How Could Chile Target Productivity Policies? [1]

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Preliminary Draft as of Feb 28, 2015

Abstract

While nowadays economists and policy-makers recognize that there are multiple market and negotiation failures that could justify productivity policies, a central challenge is how to implement them in a way that creates less distortions per unit of innovation and new economic activity. One problem that has remained more controversial, though, is the targeting of industrial policy, which in the historical past had relevant examples of rent-seeking without a productivity payoff. Since the space of *possible* targeted policies is very vast, this paper reviews strategies to search in such a large space, looking for projects of high social net present value (NPV). It also suggests a set of questions that policy makers and practitioners should use to prepare and run social cost benefit analysis of these projects. The paper aims to clarify the space for public deliberation about modern industrial policy regarding targeted vertical interventions. These are far from being the only type of industrial policy and maybe not the most productive one on average. But if there are some projects with positive social NPV in that space, pragmatic policy needs strategies to find them.

JEL Classification: F43, O4, L52.

Keywords: Growth policy, leapfrogging, diversification, dynamic comparative advantage.

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[1] The author acknowledges valuable conversations about this topic with Rosanna Costa, Gustavo Crespi, Eduardo Fernandez Arias, Leonardo Iacovone, Ricardo Hausmann, David Mckenzie, Carlos Ominami, Gonzalo Rivas, Chuck Sabel, Ernesto Stein, Andrea Tokman, Andrés Velasco and Gert Wagner. Carla Tokman made very thoughtful comments to an even earlier version of this draft. Significant portions of this draft will be adapted to be included in an ongoing work joint with my co-author Ricardo Hausmann.

A version of this draft received financial support from the Chilean National Council of Innovation for Competitiveness (www.cnic.cl), without any attached request about the views expressed in this paper. Usual disclaimers apply so the author is the only responsible for the content of this draft.

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1. AS A WAY OF INTRODUCTION

It seems that the mere fact of "not messing" with the economy can get you growth, but it is less clear that it is sufficient to get you a "miracle".

Very few cases are more illustrative of this statement than Chilean performance. In fact, the Chilean economy does not seem to be a real miracle when one looks at the last half century. Let's compare for that sake Chile and Australia, both small countries with 15-20 million people, producers of natural resources and relatively distant from global markets.

Figure 1 displays GDP divided by working age population for both countries using data from World Development Indicators (2013). Circa 1960 the Chilean GDP per person of working-age was roughly 40% lower than Australia's. Starting in the late 60s that ratio of Chilean to Australian output steadily decreased during the next two decades, grossly speaking as a result of the large distortions introduced in the economy and, when some of these were partially released, we still had a poor prevention of macro vulnerabilities interacted with international crises, generating massive social costs and increasing the gap with Australia.

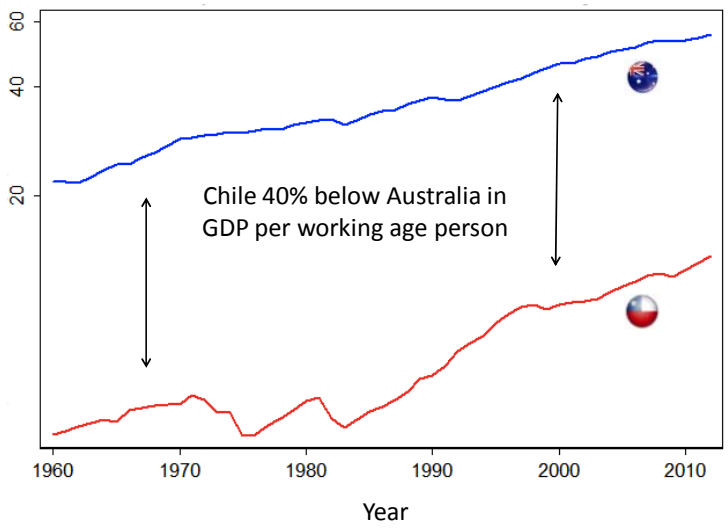

FIGURE 1. GDP PER WORKING AGE PERSON IN AUSTRALIA AND CHILE (1000 US$ OF YEAR 2005).

These two "lost decades" end around 1985, when GDP per working age population reached the same level as in 1968. This means 0% growth for two decades, despite a massive growth in the global technological frontier represented by Australia's roughly 2% growth rate.

Unsurprisingly, when Chile stopped messing it up with both micro and macro prices, and recovered of a massive crisis, it had plenty of room to catch up. It is only then that we observe a convergence with Australia, but remember this is because Chile started the 1980's well worse than the historical

40% gap with respect to Australia. This is the decade of headline 7% growth in overall GDP, and ended with the Asian crisis in 1997-98. After that crisis, as is well known, the growth rate slowed down. When looking a the short time series, this was a bit surprising, considering that the crisis was not very deep and there seems to have been substantial growth momentum. But from Figure 1 one may interpret that Chilean growth decelerated when it reached more or less the historical 40% gap with Australia. Today we are near that same starting point of half a century ago; producing 40% less than an Australian. Since then we have not observed *sustained* accelerations vis-à-vis Australia, only catching up.

Unfortunately, the "low hanging fruit" seems already taken and some of the first order distortions are already addressed. We are not in 1980s anymore. Unlike in the 1960s and 1970s, today we are open up to trade, firms have incorporated information technology and, for example, there are new management practices at least in larger companies. Importantly, we have a price system with markets allocating many if not most of the resources. More specifically, taking advantage of some "obvious" natural endowments we have created a fresh fruit industry, a salmon industry, forestry and especially developed good incentives to invest in mining, all industries that were inefficiently small three decades ago and that even a casual visitor could identify as opportunities. But that is more or less done. It is not clear what "obvious" innovations or even policy reforms should we do to unveil new private sector growth opportunities because we are now much closer to the frontier than in 1986. I do not mean the global frontier but our "frontier" of 40% below Australia. Honestly I do not know how we could catch up with Australia.

In that context we cannot afford dogmas. In the tradition of good cost benefit analysis I think we need to find new projects for productive development with a social rate of return above the opportunity cost of funds. For that of course there should be an effective evaluation of projects, but more importantly there should be enough project preparation from which later evaluate and select. Unfortunately the set of projects that reach evaluation is only a subset of the projects that some public agency has prepared for later evaluation. Moreover, that project preparation stage has massive sample selection problems. In fact, it is far from obvious that the current structure of the Chilean State is conducive to the preparation of the best projects. The problem is how we get more high return projects to be prepared. Who is preparing inter-sectoral projects that require coordination?

The best known Chilean text for cost benefit analysis by the late Ernesto Fontaine (1999) is about the *preparation* and evaluation of social investment projects. While the Executive in Chile has taken the evaluation in its standard pipeline process, nowadays I do not see enough people preparing many of the inter-sectoral projects for productive development that we saw under CORFO since the 1940s until the 1980s, where the engineers focused more on the assets than on the liabilities of businesses; or like the interdisciplinary projects prepared by ODEPLAN during the 1960s-1980s (See the Appendix for a recent Op Ed about the challenge of more project preparation). A large portion of programs in the Ministry of the Economy or CORFO are mostly financing problems, while for many new industries the problem is *coordination*, not a loan or a subsidy of money.

The central assumption of this paper is that, since preparing a project for productive development is costly and subject to congestion in its preparation and evaluation, one needs ways to search in the vast space of possible productive policies to be evaluated. Think for example in a vast rectangle of dimensions I industries at 20 digit ISIC of granularity [3] and N geographic subunits. That creates

[3] The International definition of industries is far from being as granular as 20 digit classification. So this is simply an exaggeration made to point out that the granularity at which firms in the modern economy are cost-competitive could be at a granularity that is not recognized by the usual government statistics.

an N times I matrix, and in each cell a large number P of theoretically possible projects could be implemented, including interactions with other sectors. The problem is the so called *curse of dimensionality* because we have no clue where the high quality projects lie and it is impossible to even evaluate a non random 0.1% of all possible projects, at the risk of maybe leaving the very good ones out. A conjecture is that maybe part of the 40% gap of Australia lies in one of these projects, or maybe not. But it seems reasonable to put some additional effort searching in that space.

One tremendously useful family of "search algorithms" in this vast space has been to follow Hayek's (1945) advice: letting for profit entrepreneurs to search in these boxes and do their cost benefit analysis. According to his reasoning this was the biggest advantage, beyond civil liberties, of having a market-driven economic system, vis-à-vis a Marxist regime where only a few bureaucrats were searching without that much "skin in the game". Nowadays this is the baseline, in which the N times I matrix of every market economy has already received one or many iterations of searching by private entrepreneurs. But, as a vast body of research shows, this searching leaves aside many possible boxes in this matrix as well as many types of productive projects. We know decentralized searching is not enough since these entrepreneurs do not search everywhere, sometimes because they do not know, some other times because they do not expect to pay back their development costs, meaning that they have incentive problems to even prepare and evaluate the project, not only to execute them.

In that context, the specific goal of this paper is to suggest different types of complementary "*searching algorithms*" to look for good projects in that large universe of possible projects.

In this sense this is just a problem of standard Public Economics, but with some particularities. One difference is that for Industrial Policy one needs to understand more the market forces. In other branches of public economics the first dollar of taxation to a polluting source or the first dollar of redistribution to a poor family is always welfare improving, because the existing market forces are not supposed to generate a clean environment or to be fair with the poor. In contrast, in productive development policies the market has already done some relevant optimization, and it is not obvious that a policy could *always* improve a lot what the market has already done using the Hayekian (1945) exploration by for profit agents. Another salient characteristic is that many times there are important informational gaps. For example you cannot talk to a business association of an industry that does not exist to empathize with their bottlenecks. And even if they exist, it is not obvious that the agency problems of their representation are conducive to make them truthfully reveal their true bottlenecks. A third difference is that many times industrial policy may need very specific publicly provided inputs, like an improvement in the refrigerated facilities of the international airport in order to export asparagus more efficiently, but many times these are things that could require high doses of inter-ministry coordination.

The projects with high social rate of return that do *not* already exist could be of two types: (i) projects that for-profit entrepreneurs have not yet evaluated, maybe because of inattention, ignorance or lack of incentives. (ii) Projects that for profit entrepreneurs have evaluated but do not find privately profitable. A subsample of these last projects could be socially profitable but not privately profitable. In some boxes of our matrix there might be opportunities to improve, while in others there would be none. But unfortunately it is not obvious *ex ante* where to look. The author of this paper does not know either, but this paper suggests a few strategies to purposefully search in that space for potential projects, that nobody has yet prepared.

Another motivation to read this paper can come from positive Political Economy, since for good or bad reasons most countries in the world did, are doing and will keep doing some type of targeted

industrial policy. So the question for them is how to target those efforts in some more efficient way, given that there will be industrial policy.

To be clear, this paper does not argue that "active industrial policies" will have an impact on growth. It only suggests that they could have impact, and not considering them would be an unnecessary restriction we cannot afford. The idea is simply to include these policies like an additional policy in the toolbox, with all their pros and cons; without dogmas in favor or against. Like capital controls or chemotherapy, they are sometimes useful under some contexts and not in others.

Since each targeted industrial policy is many times risky, like individual investments in a Mutual Fund or a Private Equity Fund, an effective evaluation should be as a portfolio and not on individual stocks. That means that the evaluation should challenge the general investment rules rather than the picking of a particular bad company in the portfolio. The latter type of evaluation makes portfolio managers inefficiently risk averse, because they cannot have large mistakes. In the same way, to evaluate and put discipline to industrial policies one needs a way to understand what is the strategy being followed. Also, when there are sequential bets in an industrial policy, it is important to be super clear of your exit/ stopping rules, to avoid over investing in projects that are no longer useful. Good venture capitalists know when to stop.

The challenge today in Industrial Policy is no longer to identify that there are plausible market failures in general, to which even the most agnostic economist could agree in theory. In contrast, the challenge is to diagnose these failures in particular industrial contexts (some of them in non-existent industries). More important, the challenge is how to implement efficient policies in which the government failure or distortion created is smaller than the market failure or coordination problem you want to correct. The goal is avoid excessive distortions per unit of exploration, including the necessary but not sufficient condition of keeping a market friendly economy, as well as investing in basic ingredients of neoclassical growth like human capital.

We recognize industrial policies have benefit (emerging from the solution of market failures/coordination problems), but also significant costs. The challenge for us is to prepare and bring more projects into evaluation.

From a historical perspective I perceive some people seem to have a trauma with industrial policy, in part because under that big umbrella people have done bad policies that took a lot of effort to dismantle. But there is a difference between some rational learning from these experiences and having a trauma that rejects anything that smells to targeted industrial policies. Part of the goal of this paper in public discussion is to invite readers to think of targeted industrial polices as totally standard public cost-benefit *preparation* and evaluation problems.

Unlike in the 1960s, today we know much more about how to prevent protectionism and improve the odds of having some effect on productivity by focusing on market failures and things the market won't do on its own. At the same time we know of the limitations of government failures. But crucially, unlike in the 1980s and 1990s, we are probably more aware about the *costs of inaction* with regard to industrial policy, especially for a country that has done most of its "homework" in terms of market reforms.[4]

[4] In this paper I will not talk about economy wide constrains to do business in Chile like the cost of electricity or its potential supply problems. These are very important to tackle but are out of the scope of the current work, which centers more on sectoral or sub-sectoral strategies that have proven to be more controversial in Chile.

To be fair, I have the personal impression that while some people artificially disregard targeted industrial policies too quickly, there also are some others that speak as if they love active and targeted industrial policies *per se*. As if the policy enters directly to their utility function rather than the country's productivity. Alternative, I have heard some people totally downplay costs of distortions, government failures and implementation challenges for putting in practice these industrial policies. This author believes that these are the wrong way to go. Policies should be means rather than ends and should be evaluated properly: instruments that are useful in some circumstance and not in others. *The idea of the current paper is to bring some conceptual light to practitioners so we can evaluate better an increasing number of projects with a high social rate of return*, not to have projects with negative social NPV.

Also, to get credible industrial policies is important that technocrats and policy makers, both close to government and to opposition, share some basic conceptual framework. Otherwise industrial policy would never be credible in a democratic regime with switching authorities every four years. This credible consensus, which has been reached in Chilean Monetary Policy for example, may be tougher to get for some industrial policy interventions. One contrast is that the nature of inflation and crises generates a very salient welfare cost, creating evidence that helps build a political consensus across party lines, at least among specialists from each side. In contrast, many of the social costs of *not* having a good industrial policy are counterfactual and less salient, although it might be hidden in our 40% productivity gap with Australia.

In the rest of the paper we will first review why countries cannot afford to be totally agnostic about new economic activities and targeting. In section 3 we review some principles for targeting policy efforts under uncertainty, with section 4 stopping a bit to discuss which resources need to be targeted, if any. Policy makers should not jump too fast into targeting, without a serious economic rationale. After that detour section 5 discusses targeting strategies. This section ends with a checklist of questions that policy-makers may want to ask at the moment of preparing and evaluating targeted policies. Section 6 discusses some political economy considerations and section 7 concludes.

