

# Targeted Industrial Policies: Theory and Evidence

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At some point in the next decade, the U.S. will probably adopt an explicit industrial policy. This policy may include general incentives for capital formation, **R&D**, retraining of labor, and so on, but it will also almost surely involve "targeting" of industries thought to be of particular importance. By targeting I mean an effort to change the allocation of investment — as opposed to its overall level — so as to favor particular industries in which the private market is believed to underinvest. There may be **other concepts** of targeted industrial policy, but the question of the government's role in the allocation of investment is surely the most important and controversial one.

Support for some kind of targeted industrial policy comes from a remarkably wide political spectrum. The idea is favored by nearly all Democrats and many Republicans, nearly all liberals and many conservatives, nearly all unions and many businesses. The only fairly unified opposition comes from professional economists. It is a tribute to the force of free-market ideology that we have resisted industrial targeting as long as we have.

The breadth of support for targeting is, however, partly a consequence of the fact that the specifics have not yet been defined. Which industries are to be targeted? Many advocates of targeting are, to put it bluntly, slippery on this point. They call for a coherent industrial strategy backed by new government institutions, but do not define the substance of that strategy. Presumably the details are to be worked out later. Yet there is a wide range of opinion about which industries should be targeted, and very little agreement about the criteria to be used to settle these disputes. If we can agree in advance, in more or less academic forums, on criteria for selecting target industries, it may be reasonable to expect government agencies to fill in the seven-

digit detail. If we cannot devise such criteria, the prospects for success are slim. For the problem of criteria for targeting is a deep one — and deep analysis is not something that government agencies do well.

The case for a targeted industrial policy therefore stands or falls on the issue of criteria for selection. Can we devise criteria for choosing targets which will by and large pick the right industries? If we can, can we devise an institutional framework which will actually act on these criteria and not degenerate into a system of political payoffs? The answers I will suggest are not encouraging. Most criteria for targeting suggested by the advocates of industrial policy are poorly thought out and would lead to counterproductive policies. While there are more sophisticated criteria suggested by economic theory, we do not know enough to turn the theoretical models into policy prescriptions. Indeed, we find it hard to tell whether industrial policies have been successful even after the fact. Given this lack of clear guidelines, it is very naive to suppose that government agencies can somehow intuit their way to appropriate policies.

This paper is in two main parts. The first part is a discussion of criteria for selecting target industries. It begins with an analysis of "popular" criteria which have been advanced in publications aimed at a large audience, then turns to more sophisticated criteria suggested by economic theory. The second part examines the other side of the coin, the evaluation of actual industrial policies. It discusses the difficulties in determining, even after the fact, whether an industrial policy "worked." These problems are then illustrated with two examples, the steel industry and the semiconductor industry.

### Criteria for industrial targeting

Even a skeptical discussion of targeted industrial policies should admit at the outset that there is no question that an optimal policy of industrial targeting would be beneficial. Markets are not perfect, and the numerous market failures and distortions in the real world surely lead to too little investment in some industries, too much in others. The question is, which ones? Markets aren't perfect, but they are probably not so imperfect that random interventions are liable to improve on them.

Unfortunately, most discussions of industrial targeting are vague about what we should target. There is a good deal of emphasis on the importance of detailed study of industries, but even the most detailed study will not help us formulate policy if we don't know what we're

looking for. There is also frequent **assertion** of the need for a coherent strategy; but a coherent, wrong-headed strategy may be worse than no strategy at all.

The absences of clear criteria for choosing targets makes discussion difficult. What I will try to do in this section is to **analyze** criteria which are explicit in some discussions and implicit in many others. These criteria fall into two **groups**. First are what I will call "popular" criteria. These are criteria which are frequently advanced in books and articles aimed at a large audience rather than at professional economists. The criteria which I have found most often in this literature are high value-added per worker; linkage to the rest of the economy; the prospect of future international **competitiveness**; and targeting by foreign governments. From an economist's **perspective**, all of these criteria are badly flawed. It is possible to show both by abstract "thought experiments" and by concrete example **that** an industrial strategy which uses any of these criteria to choose target industries is likely to reduce economic growth, not promote it.

While the public debate on industrial policy is dominated by these simplistic criteria, however, there is also an economist's case for targeting. This case **emphasizes the** role of targeting in the face of imperfect markets, resulting in particular from economies of scale, externalities, and the incentive-distorting effects of the government policies. These concepts furnish a valid basis for targeting — **if** the theoretical concepts can be turned into measurable **factors in practice**, and **if** one believes that the machinery of industrial policy will actually work in the way we intend.

### ***Popular criteria for industrial targeting***

Most writing about industrial policy is vague about **the content** of such a policy. Any attempt to analyze, specific ideas is therefore risky. If the analyst isolates a particular concept and **criticizes** it, he is likely to be told that he is oversimplifying. Yet there must be some specific concepts in the minds of the advocates of industrial targeting. My own reading of recent discussions suggest that the most important criteria **envisioned** by advocates of industrial **targeting** are the following:

***High value-added per worker.*** Some authors have **pointed** to the wide range of value-added per worker across industries and suggested that countries can raise their national income — to some extent at other countries' expense — by deliberately shifting their economic

structure into the high value-added industries.

**Linkage industries.** Many authors have also suggested that there is a special payoff to investment in "linkage" industries, such as steel and semiconductors, whose outputs are used as inputs by other industries.

**Future competitiveness.** It is often argued that the government has a valuable role to play in targeting industries in which a country is not currently competitive on world markets, but in which it will be or can be made to be competitive in the future.

**Responding to other governments.** A final argument which has become very popular is that industrial targeting must be used to counter other governments' industrial policies, lest our country's industrial structure become determined by other countries' targeting.

**High value-added per worker.** In their admirably clear tract on industrial policy, *Minding America's Business*, Magaziner and Reich immediately lay out their basic criteria for industrial targeting:

"We suggest that U.S. companies and the government develop a coherent and coordinated industrial policy whose aim is to raise the real income of our citizens by improving the pattern of our investments rather than by focusing only on aggregate investment levels. Our country's real income can rise only if (1) its labor and capital increasingly flow toward businesses that add greater value per employee and (2) we maintain a position in these businesses that is superior to that of our international competitors."<sup>1</sup>

Leaving on one side the issue of competitiveness, to which we return below, this passage clearly states two features of the proposed policy: a reliance on reallocation of investment rather than an increased flow, and direction of investment toward sectors with high value-added per worker.

There is great plausibility to the idea that reallocation of workers into high value-added sectors will raise national income. There is a wide range of value-added even among quite aggregate groups of industries. Other things equal, a higher share of workers in the high-value-added industries would mean higher national income per capita.

But would other things be equal? The crucial question to ask is *why* there is so much variation among industries in value-added per

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1. Magaziner and Reich (1980), p. 4.

worker. Why doesn't labor move into the high value-added sectors without special encouragement? The answer, of course, is that by and large high output per worker reflects high input per worker: large quantities of capital and extensive training and education. Sending a garment worker to a refinery does not by itself make him as productive as the existing refinery workers — you also have to equip him with several hundred thousand dollars' worth of capital equipment. Sectors with high value-added per worker generally have low value-added per unit of capital or per skilled worker.'

