Industrial policy in Europe since the Second World War: what has been learnt?

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INDUSTRIAL POLICY IN EUROPE SINCE THE SECOND WORLD WAR: What Has Been Learnt?

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EXECUTIVE SUMMARY

PROMPTED BY THE revival of interest in industrial policy in several European countries, this paper considers what lessons can be learned from earlier European experience. The focus is mainly on sectoral or targeted industrial policy, designed to improve the performance of particular industries.

Since the Second World War European industrial policy has passed through two phases. The first, starting in the 1960s, saw a series of attempts by governments, especially those of the UK and France, to create national champions in industries deemed essential to the health of the national economy. Among the favoured sectors were high-technology industries such as aerospace and computers; part of the motivation was to narrow the "technology gap" between Europe and the US. There was also a widely held belief in scale as the key to international competitiveness.

With some exceptions these interventions were generally unsuccessful. Policy-makers tended to overrate the risks and costs of market failures and to underestimate those associated with government failures. There was also a mistaken assumption that there were certain technologies which a country somehow needed to have, and that they were more likely to be acquired through centralised direction than through competitive markets. The cost to the taxpayer of ill-judged industrial policy was high.

From the 1980s, with the UK setting the pace, there was a shift towards horizontal, non-selective policies aimed at improving the environment for all firms. Both at the national and at the European level (through the Single Market Programme), more emphasis was placed on competition. The ability of governments to support their industries was curtailed, and previously protected sectors such as telecommunications and electricity were partially liberalised. At the same time new institutions were established – the Framework Programme and Eureka – to promote intra-European cooperation in research.

The surge in US productivity growth from the mid-1990s, linked to the rapid application of information technology, led European governments to rethink their approach to industrial policy. The new priority was to encourage the growth of entrepreneurial high-technology firms on the American model, to develop the venture capital industry and to make stock markets more accessible to younger companies.

By the early 2000s some progress had been made, but there was still a wide productivity gap with the US, and in several high-technology sectors, such as information technology and biotechnology, European firms were lagging behind their American counterparts. (The aerospace industry, through Airbus, was a notable exception.) There was also a growing concern about de-industrialisation, attributed in part to the shift of manufacturing to China and other emerging economies.

The financial crisis of 2008-09 heightened these anxieties, causing governments not only to provide short-term help to ailing industries such as the car manufacturers but also to consider whether a more active industrial policy might be needed in the longer term. Some economists argued for a revival of sector-based policies in a form that would avoid the mistakes of the past.

The events described in this paper cast serious doubt on the notion that governments can create competitive advantage through direct intervention, and on their ability to select winning technologies or industries. The main conclusion of the paper is that industrial policy

should be horizontal rather than sectoral, and embedded in a set of policies and institutions which promote competition, encourage innovation and facilitate industrial change.

1. INTRODUCTION

Industrial policy in Western Europe has gone through two phases since the end of the Second World War and may now be in the early stages of a third. In the first phase, governments sought to improve the performance of their national industries and companies through targeted intervention, using a variety of tools that included subsidies for research and development, preferential procurement by public agencies, and the promotion of mergers.

The second phase, which began in the 1980s and continued into the 1990s and early 2000s, saw a shift towards horizontal or non-selective policies aimed at improving the business climate for all firms, and a greater reliance on competition. This period was marked by a deepening of economic integration within the European Union. Barriers to cross-border trade and investment were reduced; state-controlled sectors such as electricity and telecommunications were partially liberalised; and curbs were imposed on the ability of governments to protect or support their indigenous companies.

The events of the last few years suggest that the trend towards non-intervention may have come to a halt. The financial crisis of 2008-09 and the severe recession that followed prompted governments to give financial support, not just to banks, but also to other industries, principally the car manufacturers, which had been hard hit by falling demand. These interventions were in response to exceptional events, but seemed to indicate a greater willingness on the part of governments to support industries or companies that were deemed to be too important to fail. There has also been a growing anxiety, apparent before the financial crisis, about the ability of European industry to adapt to the changing international division of labour and, in particular, to the shift of manufacturing to China and other emerging economies. This has encouraged the view that the active involvement of governments is necessary if European industry is to strengthen its position in knowledge-intensive sectors that are less vulnerable to competition from low-wage countries.

Arguments for some form of industrial policy are also being made in the US, by economists as well as business leaders. One of the anxieties there is whether the offshoring of production (and some design tasks) to low-wage countries in electronics and other industries may have contributed to persistently high unemployment, as well as weakened the country's innovative capacity. What the government can do to slow down this process is not clear, but there are some influential voices advocating targeted support for technologies that are likely to boost the manufacturing sector and to generate high-wage jobs.

