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Article — Digitized Version

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Intereconomics

Suggested Citation: Starbatty, Joachim; Vetterlein, Uwe (1988) : Must the semi-conductor industry be subsidised?, Intereconomics, ISSN 0020-5346, Verlag Weltarchiv, Hamburg, Vol. 23, Iss. 3, pp. 109-115,
<https://doi.org/10.1007/BF02925148>

This Version is available at:

<https://hdl.handle.net/10419/140128>

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Joachim Starbatty and Uwe Vetterlein*

Must the Semi-conductor Industry be Subsidised?

According to the memorandum entitled "Microelectronics 2000", the Japanese and American lead in semi-conductor technology threatens not only the existence of a number of European firms but the prosperity of all the European economies. It therefore concludes that if Europe is not to be at the mercy of giant Japanese and US concerns the state must ensure the development of these key technologies by paying substantial subsidies. How valid is this argument?

The extent of a country's technological development provides a measure of its international competitiveness. Since the lead in terms of productivity and quality that can be achieved by improving traditional technologies is becoming progressively smaller, the industrial countries can no longer offset their comparative cost disadvantages, especially as regards labour. Europe is coming under ever increasing competitive pressure in the production of goods embodying middle-level technology.

According to the EC Commission, however, European enterprises are already lagging dangerously far behind the USA and Japan in high technology as well.¹ The reason why this was so serious was that the "third industrial revolution" in the Pacific was leading not just to the development of improved products or processes but to the emergence of an entire new dimension of products and processes. The importance of these new technologies extended beyond their own particular industry and its relative weight within the economy; whoever possessed them also dominated the other industries, because they, as components or ingredients, made possible the development of new classes of products and processes that could not otherwise be developed; the new technologies were the key to future prosperity.²

In the view of the Commission, Europe is therefore in a critical position if it wishes to continue to influence world events as a third independent force. Its enterprises would have to master the new technologies and even work themselves into a leading position if they were not to be at the mercy of the giant Japanese and

US concerns exploiting their technological and size advantages and which in future wanted to control not only world markets but also European markets, something they would ultimately achieve.³

If the suspected technological gap cannot be closed, the fate of Europe will be at stake, not just that of individual firms that have to throw in the towel for lack of competitiveness. More specifically, if Siemens or Philips or both together cannot eliminate the lead of their Japanese and American competitors in semi-conductor technology they will not be the only ones to suffer; the international competitiveness of the European economies as a whole will be weakened.⁴ If the lack of competitiveness in key technologies is really not just, say, Siemens' problem but a macroeconomic one, the natural conclusion to be drawn is that Siemens should receive state aid.

This conclusion not only scandalises certain academics, often dubbed "market purists", but has also far-reaching financial consequences. A memorandum entitled "Microelectronics 2000" argues that state aid is unavoidable, since the development of a competitive

¹ Cf. K.-H. Narjes: Industriepolitik – eine europäische Aufgabe, in: G. Fels, O. Vogel (eds.): Brauchen wir eine neue Industriepolitik?, Cologne 1987, pp. 29 ff.; and Commission of the European Communities/FAST Team (eds.): Eurofutures: The challenges of innovation, Brussels and Luxembourg 1984.

² Commission of the EC: Verbesserung der Wettbewerbsfähigkeit und der Strukturen der Industrie der Gemeinschaft, Luxembourg 1986, p. 15.

³ The view of the EC Commission is presented in detail in J. Starbatty, U. Vetterlein: Die Technologiepolitik der EG-Kommission – die richtige Antwort auf die technologische Herausforderung?, in: R. Biskup (ed.): Europa – Einheit in der Vielfalt (in the series "Beiträge zur Wirtschaftspolitik", Vol. 50, edited by E. Tüchfeldt), Berne and Stuttgart 1988, to appear shortly.

⁴ Cf. Arbeitskreis Mikroelektronik: Mikroelektronik 2000, in: Informationstechnik 2000, Bonn 1987, text reference 0.3.

