. 22). Between 1958 and 1972 Israel enjoyed a rate of "industrial deepening" – measured by the ratio of intermediate demand to total manufacturing output – that was only slightly lower than Korea's and considerably higher than that of Mexico or Turkey (Wade, 1990, p. 45, table 2.9).

Table 4 : Growth of industrial exports, plan compared to achievement ($Million)

Year	1959	1960	1961	1962	1963	1964	1965
Plan	103	130	164	205	258	323	–
Achievement	118	149	177	202	262	301	345

Source: (Ministry of Trade & Industry, 1964, p. 8; 1965, pp. 23, 100)

In subsequent years, Israel continued this dynamic of industrial upgrading producing more skill and capital-intensive goods. In the late 1960s clothing goods replaced textiles as the largest contributor to export earnings. Also rising in importance were electrical equipment, metal products, fertilizers and pharmaceuticals (Pomfret, 1976, p. 69; Teubal et al., 1986, p. 1369). Overall, industrial planning in this period proved remarkably effective in "nudging" local industry up the value chain.

The 1960s was also when the origins of Israel's high-technology industry first began to take shape. In 1961 ECI Telecom was first founded followed by Tadiran and Elron Electronics in 1962 All three firms enjoyed generous state assistance and eventually became tech giants and "founding parents" of some of Israel's most successful high-tech enterprises (Drori et al., 2013, pp. 35-36). As we will see in the ensuing chapters, it was development efforts taken in this period that first sowed the seeds for Israel's indigenous technological sector, which in later decades became the central engine of economic growth.

Can this impressive achievement be attributed to the state's capacity to act as an effective

disciplinarian? In order to demonstrate that this was indeed the case, the following analysis will focus on two of the central investment vehicles mobilized in this period by MOTI to target investment in desired industrial sectors: the *Law for the Encouragement of Capital Investment* (hereafter The Investment Law) and loans from the *State's Development Budget*. Although the importance of both instruments has been acknowledged, no previous analysis has examined their disciplinary function. Drawing upon a variety of original archival sources, I demonstrate that, much like other disciplinary states such as Korea or Japan, these policy instruments enabled state planners to oversee the utilization of public subsidies by monitoring investments and sanctioning enterprises that did not uphold the terms and conditions attached to government assistance. To make clear, the goal of the next section is not to illuminate or identify *new* disciplinary mechanism. Rather, it aims to empirically demonstrate that Israel's developmental agencies were, in fact, disciplinarian and that this capacity manifested itself in a manner that resembled other developmental states. Once this is established, I will proceed to outlining the *sources* underlying this capacity, which represents the core theoretical innovation of the chapter.

The law for the encouragement of capital investment

Originally legislated in 1950 and later enhanced, first in 1955 and then again in 1959, the Investment Law central goals were "developing the productive power of the state" and closing the gap in the trade balance "through the reduction of imports and increase of exports".[15] The law authorized MOTI to provide new manufacturing facilities with a myriad of subsidies which included relief from payment of property taxes for five years, a ceiling on income and corporate

[15] *IEB*, special Issue: The law for the encouragement of Capital Investment, January 1951, p. 6-12.

taxes, an accelerated depreciation rate and an exclusion of imported capital goods and raw materials from custom duty.[16] It addition, the law provided investors with cheap land upon which to establish manufacturing facilities, allocated building materials for their construction and expedited the installation of vital infrastructure such as electricity, telephone lines and water.[17] Starting in 1959, manufacturing plants not originally recognized under the law could also apply to receive approved status, allowing them to enjoy similar benefits on any new investment.[18] Although the establishment of a new plant did not require government approval, in practice most manufacturers in this period found it difficult, if not impossible to compete with rival firms which were awarded the economic benefits of an approved enterprise (Aharoni, 1991, p. 220).

Serving as a one-stop-shop for investors and entrusted with approving investment proposals was MOTI's newly established Investment Center. The Center's control over the approval process played a key factor in MOTI's ability to effectively channel public subsidies to local industry. Its disciplinary capacity, however, was rooted in its authority to ascribe specific terms and conditions to each approval and, if necessary, sanction firms who did not meet these conditions by retracting their approved status.[19]

Ascribed conditions in this period directly reflected the State's developmental priorities. Between 1950 and 1962, approval was often conditioned upon proof of replacing imports with

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[16] Ibid.,

[17] *IEB* Vol. 9/10, September 1953, p.33.

[18] *Israel's Annual Government Report*, 1959, p. 240.

[19] Although this authority was not clearly outlined in the law's original formulation, this issue was addressed in a series of amendments made to the law in 1955 see: Law for the Encouragement of Capital Investments (Amendment), 5715/1955 article 35(a) and article 35(b). These amendments were outlined in *IEB* Vol. VIII no. 1, September 1955.

local production. Unlike East Asian states, whose focus on export-led growth provided planners with a clear metric of how to judge firms' behavior, Israel's state managers could not use export performance as a sole benchmark for discipline. The alternative method they devised was to evaluate firm efficiency by the amount of added value, measured in net foreign currency savings. In calculating added value, all foreign currency costs incurred for raw, semi-finished, and packaging materials, energy expenses, and depreciation of imported equipment and tools were deducted from the total foreign currency saved due to the replacement of a specific import.[20] "It is not our aim to make every product locally, at any cost," explained policymakers from MOTI, "we are interested in local production only if the cost of the dollar saved is reasonable in relation to the official rate of exchange, once initial production difficulties have been overcome."[21] In essence, this system made sure government would only support industries that proved they were efficient enough so as to not drain the state's already limited supply of foreign exchange.

In 1963, the state's developmental priorities shifted, and the expansion of exports became MOTI's primary goal. As a result, approved investment in sectors specifically targeted for export like textiles and clothing began incorporating predetermined export targets that were based on the state's 5- year developmental plans. Approved initiatives in these sectors were required to export at least half of their output while existing manufactures had to commit to expand their production by 50 percent and export at least half of this additional output (Greenwald, 1973, p. 101). Data collected from published Investment Center reports demonstrates that, in the years 1963-1972, an

[20] Letter from Deputy Director General of MOTI, M. Gilboa, to Industrial Planning Committee, April 8th, 1956, ISA/G/3442/17; Industrial Planning and Development, n.d, ISA/G/4557/1 (documents with "ISA/" numbers are from the Israel State Archives, Jerusalem). Also see: *Industry Past and Present*. Jerusalem: Ministry of Trade and Industry, Division of Economic Publications, 1985, p. 17.

[21] *IEB*, Vol. X, no. 2-4, December 1958, p. 11.

average of 44 percent of total approvals incorporated such export conditions.[22]

Because approved status was conditioned upon attainment of predetermined performance targets, the Investment Center maintained continuous follow-up which helped determine whether firms were meeting the terms stipulated by the Center (Ministry of Trade & Industry, 1960, p. 114). Starting in 1953, the Center also began to carry out annual surveys of approved enterprises which collected data on number of employees, annual output and sales, total investment, and exports.[23]

Table 5: Investment center: approved and revoked investment plans (1950-1965)

Year	Total plans approved	Number of plans revoked	Percentage of plans revoked
1950	328	154	47
1951	330	241	69
1952	176	129	73
1953	88	55	62
1954	102	48	45
1955	136	61	45
1956	147	41	28
1957	163	32	20
1958	165	41	25
1959	200	33	17
1960	440	87	20
1961	453	108	24
1962	315	41	13
1963	231	17	17
1964	237	7	3

Source: Report on Investment Center activities, 1965, table 4.

While certainly not every case that warranted loss of approved status resulted in one, there is evidence that the Investment Center did retract a significant number of approvals for plants that

[22] Israel's Investment Center report for 1972, page 23, Table 15: “Export conditions for approved enterprises”.

[23] Manufacturing Survey for Approved Industries: 1955-1956, May 1958, ISA/GL/6054/12.

were not established within a reasonable timeframe or did not uphold the stipulated terms. Between 1950 and 1965, 1,093 out of a total of 3,724 approvals (nearly 30 percent) were revoked by the Investment Center for initiatives that either failed to execute the proposed plan or did not uphold the required conditions (see Table 5).[24]

The Development Budget

A second, equally important investment vehicle employed by state planners in this period was the Development Budget. Similarly to Korea's famous "policy loans" (Woo, 1991, pp. 162-163), assistance through the Development Budget was provided largely in the form of subsidized loans with exceedingly low interest rates and long maturity. When first adopted in 1949, Development Budget funds were channeled mainly to large scale infrastructure projects and to the state's agriculture sector. Starting in 1955, under the guidance of Sapir and MOTI, the state began turning its attention to industry. In just a few years the share of total expenditure on industry more than doubled, rising from 12 percent of total development budget allocations in 1955 to as high as 26 percent in 1960 (Pack, 1971, p. 143). Long term loans to industry also grew in absolute terms, increasing from a mere IL 3.7 million in 1954 to IL 30 million in 1958.[25]

To become eligible for Development Budget loans, firms were required to submit investment plans which were initially assessed by MOTI and then passed on to a public advisory committee composed of representatives of MOTI, the MOF, members of industry, and Israel's

[24] Report on Investment Center Activities, 1965, Table 4. Approvals were revoked on a far higher rate in the 1950s (43 percent) than in the first half of the 1960s (15 percent)

[25] *IEB* Vol. X no. 6, 1959, p. 5.

central bank.[26] In line with the state's developmental agenda, top amongst the committee's goals was narrowing the trade deficit by replacing imports with local production, creating more job opportunities in the country's periphery, promoting exports, and generating vertical links by encouraging production in earlier stages of the production cycle.[27] Like in the case of the Investment Law discussed above, proposals for developmental budget loans were also evaluated on the basis of net foreign currency savings.[28]

The authority to approve or reject applications for Development Budget loans was a central factor in the state's ability to target strategic sectors. Between 1956 and 1964 over 70 percent of government loans provided to industry were distributed among four sectors explicitly targeted in the state's development plans: textiles, basic metals, chemicals and foodstuff.[29] However, like in the case of the Investment Law, the effectiveness of this instrument depended on the state's capacity to discipline underperforming firms. In 1956 Minister Sapir stressed the importance of following up on the utilization of state loans. He reported MOTI had followed up on loans as far back as 1949 and filed lawsuits against seven enterprises that failed to uphold stipulated terms (P. Sapir, 1956, p. 7). In 1959, in order to further enhance the Ministry's disciplinary capacity the state created a new government entity endowed with the authority to audit and sanction firms who

[26] *IEB* Vol. IX 5/6, 1957, p. 43.

[27] Memorandum on industrial planning, meeting in the Director General of the Prime Minister's office, December 12th, 1954, ISA G/4557/13; "Memorandum on problems in industrial development", n.d, ISA/G/4557/1; MOTI's Industrial Division management meeting summary, July 8th, 1957, ISA/G/4545/5, Planning Guidelines sent to members of the Industrial Development Central Committee, April 8th, 1956, ISA/G/3442/17.

[28] Industrial Planning and Development, n.d., ISA/G/4557/1.

[29] *IEB* Vol. 10, December 1958, p. 61.

deviated from their approved plans.[30] In its first year of operation this unit audited 896 firms and sanctioned 67 enterprises, 19 of which were forced to repay back their government loan (see Table 6).[31]

Table 6 : Audit of development budget loans, 1959

% Audit finding	Number of plans	%
Total approved investment plans	896	100
Investment plan implemented	626	69
Investment plan in the process of being implemented	203	24
Plan has not been accurately implemented, and loans have been returned or demanded	19	2
Plan canceled because unrealized or unreasonably delayed	48	5

Source: Trade and Industry: Internal newsletter MOTI, Issue 12-13, March 1960, p. 23

To summarize, I have shown that through the use of such policy instruments as the Investment Law and the Development Budget state planners located in MOTI were able to not only provide *carrots*, but also use *sticks*. Discipline was practiced by either retracting "approved status" from enterprises that enjoyed the benefits of the Investment Law or by sanctioning producers that did not adhere to the stipulated guidelines attached to loans provided through the Development Budget.

But what was the source of this capacity? What explains the Israeli state's ability to sanction underperformers, and reward others? In the next section, I explain that MOTI's disciplinary capacity lay in its ability to leverage its embedded relations with a key social actor: Israel' trade union federation.

[30] *Israel's Annual Government Report* 1960, p. 222.

[31] *Trade and Industry: internal newsletter of the Ministry of Trade and Industry*, Issue 12-13, March 1960, p. 23, table 5.

To appreciate the sources of Israeli state capacity, one first needs to recognize why these capacities cannot be taken for granted. In the exiting literature, the state's disciplinary capacity is often attributed to its monopoly over financial resources. A classic example is John Zysman's (1984) canonical study of how the French state used its control over credit-based finance as an instrument to influence investment patterns and guide industrial upgrading. A similar claim is advanced in Woo's (1991) study of the 'Korean miracle' which argues the state's unilateral control over foreign aid and domestic savings provided a lever over industrial elites.

Considering these existing studies, why does Israel's control over similarly large sources of investment capital in this period not sufficiently account for its disciplinary capacity? There is no doubt that the state's control over significant sources of investment capital increased its power over business. However, there is little reason to support the claim that such control should have make the state *sufficiently* autonomous in a manner that would permit it to simply disregard the interests of business. This is because in a capitalist economy, business will always maintain a certain level of structural power due to its unilateral control over final investment decisions. This dependence upon private firms then acts as a constraining force – exerted through the potential of an investment strike or a decline in business confidence – on the state's ability to govern by decree (Block, 1984; Culpepper & Reinke, 2014; Lindblom, 1982; Swank, 1992). A deterioration of business confidence would most likely trigger an economic slowdown and, inevitably, a decline in the overall demand for finance. If the demand for finance is itself in decline, it is difficult to see how the state's control over finance can serve as a lever over business (Chibber, 1999, pp. 321-322; also see: Lim, 1998).

Building on these insights, in this section I identify an alternative source of state discipline. To do so, I emphasize the distinctive characteristics of Israel's trade union federation, as well as the nature of its relationship with state. After first illustrating the unique nature of Israel's labor federation, I outline the ways in which state managers leveraged its embeddedness with this social actor to foster competition for public subsidies between the Histadrut and the private sector. It was this competition, I argue, that empowered the state and generated its strong capacities, including its ability to overcome the structural power of private industry.

Israel's third sector: the labor-owned industry

Israeli workers were historically organized within the Histadrut labor federation. In this period, the organization represented somewhere between 75 to 85 percent of Israel's wage laborers. Far from an ordinary peak labor union, the Histadrut also operated a conglomerate of public enterprises that encompassed numerous social and economic domains (Kleiman, 1964; Shalev, 1992). It served as the holding company of the state's largest bank, health provider and pension funds. But most important for our debate, the Histadrut also owned large industrial conglomerates such as *Solel-Boneh* and *Koor-Industries* (Aharoni, 1991, pp. 173, 181; Halevi, 1957, p. 177). The latter was Israel's largest industrial complex, overseeing more than a hundred manufacturing enterprises producing steel and heavy equipment, radios and telephones, glassware and ceramics, rubber and tires, electric-motors, and batteries. Overall, throughout this period the labor-owned sector accounted for around 20 percent of net domestic product (see Figure 2) and was responsible for somewhere between 19 to 22 percent of manufacturing's contribution to net domestic product (see Figure 3). Taken together, these elements are what led scholars of Israel's political economy to pronounce the Histadrut as "the most encompassing and powerful peak

organization of labor in the developed, non-Communist world" (Koreh & Shalev, 2009, p. 563).

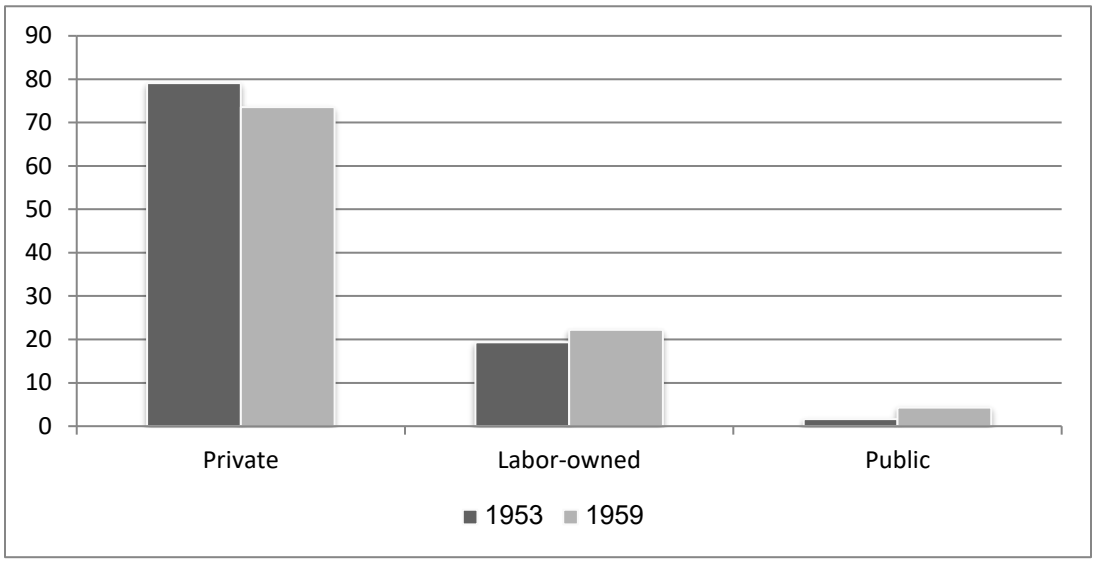

Figure 2: Net domestic product by sector 1953, 1957-60
Source: (Barkai, 1968) p. 26, table 1.

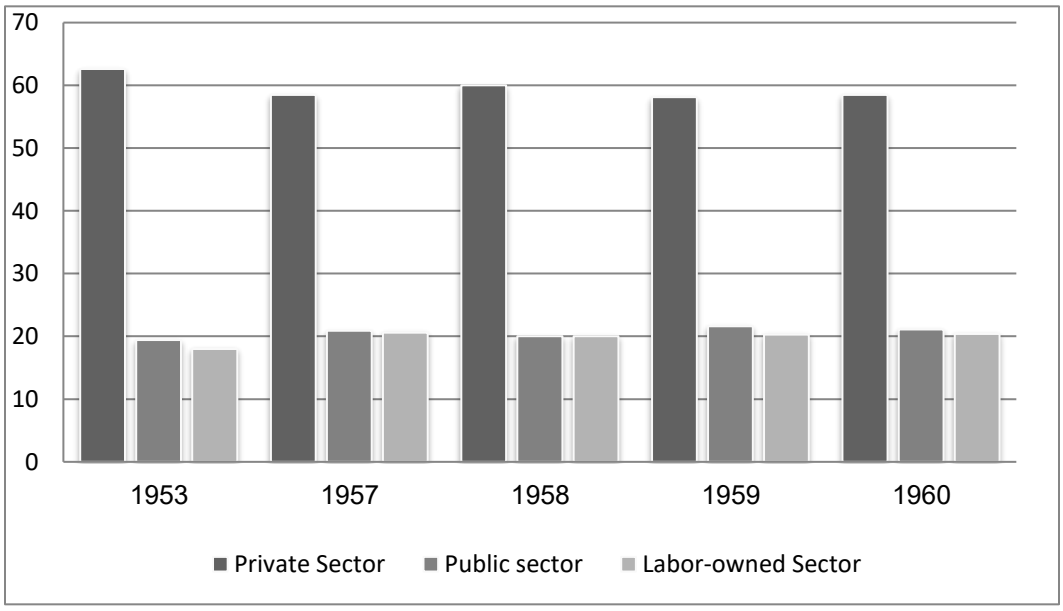

Figure 3: Manufacturing contribution to net domestic product by sector
Source: (Halevi & Klinov-Malul, 1968) p. 114, table 41.

Because Israel's political elites and the leadership of the Histadrut originated from the same political party (i.e. the labor party, MAPAI), and because of the historical role of the Histadrut in the state building project, early scholarship on Israel traditionally viewed the organization simply

as an economic appendage of the state. To support this claim, such studies often pointed to what they viewed as the Histadrut's privileged access to sources of subsidized investment capital such as the German reparations fund or the organization's pension fund (Aharoni, 1991, pp. 64-66).

This view, however, has been largely overturned. Subsequent studies have shown that, in reality, relations between the two actors were far from harmonious (Grinberg, 1993; Levi-Faur, 2001). There is no doubt that, prior to Israel's establishment, the Histadrut served as the most central economic and political agent committed to developing the economic, demographic and political infrastructure for a future Jewish state. However, in the years following independence the government was successful in weakening the Histadrut's de-facto control over many important investment outlets. Two examples are Sapir's replacement of the Histadrut's Hillel Dan as chairman of the German reparations fund in 1955 (Greenberg, 2011, pp. 125-126), and an agreement imposed by the state and signed in 1957 which required investments made through the Histadrut's pension fund receive the authorization of the Minister of Finance (Greenberg, 2005, p. 336; Levi-Faur, 2001, p. 164). While these maneuvers weakened the Histadrut, the organization still maintained relative autonomy by exploiting the potency of its economic enterprises to generate funds internally (Shalev, 1992, p. 102).

Although the Histadrut should not be viewed simply as an organ of the state, there was also much to distinguish it from a traditional market actor. Far from profit seeking in the narrowest of senses, the organization pursued a broad range of social objectives and served various stakeholders in ways which greatly relaxed the short-term behavior of its enterprises. On the one hand, managers of individual plants aspired to have a modus operandi not at all different than that of the private sector, and were reluctant to sustain losing, inefficient plants or to pay higher wages (Frenkel, 2005). On the other hand, the organization's enterprises clearly considered the profit goal

secondary to its unwavering commitment to industrial development and full employment (Bridger, 1961, p. 135; Greenberg, 2005). Their role as investment vehicles notwithstanding, the organization's enterprises fully embraced the government's development program and committed themselves to modernize and streamline production by increasing labor productivity and efficiency (Bridger, 1961, p. 46). For example, in a policy statement sent to the Board of Management in 1957, Pinchas Lavon, the General Secretary of the Histadrut, stressed the organization had more than a business point of view:

> "Labor enterprises cannot be governed solely by the aim of accumulating capital for investment. Our economy is sustained not only by machines, techniques and managerial edicts. Its strength lies in the willing support of the community and especially of the workers. […] The character of the labor economy as a servant of the community must be reflected in better service and lower prices."[32]

One clear example of this principle was the way the organization's profits were used. Rather than distributed to shareholders as dividends, all surpluses earned by its enterprises, in accordance with the Histadrut's Constitution, were ploughed back as new investment (Aharoni, 1991, p. 184; Bridger, 1961, pp. 18-19; Kleiman, 1964, p. 20). As Solel-Boneh's notorious Director General, Hillel Dan, noted: "The differences between us and the private businessmen were in the matter of profits […] we regarded each penny as a mean for further expansion" (quoted in: Kleiman, 1964, p. 21). As a consequence, in this period labor-owned enterprises were more capital intensive than private ones (Aharoni, 1991, p. 182) and enjoyed a higher rate of investment.[33] This method of operation was largely responsible for the ongoing advancement of the organization's activities. It not only retained its primacy in the traditional branches of industry but also expanded into more sophisticated, higher value-added industrial branches such as chemicals, pharmaceuticals,

[32] *Labor in Israel Newsletter (hereafter LIN)*, Vol. V. 10, October 1957, p. 2.

[33] *LIN*, Vol. VI 1, January 1958, p. 3.

electronics, rubber and plastics, machinery and equipment (Daniel, 1976, p. 171). As we will see in chapter 2, this placed Labor in an advantageous position when the state embarked on its technological upgrading campaign in the 1970s.

Fostering domestic competition as a means of generating state discipline

How, then, did the state take advantage of its ties to labor to generate disciplinary capacity? To effectively implement its industrial strategy, in this period senior officials within MOTI worked to generate domestic competition between the labor-owned and private industries. Evidence for this can be found, first, in the rhetoric mobilized by the top officials of MOTI. They repeatedly gestured to the fact that both labor and private industry would have to compete for state subsidies and that neither sector would be favored by the government. In a special issue of *Israel's Economic Bulletin* dedicated to introducing the state's new Investment Law, Dr. Gruenbaum, the first Managing Director of the Investment Center, stressed that the principle of sectoral competition would guide the center:

> "We work with the conviction that the enterprises of cooperative and trade unions, as well as private enterprises can operate in full equality and in *healthy competition* for the upbuilding of this country. We would consider the elimination of either of these factors by the other to be disastrous. […] We are further of the opinion that monopolies and claims for exclusive rights can have no place in a pioneering country such as ours."[34]

This logic was later reaffirmed by Grenbaum's replacement, David Stern, who in 1955 stressed his agency "does not discriminate between […] economic sectors, whether private, collective-

[34] "Investment Policy", *IEB* special Issue: The Law for the Encouragement of Capital Investment, January 1951, p.5, emphasis by author.

cooperative, or a combination of the two."[35] The principle of sectoral competition remained central as late as 1965, and was referred to on a number of occasions and in front of various audiences. Speaking at the MAPAI party convention in 1963, Sapir underlined that the dual existence of the private and labor sectors should be regarded as an advantage because it "forces the local economy to be in a state of constant alertness and *healthy competition*".[36] This principle was stressed repeatedly in speeches given by Sapir in this period, including at the annual meeting of the MIA in April 1965.[37]

Far from just rhetoric, effective competition between the two rival sectors was indeed realized in a number of key sectors. One example was in the field of tire manufacturing where two large production firms, the privately owned *Samson* and the labor owned *Alliance Tire and Rubber Co.*, competed over the domestic market and beyond.[38] Both firms were awarded the benefits of the Investment Law in the early 1950s,[39] and by 1962 were producing on par with international standards, supplying all local demand and exporting 70 percent of their total output to nearly 50 countries.[40]

Another indication of the ongoing competition between the private and the labor-owned

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[35] *IEB* Vol. VII, 4, May 1955 p. 9.