2. TARGETED GROWTH POLICY AND ITS ALTERNATIVES

In this section we briefly discuss how new economic activities could have a relevant impact on development through at least four channels, namely growth, volatility, impact on job creation for vulnerable groups and tradable manufacturing jobs. We argue later that being *dogmatically agnostic* about focalized industrial policies *may* have relevant costs in terms of potential welfare left on the table, and disproportionally so for new economic activities. Taboos are in fact restrictions

The channels described below do not necessarily mean that there is a net social return to all potential policies in the area, because industrial policies have costs and benefits. Nevertheless, these channels aim to provide a necessary, although not sufficient, rationale for why we may care about new economic activities.

2.1. NEW ACTIVITIES AND WELFARE

Long run growth prospects seem poor for Chile. According to experts convened by the Ministry of Finance, the Chilean trend-growth-rate was stagnant at around 4.8% five years ago, and very

recently the projection was downgraded to 4.3%. Long run growth projection by the IMF are also not very encouraging to catch up with Australia.

But new activities could matter for growth. In recent years, increasing evidence has accumulated that the more diversified and knowledgeable countries are in different productive areas, the more they are able to grow in the future (keeping all other factors constant) as well as have greater resilience to shocks to the terms of trade. [5] Similarly, the emergence of new export products has been associated with economic accelerations in less-developed economies (Lucas, 1993; Kehoe and Ruhl, 2009; Amsden, 1992).

Regarding volatility, a standard textbook for graduated macroeconomists (e.g. Obstfeld and Rogoff, 1996) shows that, in theory, an open economy should focus on what it is most productive at. And to deal with any riskiness (e.g. due to changes in the price of copper, for example) people in the country should diversify by investing in financial instruments spread around the world. The big problem is that while you can use the fiscal and pension savings abroad, the majority of the risk is unfortunately not diversifiable. Workers from all sectors in Chile depend en the Copper price and the effect that China has on Copper, even if you work on a retail store. In concrete terms, today most Chileans cannot buy an *Arrow-Debreu security* [6] to diversify the copper risk for year 2025 that they are bearing. Additionally, since volatility has macro-consequences that are not internalized by any single firm on its own, there is social value on pushing real diversification; meaning adjusting the composition of what is produced or exported. [7] [8] This is a totally neoclassical rationale.

Other channels through which innovation and diversification matter are related to labor demand for specific groups, like people without a college degree.

On the one hand a government, and especially a progressive one, may want to increase the wage income of workers. The problem though is that improvements in human capital, even if all reforms are 100% successful, do not pay back into higher salaries before some 20-30 years. Moreover, increasing union bargaining has only limited impact on wages for the median family, especially because much of the job growth is not as an employee, but as self employed. Even if one concedes that more union bargaining is necessary, it is likely that it will have only a one time effect on wages, not increasing its growth rate.[9] Therefore, it is improvements in the value of the marginal product of non-college-educated labor what will define sustained growth in wages for the median worker in Chile, at least for the following two decades.

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[5] Among others see Hausmann, R., & Hidalgo, C. A. (2011). The network structure of economic output. *Journal of Economic Growth*, 16(4), 309-342.

[6] In economic jargon people can greatly diversify risk by buying and selling contingent securities that pay in each possible scenario. These are called Arrow-Debreu securities and in standard neoclassical models markets are assumed to be "complete", so you could buy and sell for each state of nature

[7] See Haddad et al (2013), which argue that trade openness reduces growth volatility when countries are well diversified.

[8] See also how the availability of nearby opportunities to export is correlated with faster recovery from macroeconomic crises. "Growth Collapses", by Rodrigo Wagner; Ricardo Hausmann and Francisco Rodriguez (2008). In *Money, Crises, and Transition: Essays in Honor of Guillermo Calvo*, edited by Carmen Reinhart, Andres Velasco and Carlos Vegh (MIT Press).

On the other hand, modern economic growth has a well described pathology against the relatively unskilled: technical change tend to improve relatively more the marginal product of more educated people, also known as skilled biased technical change (see Acemoglu, 2002). The issue is that computers and other types of innovations are disproportionally complementary to high-skilled people, adding little to the productivity of unskilled (i.e. w/o college degree). This is a force that not only widens inequality but also complicates the elasticity of GDP growth to wages. Some of it might be behind the fact that the lower two quintiles of households in the US had essentially stagnant wages since the 1980s

Some examples of sudden shifts in the marginal product of unskilled labor were the rise in demand for female unskilled employment generated by the agri-food boom in the 1980s and 1990s; or the new Maersk Container factory now growing in San Antonio, Chile, producing refrigerated containers for export.

For additional channels pointing out towards reasons for supporting manufacturing and tradable activities in Chile the reader is recommended to a recent working paper by the author. [10]

A final note is that during times of recession or underinvestment there might be an additional type of industrial policy to explore. An extreme case would be if in the next years countries like Chile, which are strongly China-dependant, face a hard landing of the Asian nation.

2.2. TARGETED POLICIES AND GROWTH

A large family of models documents market failures in the discovery of new activities that cannot be patented (e.g. Arrow, 1962; Hoff 1997; Hausmann and Rodrik, 2003)[11]. This does not automatically mean that some policies can have a positive effect on growth. It just says that if some policy is able to remove the market failure, which is the root cause of the underinvestment in profitable new activities; then and only then there will be growth. This presumes there is some lever that policymakers can move in order to release the constraint.[12] To that one should add the efficiency question, which is how cost-effective is the policy to deliver growth both in new and old activities. [13]

Other models more clearly focus on policies, modeling that industrial policies have benefits but also costs.

Ades and di Tella (1997) show a very stylized hold-up model in which active industrial policy promotes *both* corruption and investment. Since investment K is also reduced by corruption C, the impact of industrial policies is less favorable than absent the corruption channel. The impact could

[10] "Manufacturas para Crecer con Equidad: analysis y propuestas para Chile" (2014), joint with Andrés Velasco

[11] See Sabel et al (2011) for a review of case studies of new exports in Latin America.

[12] For an application of this principle look at the last chapter of Hausmann, Klinger and Wagner (2009).

[13] Aghion et al. (2012) argue that industrial policy that focuses efforts in one sector forces firms to compete neck to neck and therefore increase innovation, as opposed to staying in differentcl sectors. They attempt to test this theory on Chinese plants.

even be negative.[14] Empirically they find in their sample that the second negative component destroys between 50 and 85% of the first positive channel. Their bottom line is that despite being useful on net, the right cost-benefit calculation should not forget about the government failures in implementing industrial policy. Hodler (2009) offers an even more detailed theoretical model considering both the benefits and costs of industrial policies.

Empirically, the relation between "active" industrial policies and growth is rather inconclusive, in part because of the heterogeneity inside the black box of what we economists call "industrial policies", but also because of a clear self-selection. Many times policies are applied to the ones that are lagging behind.

Criscuolo et al. (2012) explore the causal effect of a European industrial policy among UK regions. The identification of the effect benefits from changes in the rules assigning a EU-wide program to support manufacturing jobs. Using this technique they *"find positive program treatment effect on employment, investment and net entry but not on Total Factor Productivity."* They also argue that selection into participation matters, that the effect is heterogeneous across firms and that the policy seems cost effective.[15]

Blonigen (2013) shows that Industrial Policy favoring the iron industry (1975-2000) across countries is negatively impacts export competitiveness for an average downstream manufacturing sector, "with an effect that can be as large as 50% for sectors that use iron intensively". "These general negative effects of IPs are primarily due to export subsidies and non-tariff barriers, particularly in less-developed countries." Of course that estimate does not control for the endogeneity of the treatment.

Taking stock, there is much more consensus on the fact that policies could *potentially* help fighting the coordination problems that prevent investment in new activities. The challenge is to get design based in sound economic principles and good understanding of the political economy, in order to get rid of the word *potentially*, written above. The empirical literature gives a proof of possibility, but it is hardly a guarantee. That is why in the rest of the paper we analyze the challenges of targeting (and not targeting) as well as the political economy challenges of implementing policies.

2.3. What are the Alternatives Instead of Targeting?

Before jumping into targeting, it is relevant to understand that "not targeting" is also a strategy with its challenges, to avoid treating it like a *deus-ex-machina*.

[14] In a very simplified way Ades and Di Tella essntially argue that industrial policy P impacts investment in the following functional form: K(P,C(P)) ; with K1>0 ; K2<0 and C'(P)>0. Then the total derivative dK/dP= K1+ K2 * C'(P) ; which could be either positive, zero or negative.

[15] Criscuolo et al. (2012) argue that *"OLS underestimates program effects because the policy targets underperforming plants and areas. The treatment effect is confined to smaller firms with no effect for larger firms (e.g. over 150 employees). […]the policy raises area level manufacturing employment mainly through significantly reducing unemployment. The positive program effect is not due to substitution between plants in the same area or between eligible and ineligible areas nearby. [The] "cost per job" of the program was only $6,300 suggesting that in some respects investment subsidies can be cost effective."*

A first standard possibility instead of targeting is simply that the government does nothing on the exploration of new sectors over and above what the market does by itself. This has the advantage of not being salient, so people do not perceive the counterfactual and the money left on the table. But that does not mean that this is efficient; it's just less noticeable than a failure.

A cousin of the "do nothing strategy by design" is the pseudo-strategy of bureaucrats delaying decisions without a clear efficiency rationale. One reason behind it is risk aversion. Given the structure of bureaucracies (see Tirole, 1986), bureaucrats many times internalize only the downside of potential risky decisions they undertake, not the upside. They know that if something goes wrong in one activity the Comptroller General could fire her. If the project works well and delivers more innovation, she is unlikely to be rewarded. This structure curves their payoff function and creates risk aversion in their behavior. Another version of this problem is when a local bureaucrat has to decide on an indivisible public good, for example a bridge. If a powerful politicians of her party is lobbying for location A, while the other powerful Senator that can boost your political career or can punish you suggests location B; then the bureaucrat is between a rock and a hard place. One possible strategy to deal with that situation is simply postponing the decision. With short government terms, like the 4 years period in Chile, this can be particularly pressing.

A second and more active strategy would be one of a "flat budget" for all sectors as a way to avoid targeting. For example, one can think of allocating funds according to some rule, let's say 1% of sales or value added of the company or sector. [16] This has some limitations when you need to create critical mass or when there are fixed costs of coordinating activities, creating so called increasing returns to scale. In a very stylized example, if you have ten units of resources and ten sectors, but it takes one unit of resource to set up basic capacities in each sector, then it is suboptimal to form 10 "clusters", since none of them would have resources to invest over and above the administration costs.

Note that a corporate tax break would be equivalent to a subsidy (less the taxation distortions, of course), but it will only work as encouragement for new activities if the problem is profitability of the business. If the firm needs some industry-specific public goods, or needs a special regulation, or any other resource that we will see in section 4, then a tax break is not equivalent to effective industrial policy.

A third and popular approach nowadays is to create a program and let firms self-select into it. According to standard neoclassical theory firms would self select into participating, if they know about the program, when the perceived *private* benefits of participating B exceed the *private* costs of applying C. Since our goal in policy-making is to think about social net benefits, it is not obvious that the self-selection decision B>C are aligned with welfare improvements. One example is when there are people that become specialists in applying to governmental funds, without the corresponding private benefit in productivity, because they have a very low cost of application C. That low C can also be correlated with low benefit B, for example, when people applying have a very low opportunity cost of their time. Moreover, increasing the number of procedures in the application can self select even more low-C applicants than those with high B. This would be poor screening.

Another version of this self-selection is when firms from sectors that already exist have lower cost of applying (C). If they already have an industry board, for example, they would know how to apply and operate. This creates a self selection challenge for industries that do not exist, where this

[16] As we will see in the Section 6 there is also some way to target using flat budgets by industries, but using modern methods a la Groupon to fine tune industry-specific public goods and other specific public activities

process is more difficult. One can think about the targeting strategies we will visit on Section 6 as a way to mitigate the potential failures in communicating with the government and solving collective action problems in new sectors.

A fourth possibility usually discussed in industrial policy is to focus incentives on "anything that is exportable", which has the valid advantage of being agnostic of the sectors and also offers a market test. For example, Rodrik (2008) argues that sometimes it is too complex to choose the first best policies to incentivize productivity improvement and new discoveries. If these opportunities are disproportionally more likely in tradable goods, as he assumes, then there might be an imperfect substitute for policy: having a depreciated real exchange rate. But it is important to realize that for many countries the real exchange rate is hardly a policy variable and even the nominal exchange rate would be hard to change.[17] [18]

Moreover, this assumes that entrepreneurs look at the prospects of higher future revenues R. That does not necessarily deliver a high elasticity with respect to the exchange rate when there are large entry costs F into new activities. Moreover, Wagner and Zahler (2015) show that Chilean firms that get higher revenue from exporting a new product are not necessarily the ones that pioneer a new product. One possibility is that firms that are better at exploiting exiting opportunities might not be the best ones at exploring new areas.[19] In Chile there have been policies that implicitly pushed new export sectors, like the so called "*reintegro simplicado*" [20] that ended a few years ago due to trade agreements and WTO concerns.

A fifth option is to decentralize the decision to local governments. This is facilitated, for example, when municipalities have their local taxation systems. In the US, for example, Greenstone, Hornbeck and Moretti (2010, J Pol Econ) find a very large (12%) increase in total factor productivity after an industrial policy that brought large manufacturing plants to a county.[21] Given the taxation system is

[17] In general on way to change the relative price of traded vis-à-vis non traded is either to improve productivity in non-traded goods to fight the Balassa-Samuelson effect; but this is hard to do; or pursuing a so called "fiscal devaluation" (a combination of an increase in the VAT that is paid back to exporters, combined with a with a decrease in the payroll tax). But this works only at the margin of a few percentage points. One exception would be for countries like China that during the recent history have massively accumulated reserves to prevent an appreciation, but this strategy might not be available for countries like Chile today.

[18] See also Haddad and Pancaro (2010) who argue that *undervaluation can boost exports and growth in developing nations but not for long.*

[19] Also, when the fixed cost of exploring a new activity is increasing in the profitability of the traditional exports, it is not obvious that the exchange rate would encourage the exploration of new activities (e.g. a business group can allocate a marginal manager to operate either in the traditional sector, for example a new copper mine or to manage 10,000 hectares of forests for cellulose; or in instead start a new export activity). If the exchange rate E impacts positively the export revenue R, R'(E)>0; but also impacts positively the exploration cost F, so F'(E)>0, then it is not clear that the group of firms operating in new sectors would expand, because the firms that satisfy the condition Profits(R(E))>F(E) depends both on R'(E), but also on F'(E)

[20] Chilean law number 18480 of 1985). See Alvarez, Roberto and Cuevas, Conrado (2012) "Efectos del reintegro simplificado sobre las exportaciones teoría y evidencia para Chile". Mimeo University of Chile.