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semi-conductor industry would entail cumulative R and D expenditure of around DM 21 billion and additional investment of DM 14 billion, sums that cannot be raised solely by the companies themselves.⁵ The memorandum states that it is therefore crucial that most of the DM 21 billion to be spent on R and D between now and the end of the century be met from public funds⁶ and proposes that more than DM 1 billion a year be provided for this purpose until the year 2000.⁷ The German Federal Government considers this line of argument to be valid in principle and agrees that financial assistance is essentially justified,⁸ so that this is more than just a skirmish about the role of the state.

List's Infant Industry Argument

Let us test the validity of the line of argumentation in the memorandum by briefly examining its theoretical basis. According to the document, parts of our industry must be protected (supported financially) for a number of years (roughly until the year 2000) so that it can catch up with its competitors in other countries. At the same time, aid for key industries will maintain and improve the productive strength and international competitiveness of the entire economy.

These were precisely the arguments used in the first half of the nineteenth century by Friedrich List in his advocacy of temporary protection for emerging industries in countries that were still striving to catch up with the mature industrial nations, at that time the United Kingdom. In one key respect List therefore diverged from the view of the English classical school that free trade was beneficial for all trading partners. He did not deny that this was so in principle, but he wanted to stress the limited explanatory value of this concept: it was valid in the case where all the trading partners had mature production functions. The free trade concept based on the theory of relative prices was, as it were, static; if the development potentials of the infant industries were considered in the light of their specific production

functions and the changes in relative prices that would occur, they would be competitive once they had achieved their optimum production function; thus they had to be given the opportunity to do so.

List therefore proposed that *infant* industries in developing economies should be protected from foreign competition for a period of time by means of customs duties (external protection). This would oblige the population in the developing economies and those producers that are processing imported products to pay more for imported goods. They would all make the forced saving imposed by the state so that the economy as a whole would become all the more prosperous in later years. We are therefore dealing with a redistribution of income from the consumers and/or the processing industries burdened with the customs duties to the protected industries.

Protection for "Mature" Industries?

The justification and the method of protection now being proposed accord with the List approach, except that external protection has been replaced by domestic protection (subsidies) and "infant" industries have been replaced by traditional, "mature" or "old" industries when we here take as an example the promotion of the electronics industry in semi-conductor technology. This would of course run counter to List's line of argument, for to subsidise "mature" industries would mean that formerly leading industries had let essential developments pass them by or that locational advantages had changed because foreign competitors had been able to exploit their development potential and drive the "mature industries" from their traditional markets. It follows that technology policies aimed at supporting particular new lines of development in traditional industries cannot seek justification in List's "theory of productive forces".

Or are there aspects that cast a new light on the List argument? It could be held that if the battle for future key markets and hence for a kind of economic hegemony were fought fairly by the other two economic "superpowers", the USA and Japan, there would be no need to interfere in the free play of market forces; an improvement in the general conditions for investment and innovation would be sufficient.⁹ However, the other countries were not abiding by the rules of free competition.

Such violations of the rules of the game can take two forms: the investment of massive financial resources in specific types of research and the possible prohibition of European access to high technology or high-tech

⁵ Cf. Arbeitskreis Mikroelektronik, op. cit., ref. 0.2. f.

⁶ Cf. Arbeitskreis Mikroelektronik, op. cit., ref. 0.4.

⁷ Cf. Arbeitskreis Mikroelektronik, op. cit., ref. 5.5.

⁸ According to Lutz G. Stavenhagen, State Secretary in the Federal Chancellery, speaking at a symposium of the Institut für Angewandte Wirtschaftsforschung on 6th and 7th October 1987 in Tübingen (even though Siemens failed to catch up with the USA and Japan in the seventies despite (or because of) massive subsidisation via the "large computer programme"). See also H. Klotz: Mehr Sternschnuppen als Sternstunden. Eine kritische Bilanz der staatlichen Forschungsförderung, in: Frankfurter Allgemeine Zeitung, No. 253, 31st October 1987, p. 15.