Suppose that the government were to follow a policy of encouraging investment in high value-added sectors — that is, in sectors with high ratios of physical and human capital to labor — without at the same time increasing the overall rate of investment. It is easy to pursue a "thought experiment" to see the consequences. Since the capital-labor ratio in high value-added industries is higher than in low value-added industries', a given amount of investment would employ fewer people. Employment growth would slow, and unemployment would rise. At the same time, since the capital-output ratio is also higher in value-added industries, the rate of economic growth would actually be reduced. This may seem paradoxical, since output per worker would be rising more rapidly than before, but the paradox is resolved by the fact that the slowdown in employment growth would more than offset the rise in productivity growth.

Over time, if they are allowed to operate, market forces would tend to correct some of these effects. Rising unemployment would put downward pressure on real wages, and lower real wages would lead firms to move towards more labor-intensive techniques. In the long run, employment would be restored, with more workers in high value-added sectors but lower productivity in each sector — and probably lower output per worker in the economy as a whole. At least some advocates of high value-added targeting, however, would try to prevent this adjustment:

"As a national strategy, the substitution of lower real relative wages for productivity improvements would eventually make America a relatively poor country, albeit one with a healthy balance of payments. Accordingly, a rational industrial policy

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2. For example, the chemical industry has a value-added per worker which is more than three times that in textiles, but its capital-labor ratio is also more than three times as high. (Numbers from *Statistical Abstract of the United States*.)

should encourage **firms** to invest in productivity improvements and increased output rather than reduce real wages.'<sup>3</sup>

In other words, as unemployment rose, real wages would be sustained through government legislation or less formal suasion.

In short, a strategy of encouraging investment in industries with high value-added per worker appears, in our thought experiment, to have very poor results: slower growth, and rising unemployment. But would it actually work out that way in practice? As it happens, there is abundant experience with this kind of policy. For much of the postwar period, encouragement of capital-intensive, high **value-added** industries was a key element of development strategy in many less-developed countries. It is generally acknowledged now that such policies were misguided. They tended to produce dualistic economies, divided between high-wage, capital-intensive, but economically inefficient favored sectors and a low-wage, high unemployment **residual**.<sup>4</sup> The success stories of the less developed world have been exactly those countries which, instead of prematurely developing their capital-intensive industries, exploited their comparative advantage to export labor-intensive products. Thus the proposal to foster high value-added industry amounts to a suggestion that we adopt a strategy which looks like a bad idea in theory and has worked poorly in practice as well.

**Linkages.** A second criterion for industrial targeting which is frequently advanced is that special encouragement should be given to industries which are important "linkage" sectors, in the sense that their output is in turn used as an input by a number of other industries. A representative view on this is that of Eleanor Hadley, who writes in explaining the success of Japanese industrial policy that:

"Japanese target industries have been selected not only for their own importance but for their ramifying effect on other industries. For example, steel was chosen because, in an industrial economy, steel is the basic building block. **Have** cheap, good-quality steel, and the products made of it — ships, automobiles, rails, locomotives, heavy electrical equipment — will enjoy a price advantage.<sup>5</sup>

Similar views recur through much of the industrial policy literature.

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3. Magaziner and Reich (1980), p. 339.

4. See, for example, Little, Scitovsky, and Scott (1975).

5. Hadley (1983), p. 6.

Magaziner and Reich offer a view which is identical to Hadley's; Mueller and Moore (1983) similarly argue for a need to target "basic industries, such as steel, which have important multiplier consequences throughout the economy."

On the surface, the idea of a special significance to the production of linkage industries seems highly plausible. If capital and labor are used to produce a final good — say dishwashers — than that is all they produce. If they are instead used to produce steel, the steel can in turn be used to produce many different items. So it is natural to suppose that other things equal it is more productive to allocate more capital and labor to steel.

On reflection, however, the argument is not so clear. Saying that steel is used in many industries conveys the impression of multiple returns to output. But while steel is used in many industries, a particular ingot of steel is used only once. A linkage of industry's products can be made to sound like "catalysts" for the rest of the economy, but unlike a real catalyst, steel does not get to be reused many times.

What does formal economic theory have to say? In textbook economic models, the fact that some industries are inputs into other industries is not in and of itself a source of market failure. In the absence of other distorting factors, the market will in theory produce exactly the appropriate amount of investment in linkage industries.

These textbook models, in which all "marginal whatnots" are equal, are of course poor approximations of reality, and it could easily be that the ways in which the world is different from the models do make extra investment in linkage industries desirable. For example, there could be external economies in the linkage sector. But it is equally possible to conceive of cases in which it is the final goods sectors which should be encouraged — e.g., if they are more labor-intensive and unemployment is a problem.

The fact that an industry provides inputs into other industries does not in and of itself mean that markets underinvest in that industry. There may be market failures which do make it desirable to promote a linkage industry, but the fact that an industry provides inputs to the rest of the economy gives us no help in deciding whether or not it should be targeted.

**Future competitiveness.** Some proponents of industrial policy have realized that the differences of criteria for selection of targets represents a problem. An answer which has been proposed by some, such as Diebold (1980), is the criterion of eventual international com-

petitiveness. Adams (1983) argues that restricting targeting to industries which can eventually become competitive on world markets is a relatively hard-nosed criterion for selection:

"The criterion of present or future competitiveness on world markets . . . is a difficult market test. If the industry can meet that test, we can presume that resources are being allocated efficiently . . . [but the] world-market test must be applied with a dynamic view since industries presently in need of assistance may ultimately be competitive."<sup>6</sup>

There is a strong appeal to the notion that an industry is worth supporting if it will eventually be able to stand on its own feet in the face of international competition. We know that this is not a toothless criterion: many industries have received protection and support without ever becoming self-sustaining. (Indeed, there may well be industries deserving of support which would fail to pass the test, as discussed below.) The criterion of eventual competitiveness also has an honorable intellectual lineage, having been propounded by no less an economist than John Stuart Mill.

But it is a fallacious criterion. There are at least two ways in which an industry might meet the criterion of eventual competitiveness yet in fact not be a proper candidate for targeting.

The most obvious way in which an industry might meet the criterion of eventual competitiveness is if comparative advantage is shifting in the industry's direction for reasons independent of industrial policy. Suppose, for example, that a country has a small capital stock but a very high savings rate. Over time, as the country accumulates capital, its comparative advantage will shift capital-intensive industries, simply as a result of market forces. In the economist's imaginary world of perfect markets, the shift in industrial structure would occur at exactly the right rate. In the real world, the pace is bound to be wrong; but there is no presumption that markets are too sluggish — they could equally well move too quickly.<sup>7</sup>

The important point is that in our example — which is of course meant to be suggestive of postwar Japan — targeting of **capital-intensive** industries will meet the criterion of eventual competitiveness,

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6. Adams (1983), p. 413.