[36] Speech by Minister Sapir at the 9th convention, MAPAI, October 16th 1963, emphasis by author.

[37] Speech by Minister Sapir at the Annual Meeting of the MAI, April 7th, 1965, p.5. Also see speech by Minister Sapir, 1966, ISA/G/6969/6.

[38] *IEB* Vol. V, 1-2, October-November 1952, p. 13.

[39] *Approved enterprises in accordance to the Law of encouragement of investment as of December 31st, 1958.* Jerusalem, February 1959, p. 11 (see items 2 and 11).

[40] *Israel's Annual Government Report*, 1959, p. 246; "The March of Industry", *the Israel Export and Trade Journal*, Vol. XV, 3, March 1963, p. 40.

industry is that both their respected leaderships repeatedly voiced concerns over what they viewed as unfair discrimination and preferential treatment of the rival sector (Kalman, 2013, pp. 25-38, 59-69). For example, a speech made at the 1957 annual meeting of the MAI emphasized the widespread belief among members of the organization according to which: "the labor sector is being prioritized in the allotment of long term state loans for development while the private industry is being discriminated against."[41] In reality, however, both sectors enjoyed a share of state subsidies more or less equal to their relative size in the economy. Between 1954 and 1956, private industry received over 70 percent of development budget loans while the labor industry received about 20 percent.[42] A similar distribution applied to the Investment Law. As an internal document of the Investment Center shows, between 1950 and 1956, 91 percent of approved enterprises originated from the private sector, with the remaining 9 percent belonging to the labor-owned industry.[43] Responding to the complaints originating from the leaderships of both sectors, Minster Sapir remarked that:

> "It is not the task of the Government to protect vested interests. When a third cement works and a second tire factory were established [by the Histadrut], the Government was much criticized for encouraging overproduction, favoring one economic sector to the detriment of the other, etc. Today, all these enterprises work at full capacity, exporting a large part of their output; and although belonging to different economic sectors, they function side by side without serious friction."[44]

The state's efforts to encourage the private sector and the Histadrut industry in tandem, was

[41]"Credit policy for Industry", a speech made at the 1957 annual meeting of the MAI, *Hataassiya Monthly Review* (HMR), January 1957.

[42] "Credit policy for Industry", a speech made at the 1957 annual meeting of the MAI, *HMR* January 1957.

[43] Investment Center, the Ministry of Trade and Industry, Meeting minutes, July 30th, 1957, p, 2; ISA/G/4553/8. Similar statistics were published in *IEB* Vol. VII 4, May 1955, p. 9.

[44] *Israel's Annual Government Report*, 1960, p. 222.

also recognized by outside observers. For example, in June of 1958 representatives of the U.S. International Cooperation Administration (ICA) reported:

> "Our team […] probed deeply into the many stories and charges that the climate in Israel was not favorable to the growth of private industry, that the Government […] favored the cooperatives and the Histadrut – trade union owned – enterprises, and that those activities had unfair advantages over private initiative […]. Our probe did not support any of these contentions. We found on the contrary a genuine and active desire […] that private enterprise expand as fast possible to carry as much of the burden of developing the national economy and of providing jobs. The incentives given to private industry were of substantial character and the whole emphasis was on industrial development."[45]

As demonstrates, the existence of the labor-owned industrial sector provided the state with an alternative investment outlet which it leveraged in order to counteract the structural power normally enjoyed by business. This was carried out by fostering domestic competition among Israel's rival industrial sectors which, in turn, produced the disciplinary capacity necessary in order to implement the state's developmental agenda.

DISIPLINARY CAPACITY IN ACTION

We have seen how MOTI's embeddedness with both private and the labor-owned industries was the source of its disciplinary capacity. However, it remains to be shown how this capacity facilitated the development of Israel's industry. In this section I will demonstrate that with its disciplinary capacity secure, MOTI devised and implemented an ambitious and novel industrial strategy: they aimed to *intentionally create industrial overcapacity*. This strategy, advanced despite clear opposition on the part of private industry, was intended to overcome the trends towards monopolization and lack of productive investment often associated with an ISI

[45] "The Importance of Private American Investment in Israel", International Cooperation Administration (ICA), US Operations Mission to Israel, June 17th, 1958. RG 468, P305 Box24, National Archives at College Park, College Park, MD.

development strategy, the main parameters of which I outline in detail below.

Pursing overcapacity: overcoming the pitfalls of the ISI development

One of the reasons that makes Israel such a surprising developmental success case is the fact it was able to produce discipline in the context of an ISI developmental strategy. To fully understand why that is so requires a brief elaboration on the basic tenants of ISI development, the core principles of which are twofold. Like any industrial policy it entails providing domestic firms with public subsidies aimed to incentivize investment in risky, yet highly productive sectors. Additionally, in order to provide local manufactures with time to upgrade their capabilities and 'catch-up' to international standards, firms are often protected from foreign competition through a variety of import barriers. Herein rests the weakness of ISI development. By neutralizing external competition, ISI development weakens market pressures that induce productive investment (Barkey, 1989, pp. 292-293; Chibber, 2003, pp. 38-39). This, in turn, often leads to monopolization, as first movers into targeted sectors use state subsidies in order to dominate them. Once such control is realized firms are able to determine prices and avoid productivity enhancing investment. With state discipline being the only substitute for market competition, the incentives of local industrialists to resist the creation of such capacity are significantly heightened.

This prediction is borne out by the empirical record of ISI in places like Argentina (Sikkink, 1991 Chapter 3), Mexico (Hamilton, 2014 Chapter 6), India (Chibber, 2003 Chapter 6), Syria (Walder, 1995 Chapter 5), and Turkey (Barkey, 1989). In all these cases industrial elites mobilized against the state's attempt to construct the institutions through which discipline could be exerted. This elaboration is in no way meant to imply that generating disciplinary capacity in the context of ISI is impossible, but rather that doing so should be viewed as a considerable challenge.

How did Israel succeed despite these structural constraints? As outlined above, under ISI, private actors often take advantage of protection from international competition to bolster their own monopoly position in ways that diminish long-term productivity growth. Israel's state managers were well aware of these undesirable tendencies. For example, in an article published in *Israel's Economic Bulletin*, Michael Tzur – the Director General of MOTI – explained:

> "One deterrent to improving efficiency has been the policy of protecting our young industry by banning many competitive imports. This has provided little incentive to rationalize production and has resulted in the formation of cartels and in other monopolization trends."[46]

In other developing economies that pursued an ISI strategy, this lack of competitive pressures was often exacerbated as state planners intentionally limited the number of producers in each sector for fear that over-investment would create idle capacity. In states that implemented export-led strategies, development agencies were also weary of excessive capital investment, albeit for different reasons. Since they were concerned mainly with performance in international markets, these states' main preference was to foster economies of scale so as to improve the competitiveness of their 'national champions'. For example, this was the case in Japan, where MITI legalized cartelization and used other policy instruments to actively encourage mergers between leading firms in key industries (Okimoto, 1989, pp. 25, 38-39; World-Bank, 1993, pp. 96, 101). As a result, the number of legal cartels in Japan rose from 162 in 1955 to around 1,000 in the late 1960s (Okimoto, 1989, p. 7).

Israel's state planners were able to avoid the negative outcomes of ISI by following the opposite logic: rather than limit the number of producers in each sector, they actively pursued excess capacity. Through their control over investment capital and their capacity to discipline

[46] *IEB* Vol. X, 5, July 1959 p. 8.

unproductive firms, state managers created dynamic competition within the domestic economy which replicated the function typically served by the "natural" forces of international competition. As a result, domestic enterprises were compelled to enhance production and efficiency, as well as work to expand their export capabilities in the goal of offloading excess production which the local market could not absorb. This logic was clearly outlined by Tzur in an address made at the Textile Technician Association's annual meeting:

> "As long as the domestic market – which is protected from external competition – has not reached full saturation, it will exist with lack of competition and the necessary pressure to increase efficiency, to improve production, and to lower prices. We will only be able to achieve exports once we are able to create over capacity. "[47]

The policy's declared goal, to "weed out the inefficient producer and the incompetitive (*sic*) exporter", was shared with both business and labor on numerous occasions.[48] It remained atop the agency's agenda as late as 1965 when it was emphasized in the state's five year plan for 1965-1970 (Ministry of Trade & Industry, 1964, p. 41).

As was expected, this strategy was far from embraced by private employers. Industrialists quickly realized that, if implemented, such a policy was likely to produce competitive pressures that would coerce them to make undesired investments and potentially drive the least competitive firms out of business. As early as 1956, MAI chairman Arie Shenkar petitioned MOTI to have a decisive say in the approval of new industrial plants. Shenkar was alarmed not only by what he viewed to be an unacceptable overreach on the part of the state but, more importantly, with its ability to use instruments like the Investment Law or the Development Budget to install new industrial capacity that would compete with existing firms: "[I ask you] not to ignore the facts and

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[47] "The role of textile sector in production and export", *Yalkut,* Dec. 1958-Jan. 1959, p. 31.

[48] "Editorial Notes", *the Israel Export and Trade Journal*, Vol. X, 10, Oct. 1958, p. 3; "On our export development policy", M. Tzur, *HMR,* January 1959, p. 6.

give up on the pipe dream to establish new industries without limits," he wrote Minister Sapir, "otherwise this reality will suffocate us."[49] Similar concerns were raised three years later when Shenkar once again protested the Government's active encouragement of overcapacity:

> "For some reason, the Government encourages the foundation of new plants in any way possible while completely ignoring the alternative of increasing production in already existing firms which would require a much smaller investment. MOTI hastily approves the installation of new plants that […] create enormous difficulties for existing manufactures […] *the industrialists reject this policy of encouraging new factories in cases where similar plants already exists* […] as a result of excess enthusiasm and blind faith" (quoted in: Raviv, 1991, pp. 104-105, emphasis by author).

Such harsh criticism, however, did not cause state planners to veer from their original plans. Whereas similar threats in other contexts would normally constrain government action, in Israel, the existence of an alternative investment outlet in the form of the development oriented Histadrut allowed the state to override business opposition and pursuit polices unfavorable to private industry.

As a result, by the early 1960s overcapacity became a fact in numerous industries. One example of where this strategy proved effective was in textiles which, at the time, was Israel's most important industrial sector. By 1958 cotton spinners were able, for the first time, to supply the needs of the domestic market, and by 1961 the output of the industry doubled that of local consumption. Between 1958 and 1968 production of textiles and clothing grew six-folds becoming Israel's most important manufactured export commodity (Levi-Faur, 1998, p. 77). In 1964 many producers of cotton threads were exporting as much as 60 to 70 percent of their annual production

[49] Letter from Shenkar to Minster Sapir, quoted in (Greenberg, 2011, p. 113)

to places such as the U.S, Iran, Germany and the Scandinavian countries.[50] Similar results were achieved in tire manufacturing (discussed above) and the plywood industry where five manufacturing firms produced for the domestic market while also exporting to 24 countries, including the U.S and Canada, Scandinavia and various South American countries.[51] Remarks made by Mordecai Vecht, a member of the MAI's Executive Committee and the Managing Director of *Kitan* – one of Israel's largest cotton manufacturing plants – demonstrate that leaders in the private sector were well aware that overproduction was driving internal competition and preventing producers from raising prices:

> "I think the largest burden on most industrial sectors (if not all) is the existing excess of production capacity […] the overstocked warehouses force manufacturers to compete with one another in the domestic market. It is this competition which caused the local price of textile products to remain constant in 1959."[52]

This analysis of Israel's successful attempt to produce overcapacity in industry is important for two reasons. First, it illuminates how the state's disciplinary capacity enabled state managers to overcome the resistance of business to the state's pursuit of overcapacity. Second, it rules out an alternative reading of the evidence in which state discipline is not imposed, but rather accepted by the private sector due to a convergence of interests. One version of this argument previous advanced in the literature on Israel was that such convergence existed in Israel on the basis of a shared "nationalist ideology" (Levi-Faur, 1996, 2001). However, as demonstrated above, private manufacturers in Israel not only recognized the costs that overcapacity would inflict upon them

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[50] "Our cotton threads enjoy a good reputation and an expanding market", D. Vidman, chairman of the Sharon Textile factory, *HMR*, January 1964, p. 6; "The Top Exporting Industries", *the Israel Export and Trade Journal*, Vol. XVI, 3, March 1964, p. 38.

[51] "The Top Exporting Industries", *the Israel Export and Trade Journal*, Vol. XVI, 3, March 1964, p. 38.

[52] "What is Burdening Industry?" M. Vecht, *HMR*, Oct.-Nov. 1964, p. 3.

but openly opposed this strategy – albeit unsuccessfully. Overriding business's objections, therefore, can only be understood as a result of the state's disciplinary capacity, which permitted state managers to advance their development strategies in the face of clear opposition on the part of private industry.

CONCLUSION

In this chapter we saw that the disciplinary capacities of Israel's state managers, coupled with the state's over-capacity competitive model, proved effective in attaining the primary goal of the state's industrialization program. Like every other developmental state, however, Israel also faced constraints that limited how far it could assert its will vis-à-vis organized economic interests. One noteworthy example was the failed attempt to liberalize trade in the context of the New Economic Policy of 1962. Intended to stem the chronic problems of inflation and trade deficit this initiative called for the systematic removal of trade protections which hitherto shielded local manufactures from the harsh realities of international competition (Halevi et al., 1991, pp. 79-83). However, the plan's implementation was largely prevented by a coalition of representatives from both private and labor-owned industries. Both sectors understood the implications that such a decree would entail and mobilized effectively to curtail its implementation (Mandelkern, 2016, pp. 52-54; Raviv, 1991, pp. 123-124).

In many respects, this episode was a sign of things to come. Paradoxically, it was the *success* of Israel's industrial strategy in the 1950s and 1960s which undermined the state's capacities. This ensued as the political and economic forces – from both the private and publicly-owned industrial sectors – which the developmental state created and nurtured began challenging the state's autonomy and undermining its institutional foundations. As a result, by the 1970s the

state's developmental agencies found it increasingly difficult to regulate resource allocation and manage the economy. Established manufactures deployed their growing economic and political power to appropriate ever-increasing claims on public resources and absorbed capital subsidies without fulfilling their economic obligations (Shalev, 1992, p. 294; Silver, 1990, p. 172, also see Table 4 above).

This phenomenon, however, was not unique to Israel. Other successful developmental states exhibited a similar pattern. In Korea, for example, the growing power of business – the result of three decades of highly successful developmental state policies – considerably hampered the government's ability to continue acting as an effective counterweight to private industry. In the absence of such abilities, business began exhibiting a growing tendency toward rent-seeking behavior, culminating most famously in the Asian crisis of 1997 (Chang, 1998; Haggard & Mo, 2000).

Another limitation of Israel's developmental model, one which pertains more generally to the nature of its particular ISI strategy, was its relative weakness in fostering large business conglomerates that can become global leaders in competitive export markets. Whereas East Asian enterprises the likes of Samsung, LG, Toyota and Kawasaki Heavy Industries (to name only a few examples) were able to first reach and then surpass foreign leaders in terms of productivity, quality, price, and market share, few of the Israeli enterprises nurtured during the state's first decades became leading global players.

This outcome can be explained by considering the main difference between the East Asian model and Israel's over-capacity strategy. In places like Japan or Korea, state planners focused on export competition. As a result, policymakers in these countries oriented their efforts to rationalizing production and creating economies of scale. Israel's overcapacity model, on the other

hand, prioritized domestic competition and therefore encouraged multiple domestic firms to compete within similar sectors. Although Israel's rate of export expansion in this period was far from negligible (see Table 2 above), its development strategy placed its domestic firms at an obvious disadvantage when it came to competing in international markets.

As Israel's trade deficit became a growing concern, state planners became more aware of this limitation. As a result, towards the end of the 1960s Israel started to slowly shift away from its ISI overcapacity model. In 1969, in the goal of increasing domestic firms' export competitiveness, MOTI advanced a series of policies reforms and legislation that encouraged economics of scale. This reversal jump-started a decade-long process of economic consolidation via a wave of mergers and acquisitions that created Israel's own chaebol-like business groups: the labor-owned Koor and Hapoalim (both later privatized), the state-owned Leumi, and the privately owned Call, the Israel Corporation and IDB. (Maman, 2002, pp. 129, 134-143; 2008).

Also, in this period the initial steps towards the development of a technologically advanced industry were taken. In 1966, Prime Minster Levi Eshkol convened the Katchalski Committee which was charged with the task of examining the organization of government supported research. In 1969 the committee published its report which lamented Israel's lack of civilian industrial research and urged the government to spur civilian R&D activities by creating an official position of a chief scientist in each of the country's main ministries. The committee's recommendations resulted not only in the establishment of offices of the chief scientist in all of its major ministries, including MOTI, it was also responsible for advancing a new consensus according to which Israel's economic future depended on the creation of science-based industries (Breznitz, 2007b,

pp. 52-53).[53] This point was emphasized by Pinchas Sapir, by then the Minister of Finance, who in 1972 stressed that "the advancement of Israeli industry and its ability to compete in global markets depends in large part in the development of industrial R&D capacities"[54] Just like he had done with the establishment of Israel's traditional industries, it was Sapir who, in the twilight of his political career, took the first steps towards shifting industry in the direction of becoming a knowledge-based economy.[55]

Despite these efforts, Israel's economic hardships persisted well into the late 1970s. They were resolved only after Israel was able to fully shift its developmental regime and pursuit a full-fledged export-led development strategy which reoriented the economy around the production and export of knowledge-based, innovative products. The following two chapters will detail and explain how this process unfolded.

[53] Tzvi Lavie, "A Recommendation to Establish a National Authority of Research, the Katchalski Committee Submitted its Report to the Prime Minister", *Ma'ariv* (April 22nd, 1969).

[54] An Industrial Research Authority, *Davar* (January 28th, 1972).

[55] Author interview with Rina Pridor, January 2018.

CHAPTER 2:

The Institutional Logic of Israel's R&D-Based Developmental Model

In the previous chapter, we saw how Israel's developmental state served as the catalyst of the country's economic growth and development in its first decades. In the following two chapters we shift to an analysis of the rise of Israel's innovation-based economy and its dynamic high-tech sector, starting in the mid-1970s. Our investigation will focus on addressing the following question: how were Israel's policymakers able to overcome the challenges of innovation-led development? As we elaborated in the dissertation's introduction, this required overcoming a dual challenge: on the one hand, pushing industry to move up the value chain by shifting investments from traditional to knowledge-based industries while, on the other hand, guaranteeing that the benefits of an innovation economy are not appropriated by private actors but shared more broadly within society. In this chapter, we begin by explaining how Israel's policymakers overcame the policy challenge, or what can be called— getting the *policies right.* In chapter 4 we turn to an analysis of the political barriers, or what can be called— getting the *politics* right.

Standing at the center of our historical investigation is Israel's OCS— a "Schumpeterian developmental agency" that was established within MOTI following the recommendation of the Katchalski Committee discussed as the end of chapter 1 (Breznitz & Ornston, 2013). As we will see, it was the OCS and the MOTI which developed and implemented the innovation polices that promoted the growth of Israel's high-tech industry. After outlining the most central of these various policy programs my analysis will demonstrate that the effectiveness of these policies can be traced back to the central pillar of Israel's innovation policies: ensuring the domestic commercialization of state-funded R&D. While private firms enjoyed full ownership rights over knowledge that

resulted from state-funded R&D, their control over the intellectual property (IP) was limited is several key ways. Firstly, recipients of R&D subsidies that were successful in developing innovative products were obligated to manufacture them locally. Secondly, such firms were prohibited from transferring (i.e. selling) their IP to firms operating beyond Israel's borders. To enforce these obligations, the OCS developed institutional mechanisms by which it was able to exert effective discipline over disobedient firms. This capacity worked to contain the realization of successful R&D within the domestic economy and led numerous indigenous startups, as well as local subsidiaries of Multinational Corporations (MNCs), to scale up in Israel. By ensuring supported firms continued operating locally, state planners were able to guarantee that public investment in R&D would produce numerous public rewards, including: good manufacturing jobs, stable tax income, high value-added exports, skills and new knowledge that fostered future innovations.

THE ORIGINS OF ISRAEL'S R&D-BASED DEVELOPMENT MODEL

Israel's advanced technological infrastructure

As we saw at the end of chapter 1, by the mid-1970s Israel was dealing with intensifying economic problems that included economic stagnation and a balance of payment deficit that was projected to reach $3.5 billion. Recognizing the limited potential for further growth of traditional industrial sectors – mainly textiles and clothing – along with the risks of an economy dependent on the export of one or two basic products, state planners at MOTI argued Israel's economy was in "urgent need" of "rapid technological development" requiring "an accelerated effort in the field of industrial R&D". As a result, it was in this period that industrial R&D first became a "high-priority national goal". Fully aware of the limited size of Israel's industrial firms, both in annual

turnover and manpower, as well as the inherent risk of investment in R&D, state planners also noted that "industrial R&D in Israel will not be able to develop fully without massive government aid".[56]

The decision to target civilian R&D as a means for jump-starting economic growth and narrowing the state's chronic trade imbalance would not have been possible without Israel's relatively advanced research infrastructure, and highly skilled workforce. Thanks to efforts taken by policymakers in previous decades, by the mid-1970s Israel already possessed one of the highest ratios of scientists and engineers to total population in the world – 40 per 10,000 – almost on par with that of the United States (Teubal, 1993, p. 483). Yet, the vast majority of this skilled workforce was confined to Israel's public research universities and its security sector, both of which were producing very limited spillovers into civilian industries.[57] Israeli universities did try to promote research commercialization, setting up subsidiary technology transfer firms a full decade before the United States. Up until the 1990s, however, only a small number of scientists actively engaged in commercial activities, and academic commercialization remained "low-key, hesitant, and modest" mostly on the margins of universities' operation (A. Sapir & Kameo, 2019, p. 57).

The bottlenecks were even narrower in the case of Israel's security sector. The R&D capacities of the state's military and defense industries were already highly advanced by the mid-

[56] "Industrial Research and Development Background and Policy", August 1975, pp. 3-12, ISA/N/217/2; Also see: "Goals for the Development of Industry in Israel 1975-1985", MOTI's center for industrial planning, September 1977 (Brender-Moss Library for Social Sciences, Management and Education, Tel Aviv University).

[57] In the mid-1970s, almost 60 percent of all civilian R&D was performed at public universities, while the figures for all other countries ranged between 8 percent (UK) and 33 percent (Norway). Correspondingly, the share of R&D being performed in industry was very low - 22 percent - compared to the next in rank – 51 percent for Norway (Teubal, 1993, p. 484)

1970s, in large part the result of the Israeli government's highly risk-averse defense technology policy. Following a French embargo on the sale of arms during the War of 1967, Israel aimed to achieve independent local capacity for defense R&D and production, a policy that led to an extraordinary rise in defense expenditures and enabled the security sector to absorb a large share of the country's trained scientists, engineers and technicians (Dvir & Tishler, 2000, p. 34; Vekstein & Mehrez, 1997, pp. 47-48). In the 1970s military R&D accounted for 30 to 40 percent of total government expenditure on R&D. The number of employees in the defense industry tripled between 1967 and 1975, and increased by a further 50 percent between 1975 and 1985 so that by the mid-1980s, the entire defense industry employed about 60 thousand people (compared to 5,000 in the 1950s). But publicly funded technologies and capabilities developed through military R&D rarely found their way into civilian industries, while commercialization of defense technologies by security firms was chiefly viewed as a failure. Technology transfer across the boundaries of the military industry was limited to the private initiative of individual entrepreneurs who left defense firms or technological army units with the knowledge, and often proven prototypes, to start their own businesses (Dvir & Tishler, 2000, p. 38; Vekstein, 1999, p. 54). In short, although state managers initially hoped that state support of military industries would produce spontaneous spinoffs, in practice the security sector had a "crowding out" effect that dampened the growth of the civilian high-tech economy (Teubal, 1993, p. 485). Therefore, while there is no doubt that Israel's technological infrastructure and skilled workforce were essential components in the development of the state's technological edge, they alone cannot account for the success of Israel's technological industry.[58]

[58] Counter to Linda Weiss's argument regarding the American National Security State (NSS), where industrial and technology policies are sustainable only because of the "commercial activism of […] national security agencies," most of Israel's key innovation policies were

By the 1980s, the fact that these bottlenecks were impeding the development of a technologically advanced civilian industry, and economic development more generally, was acknowledged by various public committees and planning agencies. For example, in 1984 a government committee appointed to examine the management of government financed R&D emphasized the lack of institutional mechanisms for defense conversion and emphasized the need for a "coordinated national technology policy" and "active and unconventional" government involvement.[59] It was at this point that policymakers first began to pursue a national science and technology policy that aimed to overcome the existing bottlenecks by rapidly rechanneling public resources and mobilizing private investment in civil industries.

The formation of Israel's innovation policy

Charged with the task of accelerating investment in non-military R&D was the newly created OCS. Housed within MOTI, this agency was responsible for initiating a myriad of innovative risk-sharing programs that supplied public funding for cutting edge industrial R&D in a variety of science-based industries. The OCS's flagship program was the R&D Grants Program, initiated in 1968, which offered early stage funding in the form of matching grants for the development of an innovative, export-targeted industrial product or process. While firms were requested to fund at least 50 percent of the R&D costs, making sure they had "skin in the game", only firms that produced successful projects (i.e. those that led to sales) were required to repay the

orchestrated by a civilian innovation agency oriented towards the advancement of economic imperatives (Weiss, 2014, p. 7; and more recently:Weiss & Thurbon, 2020, pp. 8-13).

[59] "Summary of recommendations by the Yiftach committee for the organization and management of government research", Ministry of Science and Development, August 1984, ISA/GL/18079/7, p. 156-159. Also see: (Brodet, 1984, p. 888)

original state grant in the form of royalties (usually 3-5 percent of annual sales), capped to the dollar-linked amount of the original grant.