⁹ Vice President Narjes of the EC Commission describes "preventive intervention to ward off massive distortions of competition as a result of the voluntaristic policies of other countries" as justification for having a technology policy. Cf. K.-H. Narjes, op. cit., p. 29.

products. We are becoming increasingly conscious of the dangers stemming from the second type of violation. For example, the technology journal "high Tech" carried the headline "Trade war over high technology : calamity if the chips don't arrive".¹⁰

US Military Research

The USA does not have a technology policy covering the entire economy, but the Pentagon spends astronomic sums of public money on research; this is mainly for military purposes but it may also have civil applications (the dual use argument). The German Federal Ministry for Research and Technology clearly sees this as a dangerous threat to the competitiveness of German industry. A position paper for the Minister states bluntly, "In our country, on the other hand, people often behave as though the Teflon pan were the only spin-off for civil industry. Of course, those who hold this view have an easier time figuring out how to counter the competitive advantages US industry derives from government aid, for they can argue that there are none. Hence, they say, it is sufficient if we improve the climate and do not let ourselves be drawn into a subsidies race. . . Since US expenditure on military research alone is 16 times the German Federal Government's total allocations to the private sector to promote research and development and 35 times as much as the Federal Minister for Research and Technology provides for this purpose, it cannot be said that Germany is in the subsidies race at all but rather trailing along behind."¹¹

The first problem, for the USA, is the Pentagon's practice of awarding research funds on a cost-plus basis. If costs are reimbursed in full and profit margins calculated on the basis of expenditure, then the higher that firms push the research costs the more they benefit. An economist would describe this as a "perverse incentive system". Another indication of wasteful resource allocation is the practice of pork barrelling – achieving secondary political objectives by letting contracts to firms in a particular region in order to reward deserving politicians or appease recalcitrant

ones. Add to that the well-known rivalry between the US army, navy and air force for the most lucrative research contracts, and it is not difficult to see that the Pentagon's motto is "cost no object" when it comes to granting contracts.

Uncertain Benefits

But even from a more general point of view it cannot be expected that US industry benefits on balance from Pentagon financing. As with any investment, the outcome of R and D is uncertain. The returns from such investment can only be estimated and in many cases it is impossible to establish with sufficient certainty whether there will be any positive contribution margin. If it is not even possible to draw up a reasonably accurate balance sheet at company level, how uncertain must it be for the Pentagon investors, given the host of decision-makers and the higher degree of complexity?

For the sake of simplicity, we shall assume firstly that Pentagon resources for military research replace an equivalent amount of private funds that would otherwise have been used and secondly that the results of military research can be used fully for civil applications (dual use); of course, this is not a realistic assumption, but it is a conceivable marginal case. If the USA provided massive funds at the cutting edge of technological progress, firms in other countries could await the results, assess their industrial potential, draw inspiration from them and pay royalties to use the inventions they wanted. In macroeconomic terms, trading partners would find it cheaper to do this than to stumble around in the dark at the frontiers of technology. The special study carried out by the Hamburg Institute for Economic Research (HWWA) as part of the 1987 Report on the Structure of the Economy states in this regard: "Assuming that competition forces US companies to market their knowhow through licensing, direct investment or merchandise exports, it would be cheaper for European consumers if Europe used its scarce financial and human resources for commercial product development or on research and development in fields the Americans cannot cover".¹²

The conclusion is that if capital is siphoned off from the economy and then redeployed en masse, as in the USA, the opportunity cost of Pentagon funding is a forced abstinence from the private use of the funds (the crowding-out of private investment), not to mention the transaction costs involved. It is more than a little doubtful whether this makes the economy as a whole more competitive, particularly as the Pentagon's prime objective is security and not optimum resource allocation.

¹⁰ Cf. high Tech. Das Deutsche Technologie-Magazin, No. 3/1988.