[21] Interestingly, Greenstone Hornbeck and Moretti (2010, J Pol Econ) also find very heterogeneous effects, which is a fact that we will later expand regarding the inherent risks of some industrial policies and the need to evaluate them as a portfolio

more centralized in Chile, jointly to the small scale of many Chilean municipalities, it is less clear that these local governments could deal with massive efforts of industrial policy in a totally decentralized way. Still, as one can learn from the recent case of Maersk Container Industry in San Antonio, Chile, the involvement of local authorities is tremendously useful. Nevertheless, this is different from having a totally decentralized system in which municipalities bid to get a large industrial plant, which can create a race to the bottom. [22]

A sixth option is to pretend that you are not targeting, while in fact the administrative rules do target *de facto*, with or without the intention of doing so. Let's consider the very innovative and interesting Startup-Chile program. Given the mechanism, the timing and the type of budgets, the program disproportionally self selected IT and web applications (and much less so in biotech), and to areas that are intensive in skilled labor, not unskilled labor. That does not mean that the program is bad, but it is just an example of how one could be targeting special industries when designing different administrative procedures. The advantage of this method of targeting vis-á-vis explicit targeting is that it leaves some small room for others to apply.

A seventh option to targeting sectors is to focus on crucial specific inputs that are useful in many sectors. In Chile this has been called "*Plataformas Tecnológicas Transversales*". For the strategic case of electricity in Chile this is absolutely paramount and needs no further explanation, no doubt about it. But many of the things needed to get these intermediate inputs going is not money, but other resources of the government, especially coordination and credibility; not a tax break.

Having reviewed the various alternatives to targeting sectors, we see that there could be a complementary role for careful sectoral policies. In the next section we review the resources that could be targeted and classify the various types of strategies.

3. PRINCIPLES OF TARGETING UNDER UNCERTAINTY

The goal of this section is to outline some principles to guide targeting and differentiating modern industrial policy from old policies in the 1970s.

3.1. THE PROBLEM IS NOT TO PICK WINNERS, IT IS MAXIMIZING TREATMENT EFFECTS

A first important clarification is that the social-planner's problem of industrial policy would be to prioritize activities as to maximize the treatment effect of government policies, for a given amount of resources.

It is <u>*not*</u> about maximizing total output or profits in the participating firms / sectors. It is to maximize value that would not have happened had the policy not be implemented. This is important because many times in the criticisms to targeting people have said that bureaucrats (or for that matter consultants hired by bureaucrats) are unable to "*pick winners*". Picking winner

[22] Ralph Ossa (2015) calculates that manufacturing real income in the US could grow by 3.9 percent if states stop competing over firms.

horses is not the role of industrial policy. The role is to help the horse that would increase its speed the most given the governmental policy. That is treatment effect and social rate of return.

While risk and illiquidity considerations are similar, the challenge of a policymaker deciding on targeting industrial policy could seem tougher than the challenge of a venture capital (VC) picking startup companies to invest. The VC does not necessarily care whether they are adding value or not. They just care about the final value the company has. They have to pick winners! In contrast, policy-making is about creating social value and therefore has to think about the counterfactual of what would happen without the policy (or with the same policy but at lower levels).

In particular a vector of government activities $\boldsymbol{g}$ should be chosen as to maximize the net value created by the public policy, namely

$$\max_{\mathbf{g} \in \mathbf{G}} \; [V(\boldsymbol{g}) - V(\mathbf{0}) - Cost(\boldsymbol{g})] \qquad (Equation\ 1)$$

; where $V(\boldsymbol{g})$ is the value produced with the policy mix $\boldsymbol{g}$**.** This vector of policies $\boldsymbol{g}$ belongs to a set of feasible policies $\boldsymbol{G}$ that satisfy all the administrative and political constraints in a country. $V(0)$ is the value with the null policy mix of a government doing nothing[23], meaning that all the components of vector $\boldsymbol{g}$ are zero. That means $V(\mathbf{0})$ is the counterfactual of the group treated with the policy. Finally $Cost(\boldsymbol{g})$ represents the resources used in the policy-package vector$\boldsymbol{g}$**;** and it should include not only the financial resources but also the political capital that is burned as well as the administrative resources, as well as the top-management "bandwidth" that needs to be devoted for the policy to work.

The latter component of the cost is sometimes forgotten, but as we will clarify later, modern industrial policy is based under the principle that a new industry or activity does not exist because of a coordination problem, and sometimes the problem is not easily fixed with a Pigouvian tax or subsidy, with the policy maker having to instead spend time and effort, which suffers from congestion. In an analogy, busy politicians with power to coordinate have limited "bandwidth" or some of her "RAM memory", so they cannot do too many things at the same time. They need to facilitate Coasian negotiations to help the government or somebody else internalizing part of the externalities. But those require fine tuning, so coordination is an activity that cannot be performed by any random person one hires as a consultant. It is hard to oursource because it requires solving incomplete contracts. Coordination is something that usually needs authority, and precisely for that reason is hard to scale and gets quickly congested in government. Even being skilled and knowing about the industry is not enough, since one of the main goals of government intervention is to mitigate contracting failures between parties. People working in negotiation should also have credibility and power to help people make agreements.

The optimization problem in Eq (1) is a very simplified version of the real problem, but it still helps to clarify what we are talking about. In reality a policy maker only forms an expectation of the value added $\boldsymbol{E}[V(\boldsymbol{g}) - V(\mathbf{0})]$ *and the costs* $E[Cost(\boldsymbol{g})]$ as well as a measure of their respective variances.

[23] Here by doing nothing we deliberately do not mean zero government. It is just a notational simplification to say that the government would not be "doing nothing" on top of what the government is already doing and plans of keeping doing anyways. It is the counterfactual.

This same problem can be decomposed industry by industry, which can have different policy packages.

Of course the problem of the optimization problem in (1) is that we do not know the parameters that shape the function V, and the role of targeting and policy learning is to find out how the function looks like.

To be useful the government has to empathize with the private sector to see whether from looking at the current state of affairs $V(\mathbf{0})$ one can learn potential ways in which to learn something about the shape of $V(\boldsymbol{g})$. As we will see in the political economy section, it is easier to empathize when these are innovations in existing firms, because you can meet them, and even better if they have their own organizations, as we will see on Section 7. In contrast, when the industry does not exist, meaning that for industry i we have $V_i(\mathbf{0}) = 0$, then it is is tougher to learn from their constraints whether $V_i(\boldsymbol{g}) \geq Cost(\boldsymbol{g})$, but it is not impossible.

For example Chile did not know how to produce counter-season fresh fruit to export to the Northern hemisphere, but the adequate government action got an industry started from scratch, in a policy mix that included among others to send massive amounts of people to learn (and copy) Californian agriculture. Almost 100 people were sent to study abroad en ended up being essential technological arbitrageurs, to set up facilities in Chile. Of course that policy did not take off until other complementary government action, like property right to land, was sufficiently clear. You do not plant a modern variety of a Peach tree that takes 5 years to produce commercially if you do not know you'll own land.

In any case, as we will comment later, if one is proposing policies for industries that do not exist, one has to have a narrative for why it does not exist, because it helps to find catalytic effect government actions

Another crucial aspect is that the treatment effect of these policies may be very risky. The same strategy may work for some cases but not for others. So, as we will comment later, it is very important that policies are evaluated as a portfolio basis rather than on a one by one case. This has implications on how we pack and politically communicate industrial policy interventions. The recent press coverage of Solyndra, the solar energy company backed with US Federal funds that went bankrupt, provides an illustration of how these kinds of things are publicized on a case by case basis. I am not saying that Solyndra was a good investment; I'm saying we should evaluate the strategies as a portfolio otherwise the portfolio managers become inefficiently risk averse

3.2. SEQUENTIAL BETS: STARTING SMALL IN AN UNFAMILIAR ENVIRONMENT

When investing under extreme uncertainty governments should learn from Venture Capital (VC) about its ability to perform sequential investing. In particular, discovering which sectors are unlikely to be promising, without spending too much in that discovery, is useful to search the space of industries in which a country could have dynamic comparative advantage. Learning about the nature of the market failures behind it is also very useful.

The crucial aspect is not to fall into the fallacy of sunk costs, meaning that if the government invested in the stage one of a project, it needs to invest in phase two just to "pretend" that the funds

allocated in stage one were correct. That is never correct because what matters is the return on the portfolio; not on each investment. Therefore the institutional design of any structure of industrial policy needs to have some discipline to allow letting go the bad investments.

But in some industries it is easier to learn with little money. For example Kerr and Nanda (2009) remark that a simple web application can be market tested for a few thousand dollars, while the minimum size of an experimental solar power plant could mean a minimum investment of 100 million dollars for the test-drive, with similar or even higher risk. The good news is that with better financial development there will be more private agents that, provided enough diversification, may be able to enter the sectors with cheap testing. The bad news, though, is that in such a context the potentially profitable projects that are left for the government to support – because they are not funded due to market failures – will have larger sizes.

For sequential betting it is also important to have subset clauses, as we will remark later in the political economy section 7. Otherwise policies that have no worthwhile treatment effect keep being renewed. Since in the public administration one is working with State funds there are many more constraints that limit the richness of the contracts one can sign. As we will also discuss in section 7 some "small bets", like a US$ 40,000 support for a Startup Chile backed firm, could be made as a gifts, because that could simplify he administrative burden.

3.3. ARE THE NEW PROJECTS BEING EVALUATED?

Most economic models usually start with the idea that entrepreneurs evaluating business opportunities are not in shortage. The assumption is that there is a population of projects that is being evaluated and firms know what the private NPV of all projects they do and those they do not pursue. One should imagine a large stockpile of folders with projects with private IRR of 10%, then another with projects of IRR of 20%, so on and so forth.

Sometimes the assumption that private agents know exactly the IRR of projects is relaxed, assuming that entrepreneurs know the true IRR plus a noise, that could have large variance and even some bias in some direction (e.g. when entrepreneurs are overconfident, for example). The picture of this would be the same stockpile but with random mistakes in the classification of projects into the IRR bins.

But in many of the cases firms are simply not evaluating all projects, since evaluation has congestion. Even the "new businesses" units of powerful Conglomerates in Chile are not evaluating many projects, they usually restrict to a few potential acquisitions that knock their doors.

This might be especially true for multinationals headquartered abroad. They are unlikely to be really evaluating to invest in Chile all the time. In that sense it is particularly instructive to look at why Maersk Container Industries is building its plant in San Antonio, Chile; with an expected employment of 2000 people. The company had in San Antonio a shop to repair containers. And the Chilean manager of that repair shop was the one putting Chile on the shortlist of places to invest for the company. He headed the efforts to convince the company that it was worthwhile to set up the only of such plants that is located out of China. My personal view is that to get the same effect than

this manager, Chile would have need a compensating differential of at least 10 or 20% lower taxes for the company, which could be a large fiscal burden plus the stigma of opening a Pandora's box giving tax exceptions.[24]

Making sure multinationals evaluate these projects is useful, and the pre-investment subsidies the Government of Chile used to give could be useful, but there are many other non-monetary aspects of evaluation.[25]

Other countries are much more proactive at helping multinationals consider them as part of the site selection process. Unfortunately, today the Foreign Investment Office is mostly an office of lawyers that deal with offering credibility to investors that *already* want to invest in Chile. This has to be revised to improve the location of multinationals, reducing their evaluation and setup costs. Maybe instead of money we need a facilitator doing it. During the 2000s CORFO had an umbrella program called *InvestChile*, that subsidized multinationals to come to Chile in some broadly defined "high tech" sectors (see Agosin and Price, 2010, for an account of this program). With the exception of subsidies for extreme zones in Chile there has not been any obvious targeting for potentially vulnerable subpopulations or in blue-collar activities.

Overall, Chile needs more people doing what Maersk did: having someone that the company trusts spend some time evaluating the project of locating in Chile.

3.4. How is this different from Import Substitution Protectionism, 1960s style

We cannot pretend active and targeted industrial policies are a new type of policy yet to be tried as a general concept. History shows that it was tried and in many cases it did not work. The elephant in the room during policy discussion, especially in Latin America, has been the difficult dismantling of a series of massive and costly policy-induced distortions to subsidize business without any clear growth payoff. Many of these distortions were created and reinforced by closed economies during the late first and early second half of the XX century, many times with a narrative of supporting an infant industry. These distortions were so powerful that they prevented entrepreneurs from focusing on productivity improvement, also encouraging massive misallocation.

On top of implementation and political problems, there were two big "design problems" of the import substitution strategy that prevented growth of infant industries, which were recognized by Hirschman as early as in 1968. One issue was the focus on protecting consumer durables. In small economies, with few consumers, this immediately bounds the growth possibilities. A second but related issue is that the multinationals that came to the country were unlikely to create spillovers. They were not designed for growth. For example a FIAT car plant in Rancagua, Chile was designed

[24] In a well known case of site selection during the 1990s Chile and Costa Rica were bidding to get one of Intel's production plants. While Costa Rica offered a substantial tax break to the company, Chile did not. As a result of that and other factors, like logistics, Intel decided to locate in Costa Rica. While the author has not seen any formal ex post cost-benefit evaluation of this for Costa Rica, we now know that Intel just closed its operations

[25] Wagner and Zahler (2015) find that the larger exporters in a successful export product may have a harder entering, maybe because they have a harder time evaluating a new project due to salience. More important, larger exporters are unlikely to be delaying its entry due to financial constraint in fixed costs (see Manova, 2012), since they have arguably similar access to finance that the relatively smaller pioneer exporters. There could be other non financial frictions preventing firms from evaluating or entering new activities.

to take advantage of the Chilean tariffs. Exporting to Argentina was not profitable by design, because FIAT had another plant in that country to take advantage of the Argentine import tariff, located in Caserones, Province of Buenos Aires.

In short, despite the potential of multinationals to spill-over productivity enhancement, many multinationals that settled in Latin America during the 1960s were not designed to enhance productivity because they wanted to avoid cannibalization of their own plants elsewhere.

With those central features in mind it is worth remarking additional differences between modern industrial policy and 1960s' style protectionism;

While protectionism focused on the internal market, modern industrial policy has a focus on foreign markets, especially for small economies. As mentioned, while protectionism did not focus on the scale-up potential; the focus of modern industrial policies is precisely on the scale-up. While protectionist import substitution prevented market discipline, modern industrial policies attempt to use market discipline in a smart way, to promote exploration, but then to weed out inefficiencies since most new projects are not viable in the long run, even if they export. While import substitution emphasized the manipulation of input (including credit) or output prices as a regulatory tool, modern industrial policy focuses on potentially industry-specific public goods, missing complements, critical masses and sophisticated demands that we will see in this paper.

Another difference of modern policy is that it has fewer tools than in the 1960s, since discriminatory tariffs and subsidies are heavily restricted under WTO, especially for an economy like Chile that is so dependant in foreign markets. The good news is that this restriction requires government to be more thoughtful in the way markets failures are targeted.

On the political economy side, which is one of the most problematic edges, under protectionist import substitution a significant effort of entrepreneurs was diverted towards lobbying very for very specific jumps in tariffs. In most cases this had advantages over legislation-based subsidies. On the one hand this required lobbying just one or few bureaucrats rather than the whole Congress. On the other hand, these tariff protections did not need to be renewed in the budget law each year, so they were not even subject to this standard discipline of sunset clauses in the public sector. In that sense, they were a massive source of inefficiencies and potential for corruption.[26]

In contrast, the whole point of modern industrial policy is to implement a system that sets incentives to scale up and gain productivity, making it difficult to capture for rent seeking.