This funding scheme had two inherent advantages. For one, the fact that repayments were conditioned upon actual success lowered the risk associated with the necessary investment, thereby significantly lowering barriers to entry. Secondly, royalty payments functioned as a profit-sharing mechanism that ensured rewards would be shared with the public. Since these royalties were earmarked for the OCS, future earnings increased the agency's budget. This proved essential in the 1990s when the OCS's continued to function effectively despite having its budget capped, due to the exponential growth of repayments made by successful firms. Indeed, in this period paybacks increased from a mere $8 million in 1988 to $139 million in 1999 (Trajtenberg, 2001, p. 416, see Table 7 below). Throughout the 1970s, the R&D program grew in both impact and resources, and in 1984 was consolidated with the Encouragement of Industrial Research and Development Law (hereafter R&D Law), which has defined the parameters of government policy towards industrial R&D ever since and will be analyzed in detail below (Avnimelech & Teubal, 2008, p. 157; Breznitz, 2007a, p. 1471).

Table 7: The OCS Budget 1988-2000 (in $ million)

	(1)	(2)	(3)	(4)	(5)	(6)
Year	R&D Grants	Paybacks	Paybacks/Grants	Net Grants*	Magnet	Incubators
1988	120	8	0.07	112	-	-
1989	125	10	0.08	115	-	-
1990	136	14	0.10	122	-	-
1991	179	20	0.11	159	0.3	3.6
1992	199	25	0.13	174	3.7	16
1993	231	33	0.14	198	4.6	23
1994	316	42	0.13	274	10	28
1995	346	56	0.16	290	15	31
1996	348	79	0.23	269	36	30
1997	397	102	0.26	295	53	30
1998	400	117	0.29	283	61	30
1999	428	139	0.32	289	*60*	*30*
2000**	*395*	*128*	*0.32*	*267*	*70*	*30*

* R&D Grants minus Paybacks. ** Estimates

Source: (Trajtenberg, 2001, pp. 416, table 412).[60]

[60] For reasons of estimation, figures here appear in current and not in constant $s.

In addition to the Grants Program, the OCS provided further financial and institutional support through the formation of binational industrial R&D programs. The largest of these was the Binational Industrial R&D (BIRD) Foundation, which supported joint ventures between Israeli and American firms. In addition to subsidizing R&D in a way similar to standard OCS R&D grants, these programs facilitated technological transfers from foreign companies to the domestic economy, helped open up key export markets for Israeli tech firms and provided much needed mentoring in both business management and product design, skills that were highly lacking in the industry's first decades (Breznitz, 2007b, pp. 57-62; Trajtenberg, 2001, p. 416).[61] In the early 1990s the OCS created two additional channels to provide institutional support for R&D activities. The first was the Technological Infrastructure (MAGNET) Program,[62] which supported the formation of an R&D consortium that included both tech firms and academic institutions. The second was a Technological Incubators Program that offered both resources and institutional support for novice entrepreneurs, including many recent immigrants from the former Soviet Union, looking for an opportunity to translate their innovative ideas into commercial products. These programs not only encouraged the development of generic, precompetitive technologies, but also helped foster university-industry collaboration and forged new technological and business networks (Breznitz, 2007b, pp. 78-83; Trajtenberg, 2001, pp. 413-415).

Finally, it should be stressed that since the early 1980s, this increasing public investment in the civilian technology sector was accompanied by dramatic cutbacks in domestic defensive purchases. Defense purchases as a share of GDP dropped from 9.1 percent of GDP in 1982 to 6.1

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[61] Additional bi-national R&D programs were signed with Canada, Singapore, South Korea, and the UK.

[62] MAGNET was the Hebrew acronym of this program.

percent in 1987, and then to 3.5 percent by 1995. Made possible largely by the de-escalation of regional conflict following the signing of the Israel-Egypt peace treaty in 1979, such cutbacks were advanced, first and foremost, in response to Israel's worsening economic difficulties, described above. Yet economic state managers also supported these measures because they viewed them as a necessary step in the advancement of a *civilian* high-tech economy.[63] As a result, by 1994, "military equipment" accounted for just 8 percent of government R&D subsidies (down from 26 percent in 1988), whereas "electronics, and communications" and "programing and software" combined to represent the highest proportion of subsidies, at 48 percent (up from 19 percent in 1988) (Justman & Zuscovitch, 2002, p. 194, see Table 8 below). As one of the economists who produced these figures concluded, "Israel's high-tech revolution was in large measure a shift of economic resources from a technologically advanced but commercially unprofitable defense sector to civilian manufacturing based on similar technologies" (Justman, 2002, p. 447).

Table 8: Distribution of subsidies as percentage, by year and industrial sector.

	1987	1988	1989	1990	1991	1992	1993	1994
Automation and control	25	22	22	22	22	16	17	19
Programming and software	5	7	7	7	8	7	7	9
Medical industries	16	13	15	15	16	13	13	13
Electronics and communications	14	15	19	22	27	40	42	39
Chemicals and materials	5	8	9	7	8	6	6	6
Military equipment	25	26	16	18	14	14	11	8
'Other industries'	8	8	11	9	5	4	4	6
total	100	100	100	100	100	100	100	100

Source: (Justman & Zuscovitch, 2002, p. 194)

The cuts in military spending resulted in the termination of hundreds of military projects, most famously the discontinuing of Israel's Lavie fighter-jet development program in 1987. In

[63] Author's interview with Aaron Fogel, December 2019.

many ways, the Lavie Program was reminiscent of the Apollo Program's 'man on the moon' mission, wherein NASA's mission-oriented programs, driven by security concerns and by the need to maintain technical leadership over other nations, directly financed technological innovation, and oversaw private-sector companies that were contracted to deliver the needed technologies (Robinson & Mazzucato, 2019, p. 940). The termination of the Lavie program, due mainly to financial concerns, had numerous positive benefits. Tens of thousands of skilled workers were released into the labor market and quickly absorbed by the emerging civilian high-tech sector.[64] The transfer of human capital from the security sector to the private sector also served as an informal mechanism of technological transfer. Aided by R&D grants from the OCS, entrepreneurs could now convert high level, defense-related R&D into profitable civilian products, mostly in electronics, aviation, electro-optics and computers (Dvir & Tishler, 2000, pp. 37-38). Finally, the government cutbacks in defense spending sent a clear message to the military industry – which previously enjoyed lucrative cost-plus government contracts on largescale projects – regarding the state's changing economic priorities. As a result, many key figures in the business elite began looking for new, more outward-looking investment outlets beyond the security sector (Justman, 2002, pp. 446-449; Shalev, 1998, pp. 127, 133) .

Israel's high-tech sector received another boost following the unexpected end of the cold war, which marked the beginning of mass immigration of Jews from the Former Soviet Union (FSU) to Israel. A total of 711 thousand immigrants arrived between 1990 and the end of 1997, which increased Israel's population by a staggering 7.6 percent. One key characteristic of this wave of migration was the immigrants' exceptionally high level of education (Eckstein & Weiss, 2002,

[64] Overall employment in the Defense sector's largest firms dropped by more than 40 percent, from 70,400 in 1985 to 38,200 in 1996: (Justman, 2002, pp. 446-449; also see: Rivlin, 1992, p. 46)

p. 352). This served a boon for the tech industry as it supplied it with an additional source of highly skilled, yet inexpensive workforce. About 82,000 Soviet-trained engineers and technologists arrived during the 1990s, so that by the end of the decade over 40 per cent of the employees of Israeli high-tech companies were immigrants for the FSU (Remennick, 2003, p. 705).

As a result of all these factors, starting in the mid-1970s, Israel experienced a remarkable increase in the rate of high-tech exports, from a mere $422 million in 1969 (in 1987 dollars), to $3,316 million in 1987 (Trajtenberg, 2001, p. 411). By the end of the 1990s, products of information-communication technologies accounted for 54 percent of Israel's manufactured exports, compared to 28 percent in the late 1980s and only 14 percent in the late 1970s (Avnimelech & Teubal, 2008, p. 154). In fact, Israel was finally able to close its chronic current account deficit because of high-tech exports, and in 2003 it became a net-exporter (Krampf, 2018, p. 217).[65] Notably, these achievements were accompanied with the creation of new high-paying jobs. Between 1995 and 2011, the number of workers employed in high-tech more than doubled, from 98,000 to 215,000.

Over the years, various economic studies have found a direct relationship between the OCS' R&D programs outlined above and these impressive developmental outcomes. One comprehensive econometric study concluded that the OCS R&D fund played a "key role" in the success of Israel's high-tech sector, serving as a primary source of investment capital for Israel's technological entrepreneurs. The study found that 1,200 firms in the years 1987–94, received $1,400 million of subsidies in support of $3,500 million of R&D (in constant 1996 $) and estimated that this R&D generated more than $31 billion of sales, increased industrial employment by about 10 percent, and contributed almost $22,000 million to the balance of trade (Justman & Zuscovitch,

[65] In 2014, the current account surplus of Israel surpassed US$10 billion.

2002, pp. 192, 197). Another study analyzing data between 1972 and 1996 found that industrial R&D expenditures were closely linked (with a reasonable lag) with OCS R&D grants and concluded that these grant programs were "key to the emergence and early success" of Israel's innovation economy (Trajtenberg, 2001, pp. 410, 424).

THE OCS'S INSTITUTIONAL CAPACITY

Scholars called on to explain the reasons for the success of the OCS have often highlighted two key elements. The first is the agency's "neutrality" (Trajtenberg, 2001, p. 430) or "horizontal policies" (Breznitz, 2007a; Teubal, 1997) referring to the OCS's open-ended approach to innovation, which encouraged industrial R&D irrespective of industrial branch or technological field and gave the agency the flexibility to shift funding to different technological sectors. The second element is the agency's principle of risk-sharing. Because the government did not claim an ownership stake in the products it helped create, and because grant repayment via royalties was capped and conditioned upon actual economic success (sales), the OCS significantly lowered risk for private firms who were hesitant to make the initial investment in R&D (Trajtenberg, 2001, p. 434).[66]

Although those two elements were undoubtedly important, I find that an additional, yet underappreciated factor played a crucial role in the organization's success, particularly as it pertained to its ability to retain the benefits of R&D and produce public rewards. This factor was the OCS's capacity to stipulate conditions and limitations on the realization of publicly funded

[66] For more on the role of R&D policy in de-risking private investment in innovation, see: (Lazonick & Mazzucato, 2013; Wong, 2011)

R&D, and then effectively enforce these conditions via discipline. Most important in this regard were requirements that stipulated that (a) all products that emerge out of an OCS-funded project must be manufactured exclusively in Israel, and (b) that the knowledge created during the R&D stage (i.e. the IP) not be transferred beyond the state's borders. Both stipulations existed as early as 1975 and became integral parts of the R&D Law when it was legislated in 1984.[67] These conditions were also incorporated into the standard contract agreement signed between R&D grant recipients and the OCS.[68]

The logic behind these requirements was to ensure that once a state-funded R&D project succeeded, its fruits – the jobs, taxes, exports, as well as any future innovation it spawned – would remain in and benefit the domestic economy. As former Chief Scientist, Dr. Shuki Gleitman, explained at the time:

> "the state of Israel is investing a significant sum of money and is doing it when the risk is at its highest. […] It wants to then reap the economic benefits of this investment. We are not interested in recouping our investment; we want to help nurture an industry that will employ workers."[69]

In other words, although the state permitted grant recipients to patent prototypes without itself asserting any ownership stake, IP rights were limited in ways that aimed to preserve the broad benefits of R&D within the domestic economy. Since the R&D Law became the biding legal framework for all OCS operations, the same conditions applied to almost all other funding schemes

[67] "Industrial Research and Development Background and Policy", August 1975, chapter 4, ISA/N-2/217; "1984 Law for the Encouragement of Industrial R&D", articles 16(B), 19(B)(2), and 19(B)(3).

[68] OCS files for FY1981, ISA/GL/2250/18; OCS files for FY1983, ISA/GL/2273/7.

[69] Meeting 507 of the Knesset Finance Committee May 30th, 1995.

administered by the OCS over the years, including the Technological Incubators Program, and the Technological Infrastructure Consortia outlined above.[70]

To guarantee that the conditions and obligations attached to the R&D Law would not remain a dead letter, starting in the early 1980s Yigal Erlich, former Chief Scientist, initiated a process of institutional building that endowed the agency with capacities necessary to effectively oversee R&D investment, as well as discipline firms that breached the law's stipulations. It was in this period that the OCS set up an in-house unit responsible for oversight of R&D and the collection of royalties.[71] Thereafter, financial and technological representatives from the OCS would visit beneficiary firms in order to inspect progress of funded projects and examine financial records to see whether royalty payments were made accurately.[72] The fact that R&D grants were not distributed piecemeal and in accordance to a prearranged payment scheme, not in advance as one lump sum, allowed the OCS to set benchmarks and then withhold payment when projects did not progress as planned.[73]

Most significantly, however, were the institutional capacities ascribed to the OCS following the legislation of the 1984 R&D Law, which specifically empowered the OCS to

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[70] "MOTI Director General Circular Regarding: The Technological Incubators Program", September 8th, 1994, ISA/GAL/20594.8. Verified in author's interviews with Yossi Smoler, November 2018 and Ilan Peled, November 2018. The one OCS program that was excluded from the domestic manufacturing and IP requirements of the R&D Law was BIRD Foundation. This was largely due to the nature of the program which funded R&D collaborations between Israeli and American firms.

[71] Author's interview with Yigal Erlich, February 2018. Also see: (Erlich, 2018, pp. 53-54, 81-82)

[72] "Incentives for Industrial R&D: a guide for the developing firm," the OCS, November 1983, section3, p. 46. ISA/GAL/21766/7.

[73] Template of OCS R&D Agreement, p. 4, article 4, October 26th, 1983. ISA/GAL/2273/7. Verified in author's interview with Lydia Lazanes, May 2018.

unilaterally withhold or cancel previously awarded funds and even demand full repayment (with interest).[74] In 1995, at the request of the Chief Scientist, a new amendment to the R&D Law classified the unauthorized transfer of state-funded IP beyond the state's borders a criminal offense, punishable by up to three years in prison.[75] Although no case is known in which an individual or firm was prosecuted for such an offense, the law nonetheless gave the OCS a threatening stick to go along with all its various carrots.

Another highly effective mechanism of discipline was the ability of the OCS to withhold or delay all pending or future grant applications from firms that violated the conditions of the R&D Law. Because almost all large and medium tech firms in this period submitted R&D projects to the OCS annually, and because many of them were dependent on continuous state backing of R&D, the threat of delaying or withholding future proposals served as a very effective lever over disobedient firms.[76] At least in some years, the OCS even kept track of such "troublesome firms" and shared this information with other departments within MOTI.[77] It should also be stressed that OCS oversight and discipline were not limited to the initial stages of R&D. Because royalty payments were due on future sales, the R&D Law empowered the OCS to follow-up firms continuously and provided access to their financial records long after the actual R&D was

[74] "1984 Law for the Encouragement of Industrial R&D", article 45(C2-4). Author's interviews with Yigal Erlich, February 2018, Shuki Gleitman, April 2018, and Orna Berry, May 2018 helped verify that such enforcement was indeed carried out when warranted.

[75] The R&D Law, amendment 1 (1995), article 16.

[76] Author's interviews with Yigal Erlich, February 2018 and Ilan Peled, November 2018. Also see: (Erlich, 2018, p. 82) This method of discipline became an official part of the R&D Law only in 2002 but was implemented as early as the mid-1980s, [see 2nd Amendment to the R&D Law, article 45(b)].

[77] "Letter from Chief Scientist Gleitman to directors of the Investment Center and the Marketing Fund, March 26th, 1995, ISA/GAL/20594.8.

complete. Payment of royalties thus became the OCS' main method of oversight. The agency could ensure not only that royalties were paid accurately but, more important, that firms abided by the local manufacturing and IP retainment requirements.[78]

This form of monitoring allowed the OCS to effectively discipline firms that tried to transfer their IP or failed to pay royalties. For example, in October of 1994 the OCS withheld R&D funding from Tadiran – then one of Israel's largest ICT firms – for what it saw as underpayment of royalties.[79] In March of 1995 it intervened in a partnership deal signed between the OCS-funded Telrad and the Canadian firm Nortel (formally Northern Telecom) that included unauthorized transfer of knowledge from the former to the latter.[80] In 2001, the OCS again withheld R&D funds from two of Israel's largest ICT firms, ECI Telecom and Comverse Technology, for disputes over royalty payment.[81]

As intended, such conditions were instrumental in the expansion of Israel's high-tech sector. The case of Given Imaging, which pioneered the capsule endoscopy technology that visualizes and detects abnormalities of the small intestine, is a good illustration of how these requirements conditioned local commercialization. Founded in 1998 by Dr. Gabi Iddan – previously a scientist in the missile division of the state-owned Rafeal Advanced Defense Systems – the start-up received funding of up to $5million through the R&D Law. In 2001, once the R&D was successful and Given Imaging was cleared by the U.S. Food and Drug Administration, the

[78] Author's interviews with Yigal Erlich, February 2018 and Shuki Gleitman, April 2018.

[79] Navit Zomer, "Shuki Development," *Yedioth Ahronoth* (October 18th, 1994).

[80] Navit Zomer, "The Chief Scientist Suspects TelRad Violated the R&D Law," *Yedioth Ahronoth* (March 6th, 1995).

[81] Navit Zomer, "The Chief Scientist Demands Payment of 100 Million NIS in Royalties from ECI," *Yedioth Ahronoth* (July 29th, 2001).

firm sought to begin mass production. The technology required to manufacture the sophisticated capsules, however, did not exist in Israel. Because the R&D Law prohibited the transfer of production abroad, realizing the firm's patented technology required establishing a large production facility in Israel, which Given Imaging did with the help of the American firm Pemstar.[82] By November of 2001 the required manufacturing plant erected in Yokneam Illit[83] was producing 1,400 capsules a month, and was projected to increase production to 80,000 capsules by year's end, directly employing close to a thousand workers in manufacturing.[84]

The key conditions of the R&D Law highlighted above not only compelled domestic firms to scale up their operations locally. A number of MNCs that had opened R&D centers in Israel and received funds through the R&D Law expanded their local operations to include advanced manufacturing.[85] As Breznitz notes, this process was almost the exact opposite process of the usual model for MNCs in emerging economies, in which they first open assembly and manufacturing lines and with time develop more technologically sophisticated operations (Breznitz, 2007a, p. 1468).

An illustrative example is National Semiconductor, an American MNC (currently owned by Texas Instruments), which in 1978 received OCS R&D funding to set up an R&D center in

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[82] Statement by Hannan Caspi of the Israeli Association of Electronic Industries, Meeting minutes of the Knesset's Scientific and Technological R&D Committee meeting number 7, May 20th, 2003. For more, see: Daniel J. Isenberg, "Given Imaging Ltd.—First We Take Manhattan, Then We Take Berlin?" Case 9-808-033, Harvard Business School, 2009.

[83] This northern town was included in one of the Israel's areas of national promotion where additional economic incentives were provided under the same Law for the Encouragement of Investment which was outlined in Chapter 1.

[84] Avi Shmul, "Given Imaging is Erecting a New Plant for the Production of Video Capsules in Yokneam," *Haaretz* (November 15th, 2001).

[85] Author interview with Rina Pridor, January 2018.

Herzliya dedicated to the design of integrated circuits. In 1983, following the successful development of the NS32332 and NS16032 microprocessors, the firm made a $60Million investment (in 1983 dollars) to set up a top of the line wafer fabrication facility in Migdal Ha'emek dedicated to the manufacturing of the microprocessors developed in the firm's design center (Felsenstein, 1997, pp. 373-374).[86]

The American multinational Motorola followed a similar path. Initially, the OCS was hesitant to approve the telecommunication giant's R&D grant requests, fearing it was likely to transfer the production of its most successful products abroad. To overcome this barrier, Elisha Yanay – the former President and General Manager of Motorola Israel – obtained a commitment from the firm's U.S headquarters that products originating out of OCS funded R&D projects would be manufactured exclusively in Israel. This allowed Motorola Israel to comply with the R&D Law and enjoy significant public subsidies which led to the expansion of its local operations.[87]At its peak, 88 percent of Motorola's R&D in Israel was backed by OCS grants. By 2001 Motorola's local branch enjoyed total exports of over $3billion and employed more than 5,000 Israeli workers, 1,200 of them in its manufacturing plant in the peripheral town of Arad.[88]

[86] Yehoshua Porat, "A World Leading Microprocessor Manufacturing Facility Will be Erected in Migdal Ha'emek," *Ma'ariv* (May 15th, 1983); Tamar Guy, "Migdal Silicon Valley," *Ma'ariv* (October 3rd, 1986). This fabrication facility is still active today, currently owned by TowerJazz (formally Tower Semiconductors).

[87] Author's interviews with Yigal Erlich, February 2018, Elisha Yanay, February 2018, and Rami Guzman, May 2018.

[88] Statement by Rami Guzman in the Knesset sub-committee on Scientific R&D and High-Tech, protocol #3882, November 16th, 2001. Confirmed in author's interview with Rami Guzman, May 2018.

These examples are far from unique. Until the mid-1990s, when VC financing first became available in Israel, the OCS served as virtually the only available source of R&D finance (Breznitz, 2007b, p. 60).[89] As a result, the number of firms that received state assistance and were therefore obligated to adhere to the conditions of the R&D Law outlined above was significantly high. One study found that in the years 1990-1995, about 60 percent off all R&D performers received some kind of government subsidy, with grants from the OCS accounting for 87 percent of this support (S. Lach, 2002, pp. 375-376). A follow up study for the years 1997-2005 found similar results, with 56 percent of all firms engaged in R&D receiving OCS funding (S. Lach, Daniel Wasserteil, and Shlomi Parizat, 2008, pp. 39-40). Data concerning earlier years are not available, but interviews with former senior personal from the OCS attest to even higher rates of state supported firms throughout the 1980s.[90]

Table 9: R&D Performers

Year	No. of firms doing R&D	% of firms receiving subsidy	Mean $\frac{\text{subsidy}}{\text{Total R\&D}}$ ratio for firms with subsidy > 0	Mean $\frac{\text{subsidy}}{\text{Private R\&D}}$ ratio
1990	183	59.6	0.31	0.58
1991	194	56.2	0.31	0.63
1992	184	63.0	0.28	0.46
1993	189	59.3	0.27	0.48
1994	185	57.8	0.27	0.57
1995	163	60.1	0.26	0.48
All years	1098	59.3	0.28	0.53

Source: (S. Lach, 2002, p. 376, table II)

[89] Unlike other similar sized economies, MNCs played a limited role in the development of Israel's high-tech sector. In 1987 foreign direct investment was estimated at an annual average of 1-1.5 percent of all industrial investment. Similarly, employment generated by MNCs was estimated at 1 percent of total employment, see: (Felsenstein, 1997, pp. 371-372).

[90] Author's interviews with Yigal Erlich, February 2018, and Ed Mlavsky, March 2018.

Now that we have seen how Israel's state managers were able to address the policy challenge or innovation-led development, in the following chapter we turn, once again, to the political arena. Here we will discuss how Israel was able to address the political barriers involved with the state's innovation-led development strategy.

CHAPTER 3:

The Politics of Israel's R&D Policy

In the previous chapter I demonstrated the central role that conditionality and state discipline played in the success of Israel's thriving innovation economy. But how was the OCS able to amass theses exceptional capacities? In this chapter I argue that fully accounting for the effectiveness of innovation-policies requires looking beyond their specific form and content and paying attention to their institutional origins. More specifically, it entails examining how these institutional capacities were shaped and conditioned by politics, particularly by the emergence of what Doner and Schneider (2016) have recently identified as an "upgrading coalition". I therefore return to the fundamental debate about the role of politics – reflected in the relations between the state's developmental agencies and key societal actors – in development. Doing this, I trace Israel's institutional capacities to a political coalition that was established by the OCS and included an emerging cohort of domestic elites whose economic interests aligned with the developmental priorities of the state. Aside from the leadership of the OCS, this alliance was comprised of diverse social partners, including vanguard investment bankers and leaders of established industrial conglomerates and sections of labor that were nurtured during the initial industrialization period analyzed in chapter 1. These forces were joined by an emerging cohort of entrepreneurial scientists and engineers looking to commercialize electronic or software applications developed in public research universities or the military. Whereas the failure to build similar coalitions served as the main political obstacle in the face of development efforts elsewhere (Doner & Schneider, 2016, pp. 618-619), in Israel, this coalition underpinned the state's efforts to restructure industry in the direction of a knowledge-based economy and played a pivotal role in the successful

implementation of the state's innovation policies.

Finally, I depict how changes within this social alliance, due to the appearance of a new set of economic actors with distinctly different policy preferences, mainly the VC sector, triggered a political dynamic that resulted in the eventual erosion of the key pillars of this policy. This, in turn, has caused increasing vulnerabilities to Israel's innovation-led development model which now produces significantly fewer public rewards than in years past. These findings illuminate a once well-known, yet now commonly underappreciated fact: that like any industrial strategy, innovation policy is political in nature (H. J. Chang, 2002; Leftwich, 1995). A complete understanding of its effectiveness, therefore, cannot be attained without bringing politics explicitly back into the analysis.