¹¹ Federal Ministry for Research and Technology: Argumente zur F&E-Politik, 11/1985. Incidentally, the Teflon pan is not the result of space research; K. Geisen states on p. 29 of "computer zeitung", No. 63 of 12th October 1987, "That is another myth, like the story of the famous Teflon pan, the boon to housewives that was supposedly a spin-off from space research but which in reality was developed in 1938 as a result of purely civil research by DuPont. . . . and the first microprocessor (1971) was invented in civil laboratories."

¹² H.-H. Härtel et al.: Neue Industriepolitik oder Stärkung der Marktkräfte?, Hamburg 1986, p. 175. In similar vein, H. Willgerodt: Staatliche Hilfen in einer Marktwirtschaft, in: Zeitschrift für Wirtschaftspolitik, Vol. 33 (1984), pp. 59-75.

New "Quality" of the Division of Labour?

From an economic point of view, access to technological knowhow or the availability of the product and process innovations essential to the further technological development of a country's industry are of greater competitive importance than pumping money into particular lines of research. Control over the access to technological knowhow means economic power, and hence also political power. There is consequently a suspicion that the availability of information or technology is no longer controlled purely by market forces but is being used as a political instrument for maintaining or extending an economic and political advantage; if that is the case, international trade will no longer be a forum of international co-operation but one of confrontation. It is true that world trade is already being damaged by national intervention, but international economic relations would take on a new quality if the flow of information on high technology came under political control.

We have been unable to establish so far that the competitiveness of European industries has been harmed by such practices. At any event, no-one has yet seriously claimed that they are a threat to the competitiveness of industrial production in Germany. We must therefore examine whether the supposition that this may occur in future can withstand economic scrutiny.

□ From the point of view of considerations of *military security*, are controls likely to be tightened to such an extent that European firms will be cut off from information on key technologies? The test we shall employ will be the following: if we wish to know whether technology embargoes are being used more frequently as an instrument of a mercantilistic foreign and economic policy, we must establish whether the previous practice has improved the technological position of American industry. If it has harmed it, we need have little fear that existing controls will be tightened.

□ In considering the withholding of selected high-tech products from European manufacturers in order to safeguard *national welfare (employment)*, we must not overlook the risks for the country concerned. The question is not: Can the Japanese, for example, refuse to supply us with chips – yes or no? but: What would be the opportunities for profits and risks of losses for the

Japanese if they pursued such a strategy? It is the net effect that interests us; if it is negative in economic terms, there is a high probability that fears of being held to ransom are unfounded.

Effects of Current Controls

The Western allies have a long tradition of restricting the export of technology to the Eastern bloc for strategic military reasons via CoCom.¹³ The Reagan Administration's re-affirmation of the "position of strength" of the USA, its leading role in both military and economic spheres, is in stark contrast to the country's falling industrial competitiveness, large current-account deficits and depreciating currency. This and the more abrasive US attitude towards the Eastern bloc have led to a more restrictive use of the control laws, which have also been directed against Western states for the first time.¹⁴ Such developments may lead one to suppose that Congress and the Administration might also make greater use of technology embargoes in order to hold off foreign competitors for as long as possible. The following expectations might be associated with such a policy:

- it would offset the comparative disadvantages of the USA in innovation, production or marketing (as a result of high wage costs, for example);
- high pioneer profits could be made;
- good positions in world markets must be won and consolidated;
- other industries in the USA should also be given competitive advantages by allowing them exclusive access to the new technologies.

Let us therefore examine whether the trade effects of current controls benefit the USA or, rather, its trading partners. If they really do allow the USA to keep ahead of the competition, one could visualise a tightening of the screw in order to maintain or increase the lead.

Current US controls aim to restrict the spread of knowhow and trade in technologically "sensitive" goods. Since most research funding comes from the Pentagon, which classifies almost everything as "sensitive", there is an attempt to keep information on the progress and findings of almost all publicly financed research secret. This applies even to the spread of scientific knowledge via textbooks and journals.¹⁵

¹³ The economic repercussions of controls are described in detail in J. Starbatty, U. Vetterlein, op.cit.