7. An interesting point in this connection is that "growth stocks," whose value depends on anticipated future rather than current earnings, have historically been bad investments. This suggests that financial markets tend if anything to lay too much stress on future as opposed to present returns.

regardless of whether or not it actually promotes economic growth. It may be desirable to accelerate the movement into more **capital-intensive** industries, or it may not — it depends on the precise nature of capital market imperfections. Certainly it is possible to build an industry too soon. Singapore is now building personal computers; should it have tried to develop a computer industry in 1965? Adjusting too fast is as economically irrational as not adjusting at all.

Our first case, then, is where the eventual competitiveness of an industry essentially happens for reasons independent of industrial policy, something **Corden** (1974) has called the case of the "pseudo infant industry." A second case arises when industrial **targeting** is responsible for eventual competitiveness, but at excessive cost. Suppose that there is an industry with worldwide excess capacity and little new investment. By subsidizing the cost of capital, a country could induce its firms to resume investing, building more modern, capital-intensive plants than their competitors. These plants might well have lower operating costs than those in other countries, so that even after the capital subsidy is ended the targeted industry will be able to export and operate at higher capacity utilization than other countries' industries. Yet in the absence of any other special reason for supporting the industry, such as technological spillovers, the social rate of return on investment in an industry with excess capacity is bound to be quite low. Again, that is not an argument drawn out of thin air; as argued below, the apparent success of Japanese industrial policy in steel may be partly of this kind.

The last example stressed subsidy of capital. It is also possible that by subsidizing the acquisition of knowledge in an industry — either by subsidizing R&D or by protecting an industry while it moves down the learning curve — industrial targeting can sometimes create industries which are self-sustaining thereafter. As with a subsidy to capital, the eventual competitiveness does not show that the policy was justified. There is an enormous literature on the infant industry issue, which boils down to this: having the industry grow up healthy is not enough; its existence must generate enough extra national income to compensate for the initial cost. Suppose, for example, that a costly subsidy program creates an industry which is competitive, but not by a wide margin, so that it would be nearly as cheap to import the industry's products. Then the policy meets the criterion of eventual competitiveness, but it was nonetheless a mistake.

What these examples demonstrate is that eventual competitiveness

is not a useful guide to selecting targets. No doubt there are industries that will eventually be competitive and that should be targeted; there are also without question future competitive sectors that should not be targeted, and for that matter there are sectors worth supporting that will never be able to stand on their own feet. Unfortunately, knowing that an industry will or might become competitive tells us nothing about whether it should be promoted.

**Response to foreign targeting.** One of the most influential arguments for industry targeting is that it must be used to counter foreign competition. On this argument, our criterion for selection of industries ought to be essentially defensive. We should support industries which have been targeted by foreign governments, in order to avoid letting our industrial structure be determined as the "obverse of other countries' industrial policies." There is great appeal to the idea that the policies of foreign governments should not be allowed to distort our industrial **structure**. As one recent report argues:

"[The] concept that the U.S. must reduce production in any sector — such as steel, automobiles, or semiconductors — as a result of decisions taken by foreign governments, is tantamount to resigning ourselves to having our economy shaped by the policies of others rather than by the impersonal operation of the marketplace. Our adherence to a laissez-faire philosophy under these conditions would mean that the structure of American industry would be determined, not by market forces, but by the industrial policies of other governments."<sup>8</sup>

Should the U.S., then, fight fire with fire — meet targeting with countertargeting? We probably will, but like our other **popular criteria**, this one does not stand up too well under analysis.

The problem is that in economics two wrongs do not make a right. A distortionary foreign policy may reduce U.S. **welfare**,<sup>9</sup> but countering it with an equivalent U.S. policy will often merely make things worse.

Suppose, for example, that foreign countries subsidize exports of an agricultural commodity, say, wheat. This is undeniably a **distort-**

8. Labor Industry Coalition for International Trade, p. 15.

9. Or it may increase over welfare. If Colombia were to subsidize its coffee exports, this would distort the international trading pattern — but in a way which benefits us. One economist remarked that when the U.S. government determined that European governments were subsidizing their exports of steel to the U.S. the appropriate response should have been to send a note of thanks.

ing policy, and since the U.S. exports wheat, it lowers the price of U.S. exports and reduces our national income. Yet a program of countersubsidy by the U.S. would depress prices still further, compounding the damages. Here the plausible idea of meeting foreign targeting turns out to be a very bad criterion. **The example**, of course, not hypothetical: this is exactly what has happened.

The response of advocates of a policy of meeting foreign competition would presumably be that wheat is a bad example. Foreign industrial targeting should not be matched in a mindless fashion, but only when it threatens key sectors.

But what defines a key industry? If we can find criteria which make an industry particularly crucial, then we should target that industry regardless of whether other countries choose to target it. If the industry does not meet their criteria, foreign targeting gives no reason to change our judgment.

In practice, an industrial policy aimed at meeting foreign competition would probably lead to government encouragement of investment precisely where the returns to investment are depressed by the targeting of other governments. A case in point is steel. Steel is almost universally regarded as an industry worth targeting, and partly as a result is an industry with low returns. In meeting foreign policies, the U.S. would thus be targeting an industry where the market returns are bound to be low. The only justification would be if there were other reasons to target steel. As already suggested and argued at greater length below, this is a dubious proposition.

In general, meeting foreign industrial policy seems to be almost a recipe for picking sectors where there is excess capacity and low returns.

**Conclusions.** We have examined four popular criteria for selecting targeted industries, and found them wanting. These criteria are not straw men. They are the criteria which have been proposed by some of the best-known advocates of industrial targeting, and are at least as sophisticated as the ideas which shape most public debate.

Of the four criteria, two would probably be quite disastrously counterproductive. Targeting of high value-added industries is both in theory and in practice a recipe for slower growth and higher unemployment; defensive targeting to meet foreign policies will often be a way of insuring that investment is funneled into areas with excess capacity and depressed rates of return. The other criteria, linkages and future competitiveness, are less obviously destructive; but they

are not likely to be beneficial, either.

I am sure that some advocates of industrial targeting will deny that they have in mind anything as simplistic as the concepts just described. The proponents of these criteria, however, do not think they are being simplistic. And when the time to choose industrial targets comes, it will be a break with all past experience if the criteria for selection are more sophisticated than these.

Nonetheless, it is possible to suggest some more sophisticated criteria for targeting which might be used to **carry** out a successful industrial policy. I find it hard to believe that they can serve as useful guides for policy, but in fairness they ought to **be described**.

### *More sophisticated criteria*

Only the most die-hard believer in the functioning of free markets would deny that a government planner with sufficient information and freedom of action could increase national income by targeting certain industries. The idealized model in which free markets lead to a perfectly efficient outcome relies on extreme assumptions, particularly about returns to scale and the ability of firms to fully capture all the benefits of their activities. Since these assumptions are visibly violated, there clearly exists a set of government policies — including activities we would describe as industrial targeting — which could raise national income.

The problem is that knowing that a useful industrial policy exists does not necessarily help us implement it. To be helpful, an advocate of industrial targeting must be able to describe operational criteria for choosing target industries. This task may not be **hopeless**, but it is not simple. What I will do is to analyze the way three types of deviations from the idealized competitive model might give rise to a case for targeting, and discuss the difficulties in formulating actual policies on the basis of existing knowledge.