THE CREATION OF ISRAEL'S UPGRADING COALTION, 1975-1985

Israel's upgrading coalition was established on the initiative of Itzhak Yaakov, Israel's first full-time chief scientist, who in 1975 had the OCS partner with the Manufactures Association of Israel – the umbrella organization of Israel's private industry – and the holding company of Israel's General Federation of Labor Enterprises (Heverat Ha'ovdim) to form The Israeli Industry Center for R&D, or MATIMOP.[91] From its inception, this organization comprised prominent leaders of industry, finance and labor and included former military elites, entrepreneurial scientists, and heads of leading academic and scientific institutions. Aside from the Chief Scientist, MATIMOP's founding members included key figures such as Dan Tolkowsky, a former commander of

[91]Author's interview with Rina Pridor, January 2018. MATIMOP was the Hebrew acronym of this organization.

the Israeli Air Force and then the Managing Director of the Discount Bank Investment Corporation (the investment arm of Israel's largest private bank), instrumental in moving the financial sector into high-technology investment; Professors Uzia Galil and Avraham Suhami, both formerly of Israel's Institute of Technology and founders of the first generation of the country's most successful innovation-based firms (Elron Electronic Industries, Elbit Systems, and Elscient); and Naftali Blumenthal, General Director of the labor-owned industrial conglomerate Koor, a pioneer in the high-tech sector through its ownership of Tadiran and Telrad Networks, both of which became telecommunication giants.[92]

In these years MATIMOP became a key forum for intragroup coordination and state-business cooperation. It held monthly board meetings and bi-annual conferences, at which policy suggestions and strategies were debated, and collective decisions were made. Whereas the inability to forge strong social coalitions was a main obstacle of development efforts in other middle-income countries, MATIMOP illustrates the kind of broad social coalition that, in Israel, facilitated the institutional building and upgrading policies outlined above.

In addition to interest-group coordination, MATIMOP also became a central political vehicle for promoting the interests of the then embryonic high-tech sector. As the organization's charter from 1976 stated, one of MATIMOP's main goals was to "coordinate between Israeli industry and the government" on "all issues related to industrial R&D."[93] In 1980s, Arie Lavie, former Chief Scientist, wrote a letter to the then Minister of Trade and Industry to request that representatives of the association be included in the Minister's technological council, explaining

[92] MATIMOP Members of the Board of Directors, n.d. (likely from 1976 or 1977) ISA/N/217/2.

[93] MATIMOP Charter and Guidelines, n.d. (likely from 1976 or 1977) ISA/N/217/2.

that "MATIMOP's central role is to […] represent R&D intensive industries" and to "influence public opinion and policymakers."[94]

MATIMOP's many activities included sending representatives to participate in important parliamentary committees, coordinating meetings with senior state officials and ministers, as well arranging formal tours and visits of science-based industries for various state elites and other political figures. These served as an opportunity to raise problems and discuss possible policy solutions. In addition, in this period MATIMOP released a quarterly periodical intended to "inform the public about all government initiatives in the realm of industrial R&D, inform policy makers on new developments in the industry, and share hardships faced by industrial developers."[95] In all these forums, representatives of the organization would advance various policy proposals aimed at bolstering state involvement in the development of the high-tech industry and increasing government spending on R&D.

MATIMOP not only represented the interests of this emerging sector but also played an essential role in the OCS's success by providing the agency with the political clout necessary for implementing its most important policy programs. When necessary, the organization lobbied to increase government spending on R&D or mobilized to defend attempts to curtail it. This was acknowledged, for example, in a government report written by Israel's National Council for Research and Development, which observed that "the success of the Chief Scientist in the Ministry of Trade and Industry", and its ability to "safeguard, and even increase its budgets" was largely

[94] Letter from former Chief Scientist, Arie Lavie, to Minister of Trade and Industry, Gideon Patt, July 27th, 1980, ISA/GAL/2189/10.

[95] MATIMOP Board of Directors meeting minutes, June 18th, 1980, ISA/2189/10; MATIMOP-Summary of activities since the second meeting of national developers, January 16th, 1979, ISA/GAL/2162/1

due to the "presence of powerful organized interests" that operate "outside the ministry and view the encouragement of industrial R&D to be one of the Ministry's central tasks."[96]

Over the years MATIMOP advanced numerous policy proposals, yet their most noteworthy achievement was advancing the legislation of the R&D Law in 1984. Aimed to provide a legal and binding framework for the OCS's various funding programs, the R&D Law was at the top of MATIMOP's agenda. In fact, it was the leadership of MATIMOP which first proposed the law.[97] Already in 1981, the organization assigned a subcommittee the task of examining the existing means of government support for industrial R&D. In a letter addressed to the minister of trade and industry, the committee maintained that "the importance of R&D to the future economic development of Israel requires a law of encouragement of industrial R&D." Such a law, it stressed, was necessary for two reasons. First, it would "solidify once and for all the national efforts to advance industries engaged in R&D". Second, "it would strengthen the institution of the 'Chief Scientist' which would be entrusted with advancing this domain."[98] Less than two years later, representatives from MATIMOP also participated in the parliamentary debates of the law in the Knesset's finance committee. As reported by the organization's leadership,

> "the highlight of our involvement […] is our active participation in all stages of legislation, including in the original formulation of the law, through its advancement in the parliamentary debates […] and up to our intensive participation these days in the preparation of comments to the proposed law prepared by the Ministry of Trade and Industry."[99]

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[96] "Chief Scientists in Civilian Government Ministries – Notes for Debate", November 2nd, 1983, ISA/GAL/21766.7. Verified in author's interview with Yigal Erlich, February 2018.

[97] Letter to Minister Gideon Patt from the subcommittee of the technological council, May 3rd, 1981, ISA/GAL/2273/7. Verified in interview with Dan Tolkowsky, February 2018.

[98] Letter to Minister Patt from subcommittee of the technological council, May 3rd, 1981, ISA/GAL/2273/7.

It is interesting that during the legislation process, MATIMOP and its representatives offered no resistance against articles mandating local manufacturing and limiting the transfer of IP. A five-page document with comments responding to the proposed law submitted by the organization in 1982 included just one item (out of thirty-two) on the topic of local production, and no items regarding transfer of IP. In the document, the organization's leadership acknowledged the importance of encouraging local manufacturing of state funded R&D and did not push back against this guiding principle.[100] Similarly, little resistance was offered during the legislative debates in the parliamentary committees, where most of MATIMOP's energy was concentrated in attempts to resist the Ministry of Finance's desire to place the R&D Law under its firm budgetary control, and to guarantee the OCS would remain largely autonomous in deciding how to distribute its funding.[101] As a result, the original blanket restrictions remained in the final legislation.

How can we account for this lack of resistance? Three main factors help explain why MATIMOP not only supported the two requirements outlined above but found it in their own self-interest to do so. First, it is important to stress that when the R&D Law was first legislated, high-tech firms still operated within the vertically integrated "Fordist" mode of production associated with the international economic order of "embedded liberalism" (Ruggie, 1982). In the context of this model, which preceded the "fragmentation of production" common in today's "global

[99] MATIMOP- Summary of activities since the fourth meeting of national developers, January 13th, 1983, ISA/GAL/2189/12.

[100] Comments by Israel's Industrial Employer Organizations on the draft of the R&D Law proposal, October 8th, 1982. ISA/GAL/2189/5.

[101] Meeting 137 of the Knesset Economics Committee, July 11th, 1983, ISA/K/269/11; Meeting 147 of the Knesset Economics Committee, November 14st, 1983, ISA/K/274/1; Meeting 163 of the Knesset Economics Committee, January 1st, 1984, ISA/K/274/2.

production networks", the co-location of R&D and manufacturing was still very much the modus operandi of the industry (Gereffi, 2005, pp. 166-168).[102] In that regard, such conditions only reinforced the existing business model that most local firms were already operating within.[103]

Firms choose to scale-up their operations and manufacture in Israel not only because they were used to doing so, but also because they were strongly incentivized to do so by the state. Already in the mid-1970s, the OCS requested and was authorized to grant the status of "Approved Enterprise" to any recognized science-based firm, affording it all the benefits provided under the Investment Law. This was the same Law used to channel state funding to traditional sectors in the context of Israel's first industrialization campaign that was discussed in detail in chapter 1. In effect, this made any firm (both local and foreign) that received R&D funding from the OCS automatically eligible for additional financial assistance through an existing investment vehicle traditionally used to subsidize the construction of manufacturing plants in peripheral cities.[104] In the mid-1980s, a number of amendments to the original Investment Law were legislated, mainly regarding tax relief, with the goal of making it more beneficial for knowledge-based firms.[105] In essence, these changes shifted state support away from traditional industries and towards the rising high-tech sector. These actions made the legal obligation to scale up manufacturing in Israel or refrain from selling their IP a much easier pill for private firms to swallow. Indeed, many high-

[102] For a recent attempt to bridge the literature on "global value chains" and state-led development, see: (Hauge, 2020)

[103] I am grateful to Dan Breznitz for pointing out this crucial point to me.

[104] "Industrial Research and Development Background and Policy", August 1975, p. 22 ISA /N/217/2. Also see: (Breznitz, 2007b, p. 55) Confirmed in author's interview with Rina Pridor, January 2018.

[105] Zeev Stromensky, "Changes to the Capital Investment Law Will be Made", *Davar* (July 7th, 1983). Also see: (Dishon, 2014, pp. 62-66)

tech companies that established manufacturing facilities in Israel in this period, including leading Israeli companies like the Scitex Corporation and Tower Semiconductor and MNCs such as Intel and National Semiconductor, did so with the help of generous public funding provided through the Investment Law.[106]

Finally, although these two factors explain the support on the part of representatives of the private sector, the fact that Israel's General Federation of Labor Enterprises was a founding member of MATIMOP further helped cement industry's support of the domestic requirements. Here, again, it is worth stressing the Histadrut's historic commitment to the advancement of Israel's industry and the state's developmental agenda which was discussed in chapter 1. The fact that a number of Histadrut-owned firms were first movers into high-tech industry meant that, at the time, The Labor Federation already represented thousands of workers in this sector whose jobs would be protected by the proposed conditions of the R&D Law. Thus, the state and labor enterprises enjoyed a shared interest in keeping production at home.

Considered together, these three factors help explain why members of MATIMOP showed little objection to these conditions when they were introduced. Indeed, the consensus around state conditions and discipline on the part of Israel's upgrading coalition was not unlike that which existed in other developmental states. Once case in point is Korea, where the state's developmental agenda was not imposed but rather advanced "in alliance with domestic business", as a result of mutual self-interest (Chibber, 1999, p. 312).

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[106] For the Scitex Corporation, see: Davar's Economic Report, "An Electronics Plant Will be Erected in Jerusalem following a $50 Million investment", *Davar* (July 29th, 1980); for Intel, see: Shraga Makel, "Industrial Investments of 5.5 Billion NIS Approved" *Ma'ariv* (January 12th, 1984). For Tower and National Semiconductor, see: (Breznitz, 2007b, p. 55)

As we will see in the sections below, only when the industry started taking off in the early 1990s did opposition to these conditions began to mount. The most dramatic shift occurred following the appearance and rapid growth of Israel's VC industry, a watershed moment that dramatically altered the very structure of Israel's high-tech economy. As a result, for the first time since the sector's inception, the interests of the state and of leading fractions within the high-tech industry began to diverge.

The erosion of the R&D Law's Manufacturing Requirements, 1995

Only a decade after the original enactment of the R&D Law, with Israel's high-tech sector growing by leaps and bounds, the issue of domestic production first became a point of contention. In 1995, the Knesset's Finance Committee held multiple debates on a series of proposed amendments that centered around the R&D Law's blanket prohibition on the transfer of production abroad.

The position advocated for by industry – now represented by the Manufacturers Association of Israel (MAI) – was that the R&D Law should provide firms more leeway regarding when and if production could be offshored. Such a decision, they argued, should be made on the economic basis of 'comparative advantage'. This viewpoint was articulated by the MAI's representative to the committee debates, Moshe Ortas (CEO of Elta Systems, a subsidiary of Israel Aerospace Industries), who explained,

> "From our viewpoint, it would be preferable to have us make the decision [of how much production to transfer abroad] and then come with it to the [research] council

> [for approval]. Because when we make these decisions we ask: where can I get the best *comparative advantage*?"[107]

By this, Ortas meant to emphasize that decisions regarding where to locate production should be made in accordance to the price mechanism and not government decree. The competing viewpoint, which pertained to safeguarding developmental interests, was advanced by Efi Perry, a lawyer representing InterPharm. An Israeli subsidiary of the Swiss-based pharmaceutical firm Ares-Sorono, InterPharm was set up to carry out the manufacturing in Israel of a breakthrough drug for the treatment of multiple sclerosis that emerged out of OCS-funded research at the Weizmann Institute of Science. Local manufacturing facilities arising from state-sponsored R&D, such as InterPharm, were exactly the outcome policymakers envisioned when they required the production of state-funded projects remain in Israel. Any changes to the local manufacturing requirements represented a threat to its very existence, as well as to other manufacturing facilities like it. Speaking to the finance committee, Perry defended the logic of the domestic production requirement:

> "When is the state of Israel due to reap the fruits [of its investment in R&D]? […] Only once manufacturing takes place do you start reaping the fruits [of the investment] in the form of taxes, foreign currency, and the brand name of Israel. And since manufacturing often produces new knowledge—also the prospect of additional R&D. If we offshore manufacturing, there will not be a future for Israeli technology."[108]

Responding more specifically to the issue of "comparative advantage" raised by Ortas, Perry countered that creating an opening to relocate some of the production will only weaken Israel's international competitiveness:

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[107] Meeting minutes from meeting 490 of the Knesset Finance Committee, April 4th, 1995, emphasis by author.

[108] Meeting 490 of the Knesset Finance Committee, April 4th, 1995.

> "When Israel is the exclusive producer [of an innovative technology], it is also competitive in price. But when the same exact product can be manufactured abroad, even if some portion of the production remains local, Israel can no longer hold the same price advantage as it once did."[109]

The amendments legislated in 1995 reflected a compromise between these two contrasting views. On the one hand, the law still stipulated that beneficiaries of R&D grants were obligated to manufacture in Israel. However, whereas the original law outlawed outright any transfer of production beyond the state's borders, the new amendments opened the door for this possibility. To do so, firms were first required to receive approval from the OCS.[110] If their request was approved, they were then obligated to pay increased royalties of up to three times the sum received in R&D grants (for details, see Table 10).[111] Such a penalty was easily enforced by the OCS, since it was already effectively collecting royalties from funded firms. Putting a price on transferring production abroad aimed to serve as a disincentive that would offset the benefits of offshoring and thus discourage firms from pursuing this method. The transfer of IP remained prohibited at this point, as such a demand was not brought up during parliamentary debates in 1995.

The Erosion of the R&D Law's IP Retainment Requirements, 2001-2005

In 2000, a second round of amendments to the R&D Law began to be discussed. This time, however, they ended up taking more than five years to finalize. Debates were mostly carried out in the Knesset's Finance and Science and Technology Committees and centered, once again, on the domestic commercialization of R&D. Again, the merits of the domestic manufacturing requirement were questioned. More importantly, however, for the first time since the legislation

[109] Meeting 490 of the Knesset Finance Committee, April 4th, 1995.

[110] The R&D Law, amendment 1 (1995), article 19, article 2.4.

[111] Meeting 490 of the Knesset Finance Committee, April 4th, 1995.

of the R&D Law in 1984, demands were made to eliminate the blanket prohibition of transferring of state-funded IP.

One major difference was that by this period, the landscape of Israel's economy looked remarkably different than just five years prior. For one, in these years Israel's labor-owned sector was very much on the decline. In the early 1980s, the Histadrut's industrial conglomerates fell into a financial crisis. This was largely a result of the rightwing Likud-government's decision in October of 1980 to terminate the state's historical commitment to provide the labor industry with state-subsidized loans. As a result of this decision, the Histadrut was forced to lay off many of its workers, and subsequently close or sell some of its most important industrial enterprises (Greenberg, 2005, pp. 349-363). In 1995, the Histadrut lost its two remaining economic sources of power due to the privatization of its labor-run pensions and the detachment of health-care provision from union membership. Employers' active endorsement of the previously common collective bargaining also fell into decline in the 1990s, when many employers ended collective agreements that were signed at the enterprise level or withdrew from employers' associations to avoid the continuation of the collective agreement (Kristal, 2013, p. 112). These changes led to a significant decline in union density, which decreased from 79 percent in 1981 to 68 percent in 1988, and to 49 percent in 1996 (Cohen, Haberfeld, Mundlak, & Saporta, 2003, p. 694). As a result of these changes, by the end of the 1990s Labor's ability to impact policy was dramatically weakened.

Another significant difference that occurred in this period was the establishment of Israel's VC industry, which began operating in Israel around the time the previous round of amendments to the R&D Law were legislated. As with the high-tech sector itself, the main catalyst in the formation of Israel's VC sector was a government initiative. The origins of the industry dates to

the late 1980s and can be credited to policymakers in the OCS and the MOF who identified two central bottlenecks that were hindering the further expansion of Israel's technological sector. The first fundamental problem facing the industry at the time was firms' low survival rate which stemmed from their inability to grow beyond the product development phase. This was reflected in an extremely low life expectancy of new firms and a relatively high failure rate. The view within the OCS was that this outcome was largely the result of the shortage in additional sources of scale-up capital. An additional barrier was the generally weak management and marketing experience available in Israel's labor force.[112] Policymakers believed that overcoming these two barriers could be achieved by fostering a domestic VC industry and this soon became a strategic priority within the Government (Avnimelech, 2009).

To address these structural weaknesses, in 1993 Israel launched the "Yozma" program.[113] Led by Yigal Erlich, who resigned from his position as the chief scientist in order to manage the new initiative, the program created a $100 million government-owned venture capital fund that made direct investments in start-up companies and financed 10 additional limited-partnership private VC funds. Yozma supplied these funds with 40 percent of the necessary capital and required them to rise the rest on their own. In order to receive this funding, Yozma required local Israeli VC managers to partner with at least one established foreign financial firm (Avnimelech & Teubal, 2008, pp. 157-158; Breznitz, 2007b, pp. 79-81). The idea behind this demand was that

[112] Author's interview with Yigal Erlich, February 2018.

[113] The 'Yozma' initiative was preceded by the MoF's 'Inbal' program which tried to stimulate VC activity in Israel by creation of a Government insurance company that provided a 70 percent guarantee to four VC funds that listed on the Tel Aviv Stock Exchange. Launched in 1991, this program was a relative disappointment as its funds failed to raise additional capital and eventually left the program (Avnimelech & Teubal, 2008, p. 164).

through forming such partnerships, Israeli VC funds would build links with experiences venture capitalists and enjoy their global networks and investment expertise (Klingler-Vidra, 2018, p. 60). While most funds relied on foreign funding, the program ensured investments would remain local by requiring funds to invest only in cutting edge technological projects that were "Israel or Israel related". This condition was easily enforced since Yozma placed a representative at the board of each of the private VC sector it supported. This representative could then veto investment decisions that were made in opposition to this requirement (Erlich, 2018, p. 167).

The Yozma program was an outstanding success. In 1995, 15 VC funds were active in Israel, each managing an average of $20 Million. By 2000 there were 85 VC funds, with top funds managing an average of $200 million.[114] By the mid-2000s, Israel's VC sector became the largest in the world in relative terms, investing a total of $15.2 billion between 1997 and 2005 (Avnimelech & Teubal, 2006, p. 1478). Even in absolute terms, the availability of VC in Israel was impressive, ranking fifth among all other OECD countries and trailing only the U.S, Japan, Canada and the U.K, and ahead of states like France, Germany, Korea and Australia (OECD, 2013, p. 89 Table 6.1).

The growth of the VC industry was in large part responsible for Israel's high-tech sector growing integration in global financial markets. As a result, by the early 2000s, the sector amassed significant powers and influence over the industry, as it became the main source of capital for startups looking to scale up their operations and commercialize their products. The Israeli Venture Association (IVA), a new organization representing the interests of the budding VC sector, led the charge in advocating for the end of the unconditional prohibition on transferring IP.

[114] See statement by the CEO of the Vetex VC fund and Chairman of IVA, Yoram Oron, meeting number 121 of the Science and Technology committee, March 7th, 2005.

Why did the VC sector oppose these limitations? The answer to this question requires understanding the business model by which VC funds normally function. Such funds seek extremely high return on investment (ROI) by investing in and nurturing firms in high risk sectors such as software, IT or bio-technology. Yet most VC funds function under a rather limited timeline, as they are typically structured as limited partnership funds with set end dates (usually five to seven years). This set time frame for ROI places an upper boundary on the patience of venture funds. Such ROI is incurred through one of two exit routes: either an initial public offering (IPO), usually on NASDAQ, or more commonly, via a merger and acquisition (M&A) with a large MNC (Bonvillian & Singer, 2018, pp. 191-195; Klingler-Vidra, 2016, pp. 694-695; Lazonick & Mazzucato, 2013, pp. 1109-1111). Therein, however, lies the rub. Since Israel's R&D Law prohibited the transfer of IP, the likelihood of OCS-funded firms being acquired by an MNC were greatly diminished.

Representatives of the Israeli VC sector understood established multinationals would be deterred from acquiring firms whose IP they cannot fully control. This fact, they argued, also hindered the ability of startups to attract foreign investment in the first place. These concerns were articulated by Chemi Peres, the managing general partner and co-founder of the VC fund Pitango. Speaking to the Knesset's Science and Technology Committee, he said,

> "The R&D Law is an obstacle for foreign investors, and it hurts start-ups […] any [foreign] firm that learns your company [cannot transfer its IP] will not want to deal with you. The only way to deal with this is to either [alter the law] or cease investing in firms supported by the OCS."[115]

Yoram Oron, then chairman of IVA and the founder and general partner of the Vertex Ventures fund expressed a similar logic:

[115] Meeting minutes of the Knesset's Science and Technology Committee meeting #121, March 7th, 2005.

> "In today's world, it is impossible to stop the transfer of knowledge. What the state of Israel has tried to do all these years by administratively prohibiting the sale of knowledge has caused great economic damage. If a negotiating partner fears that there are these kinds of obstacles— they will pass on the deal."[116]

Although the VC sector wanted state-supported start-ups to no longer be constrained by the guidelines of the R&D Law and advocated fiercely against the existing limitation regarding the transfer of IP, they were not in favor of doing away with the R&D Law altogether. Israel's VC sector was still dependent on the innovations and technologies developed through the OCS's various funding schemes. As Peres explained,

> "Venture funds mostly invest at the stage where we can help firms become profitable. We do not want to bother too much with the development of the technology. There we cannot bring our investors the yield in the timeframe they expect it. We want to invest when a company already has a product and is about to penetrate the market."[117]

In other words, the VCs wanted the State to keep subsidizing high-risk R&D, but to refrain from intervening in the later stages of commercialization.

It is interesting that for the first-time state managers also shifted their view on the issue. Largely representative of this change was the support the proposed changes received from Ehud Olmert—then the minister of trade and industry, and future prime minister. Olmert favored replacing the outright ban on the transfer of IP with a much more flexible clause and said so publicly on numerous occasions.[118] The logic behind his position was that amending the law was

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[116] Meeting minutes of the Knesset's Science and Technology Committee meeting #122, March 15th, 2005. Verified in interview with Yoram Oron, July 2018.

[117] Meeting minutes of the Knesset's Science and Technology committee meeting #121, March 7th, 2005. Verified in interview with Chemi Peres, November 2018.

[118] For example, see: Oded Hermony, "Olmert: I Will Act to Change Articles in the R&D Law That Pertain to the Transfer of Knowledge," *The Marker* (April 8th, 2003); Hadas Manor, "Olmert Planning to Change the R&D Law," *Globes* (May 28th, 2003); Hadas Manor, "Olmert

necessary in order to make Israeli start-ups and firms in need of scale-up funds more attractive to foreign investors, particularly foreign MNCs.

In a speech to the Knesset introducing the proposed changes, Olmert outlined this position:

> "Our desire is to attract foreign investment, which in the realm of R&D is usually made by large multinationals […] and when they invest in a certain product, they obviously want to have as much flexibility as possible[…] In all my meetings with business communities abroad, this is almost the only question I am asked, and when I say we intend to change the [R&D] law it usually encourages international firms to enter negotiations with Israeli companies […]. I must admit that many large high-tech firms have encouraged us to take this route and, of course so have the venture capital funds."[119]

This shift in the state's position towards the transfer of knowledge was no doubt influenced by the government's broader economic agenda in this period. Indeed, it was in these years when, on being appointed minister of finance, Benjamin Netanyahu shifted the government's liberalization reforms into high gear. These included, among other things, deep budget cuts, privatization of government-owned companies, a decrease in public sector employment, financial liberalization, and implementation of "welfare-to-work" policies (Ben-Porat, 2005, p. 240; Mandelkern, 2018, p. 372).[120] It is not surprising, therefore, that Netanyahu was himself an enthusiastic supporter of the suggested reforms to Israel's R&D Law that were consistent with his larger liberalization program.[121]

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on Changing the R&D Law: It Will Allow to Attract Foreign Investment to Israel Under the Conditions of Globalization," *Globes* (September 29th, 2004).

[119] Meeting 198 of the 16th Knesset, Debate on Amendment 3 of the R&D Law, December 21st, 2004.

[120] On Israel's neoliberal turn more generally, see: (Maron & Shalev, 2017)

[121] Dan Yachin, "Netanyahu: I Will Act to Reform Laws Hindering Foreign Investment in Israel," *Globes* (July 13th, 2003).

Table 10: Summary of Changes to the R&D Law, 1984-2005

	Crucial Junctions		
	Original Legislation (1984)	First Round of Amendments (1995)	Second Round of Amendments (2001–5)
Domestic manufacture of OCS-supported products	Blanket requirement	General requirement; OCS can authorize transfer of manufacturing in "special cases"; transfer of manufacturing requires payment of increased royalties, up to 300 percent of the original OCS grant	No longer blanket requirement; supported products must be manufactured in Israel in accordance with the share declared in the firm's application; OCS can permit offshoring of manufacturing in excess of the declared share, at its discretion (in such an event, the rate and size of royalties is increased as detailed below)*
Transfer of IP outside Israel	Unconditionally prohibited	Unconditionally prohibited	Prohibited, but OCS can authorize, at its discretion, transfer of IP, subject to payment of a fine calculated according to the formula below†
Key societal actors in support of law/ amendments	MATIMOP (coalition of state, business and labor)	Local electronics manufacturing firms	Local electronics manufacturing firms, organized within the Israeli Association of Electronic Industries
Key societal actors supporting changes to original law		Globally oriented technological firms represented by Manufacturers Association of Israel	Israeli Venture Association, Manufacturers Association of Israel

Source: Author's elaboration of provisions of Israel's R&D Law (1984), Amendment 1 (July 1995), Articles 18 and 19; R&D Law, Amendment 2 (November 2002), Article 19; R&D Law, Amendment 3 (April 2005), Article 19.