4. WHAT ARE THE RESOURCES TO TARGET?

Right before jumping into the targeting strategies one should ask what the resources to be targeted are. This is important because not all types of strategies are equally suitable for every type of public resource.

In particular, the self-selection of groups in the private sector will be different depending on the nature of the resource being allocated. When resources are targeted to the firm, private costs and benefits of applying to public benefits are traded-off. Regulations, in contrast, are a kind of public

[26] One big advantage of setting tariffs across the board and by law was to limit the wasteful lobbying for rent-seeking.

good for the industry, which tend to self select large players which can internalize a larger portion of the value being created or captured by the industry (e.g. Bombardini, 2008). The nature of industrial political participation is endogenous to these incentives.

It is important to note that public resource is meant in the broadest possible sense. Too often the discussions about resource targeting tend to oversimplify the problem by assuming "resource = public money", in the form of fiscal or para-fiscal transfers (the latter being a tariff or tax break, for instance, that do not enter directly the fiscal budget every year). But in fact there are many other things governments can provide. Frequently the relevant binding constraint for the development of new industries or activities is not money.

When the bottleneck is regulatory certainty about specific issues, then the speed at which laws and administrative norms are discussed and passed is usually what matters, not money. Reducing this to s simple problem of public finance is totally inappropriate, even if some budget has to be allocated. For example, the salmon industry in Chile around 2011-2012 urgently needed clear rules about how to manage part of their externalities as a way to mitigate the spread of diseases like ISA virus. They also needed rule enforcement well beyond what they could achieve with "self regulation" within their own industry board. This enforcement also included an upgrade of the bureaucracy in charge. The priorities in the legislative process are managed both by the Legislative branch as well as the Executive, and given their circumstances; it is a very strategic scarce resource. In the case of Chile the use of "*urgencias legislativas*" attempts to manage congestion in the process of law making, but is is usually guided by political forces not productivity / or job creation challenges.

To fix ideas, one can think about even considering creating a "productivity week" in Congress and the normative agencies. It could target giving priority to regulatory changes in areas that are expected to have an abnormally high impact in growth. Giving these kinds of political priorities could have an important impact, especially for industries or areas that do not have a good technology for lobbying politics.

There are other very scarce resources in the public sector that are harder to quantify, but are also tremendously important to target appropriately. One example is the "political will" of high level authorities, which is tremendously important when coordinating the public-private and especially public-public interactions. By this we do not mean a general level of "guts" in the authorities, but the ability to commit high level coordination and time to follow up on the targeting of the right mix of complementary public resources, because new industries tend to require many *non-market inputs* [27] to catalyze their growth. As we will describe in more length in the political economy section of Chapter 6, achieving this public-public coordination and commitment this is not easy.

[27] By non market inputs we mean that there is an entrepreneurial process to solve incomplete contracts and coordination problems that are not simply solved by the price system. It is stuff that you have to make instead of buying, or buying it from a party that you have to monitor closely, creating transactions costs (Coase, 1937; Grossman Hart 1983). In microeconomics 101, being an entrepreneur seems as a rather boring task, since you simply maximize revenue minus cost, but the cost is modeled simply as price times quantity of inputs. These are market inputs that you buy at a market price (competitive or not), but you can buy them. In that model you get the basic prescription and prediction that firms hire inputs until the last unit of the input "pays for itself", meaning - for instance - that the market value of the corn produced created with this last pound of nitrogen you added is enough to at least pay for the price of a pound of nitrogen. These are market inputs, including "raw" labor as if it were simply a market input. In contrast, non-market inputs cannot be so easily purchased in the market. Some because you have to make them, to credibly convince third partied to make it

Another example of scarce resources is the human capital needed to lead and coordinate the formation of a potential cluster. This person ought to satisfy the highest standards for empathizing with the private sector's bottlenecks, but at the same time be able to navigate bureaucracy to facilitate solving externalities, all of that without *excessive* conflicts of interest. A few anecdotes heard by the author point out to some challenges in this area when implement the Chilean experience with "formalized clusters" until 2011. Budgets were very tight for the coordinator of cluster, limiting the type of personnel hired for this difficult task.

Another case of policy congestion is when the new activity requires additional efforts in terms of facilitating the location of a large industrial plant from, let's say, a multinational. This is precisely because many non-market inputs are needed at the same time, many of them provided by the government.

A good example could be recent location Maersk Container Industries in Chile, with a factory that produces refrigerated containers for export. They needed a multiplicity of permits, like many other plants, but also needed to massively increase the number of welders. They did so through a nice partnership between the Ministry of Labor and the Metal Mechanic Business Association; with the Minister at the time publicly supporting the project through various existing public instruments. They were also evaluating suppliers for critical materials.[28] Since they are so large for the size of the market it is not easy to be their supplier, although their size is also a crucial benefit to get critical mass, as we will see in section 5.2.4. [29]

The extreme level of coordination is when the policy proposal would make it efficient to implement a new state-owned enterprise (SOE). In section 7 we will talk for a second about SOE and their avoidance, not because we think they are often needed for targeted industrial policy, because they do not, but as an extreme example of a tool that became taboo word and should be re-thought, with lots of ifs and caveats, but reconsidered as part of the toolbox.

5. TARGETING STRATEGIES

This section is the center of our paper. It will review different types of targeting strategies with their advantages and potential challenges.

5.1. WHY TARGETING STRATEGIES?

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for you, other because you have to convince the government or any collective entity to provide the good; understanding that governments do not have the equivalent of a "price system" that reveals scarcity.

[28] In many aspects Maersk had critical adaptations that made it less sensitive to other constraints that have plagued new investments of new large plants in peri-urban areas of Chile. They do not have meaningful emissions or pollution. Also, they found a place that was previously pre-approved for industrial use, greatly reducing the marathon of permits they needed to get.

[29] Overall, this plants had some properties that made it a "camel in the desert" able to set up operations in Chile despite some standard concerns: it did not have chemical emissions, which reduced its exposure to regulatory risk and delays in permits, it also found a pre approved industrial area not far away from the port of San Antonio, and some crucial materials could be brought from abroad since they tend not to be perishable. Last but not least is that Chile has a massive export of goods in containers, while much less import of goods in containers (oil and cars), generating a gradient of demand for containers starting in Chile.

It is possible to argue that there may be no need to have strategies, because sound policies are evaluated using economic cost-benefit analysis[30] ("*Evaluación Social de Proyectos*") that simply evaluates projects case by case. While sound policies are those that create more social value than the opportunity cost of the resources they use, it is less than clear which projects are being evaluated, because in fact not all potential policies get to be considered in the cost benefit analysis. Having a searching strategy helps make sure that one can feed some type of ex ante cost benefit analysis with the right kind of projects.

Since the space of potential industrial policies to pursue is large and complex, one needs a strategy to follow to prepare the projects that later should be evaluated. Of course they are not precise algorithms that a computer can execute, but some kind of guideline about what to do, given the specific circumstances of the problem.

Additionally, as discussed before, in the context of risky industrial policies one should not expect that all realizations of an industrial policy deliver a positive effect. Like Venture Capitalists, in some cases it is impossible to figure out ex ante which specific interventions will work. In that sense the bringing of industrial plants or any other large intervention that usually have small number of cases should not necessarily be analyzed case by case. They should be analyzed as a portfolio, like Pension Funds evaluate their investments, where you evaluate them as a group and the behavior of the portfolio. If Fund Managers were forced to have positive returns on everything they invest, they will be much more risk averse and many projects with disproportionate expected return but high variance would not be carried out.

A useful analogy for our view is related to modern computational optimization, where the problem is to find a *global* maximum in a context where there are likely many local maxima. Similarly, this is like trying to find an algorithm that gets you to the top of Aconcagua while being blind, and only able to sense local slopes one meter around you. If you start at any random point of the Andes Mountain, and then you are only guided by the local slopes, which would be equivalent of the marginal price signals in the market, then you will be climbing towards the top of the mountain where you just happen to be; not to the Aconcagua. Modern global optimization methods are aware of this problem, and therefore combine two "growth strategies". On the one hand they want to make sure they are going up, so for most of the cases they just follow the local slope (e.g. 99% of the cases). But for some very small percentage of the cases/resources (e.g. 1%) they just make a random jump to explore any other point in the Andes. This is to avoid being stuck in a local maximum that is not global. Once on a random point the climbing algorithm advises to follow the standard hill-climbing procedure of following the slope. This means let the market forces work at the margin once you have done the infra-marginal jump to a new equilibrium.

It turns out that this climbing with small random exploration has more chances to get you to the Aconcagua in any given time, or at least to some better local maximum. Of course the algorithm can under some circumstances do even better if instead of a random jump to any other point in the Andes, one can also obtain some information on the height around the point where our blind person would land.

[30] See Fontaine (1999) for the standard textbook used in Chile on cost-benefit analysis of public programs and Fontaine (1997) for a historical account of rise in cost-benefit analysis with the Chilean government as a lead case in Latin America.

One area in which industrial policy programs may need some special fine tuning in their cost-benefit analysis is when a particular policy is expected to create options in the future.

In short, like in global optimization techniques, the targeting strategies suggested in this paper are meant to complement the decentralized searching for local growth opportunities made by the market, not to substitute the market.

Below we detail various targeting strategies. It is not that one strategy is preferable to the other in all scenarios, so policy preferences and the circumstances of each industries matter for selecting a combination of these strategies. As mentioned, the goal of this paper is just to clarify thinking about the possibilities available in the menu and their attributes. The paper's goal is not to reach a normative conclusion about which strategies should be undertaken. There is no substitution for the valid deliberation of policy makers.

5.2. TYPES OF TARGETING STRATEGIES.

5.2.1. TARGETING LARGE PROJECTS

To begin this list it is worth starting with a very concrete example of targeting large projects.

By late 2014 the government of Chile is experimenting with a targeted intervention to ease constraints for a group of 24 private investment projects with total capital expenditures for around 5% of GDP. The goal is neither to provide any monetary subsidy nor to by-pass existing regulation, but to reduce/simplify red tape and foster complementary public actions, so these projects could see the light at the end of the (bureaucratic) tunnel and truly move forward in their CAPEX within the next year and a half.

A few comments are in order with the use of this strategy.

A first note is that when there are fixed costs for the public sector to "deal with a project" and trying to find out how to remove barriers to growth, then one can rationalize why it might be optimal to screen only within large projects. There could be cases in which large projects may not necessarily be the ones with the highest social *rate of return* (IRR) among all industrial projects to be pursued, but they could have the largest social *net present value NPV*, given their size. Loosely speaking think of the NPV as a rectangle with height related to the IRR, but the base of the rectangle related to the size of the project. The goal is to maximize the area of that rectangle and therefore wider rectangles, even if less tall, could be preferred.

A second remark is that this kind of policies could make additional sense in a period for which many market agents forecast weak private investment.

Third is to remark who is the coordinator. While a group of "Economic ministries" is pushing the agenda and targeting the projects, a fraction of the follow up of this agenda would depend on the Undersecretary of Interior, working in the Presidential Palace. Given the centrality of his position in the government and traction with sub-national bureaucracies, it is a person with relevant power for coordination. As we will see later, this seems like an extremely scarce resource. In fact, Amsden's (1992) accounts of the Korean industrial policies in the 1960s, indicates that the Park regime devoted significant efforts of top level management, including monthly meetings with the leader, to help in the public-public coordination.

Finally, it is worth noting that this kind of totally vertical industrial policy has been perceived as less controversial in the Chilean business press and in the public discourse. After two months of this policy, the author has yet to come across any public statements against this targeting of large

projects, even by groups that have previously made statements against the government picking winners or favoring specific sectors. It is still an open question why these kind of targeting appear less controversial.[31] Could it be because the government is easing a barrier rather than subsidizing? Or, is it that the private investor provides a safeguard against the government going wild and picking totally random targets?

5.2.2. PARTIALLY OUTSOURCING TARGETING: BCG TARGETING IN CHILE.

After reviewing a few types of "pure" targeting strategies, it is useful to get back to yet another concrete example of targeting in Chile. Around 2006 the Chilean government hired a foreign consulting company, Boston Consulting Group (BCG), to suggest areas in which to target public efforts for industrial development. To this end they defined 8 "clusters" listed on Table 1.

TABLE 1. LIST OF EIGHT SECTORS OR "CLUSTERS" DEFINED BY BCG

• Aquiculture| Processed Foods |Fruiticulture | Pig and bird farming
• Copper mining
• Offshoring (* Maybe the only different)
• Financial Services
• Tourism

The complete details of the reasons for why these sectors were selected are not fully explicit, since this consulting company claims to use a proprietary method they do not f disclose. But from the discussion of their methodology one can get a few useful criteria. First, the sectors chosen were expected to have a significant global demand growth. They then focused on the subgroup of sectors for which they believed that Chile could have comparative advantage in the future without that much difficulty, although in practice the latter calculations seem to be guided by sectors with *current* comparative advantage. This second procedure delivered a list of 20+ sectors that was later discussed with different stakeholders. Chiefly, the government added Service Exports / Offshoring; the only sector of the final list in Table 1 that was not already fully developed in Chile. The final shortlist of 8 was defined together with the government. Once selected, each of the predefined clusters had a "cluster manager" paid and appointed as a government bureaucrat and some procedures were put in place. Until the change in March 2010 of the government coalition, some public targeting was done. In the early months of the new government the system was dismantled.

Various aspects of this previous targeting experience are worth remarking. First is that the sectors were very broad so there was not that much targeting. Second is that the (macro) sectors defined were not new to the country, maybe with the exception of service exports. Focusing on these well established sectors makes it harder to prove that the consulting company was wrong, but at the same time it makes difficult to assess whether it was a treatment effect rather than self selection.

[31] Of course one can always argue that the intervention was horizontal, in the sense that all projects above a given size and without legal procedures could have been considered. But when you get to 24 large projects, many of which belong to groups that were active political contributions, that looks very vertical and targeted anyways.

Moreover, they tend to use current size as a guideline to estimate future potential size. The algorithm followed does not seem to emphasize market failures that can boost the treatment effects of interventions. Third, almost all sectors in the list were already well organized in industry boards, so it is not obvious that there were many coordinating challenges. Maybe some of the already have resources. Fourth is that the way the targeting was made was more on attempting to pick winners rather than picking the highest treatment effect, as suggested in Section 3. Fifth is that long term political commitment of this system was absent, something that we will later discuss on Section 7.

5.2.3. TARGETING USING A MAP OF "DISTANCES" ACROSS PRODUCTS.

Following a series of papers since Hausmann and Klinger (2007), various countries have used a "space of products", to make the exercise of thinking about economic activities that they are not currently producing, but that they would like to potentially explore. In this map, some products are "nearby" to what the country is already producing, while other products are more "distant" and implicitly require many different skills and capabilities from what one could infer our of the current exports of a country. When using this map, export products are not that relevant by themselves but are arguably showing the set of capabilities that a country currently have. Products are ways to measure specific types of specialized intermediate inputs that the country has developed.