***Economies of scale and imperfect competition.*** The most obvious failing of conventional economic models is their assumption of constant returns to scale and the associated assumption of perfect competition. In view of most businessmen and many economists, the norm — at least in manufacturing — is some degree of increasing returns and a market structure which is more or less oligopolistic. Of particular importance for many discussions of industrial policy are "dynamic" economies of scale, resulting both from the role of R&D and from the experience cure.

It makes a great deal of difference whether these economies of scale are internal or external to firms. For **example**, does each firm in the industry have its own experience curve, or is there an industry experience curve which reflects output nationwide (or worldwide)? The case where the economies of scale are largely at the level of the industry rather than the firm is quite different from the case of **firm-specific** scale economies and is dealt with below.

In the case of internal economies of scale, the starting point for a discussion of policy is the realization that markets will not be **perfectly** competitive. An industry will consist of a small group of **firms**, or if it consists of many firms they will be producing differentiated products. Prices will be above marginal costs; firms will often act strategically, taking actions aimed at influencing the decisions of other firms. The range of possible behavior, and of response to government policies, is much wider than in the standard competitive model.

In the U.S. the traditional concern of government has been with protecting consumers from the exercise of market power by firms. The response has been antitrust and, in cases of very powerful scale economies, regulation. Only with the growing importance of trade has focus shifted to the protection or promotion of domestic firms against foreign competitors. There is definitely room for activist policy here, but deciding what to do is not straightforward. Theoretical models can be devised in which an industry with economies of scale should be targeted, but others can be devised in which it should not.

Let us begin by sketching out one sort of situation in which targeting might be advantageous. Suppose there is an industry in which there are only two serious competitors, a U.S. firm and a Japanese firm, and that each knows that its costs will fall sharply as it gains experience. Each firm will tend to follow a "Boston Consulting Group" strategy, initially setting its prices low in order to move down the experience curve. If it could, each firm would like to convince the other that it will follow a very aggressive policy, so as to encourage its competitor to pull back; but the **firms** may have no credible way of making such a commitment.

In this context, a targeted industrial policy could serve the purpose of helping domestic firms play their strategic game. A government subsidy, for example, could make credible the intention of the domestic **firm** to pursue an aggressive pricing policy, deterring its competitor. The withdrawal of the competitor could raise profits by

more than the **amount** of the subsidy, in effect **transferring** monopoly rents from foreigners to domestic residents. Thus there is at least the possibility of a successful predatory industrial policy.<sup>10</sup>

Unfortunately for **policymakers**, small variations in the situation could reverse the conclusion. Suppose, for example, that there are not one but several U.S. firms, and that the industry concerned is one in which we are a net exporter. Then it still might be the case that an output subsidy could benefit the U.S. by deterring foreign competition. **But it** could also be the case — and this becomes more likely, the **more U.S. firms there are** — that the opposite is true. In competing **with** each other, U.S. firms may be setting their export prices too low **and investing** too much for their **own** collective good; their collective **profits** might be improved if they could be induced to pull **back**. This is the classical argument for exploitation of market power in trade: you **should raise** the price of your exports, not lower it.

Which of these stories is right? The answer surely varies across industries. To act with any hope of success would require a deep study of each industry in question — a deeper study than any which has ever been **carried out**.

*External economies.* Even in textbook analyses, external economies are acknowledged to be a justification for government intervention. If the output of **firms** generates experience which is useful to other firms, or if the results of one firm's research and development can be "reverse engineered" by other firms to improve their own technology, then there is a clear opening for government action. The question becomes one of political economy: can the government act with enough wisdom to do more good than harm?

The obvious examples of external economies are in innovative industries. Developers of new products or processes cannot help conveying valuable information to competitors. Even if some details of an innovation can for a time be closely held — for example, a manufacturing-process — the simple knowledge that something can be done is often highly valuable to competitors.

Some discussions of industrial targeting also seem to suggest that there are external economies in the relationships between innovative industries and their customers. Such a view appears to be the implicit

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10. This analysis is based loosely on Brander and Spencer (1982), as well as on Krugman (1983).

model in this recent statement by the Semiconductor Industry Association:

"The U.S. advantage in semiconductors has . . . enabled the U.S. to maintain a competitive lead in most other high technology fields."<sup>11</sup>

Presumably the idea is that close proximity to suppliers makes it easier for the users of the high technology products to pick up ideas which are "in the air," enabling them to keep abreast of and exploit the latest advances in technology. The case for believing in important inter-industry externalities of this sort does not seem as compelling as the case for intra-industry externalities; but there are doubtless some examples.

Externalities are clearly important in innovative industries. If that were the whole story, these externalities would mean that firms underinvest in technology, and would provide a clear case for government subsidy of R&D and promotion of industries on the early part of their learning curve. Unfortunately, this is not the whole story. Recent theorizing on competition in **innovative** industries has suggested that there are some **other** reasons why firms may overinvest in **technology**.<sup>12</sup> There are two main reasons. First, there may be wasteful duplication of research. There may be six firms trying to develop a process when there should be only two or three. An **R&D** subsidy would encourage each firm to invest more, but it would also encourage entry, encouraging further duplication of work. Second, established firms may try to use heavy investment in **R&D** to deter potential competitors. This may lead them to develop technologies "too soon," leading to a situation where the social returns to more **R&D** are actually quite low.

For these reasons, a simple policy of subsidizing high technology industries is not necessarily a good idea. In principle one could devise a better policy, one which combines some subsidy elements with industry restructuring to reduce the number of firms, encourage them to do joint research, etc. It is possible that Japanese industrial policies actually do in some degree approach this model. All one can say from a U.S. perspective is that to successfully select targeted industries, back them with subsidies, restructure them, and do all this in an

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11. Semiconductor Industry Association (1983), p. 1.

12. See Dasgupta and Stiglitz (1982).

objective way would require that government officials show a depth of understanding and subtlety of action unprecedented in U.S. history — and that they do it on a routine basis.

**Other government policies.** It is arguable that the most important reason why the idealized model of a competitive economy is wrong is that we in fact have a large, intrusive government. The government imposes taxes and regulations which are not neutral across industries; it offers unemployment insurance and imposes minimum wages; it protects declining industries and bails out firms in trouble. All of these actions distort incentives in the market.

It is a familiar proposition from the literature on economic development that distortions due to government action may make other offsetting government actions desirable. For example, protection of imports can lead to an overvalued exchange rate, which in turn may imply that export subsidies can raise national income. Similarly, if the government tends to promote or protect labor-intensive sectors, it may be able to undo some of the damage by simultaneously promoting capital-intensive projects.

In general, however, the appropriate response to government-induced distortions is to try to minimize them, not to target particular industries in which the country underinvests. The interaction of the tax system with inflation during the 1970s probably led the U.S. to invest too much in housing, too little in plant and equipment; surely the right response was reform of the tax system, not targeting of particular capital-intensive industries.

It is sometimes argued that existing government policies, though not explicitly targeted, do have differential effects across industries, and that this means that we should respond with targeted offsetting policies. The answer, however, probably is that we should respond with policy reforms which are also not explicitly targeted, even though they too may in fact differentially favor certain sectors.