*If overseas manufacturing is performed by the company receiving the grant, royalties on sales increase by 1 percent; if manufacturing is performed by another entity, rate of royalties equals the grant amount divided by the firm's total investment in the research project. In addition, the ceiling on royalties (ordinarily 100 percent of grant amount) increases to 120–300 percent, depending on the share of overseas manufacturing. Alternatively, the R&D Law provides a mechanism whereby manufacturing rights may be transferred overseas in return for an exclusive license to manufacture in Israel.

†When IP is transferred overseas as part of a sale of grant recipient itself, recipient will pay the greater of the following: (i) the amount equal to the sales price of the grant recipient multiplied by a fraction whose numerator is the total of OCS grants received by recipient and whose denominator is the total monetary investment in the grant recipient (including OCS grants), after subtracting the amount of "net financial assets"; or (ii) the original OCS grants (with annual interest), subtracting royalties previously paid. Repayment derived from formulae above is reduced in accordance with the following depreciation formula: after three years from completion of the research project, repayment amount is gradually reduced, on a linear basis, over a seven-year period, to a minimum amount equal to the original grant amount plus interest, and after subtracting royalties paid.

Although the government largely sided with the position of the VC sector, some policymakers worried that implementing the proposed changes would negatively impact Israel's high-tech sector. As one member of Knesset, Chemi Doron, remarked when the proposed legislation changes were being discussed,

> "[Israel] has an advantage in R&D, but according to [the changes] being discussed here, we risk being turned into a research lab. Everyone will come and exploit our human capital to carry out research, but the manufacturing and the jobs will go to […] places like Thailand, China, and others."[122]

As we will see in the paper's final section, such concerns were not unwarranted.

Attempts to reform the law in this direction were also met with organized opposition from within the high-tech industry. This was led by the Israeli Association of Electronic Industries (IAEI), an organization representing the interests of 50 domestic manufacturing facilities which carried out most of the electronic manufacturing for the high-tech sector. Together, such firms directly employed 10,000 workers in the field of electronic manufacturing and supported another 20,000-50,000 workers employed in complementary industries such as: packaging, logistics, transportation, and services. The businesses this organization represented had an obvious stake in maintaining the existing restrictions. As in the previous round of debates, the logic of their position was that because the R&D of these high-tech firms was publicly financed in the goal of national economic development, they were obligated to continue operating locally. Testifying on behalf of these interests in the finance committee was the coordinator of the IAEI, Hanan Caspi, who explained,

> "We are not ignoring the fact we operate in a global market […]. Yet we say something simple: if this knowledge was created using taxpayer money, then it cannot go abroad.

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[122] Meeting 198 of the 16th Knesset, Debate on Amendment 3 of the R&D Law, December 21st, 2004.

> […] The state invests in R&D and subsidizes Israeli firms […] so that we can have R&D and production in Israel."[123]

The outcome of these debates was once again mixed, but ultimately leaned in favor of the position of the VC sector. Trying to negotiate these conflicting interests, the chief scientist, together with the help of the Finance Committee, proposed a compromise. On the one hand, more leeway would be provided to R&D firms, as the transfer of IP would no longer be prohibited outright. On the other hand, such transfer would require the approval of the OCS and necessitate payment of a significant fine. As Carmel Vernia, then chief scientist, argued:

> "we […] are not interested in promoting the transfer of knowledge overseas. Our interest is that it remains in Israel. Yet we also do not want to completely tie the hands of industry. There are situations where there is no alternative and it is more logical to transfer abroad."[124]

Although the VCs accepted this compromise, they strongly opposed the formula the OCS came up with for calculating the fine to be imposed on firms wishing to transfer their IP. It called for an amount equal to the price offered in return for the IP, multiplied by a ratio that would correspond to the share of the government's original investment in the firm's R&D (for details see Table 10). The state had historically refrained from demanding an ownership stake in the firms it funded; this formula represented a shift in that approach, but only in cases where firms pursued an exit strategy. As Myron HaCohen, MOTI's legal counsel, explained, according to these changes,

[123] Meeting minutes from the joint finance and science and technology committee on the R&D Law, meeting number 7, June 12th, 2002.

[124] Meeting minutes from the joint finance and science and technology committee on the R&D Law, meeting number 7, June 12th, 2002.

> "the state's equity [in the firms] will be dormant. It will manifest itself only if knowledge is transferred. As an investor, you always have the option to continue operating in Israel. If you do that, [the state] does not take part in profit-sharing."[125]

What mostly concerned VCs was that according to this method the cost of transferring IP would be derived based on its value at the time of sale. The fine not only would be rather significant but, more importantly, would remain unknown to investors until that point. What the VC sector advocated instead was setting a predefined cap on any potential future fine, regardless of the final price of sale. This arrangement would not only keep the fine relatively low; further, the fine would be known at the point of investment (rather than point of sale). Articulating this position in the committee debates was none other than Yigal Erlich, former chief scientist, now speaking on behalf of the VC industry that had helped develop:

> "This change is intended to deter firms from transferring knowledge because they will have to pay a large fee. […] but a new startup does not know what its fate will be. […] When [the future fine] is unclear at the outset […] it could be that investors will be deterred from investing.[126]

The opposition to the proposed formula on the part of the VCs was so strong, that these amendments took more than five years to legislate.[127] However, in 2005 the two sides finally agreed on the OCS's proposal after it offered to incorporate a depreciation mechanism which caused the fine imposed on firms to decrease over time. The logic behind this method was to reflect the loss in value of the innovative technology. Firms that wished to transfer their IP only a few years removed from the development of technology would be forced to pay a much larger fine

[125] Meeting minutes from the joint finance and science and technology committee on the R&D Law, meeting number 1, November 15th, 2001.

[126] Meeting minutes from the joint finance and science and technology committee on the R&D Law, meeting number 3, November 25th, 2001.

[127] A first round of amendments was passed in 2002 but *without* the controversial article 19 which pertained to the transfer of IP.

than firms who waited a decade to do so, at which point the fee would diminish significantly. That idea helped bring the two sides together, and in April 2005 the changes were finally enacted. Although the historical ban on the transfer of knowledge was lifted, the agreed upon formula often resulted in a significant fine that worked, at least in some cases, to discourage firms from transferring their IP.[128] In 2012 the R&D Law was once more amended in favor of the VC sector. For the first time the VCs' original demand to set a predetermined cap on the fine was adopted. From that point onwards, firms that wished to transfer their IP were requested to pay 300-600 percent of the R&D grants they received, irrespective of the price of sale. Firms that committed to preserving the IP listed in Israel and maintain local R&D operations for at least three more years were charged at the lower end of this range (300 percent), whereas firms that wanted complete freedom regarding the future transfer of IP were charged at the higher end (600 percent).[129]

FROM LOCAL TO AN MNC-DOMOINATED ECONOMY: ASSESING THE IMPACT OF ISRAEL'S INNOVATION POLICY REFORMS

Reforming the R&D Law in the manner described above not only marked a fundamental transformation of Israel's R&D policy, but it also had a decisively negative impact on developmental outcomes. Most significantly in this regard was the growing weakness of Israel's indigenous high-tech firms. In contrast to the past, firm scale-up of Israeli start-ups began to be far less widespread, as more and more firms were acquired and merged with large MNCs. In 2013, an Israeli Knesset's Research and Information Center report concluded that,

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[128] Author interviews with Yoram Oron, July 2018, and Zafrir Neuman, May 2019.

[129] Assaf Gilad, "The Knesset Announces: Did You 'Exit'? If So, Pay the Chief Scientist Up to 6 Times Your Awarded Grants", *Calcalist*, (May 14th, 2012); Ora Coren, "Firms That Existed Will Be Charge Up to Six Times Their Awarded Grants", *The Marker*, (May 14th, 20102). Verified in author's interview with Yoram Oron, July 2018.

> "The main weaknesses of the local high-tech industry are the failure of small companies to scale up into advanced production and the absence of large companies. Despite the rapid increase in the number of start-up companies, a significant number of successful companies are sold to foreign entities before they have reached the stage of extensive production and marketing. Only a few of Israel's large high-tech firms continue to operate locally, and thus the potential contribution of the knowledge-intensive industry to the economy is not realized. …[while] the entrepreneurs and investors, mostly the VC funds, benefit most from selling the venture in the relatively early stages, the economy as a whole would benefit more from the continued expansion of these companies."[130]

What accounted for this significant contrast from Israel's earlier period of high-tech development, where firm 'scale-up' was prevalent? Although assessing theses outcomes in full is beyond the scope of this research, a few noteworthy points illuminate how the scaling back of R&D conditions resulted in significantly fewer public rewards.

One notable trend that began in 2005 was an increase in the rate of foreign investment in Israel's R&D, from 29 percent of all business R&D in 2005 to 49.2 percent in 2017. This figure represents the highest rate among all OECD members, strikingly higher than in comparative economies such as Ireland (18.6 percent), Sweden (7 percent), or Singapore (5.8 percent).[131] Much of this increase in foreign investment is the outcome of the growing presence of foreign MNCs, currently over 370 and growing. Although MNCs were always a part of Israel's eco-system, their rate of growth has skyrocketed. Between 1989 and 2004, multinationals opened R&D centers at

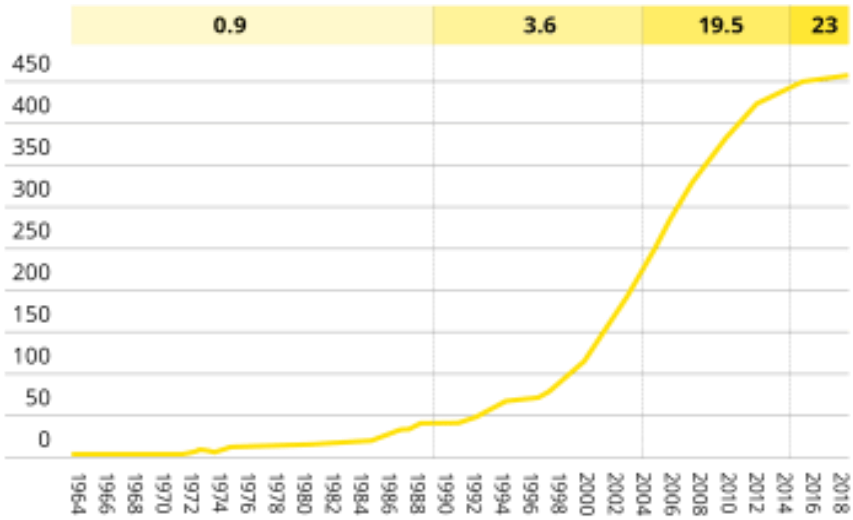
[130] Anat Levi and Roy Goldschmidt, "Analysis of the Office of the Chief Scientist Budget", *Knesset Research and Information Center*, May 2013. https://fs.knesset.gov.il/globaldocs/MMM/1ac18d55-f7f7-e411-80c8-00155d010977/2_1ac18d55-f7f7-e411-80c8-00155d010977_11_7043.pdf [accessed July 22nd, 2020].

[131] Invest in Israel and the Ministry of Economy and Industry, "Groundbreaking Partnerships: The Contribution of MNC to the Israeli Economy", 2018, p. 12, 16; online at: https://www.gov.il/BlobFolder/news/multinational-companies-contribute-to-raising-productivity-in-israel/he/Invest%20in%20Israel.pdf.

the average of 3.6 per year. Starting in 2004, however, this rate grew exponentially to an average of 19.5 per year.[132] More research is needed in order to demonstrate a causal link between the scaling back of the R&D Law conditions and this stark growth in the presence of foreign MNCs, but the historical timing demonstrates a clear association between the two. Lending further support to this view is the fact that since 2014, almost 70 percent of the 117 R&D subsidiaries opened by MNCs were the result of an acquisition and conversion of Israeli startups– the exact process the former IP restrictions aimed to curtail.[133]

Why is the dominance of foreign R&D centers a problem for development? The central weakness of the existing model is that the foreign MNCs that operate in Israel do not generate the kinds of positive spillovers that home-grown ones do. One example is in the realm of job creation.

Figure 4: Exponential Increase in Multinational R&D Centers



Source: "Multinationals Open More Than 20 R&D Centers a Year in Israel", *The Marker* (September 13th, 2018).

[132] "Multinationals Open More Than 20 R&D Centers a Year in Israel", *The Marker* (September 13th, 2018). Verified in author's interview with Eugene Kandel, May 2019.

[133] Ibid.

When a growing local company turns into a research-based subsidiary of a foreign corporation, then, potential good jobs are lost. To highlight just one illuminating statistic: for each employee of an Israeli high-tech manufacturer, two more local jobs are created. For each R&D center employee, on the other hand, only one-third of another job is created.[134] As a result, more jobs are created in countries with weaker labor market and environmental regulations allow firms to pay lower wages, disregard workers' safety, and danger the environment. Because job growth in multinational R&D centers has been far more rapid than in local high-tech firms – a staggering 16 percent annual growth between 2004 and 2011 in the former compared to only 1 percent growth in the latter – the negative impact on the creation of additional jobs as been tremendous. Overall, although the number of people employed in high-tech has been growing steadily in absolute terms, their percentage in the labor force since the mid-2000s has decreased or stagnated.[135] Considering the substantial increase of invested capital in the Israeli tech sector during this period, this trend highlights the lack of additional job creation outside of high-end R&D.

The rapid growth of foreign owned R&D centers has also negatively impacted tax income and potential IP revenues that independent local firms might have generated. One telling statistic in this regard is local vs. foreign ownership of patents. The percentage of all Israeli patents granted by the US Patent and Trademark Office (USPTO) that were owned by non-Israeli firms rose from 27 percent in 1990 to 52 percent in 2010. As one report on the topic concluded, this increase in

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[134] Matthew Kalman, "Israel's "Startup Nation" is Under Threat from the Tech Giants that Nurtured it," *MIT Technology Review,* (January 8th, 2019). Verified in author's interview with Eugene Kandel, May 2019.

[135] Start-Up Nation Central, "Human Capital Survey Report 2018," 2018, p. 12; online at: https://www.startupnationcentral.org/wp-content/uploads/2018/12/Start-Up-Nation-Central-Human-Capital-Report-2018.pdf.

foreign ownership of the fruits of Israel's knowledge is a direct result of the increased activities of foreign-owned companies in Israel in general, and foreign R&D centers more specifically.[136]

The general economic performance of the high-tech sector has also weakened. Since 2010, the high-tech sector no longer serves as the central engine of economic growth, as its expansion has been about half that of the rest of the economy. Production in this sector, which exceeded 13 percent of GDP in 2009, recently fell by 1.7 percentage points and its share in exports has stagnated.[137]

While more research in needed to explore how these changes will impact the future sustainability of Israel's tech sector, it is clear that 'subsidies without conditions' negatively affected the state's ability to ensure the economic rewards of innovation would not remain in private hands but, rather, be shared more generally.

CONCLUSIONS

As we saw in the last two chapters, although Israel generally followed the global trend in the direction towards becoming a liberalized, free-market economy, its state institutions continued to play a prominent role in promoting industrial upgrading. Far from simply facilitating or solving market failures, state institutions such as MOTI and the OCS set the direction of economic change, subsidized risky investment in R&D, invested in technological infrastructure, and coordinated

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[136] Applied Economics Inc., Research and Consulting in Economics, Marketing and Social Sciences. "Impact of the Presence and Activity of Foreign-Owned Multinational Companies on Israeli High-tech Companies, 2003-2011", May 2014, p. 19-20; online at: https://www.btl.gov.il/Mediniyut/HadarMehkar/Documents/appleid.pdf.

[137] OECD Economic Surveys Israel March 2018, p. 18, http://www.oecd.org/economy/surveys/Israel-2018-OECD-economic-survey-overview.pdf [accessed July 10th, 2020].

between various private and public actors. Yet simply promoting innovation would not have automatically produced broad-based economic rewards. In chapter 2 I showed that Israel's ability to achieve this goal required specific institutional mechanisms that enabled the OCS to condition state assistance upon domestic commercialization and to discipline firms that threatened to breach these stipulations. In this chapter I showed that installing these mechanisms required the political support of a broad social coalition that was committed to the state's upgrading agenda. Finally, we saw how changes within this coalition due to the fading power of Labor and the appearance of Israel's VC industry – a powerful new social and economic actor with distinctly different policy preferences – eventually eroded these vital institutional capacities. This, in turn, resulted in a significantly different developmental regime which continued producing innovation, yet with a decreasing level of public rewards.

In the following two chapters we move beyond Israel and adopt a comparative analysis. Comparing Israel's experience to two additional cases – Taiwan and Ireland – we are able to test our main findings and examine a few relevant counterfactuals. To these comparisons we now turn.

CHAPTER 4:

Israel in Comparative Perspective- State-led Development in Taiwan

How unique is the Israeli experience? Have similar developmental strategies generate comparable outcomes in other state-led campaigns to restructure industry around a high tech? If so, how important was the role of state conditions and disciplinary mechanisms in these cases? And what role did state-society relations play in determining these state capacities? To answer these questions, the subsequent two chapters move beyond Israel to examine two additional cases: Taiwan and Ireland.[138] In the decades following World War Two, all three countries launched state-led industrialization campaigns, with varying levels of success. Then, following the economic turbulence of the 1970s, all three countries made ambitious efforts to restructure their economies away from traditional industry and towards technological upgrading and innovation. In all three cases, the government served as the main agent of change, constructing new and redeploying existing developmental institutions. Yet despite these similarities, results varied significantly. Whereas Israel and Taiwan successfully overcame the many challenges involved in high-tech-based development, the Irish experience can be viewed as a relative disappointment and its accomplishments moderate and short-lived. What accounted for these distinct outcomes? Comparing and contrasting these three cases will enable us to address this question, as well as the questions posed above. Furthermore, such comparisons help explore a few important counterfactuals: how would have Israel's innovation policies fared in the absence of conditions

[138] Several previous studies have compared at least two of these three cases (Arora & Gambardella, 2005; Bresnahan, Gambardella, & Saxenian, 2001; Breznitz, 2007b; Klingler-Vidra, Kenney, & Breznitz, 2016; Levi-Faur, 1998; Lin, Shen, & Chou, 2010; O'Riain, 2004).

and discipline? Would it have been possible to construct such capacities without robust support from a domestic "upgrading" coalition? And finally— was the decline of Israel's developmentalism in the context of deepening globalization inevitable or can these two agendas be advanced simultaneously?

Because of their important similarities and differences from the Israeli case, Taiwan and Ireland provide ideal comparative cases for addressing these questions. The existing literature on their developmental experience will thus serve as the empirical foundation for the following two chapters. Yet fully addressing the questions outlined above requires more than just a reflection on existing studies but rather a new and original synthesis of the existing research. In the case of Taiwan, contemporary studies have unwittingly overlooked the continuing importance of state conditions and discipline. They have therefore failed to provide an adequate explanation for the persistence of this key feature in Taiwan's developmental program. As for the literature on Ireland, once divided between optimists and skeptics, researchers have yet to provide an updated assessment of Ireland's developmental experience in the 1990s which in retrospect appears far less impressive than originally believed. The reasons for its relative failure, therefore, have yet to be fully understood. The synthesis provided here will attempt to addresses these shortcomings in the existing literature. As a result, beyond its contribution in testing arguments made about the Israeli case in the preceding chapters, this these comparative chapters will also advance and update the prevailing knowledge regarding state-led development in Taiwan and Ireland. To these cases we now turn. We begin with Taiwan and follow up with Ireland in chapter 5.

Assessing the Taiwanese "miracle"

Much like Israel, starting in the late 1970s the Taiwanese government set out to restructure

its economy away from traditional labor-intensive industries and towards technological innovation and industrial upgrading. Since then, Taiwan's record of economic development has been nothing short of phenomenal. It has especially excelled in the fields of electronics and information technology (IT), where its small and medium-size enterprises (SMEs) have proved highly flexible and dynamic. In fact, it can be argued that Taiwan has been the East Asian country that has made the most impressive shift from "catch-up" to innovation-led growth. Whereas in the period of 1978 to 1982, Taiwan's total civilian R&D expenditure was about 0.5 percent of GDP, by 1996 it increased almost fourfold reaching 1.8 percent. By 2009 this figure represented one of the highest rates worldwide, at almost 2.9 percent of GDP (A. Amsden & Chu, 2003, p. 278; Y.-w. Chu, 2016, p. 128; Gee, 1993, p. 394). As a result of this increased investment in R&D, Taiwan has all but closed the gap in innovation capacities with the leading Western industrial nations and Japan. Indeed, Taiwan now ranks third in the world (behind the US and Japan) in terms of per capita take-up of USPTO patents – a common indicator of innovation – and has emerged as a world leader in patent quality (Hu & Mathews, 2005, pp. 1325, 1344). Consequently, in 2006, its IT manufacturing sector contributed to 7 percent of Taiwan's GDP and, in 2007, exports of "electronic products" and "information and communication products" reached US$75.1 billion or 30.4 percent of total exports (Y.-w. Chu, 2016, p. 121). This impressive economic expansion has gone hand in hand with quantum leaps in living standards as the fruits of economic growth have been widely shared by all income groups on the island (Gee, 1993, p. 394).

What accounts for Taiwan's remarkable transformation from a technological imitator to innovator? As we will see below, like in the case of Israel, it was the state itself which acted as the central agent of change. Furthermore, we will see that one of the keys to this success, also similarly to Israel, was Taiwan's capacity to effectively combine generous and comprehensive support with

strict conditions that could be enforced via discipline. Although their importance has been vastly understated in the contemporary literature, these mechanisms played a significant role in mitigating against the inherent challenges of innovation-based development helping to produce both private and social rewards. To explain these distinctive capacities, the analysis will highlight how, since the 1980s, and even more so after the Asian financial crisis in 1997, Taiwan reconfigured and repurposed its developmental institutions in order to address the new challenges of high-tech industrialization and overseas expansion.

To explain the longevity of Taiwan's capacity to condition state assistance and discipline private firms, our analysis will shift from institutions to politics, focusing on the Taiwanese state's relations with its social partners. More specifically, it will highlight the persistence of the embedded relations between the state's robust developmental institutions and its domestic industrialist class, which, again like in Israel, had been maintained through dense policy networks of consultation and consensus building. We will also see that, whereas Israel's disciplinary mechanisms had eventually been weakened by the entry of foreign capital mediated through the state's emerging VC sector, the Taiwanese state has largely avoided this path. I will argue that this was an outcome of the distinctiveness of Taiwan's VC sector which, unlike Israel's, was funded almost entirely by local finance. Therefore, instead of decoupling its domestic tech sector from its local economy, this allowed Taiwan to further reinforce its strong state-industry coordination structures which have continued supporting the state's traditionally strong developmental regulations.

The Origins of Taiwan's Industrial Strategy

In the 1950s Taiwan was a poor, agriculture-based economy with almost no industry or

technological infrastructure to speak of. However, within a few decades, its economy had been completely restructured, leading Taiwan's national income and standard of living to soar. The transformation of industry was remarkable. The share of agriculture in GNP declined from 38.3 percent in 1953, to only 6 percent in 1988. The corresponding share accounted for by industry in that period increased from 17.7 percent to 46.2 percent. In 1951, per capita GNP was only $145, much less than that of many contemporary developing countries in Asia and Latin America. By 1989, per capita GNP reached an estimated $7,571, much higher than that of countries economically more advanced than Taiwan in 1951 (Gee, 1993, pp. 385-387).

What accounted for this unlikely reversal? As is by now very well know, it was Taiwan's export-led industrialization campaign, spearheaded by its developmental state, which was responsible for the country's rapid economic growth (A. Amsden, 2001; Fields, 1995; Haggard, 1990; Rodrik, 1995; Wade, 1990). As these famous studies have shown, the focal point of its industrial policy since the 1960s was an MNC-Foreign Direct Investment (FDI) program which aggressively marketed Taiwan as a business-friendly location with an unlimited and reliable labor supply and an expanding market. As part of this strategy, Taiwan established large export-processing duty-free manufacturing zones. In 1961, Philips opened its first semiconductor final-assembly factory in Taiwan. In 1964 it was joined by General Instrument (GI) and between 1964 and 1966, twenty-four more U.S firms joined GI and Philips by opening similar manufacturing facilities in the island (Breznitz, 2007b, p. 102).