¹⁴ Such as the uproar over the gas pipeline affair.

¹⁵ The legal basis for this is a Presidential Order dating back to the Eisenhower Administration and amended in 1982 (cf. H.-D. Jacobsen: Internationale Wettbewerbsfähigkeit und nationale Sicherheit der USA, published by Stiftung Wissenschaft und Politik, Ebenhausen 1986, pp. 108 f. and 114 ff.).

Private research and its findings are also subject to Pentagon control.¹⁶ In addition to a ban on the export of purely military goods, there are export restrictions imposed under the Export Administration Act (EAA).¹⁷ The Department of Trade can grant export licences depending on the destination country and subject to certain conditions.

Effects of Export Restrictions

The typical effects of the export restrictions are:

- ☐ considerable delay before the grant of a (revocable) licence for the export project (at least three to four months), despite the fact that almost all applications are approved;
- ☐ uncertainty about the current and future composition of the lists;
- ☐ retroactive application of new indices in the lists to existing contracts;¹⁸
- ☐ application of restrictions to technology already available abroad (foreign availability); this was abolished when the EAA was amended in 1985, but the speed of technological advance is so rapid that the Administration is generally far behind with updating the Commodity Control List;
- ☐ extra-territorial application of the Act to all US-owned firms and all purchasers of American technology (with regard to re-export and secrecy requirements, for example);
- ☐ harsh sanctions for violations: US firms and individuals are severely punished and foreigners are blacklisted.

The consequences of these comprehensive technology controls – not only for Europe – are uncertainty about access to new technology from the USA, problems with the reliability of US suppliers and with the US Government over deliberate or unintentional violation of the regulations outside the USA.

Drawbacks of Controls on Technology Transfers

Cursory analysis shows that the disadvantages of controls on the transfer of technology are more serious for US firms than for their Japanese or European

competitors. The pace of technological development tends to slow down in the USA and US firms are having to put up with disadvantages in the worldwide marketing of new products, both important factors in international competitiveness.

Specifically,

- ☐ the many measures imposing secrecy impede the exchange of scientific information within the USA and with foreigners and the spread of knowledge;
- ☐ the economic incentives for industrial research in particular are greatly reduced by uncertainty about the commercial exploitation of the findings and limitations imposed thereon;
- ☐ secrecy requirements and controls cost not only additional resources but also time and motivation;
- ☐ given the current pace of change in markets, protracted licensing procedures mean the loss of any technological lead and hence the loss of potential shares in the world market;
- ☐ further competitive disadvantages spring from the additional costs for US suppliers and also for potential purchasers caused by the requirements regarding secrecy, security, and so forth and the inability to rely on US partners. Moreover, if an alternative exists, what non-American outside the USA will voluntarily submit to restrictive US laws?

As a rule, no country, not even the USA, has a technological monopoly with long-term prospects. It makes sense for the USA to impose secrecy on the research and development of a new product or process only if the export of the relevant technology is also to be prevented. However, if a new technology of this kind is sold in the US domestic market, the knowledge on which it is based will quickly become available outside the USA too, since competitors do not let the grass grow under their feet; hence, if the USA prevents itself from exporting the technology for long enough and does not enter the world market until it is already being supplied by competitors, it is cutting off its nose to spite its face.

We can therefore find no evidence that existing US controls weaken Europe's competitiveness as has been suspected. On the contrary, we see the United States'

¹⁶ Under the Atomic Energy Act of 1976, which requires that all the findings of nuclear research be kept secret and subjects them to Pentagon control, and the Invention Secrecy Act of 1951; on the basis of the latter, all patent applications are examined before publication to establish whether even a purely private invention affects national security and should be kept secret (cf. W. Hein: *Beschränkungen des internationalen Technologietransfers durch die USA – Auswirkungen auf die Innovationsentscheidungen deutscher Unternehmen*, Washington D. C., 1984, pp. 6 f.).