**Conclusions.** There is a theoretical case for industrial targeting. There may come a time when economists are sufficiently knowledgeable to make concrete policy recommendations based on that theoretical case. As it stands now, however, the theory does not look very operational. If we must have a targeted industrial policy, it would probably be best to target the high technology industries, which have both important dynamic scale economies and important externalities. But we have no assurance that this is actually the right policy. There

are arguments, and not outlandish ones, suggesting that targeting of these industries might well lower national income.

### **Evaluating targeted policies**

There is no lack of **experience** with targeted industrial policies. Japan, of course, has pursued a policy of targeting throughout the postwar period. France has also made **fairly** consistent efforts to target particular industries. Other countries, including Germany, Britain, and indeed the U.S. have at times targeted individual sectors. One might be inclined, then, to sweep aside the theoretical discussion of the previous part of this paper with a call for a look at the evidence. What has worked in practice?

Unfortunately, this is not so simple a question as it seems. In the first place, simply ascertaining what a country's industrial policies have been is often quite difficult. In the modern world, governments rarely use clean, transparent tools like flat subsidies or tariffs to promote targeted industries. Instead they use a variety of **hard-to-measure** instruments — tax incentives, credit allocation, procurement policies, recession cartels, red-tape barriers to imports, and so on. The extent of effective targeting is not only hard for observers to **ascertain**; it is a fair bet that even the officials administering the programs don't know how much support they are providing.

Above and beyond this difficulty is the problem of evaluation. Even if we are sure that a country did in fact target a particular industry, there is no simple way to tell whether that policy raised national income. The issue of evaluation is similar to the problem of selecting targets in the first place, and is similarly difficult.

The plan of this part of the paper is to review the problem of evaluating targeted industrial policy, then **illustrate** the difficulties with brief **discussions** of the two most famous cases of industrial targeting: the Japanese successes, real or alleged, in steel and semiconductors.

### **The problem of evaluation**

Most studies of industrial policy do not worry explicitly about the problem of evaluating a policy's success. The attitude of most authors seems to be that they will recognize success or failure when they see them. In practice, this usually leads to evaluation based on one of two criteria: the overall success of economies whose governments use targeted industrial policies, or the eventual competitiveness of targeted industries.

The argument from overall success in its basic form is the statement that "Japan has a targeted industrial policy, and Japan has a high growth rate, so Japanese-style targeting must work." I may be accused of caricaturing the position of advocates of targeted policies, but in fact this is the main argument of many advocates of targeting:

"How did Japan manage for 20 years to have real per annum growth of 10 percent? Inasmuch as no one else has achieved that, it strikes me that something other than market forces is an element in explaining it."<sup>13</sup>

The problem with the argument from overall success is that industrial policy is only one of many ways in which countries differ. Table 1 shows, for example, some readily quantifiable reasons for the disparity between U.S. and Japanese rates of productivity growth during the 1970s. Japan had a far higher saving rate than the U.S., together with a much lower rate of growth in employment; thus, capital per employee rose much more rapidly in Japan than in the U.S. At the same time, Japan was rapidly accumulating human capital, as indicated by the growing proportion of high skilled workers. Together with these readily quantifiable factors are qualitative factors remarked by many observers: an educational system which does a better job than ours of teaching basic literacy and mathematical skills; a better climate of labor-management relations; the advantage of being able to borrow technology from a U.S. economy which is still in many respects more advanced; and, hard to prove but supported by many anecdotes, a higher level of motivation generally.

The point is that there is no lack of possible explanations for Japan's rapid productivity growth, and no reason to presume that everything Japan does contributes to that growth. Japan's agricultural policy almost surely is a drain on the economy, yet the economy has **performed** well. It is entirely possible that Japanese industrial policy has also been unproductive or counterproductive, but has been outweighed by favorable factors. Argument from aggregates does not work; only an examination of the specifics of targeting can be used to evaluate its effectiveness.

But what specifics should be examined? In practice, most authors end up using the criterion of eventual competitiveness. If a targeted industry ended up as an effective competitor on world markets, the

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13. Eleanor Hadley, quoted in *High Technology* (1983), p. 20.

**TABLE 1**  
Quantifiable Factors in Japan's Faster Productivity Growth

	Japan	<u>U.S.</u>
Net saving as percent of GDP, 1974-80	19.5	6.5
Rate of Growth of Employment, 1973-80	0.7	2.1
Full-time school enrollment %		
Ages 15-19: 1960	39.4	64.1
1975	76.3	72.0
Ages 20-24: 1960	4.8	12.1
1975	14.5	21.6

*Sources: OECD, Main Economic Indicators, Historical Statistics, and Bureau of the Census, Social Indicators III*

policy is judged a success. Japanese steel and semiconductors are held up as examples of success based on the growth in Japanese market share, rather than on any careful calculation of costs and benefits. As we have already pointed out, however, eventual competitiveness does not necessarily provide any justification for industrial targeting, and it also is no evidence that targeting was a good idea. It may instead either reflect forces which had nothing to do with industrial policy, or it may represent a victory achieved at excessive cost.

In order to evaluate targeted industrial policies, we must make a careful analysis based on the same criteria we would use to select industrial targets. In particular: did the policy give domestic firms a useful strategic advantage? Did it generate valuable external economies? Did it offset a distortion caused by other government policies? Hardest of all to determine, were these benefits worth the cost?

### *The success that wasn't: the case of steel*

If the U.S. ever does adopt a strategy of industrial targeting, it is almost inevitable that steel will be one of the chosen industries. Japan's rapid emergence as a massive exporter of steel in the '60s and '70s is still the most widely cited example of successful industrial policy (although semiconductors have recently begun to share the honor). The decline of the U.S. industry is correspondingly held up as an example of the adverse consequences of the lack of a U.S.

response. In the terms of the popular criteria for choosing a target examined in the **first** part of this paper, steel has everything: high value-added per worker, thanks to its capital intensity; linkages, due to its status as a basic material; in the Japanese case, eventual competitiveness on world markets; and in the case of the U.S., the fact that at least some of the industry's problems could be attributed to foreign targeting.

But we have seen that these are not valid criteria. Looking at the industry's experience more critically suggests a quite different conclusion. Remarkably, this most famous of successes for industrial targeting was no success at all.

*Background on the steel industry, 1960-1980.*<sup>14</sup> To understand the dynamics of competition in the steel industry requires an appreciation of four factors: the "maturity" of steelmaking technology, the internationalization of raw material supply, the persistent differential between U.S. and Japanese employment costs, and the unexpectedly slow growth in demand after 1973. These factors, more than industrial policy, determined the basic outline of shifting market positions.

The technology of making steel is a mature one. That is, it is fairly standardized and not changing too rapidly. As a result, the most advanced nations do not have a significant technological advantage over only moderately advanced countries. From the 1950s on, new steel plants in Japan, Europe, and the U.S. have all been roughly comparable in their labor and materials efficiency. More recently, advanced developing countries such as Korea have also shown their ability to borrow this technology.