Notably, whereas similar policies failed to produce long-term economic development in places like Ireland (more on this below), Taiwan's FDI attraction program was an unequivocal success. The reason for this has to with the fact that, whereas many other countries offered similar incentives, Taiwan was able to combine these enticements with conditions. Since the main goal of

Taiwanese industrial policy was to spur the growth of an indigenous IT sector that could eventually provide necessary components, especially higher-value ones, to the world's leading MNCs, the state oriented its demands towards getting MNC's manufacturing subsidiaries to embed themselves more deeply within Taiwanese industry. More specifically, the Taiwanese government demanded that a large and growing share of components used for final assembly in Taiwan by multinationals be locally manufactured. As a result of this "local content requirement", by 1971, 37 percent of all components used by the electronics industry in Taiwan were manufactured locally. Taiwan also urged MNCs to establish joint ventures with local manufacturers but required them to transfer some of their manufacturing technologies to their local partners in upgrading their operations. In fact, because foreign firms had to source locally it was in their own self-interest to transfer knowledge and conduct quality control since they wanted to ensure their suppliers were as efficient as possible (A. Amsden & Chu, 2003, pp. 19-23; Breznitz, 2007b, pp. 103, 144; Wade, 1990, p. 152).[139]

In all regards, Taiwan's "catch-up" industrialization strategy was an outstanding success. Yet, like Israel, as well as most other late-developing economies, by the early 1970s the state experienced several waves of economic and political crises. In addition to overall global unrest due to the 1973 oil shock, the dismantling of the Bretton Woods system, and the economic stagflation crisis experienced by the advanced industrial economics, some local vulnerabilities also existed. For one, the sustainability of Taiwan's FDI-based industrial strategy relied on relative low wages. Yet with wages rapidly rising, mainly as a result of the industry's economic success, many foreign firms which made their fortunes in low-and medium-cost manufacturing, as well as some

[139] More recently, a very similar strategy was implemented effectively and produced impressive results in Malaysia (Khan & Blankenburg, 2009, p. 346)

local Taiwanese companies, began moving their operations to cheaper sites in Southeast Asia and China (A. Amsden & Chu, 2003, p. 11; Weiss & Mathews, 1994, p. 91). Additionally, in this period Taiwan's leading exporters, then mainly in textiles, footwear, and low-level electronics, started facing growing competition from less developed economies and protectionist measures in their target markets (Breznitz, 2007b, p. 104). Fearing an exodus of export-oriented manufacturing firms would produce a "hollowing-out" of local industry, planning officials began to devise and implement a new industrial strategy that aimed reorienting the economy around technological innovation and industrial upgrading of indigenous firms (Y.-h. Chu, 2002, p. 40).

From export promotion to technological upgrading

Following the crises of the 1970s Taiwan first began to reformulate its industrial policy. Broadly speaking, the government's objectives were a combination of economic and social goals that included improving the population's quality of life and transforming Taiwan's economic structure from labor to capital and technological intensive. (Gee, 1993, p. 392). Up until this period, most of Taiwan's SMEs devoted little resources to R&D due mainly to their limited amount of capital and manpower resources (Gee, 1993, pp. 388, 396). To overcome this weakness, in 1970 the government formed the Industrial Development Bureau (IDB) at the Ministry of Economic Affairs (MOEA). From then on, this pilot agency formulated and oversaw a new approach to industrial steering that placed a much greater emphasis on close collaboration between state and domestic industry (Y.-h. Chu, 2002, p. 40).

The IDB promoted R&D in three different yet complementary ways: 1) it undertook advanced R&D in government-owned laboratories, which it then diffused or spun-off to the private

sector; 2) it initiated public-private innovation-alliances with both local and foreign firms; and 3) it directly subsidized private R&D. In total, throughout the 1980s government sponsored R&D typically accounted for as much as half of all R&D related to industrial technology. In the 1990s this figure declined slightly, to around 32 percent (A. Amsden & Chu, 2003, pp. 111-112; Gee, 1993, pp. 394-395).

During the 1970s, Taiwan set up two additional institutions to assist its SMEs make the transition to high-tech competition. In 1973, the chief architect of Taiwan's transition into technological innovation, Yun-Hsuan Sun, worked to merge three existing government labs to create Taiwan's' Industrial Technology Research Institute (ITRI). The idea behind this initiative was to form one main national lab that would be responsible for upgrading Taiwan's industrial technology by solving the risky and more challenging parts of the R&D process and then diffuse the results to private industry, which would focus on final development, manufacturing and sales. In the following decade, ITRI was responsible for the creation of numerous public-private alliances, most famously the creation of Taiwan's largest multinational firm, and the world's most profitable semiconductor company— the Taiwan Semiconductor Manufacturing Company (TSMC). Launched in 1987, TSMC was established as a joint venture between the state-owned Taiwan Development Fund, the Dutch multinational Philips, and a group of smaller Taiwanese firms. The idea was the TSMC would offer advances fabrication facilities for local chip designers, thus relieving them of the necessity of investing in their own production facility. As part of the deal, Philips agreed to transfer its semiconductor fabrication technology in return for securing preferential access to TSMC's output (Breznitz, 2007b, pp. 104-108; Gee, 1993, p. 397; Weiss & Mathews, 1994, p. 97).

In addition, in 1980 Taiwan founded the Hsinchu Science-based Industrial Park which,

similar to ITRI, became another central component of Taiwan's R&D-based innovation strategy. Unlike the tax and duty-free export-processing zones set up in Taiwan's first industrialization push outlined above which aimed to attract foreign investment for export expansion and transfer technology, the design of Hsinchu park aimed primarily to attract and foster investment in high-tech industries by local entrepreneurs. Firms accepted to set up operations in Hsinchu park enjoyed a comprehensive set of subsidies that included below market rents in high-quality facilities, access to advanced technological infrastructure, as well as a variety of financial assistance, including tax holidays, duty exemption on imported equipment and commodity exports, low-interest loans, and matching R&D funds. By the end of 1999, Hsinchu Park hosted a total of 292 high-tech firms, generating a gross annual revenue of NT$651 billion. The Park also accounted for a large and increasing share of Taiwan's total R&D spending—as much as 18 percent by 1998 (A. Amsden & Chu, 2003, p. 110; Breznitz, 2007b, pp. 104-108; Y.-h. Chu, 2002, p. 44; Gee, 1993, p. 405). In addition to the creation of state-of-the-art technologies in the semiconductor industry outlined above, Hsinchu Park also spurred new innovations in the field of high-definition television (HDTV), telecommunications equipment and personalized computers (Y.-h. Chu, 2002, p. 46; Weiss & Mathews, 1994, p. 95).

Aside from its more direct involvement in the development of technology through government labs, science-parks, and private-public alliances, Taiwan also adopted a number of measures to encourage private firms to intensify their R&D efforts by means of direct subsidies. For example, the IDB's Statute for Encouragement of Investment (SEI) provided tax incentives and other benefits to companies that engaged in R&D (Breznitz, 2007b, p. 138; Gee, 1993, pp. 394-395). On the financial side, in 1982 the government introduced the Assistance Program for Strategic Industries (APSI) which provided cheap long-term loans for companies that set out to

produce strategic technologies specified by the IDB. Besides the APSI and SEI, throughout 1980s the IDB introduced a number of additional assistance programs, such as the "$600 million Low-Interest Loan to Promote Export Programs," the "Assistance Program to SMEs under the Sino-American Fund," and the "Assistance Program of Low-Interest Loans for Production Industries to Set Up Satellite Plants" (Gee, 1993, p. 395).

Why were these programs so effective? First, like in Israel, government initiative and risk-sharing were paramount. The transition from traditional manufacturing, where products and markets are already well established, to technological innovation, where both are unknowns, presents incredible risks. It is no surprise, therefore, that private actors seldom enter these fields on their own. This is why government funding of R&D is so vital. As we saw, in Taiwan the state not only subsidized private sector R&D, but in many cases conducted the lion's share of R&D itself, and only then diffused it to industry for final design and commercialization. In this regard, relative to Israel, the state took on greater risks in order to achieve its developmental goals.

But no less important, and again like in Israel (but as we will later see, mostly lacking in Ireland), the state's industrial strategy was effective because the Taiwanese government conditioned the allocation of subsidies to meeting "concrete, measurable, and monitorable performance standards" which it could administer via discipline (A. Amsden & Chu, 2003, p. 115). Largely understated in the contemporary literature, such conditions were essential in ensuring not only that firms in fact innovated but that innovation served as a catalyst for the sustainable development of a competitive domestic high-tech sector that produced both private and public rewards.

For example, to earn admissions into Hsinchu Park, firms had to meet seven different conditions regarding basic levels of R&D, manufacturing capacities and long-term business

operation. Some requirements revolved around ensuring state-funding would translate into the creation of local jobs. For example, firms committed to employing a staff within three years after marketing a product or service comprising "no less than 50 percent of local technical personnel" (A. Amsden & Chu, 2003, p. 116). Other conditions resolved around ensuring supported firms would expand their operations locally. For example, firms that received support through the IDB's SEI R&D tax-relief program required firms to spend a certain fraction of their revenues on additional R&D. Under such stipulations, if an enterprise's R&D expenditure to annual total sales ratio was lower than the prescribed standard it could be disciplined by requiring contributing the difference to a government fund that financed collective R&D projects. Moreover, the program specified that tax incentives should be given only to companies that control the whole production chain, from design to the manufacturing and sales. In the 1990s the IDB introduced a new Statute for Upgrading Industries (SUI) to replace the SEI. One major difference between the two was that under SUI, firms qualified to enjoy preferential treatment only if they demonstrated that in addition to meeting the subscribed R&D standards, they were also in compliance with environmental protection standards, engaged in manpower training, and set up of international marketing channels (Breznitz, 2007b, p. 138; Gee, 1993, p. 395).

Like in Israel, one of the mechanisms used by the Taiwanese government in order to enforce these conditions were in the realm of intellectual property rights. Ownership of products developed with the assistance of public funding had been shared equally, as jointly owned property, between the MOEA and the private firm it collaborated with. As a result, if a firm failed to engage in production within three years after the completion of the development plan, the Ministry could enforce discipline by revoking the firm's IP rights entirely, as well as require them to repay, in installments, money invested by the government (A. Amsden & Chu, 2003, p. 117).

Underpinning these bureaucratic capacities were Taiwan's dense and elaborate, multi-level policy networks which lined up all the relevant social partners and built consensus around the state's "upgrading" policy agenda. Like in Israel, these networks fostered an "upgrading coalition" which involved a variety of actors and interests. In Taiwan, it included senior economic officials from the state's various ministries and industrial planning agencies, senior program officers from state-owned industrial banks and investment funds, presidents of related industrial associations, private venture capitalists, senior executives of related state-owned enterprises, high-tech start-ups, leading private firms, leading scientists from universities and public research organizations, and others. This policy network was then institutionalized in the form of multiple tripartite consultative mechanisms involving the scientific community, business, and the government (Y.-h. Chu, 2002, pp. 42-42, 51-53).

These institutionalized mechanisms served as a forum of consultation and coordination at four different levels. At the first level, consensus was formulated through meetings of the Science and Technology Advisory Group (STAG),[140] the National Science and Technology Conference (NSTC), and Civil Advisory Committee. These key forums provided business leaders, leading scientists, and top government officials an opportunity to devise long-term development plans and a vision for upgrading the island's indigenous R&D capabilities. At the next level, policies were negotiated through the Industrial Development Consultation Committee (IDCC) which functioned under the auspices of the MOEA. The IDCC and its subcommittees identified emerging strategic

[140] Created in 1979 STAG included prominent retired senior executives and scientists, both American and Chinese, from Texas Instruments, Bell Labs, IBM and leading universities. Around the early 1980s, the government introduced the STAG module throughout the economic bureaucracy, as all development-related ministries had been required to set up similar advisory units. During the 1990s, many of them were upgraded into departments, such as the Department of Industrial Technology Development, under the Ministry of Economic Affairs (Y.-h. Chu, 2002, pp. 41, 58).

industries for the medium-term and formulated policy measures to promote the growth of these sectors. These organizations had also been responsible for bi-annual reviews of strategic industries which qualified for various fiscal incentives under the SUI. Declaring that a specific technological product was a "graduate" meant its producers no longer qualified for R&D subsidies, tax credits, equity-investment from the government's VC funds, favorable interest rates from state-owned banks, and various other government assistance. At the third level, for each of the selected industries, the IDB worked with relevant IDCC's subcommittees or the steering committee of a newly installed development program to formulate a medium-term development plan for a given industry. At the last and final operational level, a variety of consultative mechanisms helped the IDB and other point agencies evaluate product-specific or firm-specific projects within the guidelines of an industry-specific development plan (Y.-h. Chu, 2002, pp. 51-53). As summarized by Yun-han Chu (2002, p. 53): "with these elaborate multi-level consultative mechanisms in place, Taiwan's economic bureaucracy […] acquired a strategic capacity unmatched by any other East Asian country, South Korea and Japan included."

Addressing the challenges of "globalization" and the role of foreign direct investment

Up until the late 1990s, Taiwan's developmental trajectory was almost a mirror image of Israel. Both states addressed the economic turbulence of the 1970s by ushering a state-led restructuring of their industries from traditional to high-tech manufacturing, with an emphasis on technological upgrading and innovation. Both advanced this developmental strategy by combining generous state funding and support with conditions and discipline oriented towards fostering the growth, in both size and scope, of technologically advanced domestic firms. While foreign MNCs contributed to the development of these states' high-tech industries, foreign interests did not hold

a dominate position in their economies (A. Amsden & Chu, 2003, p. 11; Felsenstein, 1997, pp. 371-372).

By the early 2000s, however, the trajectory of the two economies diverged in several crucial ways. As was outlined in Chapter 3, in this period Israel's developmental regulations, most prominently its local manufacturing requirement and strict IP regime, were significantly weakened. As we saw, the replacement of these conditions with much more lenient regulation, as advocated for by leaders in private industry, liberalized Israel's foreign trade considerably. By no longer prohibiting the offshoring of high-tech manufacturing, Israel opened the door to expanded outward FDI. Loosening the restrictions on IP transfer or sale paved the way to a wave of M&As that opened Israel's economy up to inwards foreign FDI. As we saw, this process has considerably weakened Israel's high-tech industry and raised questions regarding its ability to maintain a leading position in the world economy.

Taiwan, on the hand, addressed the growing pressures to liberalize its foreign trade by engineering a set of institutional reforms that enabled it to continue guiding foreign investment (both inward and outward) towards developmental ends. Unlike Israel, such policy shifts reflected *continuity* – not change – in the states' commitment to strategically guiding the market. Below, I will first elaborate on the relevant reforms taken by the Taiwanese government in the last two decades. I will highlight, in particular, how these reforms allowed Taiwan to maintain its use of conditions and discipline as mechanisms for ensuring the long-term development of a Taiwanese technological sector. Following that, I will shift to a debate of the politics that enabled Taiwan to maintain this trajectory and avoid going down the path taken by Israel. Here I will emphasize important differences between the two countries' VC sectors which created two distinct political coalitions. These coalitions, in turn, conditioned the states' separate trajectories.

Prior to the 1980s, Taiwan maintained a very restrictive approach towards both inward and outwards FDI. Companies wishing to invest overseas had to demonstrate to authorities how investment would benefit the national economy or expand export opportunities for Taiwanese firms. But from the late 1980s, sharp increases in labor and land prices gave rise to mounting pressure on the part of large domestic firms for greater liberalization of trade that would allow to offshore production. To address these demands, the government introduced several reforms that expanded the types of outward investment permitted. It eliminated financial standards for outward investing firms and introduced an automatic approval and reporting system to reduce bureaucratic regulations. In the immediate aftermath of the 1997 financial crisis and, moreover, upon Taiwan's accession to the World Trade Organization (WTO) in 2001, the country continued with major financial sector reforms, removing most FDI conditionalities and relaxing capital controls on both inbound and outbound flows (Thurbon, 2020, p. 327; Thurbon & Weiss, 2006, pp. 13-14).

Yet, despite these seemingly dramatic policy shifts, Taiwan continued to maintain strategic guidance over its high-tech industry. For example, greenfield investment and joint ventures in any sector still required the approval of the Investment Commission of the MOEA. M&As required authorization by the Fair-Trade Commission which did not approve all kinds of high-tech oriented FDI. In line with long-standing concerns about sustaining Taiwan's technological position, policymakers were particularly cautious regarding investment that could lead to technology leakage to China. Therefore, despite substantial shifts in Taiwan's China-bound investment policy in the early 2000s, the government maintained significant control over investment.

One clear example is investment in leading-edge technologies like semiconductors. Prior to 2002, state laws outlawed investment in Chinese semiconductor plants altogether. In 2002, in response to requests from Taiwanese chip manufacturers, the government lifted a ban on

investment in 8-inch wafer plants. However, the permission came with strict conditions to safeguard Taiwanese intellectual property. The plan limited Taiwanese chip makers to building only three chip manufacturing plants using only equipment that had already been phased out in Taiwan. Furthermore, companies had to agree to keep their core technology in Taiwan and commit to building more advanced 12-inch wafer plants at home. In fact, the investments in China could only be made once Taiwan's 12-inch wafer fabs had started basic and stable mass production (Thurbon & Weiss, 2006, pp. 16-17).

Once again, government strictly enforced these conditions. Taiwanese firms that circumvented restrictions by investing in unauthorized chip foundries in China have been subject to harsh discipline. Those caught exporting sensitive science technology to China without government approval face up to seven years in jail and a fine of up to US$286,000. In fact, according to interviews with Investment Commission officials conducted in 2004 by Thurbon & Weiss (2006, pp. 16-17), ten individuals had already been prosecuted for violating these laws, and more than 80 were under investigation. In one high profile case, the Chairman of Taiwan's Semiconductor Manufacturing International Corporation was fined US$160,000 for illegal investment in a chip manufacturing facility on the mainland. More recently, growing concerns over knowledge spillover to China has prompted policymakers to further amend Taiwan's investment review procedures, in the goal of providing government with more power to investigate Chinese investment that is entering through third countries. The government is also considering barring personal dealing with high-end technology from visiting China during and for a certain period after their employment.[141]

[141] Kathrin Hille, "Taiwan looks to tighten investment rules for China", *Financial Times,* June 30th, 2020.

As these examples demonstrate, while Taiwan has no doubt liberalized foreign trade, it did so strategically and in ways that preserve its developmental priorities. Throughout this process, and unlike Israel, it upheld previous forms of conditionality or has replaced them with alternative mechanisms. Furthermore, as demonstrated above, the state has maintained its disciplinary capacity.

What accounts for this reality and what explains these different approaches to that challenges and pressures of globalization faced by Israel and Taiwan since the early 2000s? The answer, I argue, can be found in the realm of state-society or state-elite relations. More specifically, these diverging trajectories were largely shaped by the differences in the composition of these states' VC sectors.

In Israel, rather than a purely local industry, VCs function much more like an extension of American financial markets and its VC community. While most of the VCs that initially operated in Israel were local funds, a large and growing proportion of funds operating in Israel are foreign. In 2005, Israeli VC funds represented 49 percent of all the funds operating in the state. By 2014, this rate decreased more than 50 percent to an historically low level of 22 percent.[142] This is important as, in contrast to Israeli VCs, foreign funds do not maintain local presence and thus tend to prefer moving the companies they invest in out of Israel and closer to their headquarters where they can be more easily monitored.[143] Even more important than the identity of the VC fund itself, is the source of the actual funding raised. Here, the dominance of foreign interests is even greater, as the lion's share of financing now originating from foreign sources, the majority of which are

[142] The Luzzatto Group, *The Israel Annual National Report 2013-2014*, 2014, p. 16. https://www.luzzatto.co.il/images/publications/israel-annual-national-report-2013-2014.pdf [accessed: July 29th, 2020].

[143] Interview with Eugene Kandel, May 2019.

American. By 2010, an astonishing 95 percent of Israel's VC funding came from foreign sources.[144]

Taiwan's VC is almost a mirror image of Israel's. The local VC sector is extremely localized, as financing originates mostly from local investors or corporations. In fact, foreign resources have historically accounted for less than 7 percent of the investment in Taiwan's VC sector (Breznitz, 2007b, p. 202). These differences have had a dramatic impact on government policy. As we saw in Chapter 3, in Israel, the growing independent power of the VC sector came to dominate the policymaking arena. As a result, the sector's interest in creating more leeway for foreign investments led to significant reforms which weakened the state's existing IP regulation regime. In Taiwan, on the other hand, the VC sector was more of an expansion of the existing high-tech sector, rather than the appearance of an independent social-economic actor with distinct interests. As a result, the emergence of Taiwan's VCs only reinforced exiting social partnerships and strengthen state's embeddness with industry. Rather than weakening regulations, this allowed the state to retain its historically heavy-handed guidance over the future development of the industry.

The creation of Taiwan's VC sector

Taiwan's VC industry developed, like in Israel, as an outcome of government initiative and policies. Also similar to Israel, policymakers located in the state's developmental agencies had

[144] Ya'akov Chertoff, "Realizing the potential of the high-tech sector and government assistance to high-tech companies in the marketing and business development stages". *Israel Knesset Research and Information Center*, May 2010, https://fs.knesset.gov.il/globaldocs/MMM/2cbc8d55-f7f7-e411-80c8-00155d010977/2_2cbc8d55-f7f7-e411-80c8-00155d010977_11_7307.pdf [accessed July 22nd, 2020].

been to ones to identify that the shortage of available growth-stage funding created considerable bottlenecks for the further growth of the high-tech sector. In Taiwan, former finance minister (and future premier) K.T Li is the one who, like Yigal Erlich in Israel, has been recognized as the founding father of the industry. It was Li who believed expanding Taiwan's financial sector, promoting its domestic technological start-ups, and advancing the local use of modern management techniques required a strong VC sector (Breznitz, 2007b, p. 201; Klingler-Vidra, 2018, pp. 80-82).

To spur the creation of this industry which could direct long-term investment capital from Taiwanese investors toward new, high-growth technological enterprises, in 1983 Taiwan's Council for Economic Planning and Development (CEPD) passed the Regulations for the Administration of Venture Capital Enterprises bill. This legislation provided first-time VC investors a 20 percent tax credit, conditioned on them maintaining their high-tech investment for a minimum of two years. In 1991, the government expanded this tax credit in order to incentivize local corporations, thus expanding the size of Taiwan's corporate VC investor base. It also offered tax exemptions on capital gains earned by VCs investing in high-technology SMEs and for earnings from profits reinvested in VC funds (Klingler-Vidra, 2018, p. 84).

In addition to propping up private VC investment, in this period the government repurposed a number of Taiwan's state-owned financial institutions to supply additional sources of VC funding. In the early 1980s, Taiwan's Executive Yuan Development Fund – an investment vehicle with an initial capital of NT$12 billion – and a re-chartered industrial development bank, the Bank of Communication, were tasked with providing VC investment for all major commercialization projects undertaken by public-funded research organizations and their subsidiary firms. In-line with the government's longstanding success in more direct involvement in industry, these state

institutions acted as venture capitalists, taking stakes in high-tech startups, and then selling their shares after IPO and reinvesting profits in new initiatives (Y.-h. Chu, 2002, p. 44).

As a result of these policies, by 2006 Taiwan's VC industry become the fourth largest VC market in Asia (behind Japan, Hong Kong, and Singapore) and the world's third most active, in terms of deal volume, behind the United States and Israel. In total, Taiwanese venture capitalists invested in more than three thousand local companies, and VC-backed technology companies constituted approximately half of all technology companies listed on the Taiwanese stock exchanges (Klingler-Vidra, 2018, pp. 79, 84).

In contrast to Israel, however, Taiwan's state planners did not focus on the attraction of foreign investment but sought to promote local financing. As a result, policymakers structured incentives and regulation in a manner that ensured that the main investors in the industry would be local, rather than international sources. For example, rather than encourage foreign investment, policymakers restricted tax incentives to privately held, Taiwanese technology firms. In the 1980s, policymakers also encouraged local corporations to invest in the emerging VC sector. As a result, many of Taiwan's VC managers have been successful local technology firms that have invested in local start-ups. Taiwan's corporate legal structure (or "paper company" structure as translated from the legal term used in Taiwan) is also different in that VC companies do not have liquidation dates. This "evergreen fund" set-up means that VC managers may run overlapping funds, instead of following the American model – also adopted by Israel – of raising, investing, and liquidating funds (Klingler-Vidra, 2018, pp. 83-85). This provided Taiwanese VCs with longer time horizons for investments and further relaxed pressure for financial exits.

Notably, while most of the financing of Israel's VC sector is foreign, Taiwan's VC capital has continued to be extremely local. In 2014 more than 75 percent of the equity invested in

Taiwanese ICT firms came from domestic venture capitalists, who are drawn mostly from the financial industry or the traditional industries. Since virtually all their financing is Taiwanese, VCs are under limited pressure to seek financial exits in foreign financial markets. In fact, the government encouraged firms to pursue IPOs in the local stock market and dissuaded from listing on foreign stock exchanges market (Breznitz, 2007b, pp. 139-141, 201-202; Klingler-Vidra, 2018, p. 79).

It is largely for these reasons that the Taiwanese VC industry has remained closely embedded with Taiwan's domestic economy. This is in stark contrast to Israel, where VCs are funded mostly by foreign sources, the majority of which as American, leading most successful firms to seek foreign financial exists, most commonly by merging with an American MNCs. As previously highlighted by Breznitz (2007b, p. 204) this has weakened the linkage between Israel's high-tech industry to the rest of Israeli economy. It is also why more of the fruits of the local high-tech sector's success are redistributed to foreign investors, hence out of the Israeli economy, with, relative to Taiwan, only a small fraction of the capital staying in Israel.

Now that the key differences between Taiwan and Israel's VC sectors, and particularly the kind of links that existed between these states' local high-tech firms and their investors, the divergent trajectory taken by the two countries becomes clearer. In Israel, foreign-funded VCs, as well as large segments of the high-tech tech sector which depended on them for funding, mobilized politically to persuade policymakers the reduce exiting regulation that limited outward expansion and inward investments. In Taiwan, on the other hand, the VC sector was far more local and functioned under completely different incentive structures. This meant that, rather than mobilize against the existing developmental regime, it could more easily embed itself within the existing policy networks. This, in turn, allowed the Taiwanese state to continue serving as a leader and

coordinator of the developmental project. We now shift to an investigation of Ireland in chapter 5. After analyzing the Irish case, we conclude chapter 5 with a comparative debate of all three cases.

CHAPTER 5:

Israel in Comparative Perspective- State-led Development in Ireland

In this chapter we turn from Taiwan to Ireland. While Israel and Taiwan are both undeniably success cases, Ireland's attempt to foster an innovation-based economy can best be categorized as a disappointment. Although its industry did upgrade impressively in the 1990s, leading several commentators to go as far as naming it the "Celtic Tiger" (Arora & Gambardella, 2005; O'hearn, 2000; O'Riain, 2000),[145] its accomplishments were moderate and eventually short-lived. By the early 2000s Ireland's IT sector stagnated and its economy financialized. This produced a variety of financial and property bubbles that eventually collapsed in the economic crisis of 2008.