The measure of distance across products is built by simply what is the conditional probability that one good A (Apples) is exported from a country, *given* that product B (Beets) are also exported from the country. That would be a measure of distance between products A and B and there is an entire matrix of them, like a matrix of distances across cities.

To be clear, this is just a map of products and not a strategy to follow on that map. But given the map some types of strategies could be drawn.

One is to look for low hanging fruit that is nearby. In those cases, where the new activity to target is very close to what the country is already doing, one has to ask why the country is not producing it. One alternative is that an entrepreneur already evaluated the project, and found it privately unprofitable even without many externalities. Another alternative is that some market failure is holding it back.

Another possibility would be to use maps as a tool to make strategic bets. That means products that are distant from the current production, but that could have some interest, either directly or as a stepping stone to other products. In particular some products have been stepping stones to accumulate additional capabilities, and then following market forces other firms in the market could move into some other products. A good example of this kind of dynamic behavior is Boeing, that thought about the Boing 707 in the 1950s, but did not build it because it was too distant. Once the Department of Defense asked them to build a tanker airplane for the B-52, they found themselves much closer to next building the 707. And after the 707 they kept having subsequent market driven jumps in technology.

This map has proven interesting to complement a discussion about strategy, not to substitute a discussion. When using this kind of map, though, it is worth to make a few clarifications. The distances between products shown in the map correspond to average frequencies across countries. But it does not necessarily mean that the marginal country that wants to get into these products would have the same distance. For example in the co-location matrix of products if a country

exports apples it is also very likely to export tomatoes. But in the case of Chile there were reasons why it did not export tomatoes. Because the country is far away from main markets, unlike the average country, and since the post-harvest life of tomato is much worse than for apples, then tomato producers could not competitively arrive elsewhere, at least recently.

5.2.4. Strategies to reach a Critical Mass and infra-marginal incentives (and its relationship to public procurement)

Little is known about why companies in Latin America scale-up relatively less than in other countries (see Lederman et al, 2013). One possibility is that a small capacity expansion is inefficient, even though a large expansion can be profitable. If this is the case, companies need to achieve a critical mass. This might occur if growth requires large indivisible investments, like machinery or creating a new level of organizational structure, hiring a professional manager for the family business. To think about this one should *not* start by considering a standard U-shaped, as taught in basic economics courses, which has only a single minimum. Instead, imagine a W-shaped cost curve as in Figure 2; where the second minimum is more efficient than the first minimum, but requires the firm to first reach a critical mass. A business that is stuck in the first minimum of the W, without critical mass, may find unprofitable to reinvest an additional thousand dollars in the business, although investing some 50 million dollars would be profitable.

In Figure 2 , a company that produces a small amount, q_1, would not grow unless it gets very large purchase order to reduce the average cost and allow it to at least produce a critical mass $\hat{q}$ such that it can continue lowering its cost later, until reaching q_2. Only some will dare to cross this "mountain" of fixed costs, and would only do so if they know that they will have the market for that quantity. This discontinuity creates so called multiple equilibrium.

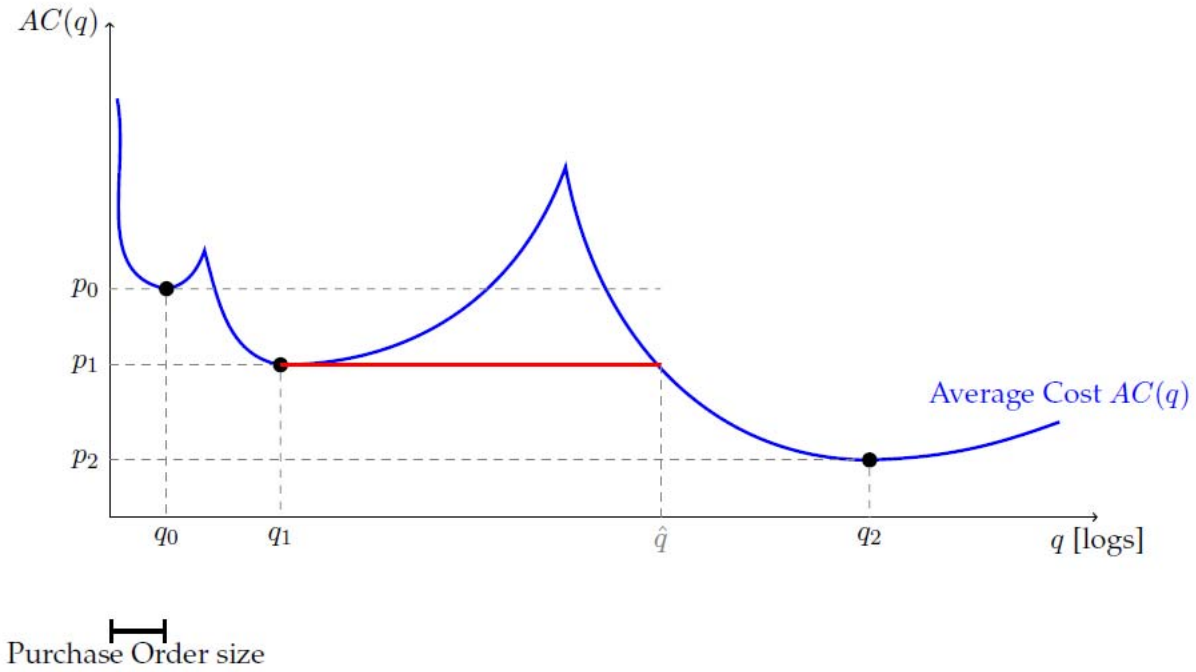

FIGURE 2. COST CURVE WITH DISCONTINUITIES.

These problems may be less relevant in larger markets with ease to achieve critical mass of customers, or in the production of commodities, where you could worry less about a purchase order because you just sell all your products in a competitive exchange. But in other situations it can be a challenge for expansion. Stein and Wagner (2014) argue that a large purchase order from the government or any other large customer (as global mining companies in Chile) could help jump into the second and more efficient part of the W-shaped cost curve

Without going any further, an excellent example of the power that critical masses had in Chile was the auctioning of new affiliates to Pension Fund Administrators (AFP), which allowed the entry of more players. You cannot start an AFP with thousand new customers. To enter the industry you need around two orders of magnitude more customers!

In Europe there has been growing use of "innovative public procurement". This is an instrument where, for example, it is defined that 5% of purchases will have requirements slightly different to the standard acquisition mechanism (e.g. equivalent to Chilecompras..). The purchase procedure and contractual clauses are friendlier to innovation, such as incorporating a local service requirement or any other features where it rewards having domestic suppliers. Such actions would be permitted within the framework of public procurement, WTO and bilateral trade agreements, to the extent that the clauses contain real needs. On section / we will talk more about the challenges of implementing innovative public procurement.

One challenge to achieve critical mass is that Chile does not have a large population and neighboring countries, especially Argentina, does not always have the level of contract enforcement to sustain a well functioning supply chain. Since it is difficult to rely on neighboring country's suppliers (and customers) industries that are sensitive to differentiated inputs from nearby firms are unlikely to develop to the full potential. Miranda and Wagner (2015) show that this is a general feature of countries that have neighbors with relatively poor contract enforcement.

5.2.5. NATURAL LABS.

Here we will explore a strategy in which you have an endowment of resources and you look for productive processes or uses that would be willing to pay for that resource. It is supply looking for a demand.

As example, starting around 2011-2012 the government of Chile launched an initiative to target/ prioritize productivity policies into what has been called "Natural Labs", which are areas of the country that are special or unusual in the rest of the world, and therefore *may* have some particular potential for developing innovations with a bias towards Chile on the supply side.

An example of this would be to explore the biotech use of a species of bacteria that grows only around hot lava in active volcanoes. This would represent an innovation with inputs that are relatively abundant in Chile and relatively less abundant elsewhere, so any discovery could potentially impact the market value of some Chilean factors, including labor but also specific types of land.

Table 2 displays a list of these "Natural labs". It includes, for example, the cold ecosystems of Antarctica, the clear skies and the foreign investments that facilitate Astronomy and the potential of volcanoes.

TABLE 2. NATURAL LABS DEFINED BY THE CHILEAN GOVERNMENT.

• Antarctica	• Flora
• Astronomy	• Mega Cities (*)
• Forests	• Oceanography
• Energy (*)	• Prehistoric Settlements
• Extremophiles	• Volcanoes.

Source: Authors tabulation based on Explora Program CONICYT, Chile.

One remark is that most of the natural labs above are about exploring whether Chilean inputs could be useful in some supply curve / technology (i.e. $f'(k)$). In an oversimplified way, the idea is to focus on any input in these areas in Chile, and then try to find an application to it. The role of the public intervention or encouragement would be to bring innovators to these "natural labs", so they can tell us whether there is economic potential, either directly or after an innovation. It is about discovering demand for given source of supply.

With the exception of Energy and Mega-Cities, which are marked with an asterisk on Table 2, the rest of the natural labs do not represent big problems for Chile. This is not necessarily bad, but one has to acknowledge that it is not the only possible strategy. In fact Italy has zero acres of coffee plantations and very little cotton, despite having incredible comparative advantage in exporting

high value processed coffee and textiles. Similarly, Switzerland has zero cocoa plantations, but has very strong chocolate industry; unlike many African countries that have abundance of that input.

Natural Labs can be classified in principle as "supply looking for a demand" strategy, to contrast it with the "demand looking for supply" strategies that we will describe later.

There are at least two challenges of "Natural Labs" with (intermediate) supply looking for demand. One, that under some circumstances the country may not benefit from the discovery. In the extreme case that the application is fully patented, with no spillovers and no local effects, all the rents coming from the discovery could be accrued to the inventor and not the input owners, including workers. Although this extreme is probably an exaggeration, it is worth explicitly outlining what are the ways in which the program aims to capture value for the country and its people, keeping in mind that one has to leave enough rents for innovators, otherwise it will not be *incentive-compatible* for them to innovate. A second challenge is that biasing innovations to these "natural labs" opens the possibility to innovations with no market value, since you are not starting from actual needs. This aspect, of course, could be mitigated by complementing this supply side strategy with some market tests.

At the same time there are some interesting features for "Natural Labs". First, under some circumstances it could be worth devoting some public resources to make sure biodiversity in some ecosystems is at least mapped, to avoid foreign researchers to get some biological varieties and then patent any innovation without leaving any value in the country. Of course one would be patenting lots of useless stuff, but patents should be valued not by their average value, but instead by their real option value (see Pakes, 1986). A second useful feature of "Natural labs" is that for some reason specific geographic inputs are useful as coordinating devices in the establishing of a new industry. To produce kiwifruits you need many special inputs, but when kiwifruits were brought to Chile, they were brought by farmers that had the land, the water and climate, and also the people to evaluate new crops. Similarly, if a copper mine is found, the existing reserves are a helpful way to coordinate investors to the possibility that copper could be produced there, same thing for special mineral water if there is a spring. But when you establish manufacturing ala Krugman (1980), which can be located anywhere, it is more difficult to coordinate expectations about what could be produced or not. [32]

5.2.6. NATIONAL PROBLEMS AND USER INNOVATION.

An alternative to the previous strategy of targeting "potential supply looking for demand" is to do exactly the opposite. Meaning focusing on things for which your country has strong valuation/demand, but are not supplied by anyone.

[32] References about targeting processed not being realistic enough are everywhere. Lerner (2009) describes how all but a few of the 50 US States have plans to be among the top five states in biotechnology in the country. Also, tourism is too often mentioned in industrial policy planning of many types of nations, many of which cannot have an "above average" performance in tourism. The worst favor one can make to the success of modern industrial policies is to start with long laundry lists of priorities, even for areas that deserve no priority, simply because it is politically too costly to prioritize. Public resources and "bandwidth" is scarce. Having said that, targeted policies are not the only dish in the menu, they are only a complement of a wider set of more "horizontal" policies that are available for everybody.

Examples of this "demand looking for supply" are everywhere. Senor and Singer (2009) in their account of Israeli development as a "startup nation" remark that the French embargo forced the country to leapfrog into the defense aircraft industry, an industry in which today they have massive comparative advantage. They are naturally a country with high defense requirements. In the context of a much closed global economy and with supplies disrupted by the global wars, Chile decided to push steel production in Huachipato as a way to promote many other downstream industries (see Echeñique and Rodríguez, 1990). Although I repudiate the use of the so called "cluster bombs" (*bombas de racimo*, in Spanish), it is worth remarking that Chile and Chilean companies had comparative advantage in the production of various types of bombs, partially generated by the US Embargo to the Pinochet Regime, and partially due to the interaction of a local entrepreneur and a state owned company. [33]

More generally, when your country values highly a particular product that does not exist, either because people, firms or the public sector values it, then it would make sense to put effort on making sure that good exists. Figure 3 depicts a demand curve for a product that does not exist and for which the top of the willingness to pay distribution corresponds to people or firms in the country. For example, if there is a technology to improve anti-earthquake construction, it would be highly valued in Chile. If there is a vaccine to protect against some strains of the ISA Virus prevalent in Chile, then the Chilean population would probably value that innovation considerably more than a country not exposed to that strain. [34]

In those scenarios the entry of some supplier, even if small, would create a lot of consumer surplus. In Figure 3 this would be equivalent to shift down the global supply curve, which is not observed so far, because the product does not exist.

This graph is a standard "supply and demand chart", but only displaying the demand curve. The demand is composed by different people, tautologically orderded based on their willingness to pay for that good. The idea is that the top of the willingness to pay curve is disproportionally composed by people from your country. That coalition of people could get together and invest in procuring the good that does not exit, as a way to get additional surplus.

FIGURE 3. THE GLOBAL DEMAND CURVE (I.E. WILLINGNESS TO PAY) FOR A GOOD THAT DOES NOT EXIST

[33] Later becoming a terrible "global success" with exports and FDI to Saddam Hussein's Irak, again with some additional support of the US, that still considered Hussein as a "friend" in the 1980s.

[34] In general any "appropriate technology" could also be in this category. See Basu and Weil (1996) and Diwan and Rodrik (1991) for models on appropriate technology and its relationship to trade and growth.

Of course any attempt to focus on this targeting for industrial policy purposes has to first explain why the product does not exist: why this high value good has not been produced already. Is there a market failure? Is it difficult to aggregate preferences? Is there a failure of the Coase theorem and the groups that benefit from the good cannot efficiently negotiate? As mentioned, one should address these "Chicago questions" not because one believes there are no frictions, but as a device to help differential diagnosis of the root cause of the problem. [35]

In fact, one also has to get a diagnosis for why user-led innovation has not solved the problem. From the research of MIT Professor Eric von Hippel and co-authors [36] we know that there is a massive but many times unmeasured innovations made directly by users with high valuation / willingness to pay for the good. If they cannot buy the innovation from the market, they can make it themselves (Coase, 1937).

5.2.7. SOPHISTICATED DEMANDS.

A related way to focus on demand is to think about how some early demand / user that could be a stepping stone to sell to a larger market. A sophisticated demand is to start with a customer that you know has preferences for final or intermediate goods that are representative of a large subsequent demand.

Unlike in the case of national problems reviewed above, in the case of sophisticated demands the top of the willingness to pay curve of Figure 3 is mostly located in other countries. But there is a niche in the domestic country or in related export markets which are useful as a stepping stone to get to the sophisticated or large market.