It should be noted, however, that while new plants have been roughly comparable in different countries, there is a strong vintage effect: new plants have higher labor productivity than older plants. This is important in explaining relative U.S. and Japanese productivity performance.

There was a time when the world distribution of steelmaking was largely determined by the location of raw materials. Steel production was located on top of coalfields which were not too far from sources of iron ore. By 1960, however, the advantages of traditional locations had evaporated. On one hand, traditional raw material sources were becoming increasingly worked out. On the other hand, falling ocean transportation costs made it possible to exploit new sources,

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14. This exposition is based on Crandall (1981).

such as Brazilian iron ore and Australian coal. The result was to turn steel into a "footloose" industry: any coastal location with a good harbor would do. The critical determinants of location became the cost of capital and labor.

In spite of the rapid rise in real wages in Japan over the past twenty years, the compensation of U.S. steelworkers has consistently been far higher than those of their Japanese counterparts. In the mid-1960s U.S. steelworkers received wages and benefits about six times those of Japanese workers; in 1981 they still received about twice as much. During the 1960s the major reason for this differential was the higher level of U.S. wages in general, which in turn reflected general U.S. economic advantages: superiority in high technology industries, a higher level of capital per worker, greater self sufficiency in natural resources. As these advantages have narrowed, the differential in the steel industry has been sustained through a sharp rise in the wages of U.S. steelworkers relative to the U.S. manufacturing average, from 38 percent above the average in 1967 to a 71 percent premium in 1977. (It is curious though perhaps not surprising that many discussions of the competitive problems of the U.S. steel industry — such as that of Magaziner and Reich — do not even mention the exercise of market power by the steelworkers as a possible source of difficulty.)<sup>15</sup>

Finally, the state of the steel industry in all countries has been powerfully conditioned by the slow growth in consumption since 1973. From 1968 to 1973, world steel output grew at an annual rate of 5.7 percent, but after 1973 the combination of higher energy prices and slower growth in industrial countries brought a sharp slowdown, even before the worldwide recession of recent years. From 1973 to 1978, world output of steel rose at an annual rate of only 0.5 percent.

**Market forces and steel competition.** Before proceeding to analyze the role of industrial policy, it is worth asking what the effect of these factors would have been if there had been no government intervention. Otherwise we may be attributing to MITI developments which would have happened in any case.

The first critical point is that by the early 1960s the Japanese steel industry would have had a competitive advantage over the U.S. industry even if the Japanese government had kept hands off. The same technological "book of blueprints" was available to both coun-

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15. Data on steelworker compensation from Crandall (1981).

tries, access to raw materials was no longer a crucial factor, and labor costs were much higher in the U.S. Capital was becoming steadily more available in Japan, thanks to a high saving rate. Quite independent of industrial targeting, Japan was gaining a comparative advantage in steel while the U.S. was losing one.

Given this underlying shift, the rational investment strategies of the two industries were quite different. Japanese firms naturally built new "greenfield" plants. U.S. firms could have built such plants, but could not have made them pay, since their labor costs would still have been far higher than those of their Japanese competitors. The rational strategy — in terms of long-run profit maximization, not just short-term advantage — would have been to invest only to maintain existing capacity or to take advantage of special opportunities to add capacity cheaply through "roundout" additions at existing sites. (The greenfield plants built in the U.S. during the '60s yielded a disappointing rate of return.)<sup>16</sup>

Because of its increasing relative proportion of newer plants, the Japanese industry eventually was bound to outstrip the U.S. in labor productivity. This would *not* have been a sign of failure on the part of either U.S. workers or managers, simply a reflection of the newer vintage of the Japanese plants. The U.S. could keep up, but only at excessive capital cost. The productivity of capital is as important an economic consideration as the productivity of labor.

Finally, with the sharp slowdown of world demand after 1973, there would have been excess capacity in the steel industry whatever the policies of government. In this excess capacity environment the plants which stayed open would be newer plants with lower operating costs — in other words, Japanese capacity utilization would be higher than that of U.S. firms.

What should be clear from this exposition is that the broad picture in U.S.-Japanese steel competition is not too different from what it would have been without Japanese targeting. This is not to deny a role to MITI, but we should not overstress its importance.

*Japan's targeting of steel.* From the 1950s to the early '70s, steel was a targeted industry in Japan. This meant several things. First, and probably most important, the Japanese steel industry became a favored claimant in a rationed capital market in which interest rates were below market-clearing levels — an important, if *hard-to-meas-*

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16. Magaziner and Reich (1982), p. 161

sure, subsidy. Second, the industry received tax breaks. Third, the industry received some subsidies and low interest loans, although these were relatively unimportant. The combined effect was basically to give Japan's steel industry a low cost of borrowed capital. At the same time, the assurance that in recessions the industry's profits would be protected by cartelization probably made firms more willing to risk having excess capacity.

The result was that from the mid-1960s through the early 1970s, the period of most rapid growth, the Japanese industry had a distinctive pattern of financing and rates of return, as shown in Table 2. Investment was overwhelmingly financed by the issue of debt, hardly at all out of retained earnings. The rate of return was well below the average for Japanese manufacturing.

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TABLE 2  
Financing of Japanese Steel Investment

Retained earnings as % of net investment 1967-71	1.5
Long term debt as % of capital employed	
1964	46.1
1971	67.7
Rate of return in steel, 1971	10.7
Rate of return, all Japanese manufacturing, 1971	17.5

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Sources: International Iron and Steel Institute, *Financing Steel Investment, 1961-1971*, and Organization of Economic Cooperation and Development, *Profits and Rates of Return, 1979*

The eventual return on this investment was even lower than this table suggests. After 1973, the growth of world steel demand fell off sharply, and Japanese steel production peaked in this year. Although Japanese firms have low operating costs and have thus managed to maintain higher rates of capacity utilization than their competitors, steel prices have been low enough that profits have been low — certainly not high enough to have made investing in steel profitable. In fact, little new investment has taken place since 1973. It is only thanks to the prevalence of low-interest loans and the capital gains from subsequent inflation that the Japanese steel industry has remained solvent. To caricature the Japanese industry's position, in

the '70s the steel companies were willing to operate the capital-intensive plants the government built for them.

*Did targeting of steel help Japan?* The crucial question now becomes, was targeting of steel a wise policy? Did it in fact raise Japan's growth rate?

On the test of market returns, the targeting of steel does not look at all like a good idea. Because of the unexpected steel glut of the '70s, the heavy investments in steel between 1965 and 1972 turned out to yield very low rates of return. By encouraging these investments, targeting funneled resources into a sector with low private rates of return. Only if social rates of return were much higher than private rates can the policy be justified.

The most common reason advanced why there may have been extra social returns is steel's role as a linkage industry. This is the justification offered by **Hadley** (1983) and **Magaziner and Reich** (1982); it is also suggested by some professional economists, e.g., **Adams** (1983). But as we have seen, linkages by themselves do not create a divergence between social and private rates of return. A true market failure is required.

As we have argued, targeting can create strategic advantages which enable domestic firms to capture rents from foreign competitors. In this case, however, with a depressed world industry, there were no rents to capture.