My analysis will focus on Ireland's transition from traditional to high-tech manufacturing in the 1990s, a transition driven mainly by the state-led development of a dynamic indigenous software industry. As we will see, in this specific sector Ireland's developmental agencies successful combined incentives with conditions and discipline – "carrots and sticks" – in ways that ensured the state's support of the sector would produces social rewards. Yet we will also see that this experience was rather limited and did not extend beyond the local software sector. This was largely the result of Ireland's inability to overcome its historic reliance on its FDI-based development strategy, which largely persisted throughout Ireland's transition from traditional to high-tech manufacturing in the 1990s. In stark contrast to Israel or Taiwan, this approach was

[145] In 1994, a Morgan Stanley report referred to Ireland as the "Celtic Tiger" and the name stuck among pundits and social commentators in Ireland and aboard. See: (O'hearn, 2000, p. 67) Also see: "Europe's Tiger Economy." *The Economist*, May 17th, 1997, 21-24.

characterized by far more clientelist relations whereby the state provided a host of economic incentives with little or no conditions in place to ensure local spillovers.

Previous studies have argued Ireland's "networked" or "flexible" development model, with the state's various developmental agencies embedded in "multiple external constituencies", served as the key to Ireland's economic success in the 1990s (O'Riain, 2004, pp. 148-159). In hindsight it seems that, rather than an advantage, this fractured state structure represented the source of Ireland's upgrading failure. In this regard, the notable buildup of Ireland's indigenous software industry can be viewed as an exception to the norm. As I will argue here, this was largely the outcome of what development scholars like Peter Evans and Barbara Geddes have previously referred to as institutional "pockets of efficiency" whereby insulated agencies located outside the traditional bureaucracy are charged with specific, usually developmental tasks. This occurs when political leaders that are unable to transform the bureaucracy as a whole elect to "modernize the state apparatus by addition rather than transformation" (Evans, 1989, pp. 577-579; Geddes, 1990, pp. 225-229; for more recent work in this vein see: McDonnell, 2017; Paus, 2012a). Yet as these previous studies have shown, this strategy has several disadvantages. For one, as long as these pockets are surrounded by a sea of traditional clientelist norms, they are dependent on the political support of the individual or party in power. Secondly, the character of the state's embeddedness makes it harder to construct a unified industrial elite, or what I have referred to here as an "upgrading coalition." As we will see below, both weaknesses manifested themselves in the Irish case leading to the model's eventual demise in the 2000s.

In explaining these institutional outcomes, I will shift the analysis from institutions to state-society relations. More specifically, I will demonstrate how Ireland's pervasive "carrots with no-sticks" approach was an historical legacy of the state's original industrialization model shaped by

the historic balance of class forces. I will also show that Ireland's fleeting success in software innovation emerged due to the unique circumstances created by Ireland's incorporation into the Single European Market. It was under these specific conditions that a new upgrading coalition emerged between Irish state planners located within a newly constructed development agency – Forbairt (later Enterprise Ireland) – and an indigenous high-tech entrepreneurial class, as well as a broader coalition of business and academic interests around science and technology. Yet, as I will also show, this coalition did not replace Ireland's historic embeddedness with foreign capital and managers of MNC subsidiaries in Ireland, but rather existed *alongside* of it. Thus, rather than re-embedding itself in a new upgrading coalition, similarly to what we saw in Israel and Taiwan, the Irish state simultaneously contended with both local industrial and transnational capital in ways that limited its ability to fully restructure its economy. After presenting the Irish case we will conclude with a discussion of the lessons that can be learned by our comparative analysis of all three cases.

The origins of Ireland industrial strategy

Responsible for leading and administrating Ireland's industrial policy throughout the postwar period was Ireland's Industrial Development Authority (IDA). Operating within the Department of Industry and Commerce, during the 1950s the IDA built up significant powers within the state apparatus and became an autonomist developmental agency. Its method consisted largely of approaching small but promising foreign firms through its international offices, building relationships, and then, once the MNC began looking for a base in Europe, to entice them to locate manufacturing activities in Ireland. In fact, IDA was one of the first, as well as one of the most successful, star foreign-investment attraction agencies in the world (O'Riain, 2004, p. 75).

To get foreign investors and export-oriented manufactures to locate in Ireland, the IDA provided an array of financial incentives. Many of these polices were first tested in the free-trade zone (FTZ) around Shannon Airport in West Ireland (the first FTZ in the world, established in 1958), but starting in 1964, government extended these policies to the rest of the country. From then onwards, all restriction on foreign ownership or control on the repatriation of profits were eliminated. Most notable among its different tax concession programs was the Export Profits Tax relief (EPTR). Initiated in 1958, this program provided a 100 percent tax remission on any export-based profits. Although originally intended to run out after ten years, the period of tax relief was extended until the 1990s and then replaced by a still significantly low 10 percent tax. The IDA also provided a package of available grants to foreign investors, which were on average much higher than grants to domestic industry. In addition to these various financial incentives, Ireland became an attractive location for additional reasons: an affordable yet highly educated English-speaking workforce,[146] limited market regulation, a nonunionized environment and, starting in the 1980s, also advanced telecommunication infrastructure. Taken together, these incentives turned Ireland into one of the most attractive locations for foreign investment within the EU, which it joined in 1973 (Breznitz, 2007b, pp. 149, 151-152; O'Hearn, 1989, p. 581; 2000, p. 72; O'Riain, 2004, p. 71; Ornston, 2012b, p. 51).

While this assortment of incentives remained highly effective in attracting foreign MNCs

[146] Ireland's educated workforce was, itself, an outcome of state policies and public investment that aimed to make its economy more attractive for foreign firms. Starting in the 1960s the Irish education system expanded rapidly with public expenditure on education growing from just over 3 percent of GNP in 1961 to 6.3 in 1973. In 1967, the state also introduced free post-primary school education and increased spending on higher education. This facilitated, in particular, the expansion of engineering and computer-science education. The IDA played a key role in this transformation, as the agency included educational policy in its overall view of the supply side of Ireland's industrial policy (Breznitz, 2007b, pp. 153-156; O'Riain, 2004, pp. 73-75).

and increasing exports, this industrial strategy did little to improve the status of the Irish economy. Between 1955 and 1983 real foreign investment grew at an annual rate of 25 percent, real exports grew by 7.5 percent, and manufactured exports by more than 10 percent. Yet this did not foster economic growth. Throughout this period, annual growth rate of per capita GNP was a mere 2.3 percent, and at its highest (1965-1970) reached no more than 3.4 percent. After Ireland joined the EEC, annual per capita economic growth fell to 0.4 percent, and was negative (-1.25) in the 1980s. These represent strikingly low rates of growth compared to other states from the European periphery, and far below developmental states such as Korea, Taiwan or Israel (O'Hearn, 1989, p. 586).

Largely responsible for the failure of this FID-oriented development strategy was that, unlike Taiwan or Israel, state subsidies were provided with no or very few strings attached. The state did not require payment of profit taxes on most manufactured exports, so that profits could be freely repatriated. Unlike Taiwan, the Irish state also failed to place any conditions on MNCs to sources locally in order to establish linkage with or transfer knowledge to indigenous firms. As a result, means of production were freely imported by MNC, and their output was freely exported. In fact, in many cases foreign companies imported finished or semi-finished components, relying on Ireland mostly as an assembly and exporting center. Irish dependence on low labor costs, grant aid, and tax concessions reinforced this "low-road" trajectory. Since the IDA did not make any demands regarding local investments, multinational producers also refrained from setting up local R&D facilities. Consequently, while this strategy was a boon to American MNCs, which amassed tax-free profits at two to three times their average rates in the rest of the world, it did little to improve Ireland's location in the global division of labor (Breznitz, 2007b, pp. 149-152; O'Hearn, 1989, p. 581; 2000, p. 72; O'Riain, 2004, p. 71; Ornston, 2012b, pp. 50-52; Taylor, 2016, p. 262).

In this period the IDA became deeply locked into the interests of its client companies. It not only became a representative of the interests of the MNCs but also a potential organizer. As one senior IDA executive commented: "We would blatantly use the multinationals to influence government" (quoted in: O'Riain, 2004, p. 155). While IDA catered to the interests of MNCs, indigenous firms had to fend for themselves. At least until the early 1990s, the Irish regime perceived foreign industry as a substitute for, but not a complement to domestic industry. The bias in favor of MNCs was reflected in their share of new industry. In the late 1950s, MNCs accounted for over a quarter of new manufacturing jobs. By 1965, MNCs were responsible for the creation of somewhere between 70 to 80 percent of new manufacturing jobs (O'hearn, 2000, p. 581).

This massive job growth in MNCs was an intended outcome. In fact, employment creation was the only condition attached to IDA grants, as "employment creation-tied grants" became the main yardstick of assessment (Breznitz, 2007b, pp. 151, 229). Still, while job creation fueled by MNC investment was impressive, overall employment growth stayed low and even declined in the 1980s. This was because, while MNCs created new jobs at an impressive rate, this achievement was offset by massive job loss in Irish-owned firms (Breznitz, 2007b, p. 153).

The rise and fall of the Celtic tiger

Overall, the Irish FDI-based development model resulted in alternate periods of boom, characterized by rapid inflow of foreign investments, and bust when investment dried up and was too low to ensure sustainable levels of economic growth and job creation. This trend peaked in the "growth without jobs" crisis of the 1980s, when many MNCs left Ireland and few entered in their place. This resulted in economic stagnation, including negative growth in the mid-1980s, which cause unemployment to approach 20 percent. This, in turn, caused a dramatic increase in the rate

of outward migration, and caused public debt to skyrocket (O'hearn, 2000, p. 73; Ornston, 2012b, pp. 127-128).

Yet, by the end of the 1990s, it seemed that the Irish economy might be on its way to breaking out of this boom and bust pattern. Economic growth and export rates soared, the state relieved its debts problems, and the country was being heralded as economic miracle. Between 1988 and 1998, economic growth averaged 6.4 percent, accelerating to 10.4 between 1997 and 2000. Per capita GNP growth in this period was almost as impressive, averaging 8.9 percent. At the same time, the unemployment rate was slashed significantly dropping to 4.3 percent by the year 2000 (O'hearn, 2000, p. 73; Ornston, 2012b, pp. 127-128).

What accounted for unexpected reversal of fortunes? Primarily, it was an outcome of Ireland reorienting its industrial policies around new, high-technology industries such as electronics, software and pharmaceuticals that began in the mid-1980s. Between 1985 and 2000, the share of high-tech manufacturing employment more than doubled, and the share of high-tech manufactured exports more than tripled (Ornston, 2012b, p. 128). This accomplishment can, in part, be attributed to Ireland's ability to use the myriad or incentives outlined above to entice leading MNCs, and U.S information technology firms in particular, to establish or expand their existing manufacturing activities in Ireland. This wave began in 1991 when Intel first decided to locate its European production of computer chips near Dublin. Intel was soon followed by other star firms such as: Dell, Apple, HP, Siemens, Microsoft, Oracle, IBM and many others. By 1998, Ireland became the world's second largest exporter of computer software after the U.S. (O'hearn, 2000, p. 74).

Yet the success of Ireland's high-tech based export-led growth was short lived, and in many ways overstated. First, corporate profit shifting of large MNCs, common among firms attracted to

Ireland for its low corporate tax rates, had very likely inflated Irish growth rates to an unknow yet serious extent (Sands, 2005, p. 45). The most compelling evidence for Ireland being used as a tax haven are the inflated profit rates of American MNCs, about 30 percent compared to an average of 3 to 5 percent of Irish companies (O'hearn, 2000, p. 76). As the sociologist Denis O'hearn (2000, pp. 76-77) concluded: "unless some feature of Irish soil or society produces astounding super productivity, we can safely assume that these profit rates are enhanced by corporate accounting practices." Another anomaly was Ireland's "rapid growth without investment" (O'hearn, 2000, p. 77). According to official data, in the 1990s MNCs invested a third *less* than in the early 1980s, even though their output was growing at historic rates. In fact, the most rapidly growing sectors in terms of output grew *least* in terms in investment (O'hearn, 2000, p. 77). Foreign firms like Microsoft, Claris and Symantec generated huge sales from their Irish operations, yet relatively little value added. This was because most of the core software development still took place at their U.S headquarters (O'Riain, 2004, p. 57). Furthermore, when MNCs did invest, they concentrated mostly on manufacturing rather than on R&D (Taylor, 2016, p. 263). This explains why Ireland's spending on R&D (per GDP) has averaged around half that of Taiwan and as little as third that of Israel, and consistently trails the OECD and EU averages (Ornston, 2012b, p. 129; Taylor, 2016, p. 149).[147]

Finally, while the share of high-tech exports in Ireland was relatively high, measures of high-tech employment had been significantly less impressive. The share of the labor force employed in high-tech industries (6.2 percent in 2011) was significantly lower than in Israel or

[147] Although Ireland's investment in R&D was low in comparison to international leaders such as Israel or Taiwan, it did increase throughout the 1990s, from 0.48 percent of GDP in 1986 and 0.53 percent in 1990. This was achieved through a per annum real rate of growth of R&D spending of 15 percent among foreign firms and 16 percent among Irish-owned firms (O'Riain, 2000, p. 161).

Taiwan. A further sign of weakness was the fact that jobs created by MNCs were still mainly concentrated in routine, low-paying services. Largely responsible for this was the fact that MNCs in Ireland introduced practices that weakened trade union power and increased their ability to hire and fire or manipulate hours. In fact, during the 1990s the Irish state combined with business and trade unions in corporatist tripartite agreements that worked to increase flexibility. The Program for National Recovery (1987), The Program for Economic and Social Progress (1990), and the Program for Competitiveness and Work (1996) had all constrained wage rises and increased worker flexibility. Trade unions and the state went along with this framework because it created jobs and rapidly reduced the official unemployment rate (O'hearn, 2000, pp. 79-80). The agreements also compensated workers with a succession of cuts in personal income taxes so that for many workers net wages increased. Yet, in the long run this form of compensation only eroded the state's revenue base which became a major political issue once the economy slowed down in 2001 (O'Riain, 2004, p. 63).

The birth of Ireland's indigenous software sector in the 1990s

Most unique about this period, however, was not the restructuring of FDI around the technological sector. It was that, for the first time since the 1950s, Ireland also witnessed a robust growth of its *indigenous* enterprises, most prominently its software industry. Throughout the course of the 1990s, employment in this sector quadrupled and exports increased tenfold (Ornston, 2012b, p. 128). By 1997, employment in the indigenous software sector equaled the number of workers employed by MNCs (9,200 to 9,1000, respectively) (O'hearn, 2000, p. 84). More importantly, this period saw the emergence of a "system of innovation" that fueled relatively broad

upgrading of investment, R&D, skills, and productivity (O'Riain, 2004, p. 48). Many of the leading Irish software firms that emerged in this period did so as a result of government initiatives or contracts, including spin-offs from state-owned entities or research universities. They also benefited greatly from the government's growing investment in education and the accumulation of national expertise in the area of computer science and software engineering (Sands, 2005, pp. 50-52). By 2001, seven indigenous software-product-development companies emerged as a major player in their industry: Smartforce (formerly CBT), Iona Technologies, Baltimore Technologies, Trintech, Riverdeep, Parthus, and Datalex. These seven firms accounted for five thousand of the sector's eleven thousand employees (45 percent) and half of the sector's revenues. By the end of the 1990s, all seven companies have been involved in a range of international alliances, opened marketing and development offices, listed on one or more international stock exchange, and had undertaken a variety of merges or acquisitions (O'Riain, 2004, pp. 105-109). Many of these successful first-generation domestic firms had also been responsible for the upsurge of new technology firms by acting as 'role models' in the industry creating a 'follow-the-leader effect'. Indeed, studies have found that a large share of Ireland's software start-ups had been either spun out from or founded by entrepreneurs who previously worked for a leading indigenous Irish software company. IONA, for example, was the single most significant parent of new indigenous firms, with almost twenty spin-offs to its credit (Sands, 2005, pp. 52-53).

The surprising success of Ireland's indigenous software sector was an outcome of institutional changes that took shape in the early 1990s and refocused industrial policy around the indigenous industry. This process began following the release of two public reports commissioned by the National Economic and Social Council (NESC) – the Telesis and the Culliton reports published in 1982 and 1992, respectively – which highlighted the weak links between foreign and

indigenous firms and the government's insufficient attention to the indigenous manufacturing sector. The reports criticized Irish industrial policy and, rather than a continued reliance on foreign investment, advocated for "hands-on industrial policy" that would provide selective support for the more promising indigenous firms. These reports played a key role in the development of Ireland's indigenous tech sector by providing legitimacy for two waves of bureaucratic reshuffling. In the first, under the Industrial Development act of 1993, the IDA was reorganized into two separate agencies: Forbairt, responsible for the development of the indigenous industry, and IDA Ireland, which replaced the IDA as the agency in charge of MNCs and FDI-related activities. In 1998 this reshuffling was complete as Forbairt merged with the Irish Trade Board and parts of FAS (Ireland's training agency) to become Enterprise Ireland (Breznitz, 2007b, pp. 168-169; O'Riain, 2004, p. 99; Paus, 2012b, p. 169). As we will see below, these changes were highly effective as Forbairt (and later Enterprise Ireland) was able to foster upgrading and the formation of large integrated Irish-based high-tech firms.

Until the early 1990s, Ireland's indigenous technological sector was comprised mostly of small start-ups that failed to emerge as large and fully integrated firms. Most commonly, Irish software entrepreneurs who built up a promising product proceeded to cash in their assets as soon as they could, most often through selling their innovative technology to American firms. The problem was that in most cases such acquisitions resulted in the local firm's operations being moved out of the area or, at best, curtailed as the company would be converted into a subsidiary role within the larger MNC (O'hearn, 2000, p. 85; O'Riain, 2014, pp. 122-123). Recall that this is exactly the challenge of innovation-based industrialization highlighted by Breznitz & Zehavi (2010), which Israel overcame through the regulations of its R&D Law. Policymakers at Forbairt realized they would not be able to form a successful indigenous tech sector if they did not find

ways to upend this problematic trend.

To do so, Forbairt first increased its support of the sector. In the early 1990s total grant payments to indigenous software firms increased significantly, almost doubling between 1988 and 1992. By 1997, the state provided one third of all investment in the software sector, and an additional 25 percent had been stimulated by the state through "matching funds" arrangements. Additionally, Forbairt began shifting its attention to firm 'scale-up'. Instead of its previous emphasis on funding entrepreneurs with promising product ideas, it began increasing its focus on existing startups that demonstrated potential for growth (O'Riain, 2004, pp. 95-99). For example, in order for companies to receive tax benefits and qualify for R&D grants, they first needed to be approved as "fast-growing startups", i.e.—firms viewed as capable of reaching sales of €2 million within a few years (Breznitz, 2007b, p. 181).

Yet overcoming the challenges of innovation-based development entails more than just shifting resources. It also requires ensuring assisted firms would commit to expanding locally. Indeed, the reason that Forbait's "science, technology and innovation" strategy succeeded was precisely because the agency constructed the kind of state capacities necessary for setting conditions and enforcing them via discipline. In the early 1990s, Forbairt began to tie funding to various aspects of company development. By the end of the decade, the agency provided such conditioned funding for each stage of company development: feasibility grants as seed capital for start-ups, employment grants for the early growth stage, and then funding for R&D, training, and management development for the company development stage (O'Riain, 2004, pp. 99-101). As one Irish emigrant stockbroker in Silicon Valley put it: "I think Forbairt have been great. There's a lot of money for companies, but you have to be good; you almost have to be selling in Britain or Europe before you get the grants. Forbairt are very tough" (quoted in: O'Riain, 2000, p. 174).

In addition, Forbairt made efforts to improve its monitoring capabilities. First, it used its close face-to-face ties, developed through the grant-aid process, to collect information and exert influence of funded firms. Second, it gathered huge amounts of data on individual firms by conducting surveys and having officials monitor "their" companies more closely (O'Riain, 2004, p. 156). To further avoided clientelism and rent-seeking the agency made extensive use of "external evaluations". These assessments upheld strict "performance requirements", with poor evaluations leading to "closure, sale, or reorganization" of specific funding programs (O'Riain, 2004, pp. 160-161). Together, such efforts proved highly effective in curbing the "intellectual asset-stripping acquisitions" common in the early 1990s and helped Irish startups grow into fully integrated companies (O'Riain, 2004, p. 123).

The source of these capacities can be traced to Forbairt's heavy reliance on EU funding for their activities. Indeed, most of the programs undertaken in the realm of science and technology were funded primarily by "European Structural Funds" which had been designed for Ireland as part of the EU's effort to develop its peripheral members in preparation for the upcoming Single European Market in 1992 (Taylor, 2016, p. 264).

Throughout the 1980s, EU structural funds for Ireland had amounted to around 1.5 percent of GNP. In 1991–1993, however, they increased to nearly 3.5 percent, and for the rest of the 1990s they hovered around 2.5 percent. This represented a remarkable inflow of capital, equivalent in magnitude to the Marshall Aid. Many have attributed Ireland's growth in the period to this injection of capital into its economy (Paus, 2012b, p. 172). Yet, as O'Riane (2004, p. 187) noted, the Irish state had compiled significant amounts of capital before without being able to foster sustained economic development. Most significant this time was not the EU funds themselves, but more importantly the fact they incorporated considerable performance conditions which they

enforced by strict evaluation and accounting. This created a climate in which regular evaluation of policies was the norm and where clientelism was mitigated.

Also key to their success was the fact that using these funds to finance the development of Ireland's indigenous software sector did not require shifting funding away from other government agencies, or social constituencies, that would have likely resisted such a reorientation in developmental priorities. In order words, these funds permitted the state to sidestep political barriers (O'Riain, 2004, p. 187). In this manner, the arrival of EU funds enabled Ireland to foster a new developmental complex *alongside* its existing old one without needing to completely dismantle it or escape its historic dependence on foreign investment. Yet as a result, the central weaknesses of its economy, the lack of linkages between foreign and domestic firms, largely persisted throughout this period (O'Riain, 2000, p. 85). It thus continued being an impediment to economic development. Fully appreciating this structural weakness and how it continued to shape Ireland's economy requires examining the political origins of Ireland's industrial strategy.

The politics of Ireland's developmental strategy

Beginning in the 1930s, Ireland's indigenous industry developed thorough the traditional tools of ISI which included trade protection via a quota and tariff system. Similar to the experience of ISI in places like India, Turkey and elsewhere (but unlike the unique experience of Israel discussed in chapter 1), this period saw local businesses import necessary equipment and raw materials without exporting much of their product in return. To maintain profits, business charged monopoly prices and, with no mechanism in place to condition state protection on minimum levels of performance, firms avoided reinvestment and speculated elsewhere in Ireland or abroad. As a result, the economy stagnated, creating a severe balance of payment problem.

To contend with these systemic problems, following the Second World War, Irish policymakers first tried to initiate a state-building project whereby the institutions of a developmental state would be constructed. In 1947, then-minister for Industry and Commerce, Seán Lemass, drafted a bill to create an "Industrial Efficiency Bureau" that could monitor and discipline industrial firms that received state support. More specifically, the law would permit the Bureau to "examine any company's records to see if it was operating efficiently, pricing fairly, and reinvesting its profits productivity". The proposed legislation also proposed the Bureau would be empowered to "sanction against companies that violated efficiency standards" and even "take control of companies that failed to respond to state interventions" (O'hearn, 2000, p. 72).

These reforms, however, did not materialize. A mobilized capitalist class and free-trade oriented business interests opposed and eventually blocked the proposed legislation portraying it as "socialistic" and a violation of "free enterprise". The chances for state-led development based on the fostering of a domestic industry were further diminished when Ireland accepted U.S. Marshall aid forcing upon itself the acceptance of a series of U.S. policy requests. Chief among these demands was opening up the economy to free trade and foreign investment. Recipients of Marshall aid were also required to join the Organization of European Economic Cooperation (OEEC, a precursor of the EU), which also required Ireland to liberalize trade by removing quotas and tariffs— the central policy tools of any ISI regime. The removal of trade protection with the enactment of free trade flooded the Irish markets with cheap imports leading large swathes of indigenous industries to go out of business (O'hearn, 2000, p. 72). Ironically, as Sean O'rain (2004, p. 173) concluded, while "domestic capitalists were strong enough to resist [the] efficiency measures" outlined above, they had been too weak to "block the free trade that would ultimately decimate them." With the construction of a disciplinary developmental state now off the table due

to the resistance of a domestic capitalist class and the adoption of the OEEC's free-trade architecture looming, Ireland was left with few avenues for ushering economic growth. It thus went on to develop its FDI-based strategy outlined above which dominated industrial policy through the 1990s and beyond. Ireland's domestic industry paid the price of this decision with its interests sidelined in favor of those of foreign multinationals.

As outlined above, only in the 1990s did Ireland's approach shift. In this period the notable expansion of Ireland's indigenous high-tech sector first began to take shape. Forbairt – the developmental agency which received responsibility for fostering Ireland's domestic technological sector – led the charge implementing various industrial policies necessary to do so. Yet Forbairt's effectiveness originated not only from its institutional independence from Ireland's central development agency – the IDA – but also because it was embedded with an entirely separate set of social actors. Recall that, whereas IDA maintained close ties with the management of MNCs around the world, as well as their local subsidiaries, Forbairt developed relationships with a completely different set of social actors which included Ireland's indigenous high-tech entrepreneurial class and other business and academic interests rooted in the field of science and technology (O'Riain, 2004, pp. 75, 149, 156). As a result, Forbairt's (later named 'Enterprise Ireland') influence within larger policymaking circles was limited and never reached the kind of impact or political clout of the IDA. As one senior IDA executive explained:

> "Enterprise Ireland doesn't have something the IDA has –IDA was far closer to its companies. Enterprise Ireland is trying to influence government, talking about policy and strategy and not needs of specific companies; it's not as effective. The views of the MNCs have far more political clout than of an Irish firm." (O'Riain, 2004, p. 156).