¹⁷ This Act replaced the stricter 1949 Export Control Act in 1969 and was amended in 1979 and 1985 by means of the Export Administration Amendment Act. The essence of the Act is a general export ban on sensitive items and goods, which are listed in the 104-page Commodity Control List; cf. H.-D. Jacobsen, *op. cit.*, pp. 109 ff.

¹⁸ This was revoked by the 1985 amendment but continues to be practised by the Pentagon.

leading role in technology vanishing as a result of the restrictions. The problems the embargo is causing for US firms are therefore becoming an issue in the USA, so that we expect the controls to be eased rather than tightened further.¹⁹

Is the Flow of Chips Drying Up?

We are as dependent on imports of microprocessor chips as on imports of oil, with the difference that oil can be replaced by other sources of primary energy. The very existence of German industry depends on the availability of this strategic resource. As outlined above, the conclusion is therefore drawn that since Siemens alone does not have the financial resources to establish a national semi-conductor manufacturing base public funds must be provided. This view is shared by the German Federal Ministry for Research and Technology, but it is contested by Klaus Luft, the Chairman of the Board of Managers of Nixdorf, who points out that chips are traded in the market like any other raw material and can be ordered at any time from anywhere in the world. "In such a situation and in the light of fluctuations from day to day in chip prices, it is utter nonsense to say that

the Germans must now jump on the chip bandwagon and to believe that this would be the way to make a killing."²⁰

Of course, Luft is an interested party and his judgement may be coloured accordingly. We shall therefore systematically investigate the feasibility of throttling the supply of chips. Our reasoning is inevitably based on hypothesis, but so too is the reasoning of those who advocate subsidising the manufacture of semi-conductors. What we can do here is to test the soundness of the hypotheses on which each party bases its case.

The mere fact of being dependent on a particular raw material or technology cannot justify the development of corresponding industries in one's own country. The international division of labour is based on mutual

¹⁹ Cf. US Department of Commerce (ed.): Final Report. The Status of Emerging Technologies: An Economic/Technological Assessment to the Year 2000, Washington, D. C., 1987, pp. 9, 14 and 19; see also R. H a s s e: Die sicherheitspolitische Bedeutung von Spitzentechnologien, in: Handbuch Strategie, published by Strategieforum ("res publica", Publikationen zu Grundfragen der modernen Demokratie, published by G. von Voss), Pfullingen 1988, p. 29 in the manuscript.

²⁰ Quoted in: high Tech. Das Deutsche Technologie-Magazin, No. 3/1988, p. 86.

PUBLICATIONS OF THE HWWA-INSTITUT FÜR WIRTSCHAFTSFORSCHUNG-HAMBURG

Leonhard Firlus

ZWISCHEN SCHOCK UND KALKÜL

Die permanenten Verschuldungsprobleme der
Entwicklungsländer

BETWEEN SHOCK AND CALCULATION

The Permanent Debt Problems of the Developing Countries

The debt crisis of the developing countries is among the most discussed problems of the world economy. Exogenous shocks and mistaken economic policies are generally named as the causes of the crisis. From an historical perspective, however, periods of debt servicing problems are the rule. It is thus too narrow a view to interpret debt problems solely as a consequence of exogenous shocks and mistaken economic policies. This study examines the question in how far calculated behaviour by decision-makers in developing countries must be included in attempts to explain debt problems, in order to be able to explain their permanence.

Large octavo,
331 pages, 1988,
price paperbound DM 59,-
ISBN 3 87895 345 3

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dependence. Autarky cannot be a maxim of industrial policy; that would hardly be in line with Technology Minister Riesenhuber's intentions, still less with those of an export-oriented enterprise like Siemens.