Standard examples from Chile are world class multinational corporations. If a procurement company starts selling to the Escondida mine, then that is an opportunity to understand the needs of other BHP Billiton mines or any other copper mine, which may have differentiated needs that are correlated to the ones of the local mine operations. In general, connection to nodes of the Global Value Chain could connect firms to other nodes of the same firms in other countries (see Blyde, 2014, for a recent review of global value chains in Latin America).

Some countries want to favor spillovers from FDI, and require firms to meet some minimum standards of training for local workers and even local content requirements. While there are various reasons to promote such spillovers, governments should be smart enough not to force them with extreme forces. The very fact that multinationals bring better management could be by itself a central factor to improve productivity (see the World Management Survey in Bloom and van Reenen, 2010; and the application for Chile see Tokman, 2010)

It is worth clarifying that by sophisticated markets we do not necessarily mean here that the customer is "sophisticated", in the sense of paying a high unit price. It can perfectly be a differentiated product with a low unit price but a very large market size. What matters is that, on

[35] See Hausmann, Klinger and Wagner (2008) for a systematic and constructive use of these "Chicago questions" to build analytic narratives describing bottlenecks of the growth process.
[36] See Von Hippel (1987); Von Hippel and Von Krogh (2003); Morrison, Roberts and Von Hippel (2000). Henkel and von Hippel (2003) discuss about the welfare implications of user innovation

top of the minimum size, there is learning going on about how to satisfy the requirements of these large differentiated customers.

Italy has a few nice examples of sophisticated demand in music, among many other fields. Italian is a language that only 60 million people speak as official language, an order of magnitude below Spanish or English. Having said that, once key songs become popular in this sophisticated market (think of the still popular San Remo Festival), it is relatively easy to translate the songs to other languages like Spanish or English, expanding market size as Umberto Tozzi did with "Gloria".

Migrant populations in the country can also be a source of sophisticated demand. One could in principle drive-test products with this population and then access the demand elsewhere.[37] Also, one can think that having a sophisticated demand nearby can simplify the process of leapfrogging (Lee et al 2005; Lee ad Kim, 2001).

Once in the global value chain there is potential for quality upgrading. As argued by Henn et al. (2013) in a IMF working paper, quality improvements could also be a way to increase productivity chains. They argue that specific policies may not be highly correlated to improvements in quality, while quality is positively associated to improvements in the institutional system.

5.2.8. (POSSIBLE) STRATEGIES TO FIND SPECIFIC COMPLEMENTARY PUBLIC INPUTS

As a way to rethink the role of the state in the productive development is instructive to think that companies produce combining its technology with the workers they hire, but also including a potentially very large number public inputs **g**. With a bit of simple math it would formally look like a function

$$Y_i = A_i L_i^{\alpha} \mathbf{g_i} \qquad (Equation\ 2)$$

; where as is common we assume y_i is production, A_i is the productivity of the company that is not directly observed, and L_i is the level of employment in the company. The novel item considered is $\boldsymbol{g}_i \equiv \beta_i\ \mathbf{g}$; which is a vector of publicly provided goods required by company to be more productive (note the symmetry between A and g_i) It is important to clarify that g_i is not the amount of money spent on public goods, it is a huge vector of inputs that the company values, but unlike the market-inputs of the company L_i ; public inputs do not have a formal price as a signal of scarcity, so they require other mechanisms to be prioritized. This vector of possible publicly provided goods $\boldsymbol{g}$ can be very large and highly specific.

What really matters from Eq (2) is that since government inputs g and market inputs L are complementary, then firms that are hiring more workers or investing more may also be the firms that could be in need of more publicly provided goods.

In this context, the goal is that the State can identify in some way what public goods $\boldsymbol{g}$ are needed, who needs them and why there is scarcity, urgency and priority. Note that a very large fraction of

[37] Bahar (2013) shows how getting inward migrants from a country is related to increasing comparative advantage in the products that the sending country has, suggesting there can be either a flow of information with migrants and/or some differentiated demand at home to test-drive products, as well as simply

these *possible* public inputs that the state could potentially provide are currently at zero. The matrix is very sparsely populated.

As a way to explore the needs of firms, if they exist, one can think of various mechanisms to discover these complementary inputs.

(a) Discussion tables with the private sector. **Granularity is key.**

These tools have been used by various governments around the world, including Chile. During the 2010-2014 government they had a series of open meetings with the private sector in what was called "*mesas publico-privadas*", organized by sector. Something similar has also been made for a few years in Chile, with a few variations. The goal of each of these meetings is to unveil so called bottlenecks for growth that impact each sector. Usual challenges in these cases are how representative is the table[38] and the granularity at which it is conformed. If you meet with very large business associations one is unlikely to find the true win-wins, as suggested by Hausmann and Rodrik (2006), In these meetings with what in Chile would be CPC or SOFOFA, one is likely to discuss something that is common to all businesses, like taxation or labor regulation, which are issues that are unlikely to be easy to solve for the government, and probably would generate losses, either fiscal or political. In contrast, as you move down into finer and finer granularity of meetings you are more likely to know that the Association of Asparagus Producers of Los Lagos desperately need a new refrigerated terminal in the Tepual Airport, a project that could pay back in one season for the government, given the additional price that asparagus would get. These kinds of absurdly granular things will not be discovered in broad meetings or by a bureaucrat unconnected from public sector needs. The problem though is that after you identify the problem, then you need at least 4 or 5 different public agencies from different ministries to follow up on that need, for example the Airport Administration (Min of Defense) and the Phyto-sanitary authority (Min of Agriculture).[39] The challenge of coordinating multiple agencies and have their follow up is discussed on Section 7.

(b) Account executives in a matrix-like structure.

Banks have a matrix-like structure. On the one hand they have the production units (deposits, mortgages, insurance, brokerage); and on the other hand they have account executives that connect with the customers. One alternative to better allocate publicly provided inputs would be to take that structure. One challenge, though, is that the government needs to coordinate to provide these inputs. That is what the account executive can make with a simple email, but in the government this is more complicated, because it is designed not to do so (more on this on section 7). Another challenge is that the number of account executives is below the number of subsectors, defined at a

[38] "*If you do not have a seat on the table, then you are probably on the menu*" . This is a recent pitch by Elizabeth Warren, Democrat Senator from Massachusetts, about the support for women in politics. Although originally stated in a different context, it could be applied also in some business-government meetings.

[39] An interesting innovation promoted by the Chilean government 2014-2018 is a "Strategic Investment Fund", that is a kind of voucher to invest in, let's say, a road; but that does not belong to the ministry of public works. A public committee that for example is trying to attract a foreign firm to locate in the country could use such a voucher and ask the ministry of public works to build a road to connect the plant to the port. In short, this investment fund is trying to facilitate Coasian negotiation within the structure of the government in order to provide tailored complementary public infrastructure.

very fine granularity. Therefore you have the problem of how to allocate the executives. An implication of Eq (2) is that, given the complementarily, firms that are hiring more people or investing more could be a good signal that they may need additional complementary public inputs. This is even more important before these subsectors get large enough as to create their own industry association.

(c) Votes, weighted by job creation, or a "crowdfunding" platform complementary public inputs.

Modern information technology has been able to create markets that did not exist before, and also allowed new ways for aggregating preferences. This can also be used for public projects.

One relatively less breakthrough possibility would be to create a voting mechanisms for firms in each industry and region. Based on some criteria (like employment growth, if one believes Eq (2)), one can allocate votes over a series of public goods to create a sense of demand. The scarcity comes from the fact that each firms would have a precise "budget constraint" of votes.

A slightly more sophisticated way of doing it would be like a crowdfunding method or a "Groupon". Since many public goods are indivisible, the planner would like to know whether there are enough firms valuing these resources. The Vickrey-Groves-Clarke mechanism, which is a standard result in public economics, is currently being implemented in many web platforms. The idea is that if building a bridge costs 100 millions, then people would make their donations, and if the 100 millions are not met, then they money is returned. This structure incentivizes people to truthfully reveal their valuation of the goods. One can think that something like this could also be allocated through a public subsidy that gives all firms a budget of points, which they can allocate according to their preferences. One can think something along these lines could be implemented following up the tax declaration in April, for example.

5.2.9. TARGETING (SCALABLE) ACTIVITIES INTENSIVE IN LABOR OF VULNERABLE GROUPS

As we discussed in section 2.1, some new activities could disproportionally impact the demand for labor of population groups that deserve special consideration, like female workers with less education or youth that neither work nor study (so called "*ninis*" in Spanish). While in the long run we expect to improve human capital for everybody, in the next 20-30 years the stock of human is a variable that would move very slowly due to demographics and the arguably small changes that could come from labor training. If we want to create sustained increases in wages for blue-collar workers, we need something that pushes productivity in this subsectors. Examples are the mentioned development of the fresh fruit industry in Chile in the 1980s and 1990s or container manufacturing, which disproportionally demand blue collar woman in tradable sectors.

It is instructive to remember why we should especially care about blue-collar tradable industries rather than just focusing on "plain vanilla" productivity, independent on the sector.

First is that the second theorem of welfare economics, although useful as a gross guideline, may not apply at the margin in many situations. The theorem says that a country that cares about the poorest households, as we do, should focus on enlarging the pie (i.e. increasing productivity, agnostic from the sector) and then give *lump sum* transfers to solve inequality, rather than distorting prices. First of course is that lump sum taxes and subsidies do not exist. Both types of

transfers do distort productive decisions in an increasing way, generating at the margin larger and larger Harberger triangles. In fact some people may not want to work if subsidies for the unemployed are excessively juicy, and other people may not want to work as hard if taxes are excessive (please note I am saying *if*, it does not necessarily follow from my statement that I consider current taxes or subsidies in Chile as "excessive"). In short, redistribution has limits and given the standard analysis of Harberger's triangles, within a certain scheme the distortions grow *more than proportionally* with the size of the taxes and benefits. That means redistribution can do so much for the poor and for inequality. One has to deal with inequality before taxes and transfers.

Second is basic fiscal arithmetic. In the late 1980s, when Chile had a much smaller safety net for the poor, then having a poor household-head out of employment meant only foregone VAT taxes from its consumption and some multiplier effect on the fiscal income, which was small anyways since their wage was small (and VAT was also smaller than today). In contrast, today we not only have higher real wages and higher VAT taxes, but also a stronger safety net. Bringing poor households to employment has a double fiscal dividend: it could increase income and it could also reduce some transfers, which could be used for the provision of public goods. Any public cost-benefit evaluation should take into account this double effect of improving productivity of a labor force that is at the margin of entering employment.

Third is about focusing on (ultimately) tradable industries with some scale-up potential. As shown by analyzing the CASEN survey in Chile, and in the rest of the region, most urban people tend to work in non-tradable industries[40]. And most models in international economics predict that the non-traded sector prices (and marginal revenue product) simply mimic the dynamics of the "main" tradable sector. When there is a boom, then the non-traded sector has a boom; while when there is a bust, its gets transmitted to the tradable sector. In contrast, some other tradable sector could have the potential to have less correlated shocks, and therefore partially stabilize, at the margin. Another important feature of traded sectors is that firms are less bounded by the size of the market, and therefore could have a stronger growth potential. If a firm has high productivity, one would like that firm to expand to favor the reallocation of a worker from a low TFP sector to a high TFP sector. If firms cannot grow large, for example because they are "inefficiently" bounded by the size of the local non-traded market, then it will be harder to achieve reallocation. This should necessarily be a dogma, though, since some non-traded activities could still have relevant scale-up.

Having clarified why a benevolent government should favor productivity in tradable blue-collar intensive industries, it is important to make sure that this targeting criterion does not compromise too much on overall productivity.

Note however that sometimes the labor intensity of a specific demographics would not come from the industry, but from the firm's location, as in the case of segmented labor markets in cities. For clarity let's think of a new manufacturing firm starting in the urban periphery, in a municipality with few jobs around. It can create opportunities for people that would take a job if it is nearby, but would not do so if the job entailed a two hour bus ride. Those people at the margin, which could be women head of household, are sensitive to distance to the job in its labor participation decision. If

[40] Calculations not shown in this report, available from the author upon request

you cannot make people go to work, maybe you could bring the jobs were people live. This could be particularly relevant in a country in which people did not choose its neighborhood, but rather received social housing.

As a way of implementing this it is hard to think of a detailed mechanism. The only suggestion we make would be to proactively ask (as we suggest in section 6.3 of this report) whether the industry that is considered for targeting of productivity policies is in fact intensive in the labor of a particular group.

5.2.10. DIVERSIFYING AGGREGATE RISK

As a final strategy we focus on a different motive to targeting a new productive activity: its capacity to reduce aggregate risk. Even if a sector entails a lower productivity than existing sectors, it could be worthwhile fostering its growth when it has a low or even negative correlation with the rest of the economic activities. This is a basic corollary of portfolio theory that could help reduce aggregate volatility.

In a nutshell, standard comparative advantage theory indicates that a country that wants to maximize welfare should focus only on the commodity it produces relatively better given global prices. That means ignoring any *real* diversification, because all risk would be mitigated perfectly by *financial* diversification, achieved by properly buying or selling the so called Arrow-Debreu securities that span all possible future states of nature. In that standard theory there is no need to change the composition of the export basket because financial markets can do the job of smoothing shocks. But some papers (e.g. Islamaj, 2013; Saint-Paul 1992; Obstfeld 1994) already make the point that, when there are missing markets for financial diversification, then there might be a role for *real* diversification, meaning change the structure of you produce as a strategy to diversify risk, even at a cost of some productivity loss.

However, as in portfolio theory, not all new export activities would have the same value to lower volatility. The first thing is that to reduce volatility the new activity needs to expand, at least up to a point, because a small $10 million dollar industry will not reduce volatility in a $250 billion economy. The challenge, as we will discuss later, is that this extra reduction in volatility cannot be at the expense of an excessive loss in productivity. Like in finance there is a risk-return trade off. Practical ways to proxy for the "social shadow price" of a new export activity that reduces volatility would be to consider:

- Sectors where the commodity price p_i is less correlated with the aggregate index of prices of current exports.

- New export destinations with low correlation between their demand shocks and the demand shocks of the current export basket in Chile. As a counterexample, a new destination for an export product would add very little if its demand commoves closely with Chinese growth, which is a risk factor to which the Chilean economy is already well exposed.

- Consider the trade-off between revenue productivity and insurance. Within those previously described goods one should consider the productivity costs of targeting that new good instead of devoting the unit of input to produce some other goods already in the basket. For a industries in which a worker produces A_i units per month at price p_i ; the lost output of moving a share s of workers to industry i is $A_i p_i / A_0 p_0$; where the subindex 0 means that it is the current export basket. In contrast the insurance value comes from the volatility of the new sector and its covariance with existing activities: $s\ Var(A_i p_i) + (1-s)\ Var(A_i p_i) - Cov(s\ A_i p_i, (1-s) A_0 p_0)$.