In the early 2000s, Sean O'Raine (2004, pp. 148-158) argued that the key to Ireland's economic growth in the 1990s was the "networked" or "flexible" nature of its developmental agencies, which were "multiply embedded" within different social groups. Unlike the prototypical

"Bureaucratic Developmental State" of Korea, Taiwan or Japan, whereby key state bureaucrats located within a pilot developmental agency became embedded with a coalition of "domestic business owners and managers", he argued, the "flexible developmental state is defined by its ability to nurture post-Fordist networks of production and innovation, to attract international investment, and to link these local and global technology and business networks together in ways that promote development" (O'Riain, 2000, pp. 158, 164). Yet, in hindsight, it seems that Ireland's "flexible development state" was far less successful than initially imagined. Despite the effectiveness of Ireland's Forbairt, this agency was the exception to the norm. As with similar institutional "pockets of efficiency" elsewhere, its emergence was largely made possible by unique circumstances at the party-political level, where a left-of-center "Rainbow Coalition" government briefly opened up the institutional space for developmentalism in the 1990s. Yet this window of opportunity narrowed significantly in the proceeding decade with the creation of a populist, center-right coalition government (O'Riain, 2014, pp. 79-80). Yet Ireland was not able to overcome the structural weaknesses of its development model which became more evident following the dot-com crisis in the early 2000s. Here a comparison with Israel is illuminating. In Israel, even after the bursting of the dot-com bubble in 2000, annual formation rate of new startups remained above a hundred. In Ireland, on the other hand, in the whole of 2001 no more than three seed investments in startups had been made. It is also clear that despite the success of the indigenous high-tech sector, its emergence did not alter the structural dominance of MNCs which in 2002 still accounted for almost 90 percent of the industry's profits and over 90 percent of its total exports (Sands, 2005, pp. 43-44). By 2004, employment, sales and exports of Irish-owned software firms all declined from their peak in 2001 (Breznitz, 2007b, pp. 79, 180; Sands, 2005, p. 46). These weaknesses were fully exposed when Ireland's financial and property bubbles burst in 2008 resulting in one of the

worst financial and economic crisis in the world (O'Riain, 2014, p. 55).

As the analysis depicted above shows, it was largely this dual nature of Ireland's development regimes, and their links to different growth coalitions, that were responsible for Ireland's relatively weak and short-term performance. Despite the success of its indigenous software industry, Ireland never overcame its structural dependence on foreign investment. And although the IDA embedded itself with foreign capital, unlike Taiwan, it never enjoyed the capacities necessary for requiring foreign firms link up with local firms in ways that advanced local upgrading. Even in its most successful days, the IDA mostly responded to the needs and desires of MNCs, doing whatever it could to keep them in Ireland, then the other way around (O'hearn, 2000, pp. 76, 84). The disciplinary capacity of Forbairt was important, but ultimately limited. As we saw, its influence never extended beyond the realm of the indigenous sector. Compare this with Israel, where one central development agency, the OCS, advanced innovation policy and provided support for both local and foreign firms under the same terms and conditions. Taiwan's IDB functioned in a very similar manner.

CONCLUSIONS

After presenting updated accounts of both the Taiwanese and Irish developmental experiences, it is now possible to address the central research questions outlined in this chapter's introduction. First, by comparing Israel's trajectory with that of Taiwan, we can see that while Israel's developmental achievements were no doubt remarkable, they were not unique. More importantly, the cases of Taiwan and Ireland help further demonstrate the importance of conditioning public R&D subsidies and institutional support in ways that ensure a host of

economic and social objectives. Like in Israel, much of Taiwan's success can be attributed to the capacity of policymakers to condition state assistance on the future buildup of integrated domestic firms that can become global leaders. The Irish experience provides an important counterfactual that demonstrates what happens when states provide subsidies with few or no conditions. As we saw above, Ireland offered MNCs a host of attractive economic incentives yet failed to accompany these subsidies with specific conditions. Since incentives were viewed as "gifts" rather than "implicit contracts" the mere presence of MNCs contributed little to Ireland's domestic economy (Chibber, 2014, pp. 32-33). As a result, Ireland failed to produce an economic transformation on scale similar to that of Israel or Taiwan. The impressive, yet brief success of Ireland's indigenous software sector during the 1990s was the exception that proves the rule. As we saw, the development of this specific sector occurred outside of Ireland's main developmental axis of the IDA and its client firms. As a result, policymakers were able to sidestep political obstacles and establish enforceable conditions which, in turn, contributed to the effective development of the sector.

Furthermore, our comparative analysis also helps strengthen the argument made in Chapter 3 regarding the political sources of the state's capacity (or lack thereof) to set conditions and enforce discipline. As our analysis above showed, what largely accounted for the variation between Israel, Taiwan and Ireland's developmental capacities were their state-elite formations. In both Israel and Taiwan, the state's leading developmental agency was successful in forming broad "upgrading coalition" with leaders in industry, finance, and entrepreneurial scientists and engineers. This state-elite cooperation allowed that state to coordinate interests and build consensus around its developmental policies. In Ireland, on the other hand, the state's developmental regime was embedded mainly with foreign multinationals and their local

representatives, whereas indigenous firms were largely absent from this coalition. This weakened Ireland's development agencies and turned them into representatives of the interests of MNCs, rather than the other way around.

Finally, our discussion of Taiwan's more recent foreign trade reforms allows us to examine another counterfactual: was Israel's trade liberalization and deregulation of its R&D regulations an unavoidable outcome of deepening globalization worldwide, or were other developmental pathways available? Taiwan's experience shows that increased globalization can, in fact, go hand in hand with continued upgrading. As we saw, like Israel, starting in the early 2000s Taiwan began liberalizing foreign trade, removing many previous trade barriers, and opening its economy to foreign investment. Yet unlike Israel, it did so strategically in ways that maintained its developmental ends. This example highlights that Israel's adherence to the imperatives of globalization and free trade was not an unavoidable faith. In fact, as numerous studies have shown, the existing framework of the WTO still provides ample space for strategic targeting and industrial policies (A. H. Amsden & Hikino, 2000; Hung, 2020; Naqvi et al., 2018; Weiss, 2005).

Rather than point to "globalization" as the culprit in Israel's adoption of free trade, our analysis identifies changes in Israel's upgrading coalition, primarily the formation of Israel's VC sector, as the main source of its liberalization reforms. Indeed, as demonstrated above, one central difference between Israel and Taiwan was the source of their VC investment. Whereas Israel's VCs relied mostly on foreign investments, Taiwan's policymakers were wary of foreign involvement and insisted on finding local sources of funding. As a result, whereas Israel's VC sector pushed for reforms that would further integrate Israel's high-tech sector within existing global supply chains, turning Israel into an R&D node within a larger network, Taiwan's VC sector was deeply embedded within its local economy and thus contributed to the further advancement

of the state's indigenous high-tech economy.

CONCLUSION

This dissertation advances the literature by making two specific contributions. The first is to highlight a crucial, yet underappreciated feature of contemporary industrial strategy: the state's capacity to condition public assistance on the fulfillment of specific terms and obligations and enforce discipline when private firms do not adhere to government guidelines. I find that, much like the catch-up developmental state of the postwar period, these specific capacities represent a necessary condition for the effectiveness of innovation policies. Whereas state assistance was historically tied to maintaining strict performance standards, mainly in the realm of export promotion, contemporary innovation strategies require conditioning assistance on the domestic commercialization of state-sponsored innovation. These capacities are necessary in order to guarantee that the economic benefits produced by the state's investment in innovation are not appropriated by private actors but rather distributed more broadly within the domestic economy. This finding is supported not only by our analysis of Israel's innovation-based upgrading campaign, but also by evidence of the Taiwanese experience. The case of Ireland provided additional support, serving as a negative case.

The second theoretical contribution involves returning to the fundamental debate about the role of politics – reflected in the relations between the state's developmental agencies and key societal actors – in development. With some notable exceptions, the scholarship on innovation has not paid much attention to how state action is constrained (or enabled) by its relationship with various social groups. By incorporating an analysis of the politics of policy formation, I argued that politics represents a key causal factor in the effective implementation of innovation policy. I

substantiated this claim with evidence from Israel as well as Taiwan and Ireland. In the case of Israel, I highlight the emergence of MATIMOP— a political coalition formed under the initiative of the OCS and which included key members of industry, finance, and labor as well as former military elites and leading entrepreneurial scientists and engineers. As demonstrated, this "upgrading coalition" underpinned the state's efforts to restructure industry in the direction of a knowledge-based economy and played a pivotal role in the successful implementation of the state's innovation policies. In Taiwan, as we saw, a similar function was provided by the state's dense multi-level policy networks. It included senior economic officials from the state's various ministries and industrial planning agencies, senior program officers from state-owned industrial banks and investment funds, presidents of related industrial associations, private venture capitalists, senior executives of related state-owned enterprises, public research organizations, and others. This policy network was then institutionalized in the form of multiple tripartite consultative mechanisms which involved the scientific community, business, and the government. Finally, in Ireland, we demonstrated how the state's inability to promote a broad upgrading coalition like the ones that existed in Israel and Taiwan, was largely responsible for its relative policy failure.

Politics, I argue, plays a key role not only in policy *formation*, but also in policy *reform* and institutional change. In Israel, we also saw how changes within the state's upgrading coalition, due mainly to the appearance of Israel's VC sector, led to a series of institutional reforms that eventually eroded the state's developmental policy regime. In Taiwan, on the other hand, this outcome was largely avoided as the state's VC sector developed as an extension of the state's domestic technological sector and thus shared the state's upgrading agenda. Therefore, this study not only contributes to growing debates on the "political economy of innovation," (e.g. Doner & Schneider, 2016; Meckling & Nahm, 2018; Sancak & Özel, 2018) but also to the robust literature

on the role of politics in institutional change (e.g.Hall & Thelen, 2008; Streeck & Thelen, 2009).[148]

In the account offered here, the effectiveness of Israel's upgrading agenda is attributed not to the state's exceptional features or its turn towards free market, but rather to its skillful policymaking capacities and its ability to marshal political support for its policy agenda from a broad social coalition. What accounts for the presence of these two crucial factors?

In this dissertation I argued that fully accounting for these factors requires extending the historical analysis beyond the 1970s. As we saw in chapter 1, Israel's experience with industrial policy did not begin in the 1970s, but rather dates back to the state's first industrialization campaign in the decades following its independence in 1948. It was in this period that Israel developmental agencies, such as MOTI, and policy instruments, such as the Investment Law, were first established. In this regard, in their subsequent efforts to advance Israel's innovation economy policymakers did not need to establish new state organizations and policy instruments. Rather, they could draw on the institutional legacies and redeploy existing institutions and policy instruments forged in the 1950s and 60s. The same was true in the case of Taiwan, where state agencies and policy tools that were forged during the state's initial industrialization efforts were later refashioned to advance the state's transition to technological innovation and upgrading. In Ireland, on the other hand, the endurance of the state's original developmental regime produced the opposite effect. As we saw, the strength of Ireland's IDA and the state's historical reliance on an FDI-based development strategy significantly weakened its capacities to implement a new developmental regime aimed at fostering an indigenous technological sector.

The upgrading coalition that supported Israel's innovation-led strategy also emerged out

[148] For a recent attempt to bridge the literature on institutional change and the developmental state see: (Hamilton-Hart & Wai-chung Yeung, 2019).

of the state's initial industrialization efforts. As we saw, these included members of both private and labor-owned sectors. The fact that leaders in private industry that developed out of Israel's first developmental era remained a central coalition partner in its push to become an innovation-based economy is not surprising.[149] Indeed, that has been the norm elsewhere; Korea, for example, included the Chaebols as senior partners in its recent attempts to transform from fast follower to a leading innovator (Kim, 2019; Thurbon & Weiss, 2019). More surprising, and in many ways counter to leading theories of innovation, is the fact that labor also remained an influential partner in this more recent development coalition. The "varieties of capital" literature, to name one prominent example, views organized labor, and the corporatist model more generally, as an impediment to innovation (Hall & Soskice, 2001). Yet the finding that powerful industrial unions were instrumental in the transition to high tech is not unique to Israel. In fact, organized labor has played a key role in the development of other innovation-led economies, such as Finland, Denmark, and Sweden (Ornston, 2012b).

These insights in no way diminishes the importance of the institutional building and political processes analyzed in this dissertation. After all, Israel's OCS or MATIMOP did not exist before the mid-1970s. The same is true of IDB and Hsinchu Park in Taiwan, or IDA in Ireland. What it does suggest is that the conditions that allow these institutions to produce the desired developmental outcomes have links to the state's previous developmental experience. Although the literature on state-led developmental has tended to distinguish between different developmental eras and regimes, future studies will benefit from considering the ways in which the two are linked, or in other words: how contemporary developmental efforts are conditioned by the nation's developmental past.

[149] On "big business" in Israel throughout these two developmental periods, see (Maman, 2017).

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These days, as national governments worldwide scramble to respond to the social and economic ramifications caused by the Covid-19 pandemic this dissertation's theoretical insights could not be more relevant. Whether it is support of the pharmaceutical sector's attempts to produce a vaccine and numerous others treatments for the coronavirus, the ramping up of production of various medical supplies including masks, ventilators, and protective gear, or the provision of financial assistance to business, finance, and ordinary families that are struggling to stay afloat, state governments have been front and center in managing the response to the outbreak. Indeed, the Covid-19 outbreak has even pushed ostensibly market-oriented economies like the US and the UK to consider – and in some cases implement – industrial policies that would have seemed inconceivable prior to the pandemic.

While governments have been quick to inject huge sums of capital into the economy, they have largely done so with limited conditions and few strings attached. In the framework of the U.S.'s CARES Act, for example, corporate-bailout money, potentially amounting to more than an unimaginable sum of $6 *trillion*, was not made conditional on how corporations spent this money or their economic decisions more generally (Brenner, 2020). What this dissertation makes clear is that for state assistance to be effective, governments must structure their financial assistance programs in ways that do simply hand out money and ensure private profits, but also advance long-term public interests. Israel's experience in state-led development teaches us that doing so effectively requires combining state subsidies with specific conditions, as well as establishing institutional mechanisms that can monitor investments and impose discipline when warranted.

Such capacities cannot be enacted in top-down fashion, as they are likely to be met with severe opposition from business interests. Instead, policymakers must find ways to organize various societal actors and form broad coalitions with groups that share the state's long-term vision.

APPENDIX

Table A1: Interview List

	Name	Biography	Date/location
1	Aharon Fogel	Former head of the budget division at Israel's Ministry of Finance (1983-1987) and Director General at Israel Ministry of Finance (1992-1995). Also: General Partner at Jerusalem Venture Partners (JVP) VC fund, Chairman at IDB Development Corp., Chairman at Ness Technologies, and Director-Economic & Control Division at CLAL Israel.	December 3rd, 2019/ Tel-Aviv
2	Amiram Shor	Serial entrepreneur and VC investor. A pioneer of Israel's software industry	February 7th, 2018/ Tel-Aviv
3	Chemi Peres	Venture Capitalist and high-tech entrepreneur. Founded the Mofet Israel Technology VC Fund in 1992; currently Managing General Partner and Co-Founder of Pitango VC fund. Former chairman of the Israeli Venture Association (IVA) (2002-2004)	November 20th, 2018, Herzliya
4	Dan Tolkowsky	Managing Director, the Discount Bank Investment Corporation (DBIC) which financed Israeli high-tech greats Elron, Elbit, Elscint and Scitex. In 1985 founded Athena— Israel's first VC fund, together with Fred Adler, American venture capital investor	April 23rd, 2018/ Tel-Aviv

5	Dan Vilinshy	Chairman of Applied Materials Israel (1997-2006), Executive Director of the Israel-US Bi-National Industrial Research and Development (BIRD) Foundation (1993-1996); served as the Vice President and General Manager of KLA Instruments in Israel (1985-1992)	April 23rd, 2018/ Tel-Aviv
6	David Assia	Serial entrepreneur and angel investor. Co-founder, chairman/CEO of Magic Software (1986-2007)- the first Israeli Software Company to be listed on NASDAQ.	March 12th, 2018/ Tel-Aviv
7	David Boaz	Economist, formerly head of National Budget Division at Israel's Ministry of Finance (1987-1991)	January 22nd, 2018/ Tel-Aviv
8	Dov Mishor	Former Director General of MOTI (1997-1999), also served in a series of jobs at the Bank of Israel, as economic advisor to the Minister of Finance, and as deputy general manager for finance at Israel Chemicals	February 15th, 2018/ Tel-Aviv
9	Dov Moran	Serial entrepreneur (invented the USB flash drive), formerly: chairman/CEO and founder of M-Systems (1989 – 2006), today Managing Partner of Grove Ventures VC fund	July 5th, 2018/ Tel-Aviv
10	Dr. Orna Berry	Policymaker and high-tech entrepreneur. Former Chief Scientist at MOTI (1996–2000), chairperson of	May 1st, 2018/ Tel-Aviv

		the OCS's Israel-US Bi-National Industrial R&D (BIRD) Foundation, Partner at Gemini Israel Funds (VC fund) (2000-2011), chairperson of the Israeli Venture Association (IVA) (2006-2009)	
11	Dr. Yehoshua (Shuki) Gleitman	Former Chief Scientist at MOTI (1992-1997) and Director General of the MoTI (1996-1997). Former Managing Partner Platinum VC (2000 – 2012)	April 11th, 2018/ Tel-Aviv
12	Ed Mlavsky	Former executive director of the OCS' Israel-US Bi-National Industrial Research and Development (BIRD) Foundation (1979 -1993); co-founder and former chairman of Gemini VC fund	March 27th, 2018/ Tel-Aviv
13	Elisha Yanay	Former President and General Manager of Motorola Israel (1990-2001); Senior Vice President Motorola Inc (2004–2011)	February 20th, 2018/ Tel-Aviv
14	Ilan Peled	Program Director of the OCS's Technological Infrastructure (MAGNET) Program (1994-2015)	November 7th, 2018/ Ramat Hasharon
15	Kerem Navo	Head of Government Relations at Wix.com (2015-present)	March 11th, 2019/ Tel-Aviv
16	Lydia Lazanes	Formerly Deputy Chief Scientist at the OCS (1977-2017)	May 9th, 2018/ Tel-Aviv
17	Micah Pearlman	Formally the Manager of R&D and Higher Education Sector for the National Budget Division at the Israel's	March 24th, 2019/Rehovot

		Ministry of Finance (2012-2016), involved in the creation of the new Israel Innovation Authority, and the reform in the R&D Law	
18	Netta Linzen	Head of Policy Planning, Israel Innovation Authority (formerly the OCS) (2017-2020)	February 4th, 2019/Tel-Aviv
19	Prof. Eugene Kandel	Israeli economist, CEO of the Start-Up Nation Central, and a Professor of Economics and Finance at the Hebrew University. Former chairman of Israel's National Economic Council at the Prime Minster Office (2009-2017)	May 6th, 2019/ Phone interview
20	Prof. Manuel Trajtenberg	Prof. of Economics Tel-aviv University expert on Israel's innovation, high-tech sector and R&D policy	May 21st, 2018/ Tel-Aviv
21	Prof. Niron Hashai	Professor of Strategy and International Business at IDC Herzliya, formally Deputy Dean and Head of Strategy and Entrepreneurship area at the Hebrew University's School of Business Administration	February 12th, 2020/ Tel-Aviv
22	Rami Guzman	Held various senior positions at Motorola Inc. and Motorola Israel. since 1985, including VP and CFO of Motorola Israel. Prior, he worked for the Ministry of Finance first as senior assistant and deputy to the Director of the Budget and then as Government-wide MIS and IT Commissioner	May 23rd, 2018/ Tel-Aviv
23	Rina Pridor	Former Deputy to the Chief Scientist at MOTI (1974-	January 21st,

		77), director of the OCS's Incubators Program (1990-2008)	2018/ Herzliya
24	Sagi Dagan	Vice President, Growth Division at Israel Innovation Authority (2016-present), formerly senior economic consultant at the Office of the Prime Minster (2008-2013)	February 20th, 2019/ Airport City
25	Tamar Ben-Yosef	Former deputy of industrial planning at MOTI, former economic journalist at Globes.	July 27th, 2015/ Jerusalem
26	Uri Gabai	Chief Strategy Officer at the Israel Innovation Authority (formally the OCS) (2011-2019); currently co-General Manager at Start-Up Nation Central	February 26th, 2019/ Airport City
27	Uzi Eilam	Head the Military R&D Unit in the IDF. Former Chief Scientist of the MoD and the director of the defense R&D (1986 to 1997)	March 21st, 2018/ Tel-Aviv
28	Yigal Erlich	Former Chief Scientist at MOTI (1984-1992), founder and chairman of the Yozma Program, considered the founding father of the Israeli VC sector; founder and first chairman of the Israeli Venture Association (IVA) (1996-2003)	February 18th, 2018/ Tel-Aviv
29	Yoram Oron	Founder & Managing Partner of Vertex Venture Capital. Former chairman of Israel Venture Association (IVA) (2004-2006)	July 30th, 2018/ Phone interview
30	Yossi Smoler	Policymakers and high-tech entrepreneur. Former	Nov 6th, 2018/

		director of the Incubators program in the OCS (2009-2014)	Rishon Le-zion
31	Zafrir Neuman	Chief legal counsel, The National Innovation Authority (formerly the OCS) (2007-present)	June 16th, 2019/Tel-Aviv
32	Zohar Zisapel	Serial entrepreneur, co-founder (together w/ brother Yehuda Zisapel) of RAD Group in 1981 which spawned more than 185 companies, 8 IPOs and 19 mergers and acquisitions.	March 14th, 2018/ Tel-Aviv

Table A2: List of Archives

Archive Name	Location
Israel State Archives	Jerusalem
Knesset Archives	Jerusalem
Pinhas Lavon Institute for Labour Movement Research (archive of the Histadrut)	Tel-Aviv
U.S. National Archives	College Park, Maryland
National Library of Israel, Hebrew University	Jerusalem
Brender-Moss Library, Tel Aviv University	Tel-Aviv

Table A3: List of Newspapers

Haaretz
Yedioth Ahronoth
Maariv
Davar
The-Marker
Globes
Calcalist

Interview Protocol

Questions for former leaders in private industry

1. Tell me about your career trajectory starting with the army service or undergraduate degree, firms you worked for and positions held in those firms
2. During the late 1970s and early 1980s, Israel's economy and industry dramatically shifted from a focus on traditional manufacturing to very advanced high-technology production. Can you describe this shift and what you think contributed to it?
3. How did private industry in Israel contribute to this shift?
4. How did relations between industry and the state change in this period?
5. What was the role/importance of public/government policy? How did it contribute to this shift?
6. What was the role of the Office of the chief scientist? Did your firm receive funding for it and if so, how important was it to the firm's success?
7. What was the nature of the relationship between private industry and the OCS?
8. What did you think of the requirement not to see knowledge (intellectual property) to foreign firms?
9. What did you think of the requirement to pay kickbacks to the OCS?
10. What kind of conditions (strings) were attached to gov. support?
11. What kind of oversight existed, if any, on the part of the state?
12. What kinds of sanctions were given by the state, if any?
13. Did your firm receive grants/loans from the MOTI through the "encouragement of investment law"?
14. What was the nature of the relationship with the MOTI's investment center?

15. Did you firm enjoy any funding through the "investment law"? If so, how important was this?

16. In the 1980s, the state stopped providing subsidized loans and grants, and began to provide large tax breaks via the law of encouragement. What was the reaction toward this change? How was it perceived by leaders in industry?

17. In the 1990s there were dramatic shifts in israel's macro-economic environment (taxes, trade liberalization, labor law, stock market reform, bank reform). How did industry perceive these changes? How did they influence the growth of the industry?

18. In the 1990s a large input of VC entered Israel. Why did this process begin and how did it contribute, if it did, to the growth of the industry?

Questions for former senior state officials

1. Tell me about your career trajectory starting with the army service or undergraduate degree, state agencies you worked for and role/position there
2. During the late 1970s and early 1980s, Israel's economy and industry dramatically shifted from a focus on traditional manufacturing to very advanced high-technology production. Can you describe this shift and what you think contributed to it?
3. Which government program/law contributed to the development of the sector?
4. How did Program/law (name of spec. program interview was involved in) contribute to the growth and development of the high-tech sector?
5. What were the goals of this program?
6. What were its main policy tools? What economic incentives were provided and what kind of institutional support?
7. How involved were private interests in the development of these public plans? Did they support? Did they push for their enactment?
8. Were the office's interventions neutral/horizontal or did it set goals, make strategic decisions, etc.?
9. If the latter- which specific goals were targeted?
10. Were there any conditions or specific targets set and attached to the provision of public funds?
11. Were there any mechanisms in place that would guarantee the effectiveness of these programs? To make sure these conditions were met?
12. Were there any sanctions or punishments given to firms who did not comply with these conditions?

13. How did the OCS follow up on ongoing investment plans?

14. How involved were OCS representatives in the everyday work of private firms?

15. Were there any internal debates and conflicts within the OCS or within the MOTI?

16. Were there push backs or criticism on the side of the industrialists? The MIA? What was the nature of this criticism?

17. In the 1990s there were dramatic shifts in Israel's macro-economic environment (taxes, trade liberalization, labor law, stock market reform, bank reform). What role, if any, did agency X (name of agency interviewee worked for), play in their implementation? How did they influence the growth of the high-tech industry?

18. If any, did any states serve as a model for Israel's S&T policies?

19. In the 1990s a large input of VC entered Israel. Why did this process begin and how did it contribute, if it did, to the growth of the industry?

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