It is also possible for a targeted industry to generate useful technological externalities. But the mature technology of steelmaking makes such externalities unlikely; indeed, the **U.S.** and Japanese industries seem to have had rough technological parity from 1960 on.

If there is another argument for the usefulness of Japan's targeting of steel, it is not prominent in the literature. Heresy though it may seem, it is hard to avoid the conclusion that the most famous of industrial policy successes was no success at all. It encouraged Japanese industry to invest in an activity with low returns, and it generated no visible side benefits.

*Should the U.S. have targeted steel?* If the **U.S.** had targeted steel in the '60s and '70s, the results would have been similar to the Japanese results, but even less favorable. The **U.S.** could have built new greenfield plants as productive as Japan's, but because of higher **U.S.** labor costs they would have had lower capacity utilization and lower profit rates than Japan's. In other words, the private rate of return on any targeted investment in the **U.S.** steel industry would have been

low indeed.

Arguments for extra social returns in steel in the U.S. are similar to those for extra returns in Japan, and are similarly dubious. The one exception we might make is an argument rarely mentioned. There *is* a market failure in steel: the market power of the steelworkers. This provides a possible though risky justification for intervention. Because steelworker wages are above their free-market levels, it makes sense to offset this distortion by subsidizing the steel industry's labor costs. The problem is of course that this might only encourage wages to go still higher. Ideally the government could strike a bargain: employment subsidies in return for wage restraint. The problem is that politically such a bargain is almost inconceivable.

**Conclusions.** The experience of the steel industry is usually cited as an example of the favorable consequences of industrial targeting in Japan and the unfavorable consequences of U.S. inaction. In fact it is a poor example. Japanese targeting was probably not crucial in determining the course of **U.S.-Japanese** competition, and to the extent it was ineffective, it probably reduced Japanese national income.

### *The success that may have been: semiconductors*

In recent years, the semiconductor industry has acquired much of the aura once associated with steel as a symbol of national economic prowess. As was once the case with steel, a semiconductor industry is something possessed only by the most advanced countries; like steel, **semiconductors** are an input into other advanced industries; like steel, semiconductors are closely connected with a country's military potential. In the **1950s**, a national presence in steel was a political must for every country that could afford it; in the '80s and '90s, semiconductors will play much the same role.

**More** important for our economic analysis is the indisputable fact that the semiconductor industry is about as far as one can get from the classical model of a perfect market.

**Background on the semiconductor industry.** The key feature of the semiconductor industry is its extremely rapid pace of technological change. **The** real cost of a given amount of computing capacity is cut in half every few years. This means a very short product cycle, which in turn has two major consequences: strong dynamic scale economies and important external economies.

The shortness of the product cycle makes dynamic scale econo-

mies important in two ways. First, the costs of R&D cannot be amortized over many years' production. As a result, R&D is a large part of a firm's cost, and the per-unit cost depends strongly on a firm's sales. Second, because product cycles do not last very long, firms are always in the early, steep part of the experience curve. So for each individual firm, average costs fall quite sharply with cumulative output.

In addition to the dynamic scale economies at the level of the firm are additional, external economies that spill over between firms. Some of these spillovers seem to operate through personal contact — hence the high-tech clusters of Route 128 and Silicon Valley. Others operate through the possibility of "reverse engineering" or more general forms of imitation, and may apply at a national or even a world level.

*Determinants of international competition.* In an industry with strong dynamic scale economies, international competition is somewhat more complex than in conventional models of international trade. There is an important element of simple comparative advantage, but history and market access can also be crucial. And the importance of the experience curve makes it normal for shifts in market position to occur suddenly rather than gradually.

Comparative advantage in high technology industries is largely determined by access to human capital of the right kind. The countries and regions which have done well in high technology competition are those with relatively abundant supplies of highly educated workers. Labor costs in production are not 'as important as the ability to maintain close links between production and R&D'; so as to keep abreast of changing technology.

As Table 3 suggests, a once-overwhelming U.S. lead in highly educated labor has been narrowed over time by other countries, especially Japan. Even in the absence of industrial targeting by other countries this would lead us to expect some reduction of U.S. market share in high technology industries, including semiconductors.

How would this fall in market share come about in the absence of targeting? One recent study has argued that in the absence of targeting the process would be gradual:

"In an open market American firms would lose market share slowly when Japanese production began . . . the overall pattern of trade in a range of semiconductor products in an open market should see American producers losing market share slowly to

Japanese producers but retaining a permanent market position based on their initial advantage.''<sup>17</sup>

TABLE 3  
Human Capital Indicators for High Technology Industries

	<u>Japan</u>	<u>U.S.</u>
Scientists and engineers engaged in R&D per 10,000 workers		
1970	33.4	63.6
1978	49.4	58.3
Electrical engineering graduates per 1,000,000		
1970	133	85
1977	185	66

Sources: National Science Board, *Science Indicators*, 1980, and Borrus, Millstein, and Zysman (1982)

This argument is, however, almost surely wrong, because of the importance of the experience curve. The basic situation in high technology industries is that Japan is acquiring a comparative advantage in areas in which U.S. firms have historically had dominant market shares. U.S. firms thus have the initial advantage of greater cumulative experience, but Japanese firms have lower input costs. It makes no sense in this situation for Japanese firms to try to increase their market share gradually across the board, since this would fail to overcome the U.S. advantage in experience. Instead, the natural strategy of a Japanese firm — regardless of whether or not the government is involved — is one of rapid penetration of a narrow market segment. This involves aggressive pricing to gain market share and move down the learning curve. Thus "surges" involving a Japanese willingness to take initial losses and a rapid increase in Japanese market share in a narrow product line are probably endemic to the process of Japanese catch-up to the United States.

This is not to say that targeted industrial policies could not also play a role. Subsidies to R&D could obviously promote a particular industry. More subtly, a protected domestic market could serve as a springboard for exports. By providing a secure base, a protected

17. Borrus, Millstein, and Zysman (1982), p. 147.

domestic market can encourage domestic firms to invest in R&D and to move down the learning curve, while at the same time deterring foreign competition from doing the same. This can lead to a larger market share for domestic firms even in unprotected markets." The allegation of the U.S. semiconductor industry is that it is a combination of subsidies and the advantage of a protected domestic market, rather than market forces, which have led to the rapid growth in Japanese semiconductor exports.

*Japanese targeting of semiconductors.* Japan's targeting of semiconductors contains one well-documented but probably not too important element — government-subsidized, collaborative research — and one disputed but possibly crucial element — closure of the domestic market. Several major studies have alleged that these two policies in conjunction have been the prime cause of Japanese success,<sup>19</sup> but it remains possible that policy was actually a minor factor.

The undisputed part of Japanese policy has been the encouragement of joint research projects supported by government subsidy of which the best known is the Very Large Scale Integration (VLSI) program. Relative to the size of the industry, the subsidies do not appear to have been very large. The Semiconductor Industry Association estimates a total subsidy of \$507 million from 1976 to 1982; i.e., about \$75 million per year. At the same time, Japanese sales of integrated circuits in 1981 were valued at nearly \$3 billion.<sup>20</sup> So the extent of subsidy by itself was almost certainly not enough to give Japanese firms a decisive advantage. More uncertain is whether encouragement of joint research and market-sharing allowed Japanese firms to avoid duplicative research, thus making their R&D more efficient than that of U.S. competitors. U.S. industry executives tend to be doubtful about this. In general, the allegations of predatory Japanese targeting focus less on subsidized research than on the effects of a closed domestic market.