A final note of caution from this rather standard framework is that the mere "export of a new product" is not relevant by itself, unless it has higher productivity, lower variance or lower correlation with the existing portfolio of activities. The rhetoric of averaging more export products with the same variance/covariance properties does not reduce risk. Therefore, any time that industrial policy appeals to diversification to support a new sector, it needs to at least submit some (quantitative?) evidence indicating why switching a worker reduces volatility. Not all diversification helps reducing variance.

5.3. TAKING STOCK OF SOME QUESTIONS TO ASK

Below we take stock of a few families of questions that the public sector could ask for targeting

TABLE 3. QUESTIONNAIRE SUMMARIZING KEY CONCERNS TO ANSWER WHEN TARGETING A SECTOR, IF ANY.

Questionnaire for industrial policy targeting	Answers
1. "Make a dent questions" (Is this big?) If the new activity or industry were to exist, how big would it possibly be?	
a. How large in the country of origin? Can the domestic country be like a stepping stone?	
b. Some "Fermi Calculations" to get a sense of the size of the market	
c. Potential impact on either Jobs and/or Taxes[41]	
2. "The Chicago questions."	
a. If so good and profitable, why the industry does not exist? Answers to this question should not make a "straw-man" of the private sector, but rather analyze potential market failures as well as negotiation failures.	
b. Which specific market failure could plausibly explain why the industry does not exist? This is not meant to be a list, but a narrative of each failure.	
c. Are there any negotiation failures that prevent efficient internalization of externalities? Which? Attempt to analyze which assumption of the Coase theorem is being violated. Are the industry boards already organized? If money is in need, why do not they collect the resources by themselves? Is there something different from financing what is needed?	
3. How does it contribute to specific goals different from plain vanilla growth?	
a. Is it creating jobs for sectors that are underserved of job opportunities nearby?	
b. Unskilled intensive? Jobs friendly for people living in urban periphery?	
c. Is there a dynamic effect of these industries in other industries?	
d. Does it disproportionally diversify from important macro shocks (e.g. potential China deceleration)? Lowering volatility? Due to variances or covariance?	
4. What proxies are there for the probability of success?	
a. Is there still a window of opportunity to leapfrog? Or is it closed?	
b. Are the policies needed to target the failure feasible given the level of institutional development?	
5. Policy challenges and mitigation	
a. Outline the types of policies that could be 1st best and 2nd best. Are there implementation or political challenges involved in them?	
b. How could the challenges above be mitigated?	
6. Exit strategy	
a. Could the policy be very difficult to dismantle when no longer needed? Does the cost benefit analysis include the exit costs? Is there an estimate of this future liability? Can one make the proper fiscal (and political) provisions for those events?	
7. Other questions	

[41] To think of an example, the internationalization of Chilean retail does not create a significant number of jobs at home and, importantly, does not end up paying too many taxes.

6. POLITICAL ECONOMY REMARKS

In the previous section we documented a menu of targeting strategies that governments could use. But as we said at the beginning, the biggest challenge in industrial policy is not to identify market failures in the abstract, but to get them in the specifics and especially to implement policy solutions in a way that generates less distortions and government failures. [42]. Therefore, this analysis of targeting would be incomplete without discussing political economy considerations.

Without aiming for completeness, to wrap up our analysis we will discuss the role of public coordination, credibility of commitments, discretion and also a brief discussion about public procurement.

6.1. PRIVATE-PRIVATE COORDINATION

A first central issue about private-to-private coordination has to do with efficient negotiation also known as the Coase theorem.[43] If there are externalities across firms and they have clear property rights as well as low transaction costs, then the externality is efficiently solved.[44] But of course we do not use this benchmark because we think it is true. Like a doctor that knows that a patient is sick, but still finds useful to compare her to a healthy individual, in order to find what the root cause of the problem is. In fact most of the time Coase's assumptions do not hold, but we care about why they do not hold, because it is instructive to know what the coordination pathologies are.

In particular, with new export products the followers that could benefit from the entry of a pioneer may not able to negotiate with this pioneer, since they do not know each other or maybe they do not even exist. That is a failure to the assumptions of Coase's theorem. Other times the transaction costs arise from the inability to commit. They know each other but cannot sign credible binding contracts, so we are left with incomplete agreements and inefficiencies, as in Grossman and Hart (1983). If the industry already has an industry association, then we could ask why they do not solve the problem by themselves. The answer to that question is illuminating to later design policies. If an industry is willing to pay, but cannot tax themselves in a credible way, then the optimal policy to solve the externality is not a subsidy, but using the capacity of the State to tax or enforce special contracts (Chile does that today with Pension Fund contributions). If instead the group of players is unknown or needs to be formed, then subsidies or other coordinating mechanisms could be justified.

An alternative way to solve externalities is when there are large players in the industry. On the one hand, if players are large, then they are more likely to internalize a large portion of the externality. Also, sometimes large plants can create an asymmetric externality, like anchor stores are a source of coordination to create a shopping mall. Bernstein and Winter (2012) formally model these

[42] Rodrik (2009). Industrial policy: don't ask why, ask how Middle East Development Journal. 1, 1-2

[43] Glaeser et at (2001) summarize: "*The Coase theorem implies that, in a world of positive transaction costs, any of a number of strategies, including judicially enforced private contracts, judicially enforced laws, or even government regulation, may be the cheapest way to bring about efficient resource allocation. Unfortunately, some Coasians have ignored the possibility that the last of these strategies [meaning regulation] may sometimes be the best [*option, instead of property rights cum negotiation*].*" Brackets added.

[44] It is well known that Coase's solution to externalities does not need to be fair.

asymmetric externalities, where the optimal policy is to bring first the activity that creates positive externalities on others, namely the "anchor store", because then the other firms would find a dominant strategy to locate there. For example, when creating a new shopping mall, once you have convinced a large retail store like Walmart you can easily convince a small restaurant to locate in the same mall, while the reverse is far from true. This could be a rationale for bringing large industrial plants as devices to coordinate a cluster.

6.2. PUBLIC-TO-PRIVATE COORDINATION

A second challenge of coordination has to do with the public-to-private interactions.[45] In this context it is instructive to use an example of successful industrial policy in the 1980s.

The following example of the industrial policy in Chile shows the need for both: (i) Having an coordinating authority with some power within the government, to deal with the multiple branches of government needed to solve the problem; and (ii) credibility of commitments.

In the 1980s a group of entrepreneurs pushed to create Valle Nevado, nowadays a major ski resort in central Chile. Tourism in this area is a competitive global industry today in Chile, benefitting from the counter-season with the northern hemisphere. But to create the ski resort, it was not only necessary to build it. It also needed a number of specific complementary public goods, like a road connecting the resort to other ski areas, the capital and its international airport.

The imperfect anecdote says that in the mid 1980s these entrepreneurs contacted the Finance Minister, and asked him to build the road. While the Minister was interested in the project and also liked skiing, he wanted to minimize the chance of ending with a new white elephant, a road to nowhere. So he asked the entrepreneurs to build the ski resort first, and then he would support the road. The entrepreneurs did it and today it is an important new business for the country. It is worth noting a few things in this case.

First is that the conversation was with the Minister of Finance, not the Ministry of Public Works, although they needed a road. One interpretation for this is that the Finance Minister had de facto power to do things and played a coordinating role in defining priorities. Before he was Minister in charge of the National Planning Office[46] and had a long career in various government positions.

The second remark is that entrepreneurs believed in the word of the Minister. In the 1980s, with extremely stable political horizon and having an agreement with one of the star members of the cabinet seemed enough of a commitment to incur in a large fixed cost. This commitment seems consistent with what happened with Korea's great productive transformation during the Park regime in the 1960s, who reached agreements for the credible provision of complementary public goods with large business groups in order to enable new economic activities. For example, the Government promised a port to supplement building a ship yard (Amsden, 1992)

[45] As a policy-maker one would like to prevent white elephants. But that is not always the case. Robinson and Torvik (2005) offer a model of why some politicians may want to build a white elephant instead of avoiding it.
[46] This is a Ministry that no longer exists in Chile since 2011, but that well before that, since the mid 1990s, this Ministry lost its de facto influence in creating large projects with long term plans. Its project activities activities were centered in cost-benefit analysis.

Unlike the 1980s in Chile or Korea in the 1960s, today there are a number of "checks and balances" that have enormous benefits to society, but that can shorten horizons and undermine the perception of credibility by the government. There is an open challenge on how to build this kind of credibility in a democracy.

In Chile there was a policy to target clusters from 2007 until 2009 (see section 6.2.2) but that policy was abandoned circa 2010 with the change in the ruling coalition. Without entering into a debate about whether it was a good or a bad decision, one clear lesson is that policies should achieve a minimum level of stability over time to influence the private sector's expectations. If one wants to incentivize private investment, the policies should have credibility to last at least for a period close to the period of those investments. As a natural corollary, for future reforms in industrial policy it would be important to have some degree of agreement by the people leading the industrial or economic policy debate in the opposition. Without that de facto agreement the mere expectation of political swings could kill the treatment effect of these policies, since they will not impact long run expectations. One promising although still risky example of modern agreements would be the ongoing Public-Private partnership for Mining, signed with a 10 year horizon and with massive support by both industry and private sector.

6.3. PUBLIC-TO-PUBLIC COORDINATION.

The above stylized case brings us to a third implementation challenge: the public-to-public interaction, which is perhaps the hardest and least understood of all. Coordinating the public sector is by itself a challenge, since different institutions are built precisely not to trade favors with each other, for good reasons (see Tirole, 1986)[47].

When there are multiple portions of the government that need to converge to solve a problem the situation gets worse. In that sense Hausmann and Rodrik (2006) suggest that one should have an account executive to help manage these projects and interacts with various bureaucracies. We do not mean that this coordination would by-pass environmental permits, but make sure that if a project is built, the complementary publicly provided inputs will be available.

A big trouble is that to credibly coordinate two bureaucracies one faces the problem of the "*minimum common authority*". For example if one needs to coordinate the pest control agency to issue a special permit together with the forest agency, then you probably need the commitment of the Ministry of Agriculture and Forests, that is the minimum common authority between the two. But as the number of public inputs grow, it becomes harder and harder that this coordination could be solved by just a Secretary of State. Once you need to coordinate a road, a certification procedure for pests and the Customs agency, then the minimum common authority is simply the President.

[47] Tirole (1986) rationalizes bureaucratic rules as a way to prevent collusion. Unfortunately I am not aware of formal models that connect this fact with the additional challenges of coordination in the public sector, because utility cannot be freely transferred among agents and property rights over policy domains are not fully defined, breaking at least two assumptions for Coase's efficient negotiation.

In practice, this means that industrial policy would be intensive in high-level coordination within the State, which is difficult to achieve. As one goes up in the chain of command the shadow price of the time available is much higher.

That could be one reason why it seems so pleasant to reduce the difficulties of industrial policy to a subsidy or a budget line, because public finance problems are much easier to solve than the "*bandwith*" shortages of governments to deal with these. But just because you allocate a budget to industrial policy it does not mean that the problem is solved with just money.

In the next two subsections we will zoom in into two different areas of public-public coordination; first is the top management of industrial / targeted policy within the government and second as a way to organize innovative public procurement.

6.4. THE TOP MANAGEMENT OF TARGETED INDUSTRIAL / GROWTH POLICIES.

Here we will analyze some possible institutional arrangements for the top management of industrial policies in Chile

One first proposal is that industrial policy should be headed from CORFO, the Chilean "second floor development bank", which has a CEO that has sort of the powers of a Miniustry but with less political burden. Prima facie it looks like an interesting place, as it has been so far, since the agency in charge should have resources. The problem is that many times the challenge is not financial resources, which CORFO has, but some other type of public input like the ones mentioned in section 6.2. In those situations the bureaucracy of CORFO had little de jure power to coordinate; and only in some cases – given personal connections with the President – it had some small de facto power to coordinate different bureaucracies to provide complementary public inputs.

Another proposal some people had suggested is that the "*Ministerio de Economía*" should be some kind of super-member of the cabinet, with powers to coordinate industrial activities. The challenge though is that it lacks any mechanism to negotiate – to transfer utility – within the government. It is neither the President's Office, which can credibly threat different Ministers to coordinate, nor the Ministry of Finance / Budget Office that can give fiscal carrots or sticks. Without those tools it is unlikely that this super-cabinet can succeed as a broker. Note however that an empowered Ministry of the Economy could still work fine for standard support programs, that require the financial resources but do not require a lot of coordination among different ministries. The role of between agency coordination is different.

On a different flavor some authors have suggested an "Australian Style" Productivity Commission for Chile (see Gonzalez, 2014; in volume edited by Vittorio Corbo), which in some way could be interpreted as a much improved version of the current National Council of Innovation for Competitiveness (CNIC for its acronym in Spanish). While that kind of institutional arrangement could be rather interesting for many growth policies, I have the perception that it will not help in targeted policies that require public-public coordination.

An interesting historical example of public-public coordination for both urban and industrial development was the "*Plan Serena*" (1946-1952); creating massive changes in La Serena, the city where President Gabriel Gonzalez Videla was born. While it received some criticism for targeting resources to his own city, different accounts show that the final results were impressive given the relatively small share of the public budget invested in the project. The secret, as described in the President's autobiography (Gonzalez Videla, 1975) was that there were weekly and monthly monitoring by the President himself, and when he could not do it, a special advisor in the Presidential Palace was put in charge. It was someone that everybody understood had the President's voice on the matter.

This coordination power is not that different from what Amsden (1992) described in the targeted industrial policy during Park in Korea; or what Cornick and Trejos (2014) discuss for Costa Rica during the Presidency of Rodriguez, when the President's son was in charge of such coordination. During other periods Cornick and Trejos summarize the pivotal power of the investment promotion agency: they were the only bureaucracy in Costa Rica that were able to get a meeting with the President if requested on the same day.

Since top coordination is probably among the most non-contractable activities a government can perform, then implementing agencies need to be "*monitored closely by a principal with a clear stake in the outcomes and who has political authority at the highest level*" (Rodrik, 2004).

In sum, any institutional proposal to implement large industrial policies should take into account that the crucial and scarce resource would be public-public coordination.

6.5. COORDINATION FOR INNOVATIVE PUBLIC PURCHASES.

An especially interesting case in which coordination is difficult is the implementation of public purchase programs that can foster innovation. As well known, in the US the Department of Defense and the NIH are powerful engines for innovation, and a significant portion of it comes through public procurement. If one were to mimic that in a small economy like Chile there are various challenges. The Colonel in charge of making the purchasing decision in the US internalizes the technological breakthrough of a new type of drone, because the purchase order is on the frontier of technology. The new drone probably does not exist elsewhere, and even if it exists, for security reasons the Colonel is not allowed to purchase it from China or Russia. In contrast, the analogous Colonel deciding on purchases in a small open economy like Chile would not benefit from the innovation being made in Chile. First is because the Chilean Department of Defense is usually making purchases inside the world technological frontier. Second, it can easily substitute local technology for global technology.[48][49] A similar situation happens with the Ministry of Health. In

[48] Defense procurement has been one of the central areas of industrial policy in countries like the US. Having said that, for smaller countries that lack either the critical mass or that are further away from the frontier, there are additional challenges to use defense procurement. For example Molas-Gallart (1998) discusses how public procurement has been used in Spain as an industrial policy tool, remarking the challenges of from an open international procurement system that only occasionally considered industrial policy issues to a scheme in which they systematically tried to support domestic industries.

short, the bureaucracy that can in principle create a critical mass for innovation (DoD, Health) is not the bureaucracy that internalizes the benefits of innovation. Solving this problem requires hign level coordination, which is hard to achieve.