The fear is that our dependence on a steady flow of chips could be exploited to bring our industry to its knees or seriously to undermine its competitiveness. What will happen if Japan shuts off the flow of chips? Since Japanese chip manufacturers do not have a monopoly, they would lose customers and market share if they embarked upon such an industrial strategy. Apart from US manufacturers, there are the "Four Little Dragons" of South-East Asia, for whom such a market opening would be heaven-sent. In the West we have a stereotyped view of the Japanese mentality of pulling together, of which the MITI is the institutional manifestation, but within the collaborative relationship between business and the state Japanese companies have shown themselves responsive to the wishes of the state only if they derive net benefits from the give and take. Experience to date does not indicate that large Japanese enterprises will forgo profits to oblige the state.²¹

If we nevertheless assume that Japanese semi-conductor producers would be prepared to bear such opportunity costs (or were reimbursed by the state) and that on balance Japanese industry had a lead in some high-tech areas and thus had a quasi-monopoly in growth markets, the profit margins to be earned in Japan would also be higher than would otherwise be the case. The yen would then rise as a result of increased demand for Japanese high technology and additional capital would flow into Japan for investment in the Japanese equity market. The resulting appreciation of the yen would be so large that Japan would become uncompetitive in traditional consumer goods industries. It is quite possible that the adverse employment effect would outweigh the benefits from the increased production of high technology goods.

Aggressive Retaliation

The assumption made in the "Microelectronics 2000" study that our industry could be deliberately harmed by withholding raw materials and key components brings a new quality into international trade relations. Until now, restrictions on the international division of labour have

been designed to protect the country's own industry by reserving it a share of the national market, usually with the consequence that the entire economy became less and less competitive. This could be described as "passive protectionism", whereas the form the memorandum fears would be regarded as "aggressive protectionism". If that were to materialise, the Japanese would have to reckon with equally aggressive retaliation.

Japanese semi-conductor manufacturers could be denied access to their raw material silicon; a German firm supplies the silicon for half the world production of chips.²² Alternatively, Japan's supplies of other raw materials could be cut off. The most effective weapon, however, would be the uncompromising exclusion of the Japanese from European markets. One can imagine how quickly the Japanese car manufacturers would make representations to their Prime Minister if the Japanese Government even considered "aggressive protectionist measures". The assumption that the Japanese would withhold supplies on grounds of industrial policy is simply absurd. Even the above-mentioned article from "high Tech" acknowledges this, but not before it has painted the consequences of such a strategy and set the mood for subsidising semi-conductor technology.²³

There remains the possibility that Japanese producers might limit the flow of chips somewhat to drive up prices, given the inelasticity of demand. Such a strategy can never be ruled out, but if such a possibility exists, why have the chip manufacturers not exploited it rigorously in the past? Why have the Americans urged the Japanese to stop swamping the world with cheap chips and ruining their markets? In our opinion, there is no economic basis to the supposition that "chip power" will be wielded in future.

Those who nevertheless consider it probable that chip power will be exploited to some extent would do well to diversify their sources of supply or to rely more heavily on US manufacturers, as chip broker Erich J. Lejeune recommends.²⁴ Scrutiny has shown that the arguments in favour of subsidising semi-conductor technology are based on flawed hypotheses. Our conclusion is therefore that to pump taxpayers' money via Siemens into such a risky venture as chip production would not be wise from the economic standpoint.

²¹ According to K.-H. Meid, it has been shown "... that those of the Ministry's ideas that met with categorical rejection by the industries or firms involved could not be implemented"; see K.-H. Meid: Wirtschaftsmacht Japan, in: *Aus Politik und Zeitgeschichte, Beilage zur Wochenzeitung 'Das Parlament'*, B 9-10, Bonn 3rd March 1984.

²² Cf. F. Frisch: Böses Erwachen, in: *high Tech. Das Deutsche Technologie-Magazin*, No. 3/1988, p. 3.

²³ Die Halbleiter, in: *high Tech. Das Deutsche Technologie-Magazin*, No. 3/1988, p. 86.

²⁴ See the interview with Lejeune in: *high Tech. Das Deutsche Technologie-Magazin*, No. 3/1988, p. 88.