Until the mid-1970s, Japan had overt protection of its semiconductor industry, through tariffs and quantitative restrictions. After dismantling of these barriers, however, the share of imports in Japanese consumption did not rise. Indeed, it showed a downward trend during

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18. See Krugman (1983, forthcoming).

19. Borrus, Millstein, and Zysman (1982) and Semiconductor Industry Association (1983).

20. Subsidy figure from Semiconductor Industry Association, sales figure from Borrus, Millstein, and Zysman.

the period 1975-82, except for a temporary reversal following the massive appreciation of the yen in 1978. The argument of U.S. critics has been that the structure of the Japanese industry allows de facto closure of the market through formal guidance without any explicit controls on imports.

The key feature of Japan's industry structure is that the major producers of semiconductors are also the major consumers. These firms are not, however, vertically integrated in the usual sense of the term. Each firm sells most of its output on the open market, while buying most of its semiconductors from other firms. It is argued, however, that these are really not arm's-length transactions. In effect, Japanese firms may be colluding to buy only from each other, with this collusion promoted by discreet guidance from MITI.

Is this really the case? The prime piece of evidence usually cited is the low share of imports in the Japanese market. Although U.S. semiconductor firms make about two-thirds of the world's integrated circuits, they account for only about a sixth of the Japanese market. One might point out, however, that a similar though less striking disparity exists between Japan's share of the world and U.S. markets: Japan accounts for nearly 30 percent of world IC production, but only 12 percent of U.S. consumption.<sup>21</sup> Japan does run a substantial surplus in semiconductor trade with the U.S., but this need not be taken to demonstrate protection. More significant but less objective is anecdotal evidence of a "buy-Japanese" mentality among Japanese firms. Whether this represents a hidden official policy is much less clear.

In any case, is the combination of subsidy and market closure the basic explanation of Japan's rising market share in semiconductors, particularly its leading position in memories? The answer is probably not. As we have argued, a rising Japanese market share in high technology industries generally would be happening in any case, and the rapid penetration of narrow market sectors is exactly what we would expect. Government policy may have helped determine that memories rather than some other type of product were the market segment selected, but the general character of what has happened probably has little to do with official targeting.

***Was Japanese policy a success?*** To the extent that Japanese industrial policy has been responsible for the growth of the semiconductor

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21. Figures from *Business Week*, May 23, 1983

industry, was that policy a success? The basic criteria for success would be either (1) capture of substantial rents from U.S. firms, or (2) external economies benefiting other industries. In both cases the returns are not yet in.

The rents from semiconductor targeting, if there will be any, lie in the future. Although numbers are not available, it seems clear that Japan's export of 64K RAMs has not yet earned a return sufficient to justify the investment. The large Japanese market share was won through a price war which led to substantial losses for U.S. firms and is unlikely to have been marked by Japanese profits. There has been no sustained breathing space for the Japanese to exploit their market dominance, since a similar costly battle for the 256K RAM is now looming. If there are to be big profits for the Japanese firms, they still lie several years in the future.

The external economies from semiconductor production are also yet to be seen. It is often asserted that a country which has a decisive advantage in production of semiconductors will thereby gain a comparable advantage in "downstream" products such as computers, but there is no solid evidence that this is true. The U.S. is far from being out of the semiconductor business and retains leadership in many other high technology areas. Thus it will be years before the alleged adverse effects of Japanese targeting on U.S. economic performance become clearly visible.

*Conclusions.* In contrast to the fairly clear case of steel, the effects of industrial targeting in semiconductors are enveloped in fog. We do not know clearly the extent to which the industry was really targeted, we do not know how important the targeting was in international competition, and we do not know whether the policies of the Japanese government, whatever they were, raised or lowered Japanese national income.

Semiconductors are a classic example of a non-classical industry. Nearly every market failure that one can think of is present. So if any sector is suitable for government intervention, this is the one. Yet it is unclear whether the government intervention which has taken place was either crucial for the industry or beneficial from a national point of view.

### *General conclusions*

The advocates of industrial targeting generally claim that targeting has worked in other countries and is a major reason for better eco-

conomic performance abroad than in the U.S. While the discussion just presented is far from a conclusive rejection of this assertion, it certainly raises questions.

The crucial point is that evaluating the success of targeted industrial policies is a very difficult task. Most authors do not realize this. They go into painstaking detail on the technology and history of an industry, then become sloppy and casual when they come to the truly difficult task of economic evaluation.

We have examined briefly two industries in which most people believe that targeted industrial policy scored major successes. In one case, that of steel, it is hard to find any reason to call the policy a success — unless one reverts to the view that because Japan is a successful economy, everything Japan did must have been well-conceived. In the other case, semiconductors, we are not sure what Japanese policy was — and the payoffs to that policy, whatever it was, are still matters of the uncertain future.

### Prospects for successful industrial targeting

It would be foolhardy to say that there is no case for a targeted industrial policy. Market imperfections are legion. Given sufficient information, enough power, and enough freedom from political pressures, a MITI-type agency might make a significant contribution to national income. But in the real world, the prospects for such gains are poor. We have noted a series of negative points:

- The most commonly cited criteria in popular discussions of targeting — criteria which are at least as sophisticated as the criteria likely to govern **actual targeting** — are misconceived, in some cases disastrously so.
- While **there** is a valid case for targeting grounded in economic theory, the theoretical basis is too complex and ambiguous to be useful given the current state of knowledge.
- We are not easily able to evaluate the costs and benefits of industrial targeting even after the fact. In spite of the huge literature on industrial policy, the criteria generally used for evaluation are crude and can easily be misleading.
- There are no clear-cut cases of successful industrial targeting. Of the two most famous **examples**, **Japanese** targeting of steel probably reduced national income, while the returns are not yet in on Japan's targeting of semiconductors.

In some respects this paper has loaded the dice in favor of target-

ing. The examples surveyed were the apparent successes, not the obvious failures: steel and semiconductors, not synfuels and the Concorde. Yet the verdict still has to be that there is very little support for the idea that industrial targeting is a desirable policy.

It is already clear from Congressional hearings and popular discussion what the elements of a U.S. program of industrial targeting are likely to be. The key element will probably be a development bank which will provide low-interest loans and loan guarantees to favored firms. These firms will mostly be of two types. First will be firms in mature, linkage industries — in other words, the troubled, high wage, unionized, politically powerful traditional heavy industries. The second will be key emerging industries — in other words, the glamorous and prestigious high technology areas. Whatever the intentions, in the U.S. political system it is inevitable that political factors will weigh heavily on the choice of favored firms.

It is hard to believe that such a policy will accelerate U.S. economic growth. Its direct effect will probably be to slow growth and raise unemployment. More important, the easy answer of targeting will help postpone our coming to grips with the real sources of disappointing U.S. performance.

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