6.6. STATE OWNED ENTERPRISES

One way in which CORFO organized itself to remove bottlenecks for growth, in the 1940s, was the creation of state-owned enterprises in sectors that did not exist. This is an area in which countries like Chile should very carefully start thinking with modern economic principles rather than dogmas, although without excess confidence either[50]

Under some circumstances, when contracts are incomplete and could be renegotiated at a massive ex-post cost for the government[51], then it could make sense ex-ante to get a state-owned enterprise (SOE) to do it and learn a bit. Later, the service would be better defined in order to write a procurement contract less subject to costly renegotiation. Only then one should proceed to contract the service out in a public-private partnership (PPP). This is how some of the Water and Sanitation companies started in Chile, this is how ports started in Chile.

In short there might be a trade-off between the costs of inefficiencies from SOEs and the renegotiation costs in a very raw PPP. Note that these latter renegotiation costs could in principle be higher in countries with good rule of law, like Chile, because contracts are indeed enforced even if they challenge the fiscal position (see Caballero et al, 2014, for a discussion on how enforcement impact restrictiveness)

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[49] Some smaller or less developed countries have argued that accepting the "Government Procurement Agreement" (GPA) of the WTO would prevent them from using Public Purchases as a tool for industrial policy. The GPA is an agreement that essentially gives equality of opportunity to all bidders in Gov procurement. Kattel et al. (2010) show that indeed, by 2010, only 40 countries have joined that decision. While these authors agree with the idea that procurement could be used for industrial policy, they acknowledge that doing so requires high levels of policy capacity, which might be missing in many developing countries, so these kinds of countries would not be losing a lot from signing the GPA .
Geroski (1990) discusses procurement as a tool for industrial policy.

[50] As a matter of vision, the author of this paper is very critical of the current proposal of a State Owned Pension Fund "*AFP Estatal*" in Chile, because it would use public resources and it is unlikely to have a relevant additional impact on pensions. The author believes it would also contribute to publicly discredit the usefulness of state owned enterprises, limiting the taste for this kind of policy solutions in the future. In contrast state owned enterprises in other areas could potentially be useful. In Chile many municipalities do not have a Pharmacy. In Chile we had made PPP contract for ports without the proper institutional framework, which created a massive holdup to the fruit export sector due to a labor strike in ports. At the end that conflict needed to be solved offering government money in yet another "to-big-to-fail" case. At the end of the day the government is taking responsibility for those cases. This example is to point out that without the adequate institutional framework there are cases in which optimal policy includes direct starte provision. The specifics would depend on the case, but theer are real costs of being dogmatically against state owned enterprises.

[51] See Engel, Fischer, Galetovic, Schargrodsky and Montero (2003) and Engel, Fischer, Galetovic (2006) for a discussion about the costs of renegotiations in roads. Note that at least in roads the nature of the service is more or less clear and easier to contract out. The problem of contracting out is less clear for a bureaucracy that is starting with a fuzzier mission.

When a modern standard Finance Minister is "thinking fast" [52] then an SOE seems *never* a good idea. This total avoidance of SOEs could have been a reasonable mental shortcut for a period like the 1980s and 1990s, which in clinical terms could have been classified as a "fiscal and monetary" emergency room, with massive deficits, some of them from SOE and in other cases selling some SOE to pay debt. Moreover, the fact that SOE were unproductive could have been a useful shortcut, and in many cases it was consistent with evidence for the average SOE

But nowadays most middle income economies are out of the emergency room, and they need to talk to the Cardiologist or to change their diet in order to get growth. That is no longer the emergency room. And like in the hospital, the decisions and institutions to produce sustainable growth are not the same institutions for the emergency room. In these two cases the relative costs of type I and type II errors are different and therefore power is allocated in a different way. A very open agenda in modern macroeconomics of growth is to explore how to create an institutional arrangement to deal with growth, in a way that generates equivalent results to what sound Central Banks and Ministries of Finance have created sustainable monetary and fiscal policies. The institutional arrangement does not need to be similar, the results do.

6.7. EXIT STRATEGY IN INDUSTRIAL POLICY

One big problem of industrial policies is that they may not end when they need to end. A 20 years old industry is not, for instance, an "infant industry".

An example in Chile could be the DL701 subsidy to (artificial) forest plantation that started in 1974. In the 1970s, after a lot of uncertainty about land tenure and with very limited access to long term finance, the take-off of the pulp paper industry needed the guarantee its jumpstart: if they built a pulp-plant, they needed to make sure there would be enough trees to be processed and if trees were planted one needed a processing plant.[53] In that context a subsidy to plantation could have been a game changer, facilitating the development of the forest plantation and pulp paper cluster in Chile. But 40 years later this policy still exists, in some form. Despite having specific sunset clauses in their previous incarnations, a relevant lobby has managed to renew the benefits of the DL701; during dictatorship, during democracy, during left wing governments and also right wing governments. This program is, to some extent, a living example that it is hard to replace such subsidies and one needs to proceed with caution in the cost-benefit calculations: the cost of mopping up and closing should be incorporated and hopefully provisioned for.

[52] Nobel Prize winner Daniel Kahneman brilliantly summarized his research career in a book entitled "thinking fast and thinking slow" (Kahneman, 2011). He argues that humans have these two modes of thinking: fast and slow. The slow one is more analytic, deductive and in some ways more rational. But there is a trade-off because thinking slow uses too much "bandwith" of your attention. Therefore humans have also evolved thinking fast, with heuristics and mental shortcuts. He argues we needed that as an essential survival device during human evolution, making possible to quickly escape from a Lion in the Savanna. When you are learning to drive at age 18 you need to "*think slow*" about driving; while when you become an expert driver you just simply drive "thinking fast", without consuming too much of your bandwidth. The problem arises when you go from the US to England, where they drive on the right side of the road. Then you need to re-think many of your driving habits (re-wire your thinking fast). Since you are now in a new environment where old mental shortcuts are no longer optimal.

[53] According to some account the exports of logs were forbidden in Chile during some years, maybe generating and additional holdup between the paper industry and forest producers.

To be fair, no policy is exempt from future renegotiation and renewal. But when supporting a group of firms that live out of that subsidy it is very difficult to withdraw it, unless skills and capital are very mobile afterwards. But if skills and capital were very mobile to begin with, then the industry would have more easily develop without policy, since it would not have needed such a strong "fundamental transformation" in Oliver Williamson (1978)'s sense.

In case of subsidies, its renewal through the budget law each year is a natural sunset clause; which mitigates the natural trend to ever-greening of subsidies, which were very prevalent when industrial policy was made through tariff protection in the 1960s, since Customs are not part of the national budget and were therefore self-renewing.

Dani Rodrik asks that these policies should have sunset clauses.[54] Given some experience is Chile with protracted and later traumatic clauses I would add that one should build *credible* sunset clauses.

In the case of State Owned institutions one productivity trick would be to make a credible commitment to transparent privatization, like a sunset clause, since that could avoid the build-up of rent seeking within these bureaucracies. Lerner (2009) discusses how an Israeli State Owned Venture Capital Fund had a credible commitment to be privatized, and got all the benefits of State Control at the beginning, but also the efficiency gains from market discipline.

6.8. MANAGING DISCRETION AND CONFLICTS OF INTEREST.

Having remarked in Section 2 any institutional design has to avoid the 1960s rent-seeking style, it still important to recognize that the goal of any institutional design is not to minimize capture. Zero conflict of interest cannot be the objective function. In contrast, the proper way to view the problem of capture is as a constraint to institutional design, not a goal by itself. In particular, there are cases in which you may want to design a system with more discretion, trading off the potential losses from capture that need to be mitigated, with the potential gains of having people that truly understand the details of the policies needed.

An extreme example is a recent speech by Larry Summers, former advisor to President Obama. He remarked the challenge of appointing an emergency committee circa 2009 to deal with the financial sector during the crisis, a huge exercise of industrial policy in emergency mode. On the one hand you really want to avoid the conflict of interests that arise from having former investment bankers in the committee, but at the same time in such a sophisticated and complex world of regulations, with little time and room for mistakes, you need to have people with enough expertise, that are up to speed with how the industry works. Unfortunately, the acquisition of this expertise is not something you learn in University, but an industry expertise you accumulate because it has private returns for you to do so. As a result, Larry Summers argued, the intersection of the group of people without *any* conflict of interest and the people with sufficient expertise was simply the empty set!

[54] "Industrial Policy in the XXI century" Rodrik (2004)

While in very specialized topics the trade-off between expertise and conflict of interest is at some point unavoidable, the goal of the institutional design in these settings is to make sure you are truly in the frontier of possibilities, where the trade-off is unavoidable. Inside the frontier of possibilities one can think of way to mitigate conflict of interest without reducing knowledge, for example by bringing different experts or even foreign groups.

6.9. IMPLEMENTATION PROBLEMS: DO NOT OVER-ENGINEER THE SYSTEM

As a final remark on political economy it is important to recognize the temptation to over-engineer public instruments, making them very difficult to operate. In the past the Comptroller General in Chile, for example, was not that active in enforcing rules. Then, the complicated rules of programs were not much of a binding constraint, because people could work out shortcuts or by-passed them. In contrast, when enforcement of administrative rules became tougher, some unnecessary rules became binding, complicating policy implementation. [55]

One area that is particularly sensitive to administrative rules of the State is the support of risky projects. That is why, for example various international bureaucracies like the IADB have packed their industrial policy support to Venture Capital as a non-refundable gift, because the internal bureaucracy has a hard time dealing with a loan that has a (low) probability of paying back. In that same direction, the design of the Startup Chile program was smart in just giving away money in a non-refundable way, and not asking for equity. Unless the optimal policy could have been a loan, once you take into account the administrative restrictions sometimes it makes sense to just make it a subsidy, as a second best policy, to avoid an administrative nightmare.

7. CONCLUDING REMARKS.

This paper reviewed strategies to search in space of *possible* projects of industrial policy.

The idea is that using some of the machinery proposed in this paper, especially the checklist in section 5.3; a country like Chile could be better equipped to prepare projects with a better chance to have social rate of return above the opportunity cost of public funds. The final part of our paper described the challenges and trade-offs to design an institution able to implement this in practice.

Overall, this paper aimed at clarifying the space for public deliberation about modern industrial policy regarding targeted vertical interventions. These are far from being the only type of industrial policy and maybe not the most productive one on average. But if there are some projects with positive social NPV in that space, non-dogmatic policy needs strategies to find them.

[55] See Lerner, 2009, for additional remarks about this over-engineering concern

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Appendix.

A summary of Dani Rodrik's "ten principles" for modern industrial policy (Rodrik, 2004)

1. Incentives should be provided only to "new" activities.
2. There should be clear benchmarks/criteria for success and failure.
3. There must be a built-in sunset clause
4. Public support must target activities, not sectors.
5. Activities that are subsidized must have the clear potential of providing spillovers and demonstration effects.
6. The authority for carrying out industrial policies must be vested in agencies with demonstrated competence
7. The implementing agencies must be monitored closely by a principal with a clear stake in the outcomes and who has political authority at the highest level.
8. The agencies carrying out promotion must maintain channels of communication with the private sector.
9. Optimally, mistakes that result in "picking the losers" will occur.
10. Promotion activities need to have the capacity to renew themselves, so that the cycle of discovery becomes an ongoing one.

Op Ed: Que vuelva la Planificación (Chile necesita un ODEPLAN como el de antes)

por **Rodrigo Wagner** **[Diario Financiero 10 Dic 2013]**

Digámoslo sin traumas: en Chile nos falta planificación económica de alto nivel. En cambio los Gobiernos de Frei-Montalva, de Allende y de Pinochet tuvieron verdaderas Oficinas de Planificación Nacional (ODEPLAN). Esta operaba en línea directa con el Presidente, preparaba y coordinaban nuevos proyectos complejos muchas veces interactuando con varios ministerios. De ahí salieron enormes proyectos de políticas de competitividad, de política social y también de política energética. No se puede pretender que un Ministro de Energía negocie exitosamente con los habitantes de una Provincia para facilitar una hidroeléctrica. Dicho Ministerio sectorial no tiene nada interesante que ofrecer a la provincia si ésta necesita un mejor camino, colegio o conectividad. En jerga económica tenemos hoy una falla brutal a las condiciones para negociar eficientemente externalidades, por las cuales ganó el Nobel el recientemente fallecido Profesor Ronald Coase. Los problemas eléctricos, el Transantiago y las avisadas protestas de Aysen han sido algunos síntomas de esta carencia que puede ser un cuello de botella al desarrollo

En los últimos 25 años el Estado fue lentamente perdiendo su capacidad de resolver problemas institucionalmente complejos. Primero ODEPLAN se transformó en bien merecido ministerio, pero también perdió cercanía con Presidencia. Luego, como era tan necesario tener un ministerio que se enfocara en la pobreza y los servicios sociales, su original misión de planificación se diluyó. Y la verdad es que si no tienes línea muy directa con el Presidente importa bastante poco lo que tú planifiques estratégicamente. Afortunadamente en los últimos años el MIDEPLAN "salió del closet" y se transformó en un verdadero Ministerio de Desarrollo Social, sincerando que ya no se planificaba, ni tampoco nadie esperaba eso de él.

Si bien sobrevivió testimonialmente una pequeña oficina de evaluación de proyectos, hay enormes diferencias con el ODEPLAN de antes, porque antes también se formulaban muchos proyectos complejos, con aristas nuevas. No sólo evaluación, sino que formulación e innovación.

La SEGPRES hizo proyectos interministeriales con Boeninger, pero se fue moviendo hacia coordinar la relación Ejecutivo-Parlamento y a dar seguimiento a promesas. No a planificar. Hacienda también fue asumiendo desafíos en proyectos nuevos, aunque Hacienda parece funcionar mejor para diseñar una reforma de Pensiones – dónde todas las variables son financieras – y no tanto cuando debemos entender más de la práctica, de la ingeniería y de empatizar con las condiciones locales. Otra parte de la así llamada planificación se fue a las Intendencias; pero donde se rompía la cercanía con la Presidencia y la capacidad de coordinación / ejecución.

Yo quiero un ODEPLAN como antes: muy cercana al presidente, con buenos profesionales pensando fuera de las restricciones de un Ministerio, y con una buena conexión regional. Quizás a algunos la palabra planificación les sonará como a "soviética", pero eso es trauma. No hay que confundirse pues nos falta mucha coordinación y proyectos nuevos. Para un Gobierno progresista debería ser una vergüenza tener menos planificación económica que el "neoliberal" Gobierno de Pinochet. Y muchos históricos de la Derecha - que nacieron políticamente en ODEPLAN - deberían sentir nostalgia. Necesitamos un ODEPLAN potente en el programa de ambas candidaturas que lleguen a segunda vuelta.

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