How to define the government's role, and what the balance should be between horizontal and sectoral policies, is the subject of active debate on both sides of the Atlantic. The purpose of this paper is to contribute to the debate by reviewing the evolution of industrial policy in Europe since the Second World War. The paper discusses industrial policy both at national level, focusing mainly on the UK, Germany and France, and at European level. The aim is to identify successes as well as failures, drawing on American and Japanese as well as European experience, and to draw some conclusions about what policies are likely to be effective in the current circumstances.

1.1. DEFINITIONS

Industrial policy can be defined in several different ways. In this paper the term is used to refer to measures taken by governments to bring about industrial outcomes different from those that would result if markets were allowed free rein. These measures may be horizontal in character, affecting all firms, or specific to particular sectors or companies.

The latter may include: the promotion of "infant" or fledgling industries in the hope that, through government assistance, they will become profitable and internationally competitive; support for the restructuring and modernisation of industries that are regarded as important because of their role as employers or exporters, or because of their links to national defence, or because they produce technology that will be used in other parts of the economy; the creation of national champions through government-induced mergers; and the rescue of failing firms.

Industrial policy is closely linked to technology policy. The latter refers to the policies and institutions through which governments seek to encourage the development and exploitation of advanced technologies.[1] Here, too, the policy instruments may be horizontal – for example, tax incentives for research and development – or directed at particular industries such as biotechnology or information technology.

This paper treats industrial policy and technology policy together, since both are directed at the same objective, improving industrial performance, and both have been extensively used in Europe since the Second World War.[2]

The theoretical case for industrial policy is that it is necessary to offset market failures. Most economists accept that government support for basic scientific research, conducted principally in universities and public laboratories, is justified because the market – competition among private-sector firms – cannot be relied upon to generate investment in research at the socially desirable level. Successful inventors are not able to secure all of the benefits of their discoveries, even with an effective patent system; they share these benefits with customers, and with imitators. Thus the social benefits from basic research can exceed the returns that a private-sector firm can obtain from investing in this activity.[3] A central question in the industrial policy debate is how far the market failure argument justifies intervention "downstream", to support the production of goods or services which would normally be supplied through the market – for example, to create or enlarge industries which are potentially valuable to the economy but in which private companies are reluctant to invest.

Other policies which affect industrial performance, and which to some extent overlap with industrial policy, are competition policy, trade policy and education and training policy. Governments can choose, within the limits imposed by international trading rules, how much weight to give to competition, both internal competition and competition from imports, as a spur to industrial efficiency, and how big a role foreign companies should play in their economies. In education and training, countries differ in the way the supply of skills is organised, and in the extent to which universities serve the needs of industry. National policy in all these areas can have at least as big an impact on the structure and performance of industry as industrial policy.

2. THE FIRST PHASE: FROM THE 1950S TO THE 1980S

THE IMMEDIATE TASK facing European governments after 1945 was to repair the damage caused by the war and to re-establish a well-functioning peacetime economy. The longer-term challenge was to exploit the technical and organisational innovations that had been made by American companies before and during the war, and to raise productivity closer to US levels. In steel, for example, an early priority was to install continuous hot strip mills, which had been widely adopted in the US for making high-quality sheet steel for the car manufacturers. Whether or not they were directly owned by the state, most European steel companies were given financial assistance, some of it coming from Marshall Plan funds, to finance the modernisation of their factories.[4]

Other industries which were seen as basic to the health of the economy, such as coal, electricity and railways, also received government support in the early post-war years. Some of them were taken over by the state, and remained in the public sector until the privatisations of the 1980s and 1990s. However, nationalisation was not linked to industrial policy in the sense in which that term came to be used in later years.

The impetus for greater government activism in the 1960s stemmed in part from disquiet over the "technology gap" between Europe and the US.[5] European firms were losing ground to their American rivals in high-technology industries such as aerospace and electronics, and government support was thought to be necessary if the lag was to be corrected. At the same time some of Europe's older industries such as textiles and shipbuilding were hard hit by competition from low-wage countries; some governments sought to slow down the decline through state-financed rationalisation schemes. This defensive aspect of industrial policy – the attempt to rehabilitate distressed industries - became more prominent in the difficult economic conditions that followed the increase in oil prices in 1973/74. Several industries, including steel and some branches of the chemical industry, were struggling with severe excess capacity.[6] A painful adjustment was necessary, prompting intervention both from national governments and, towards the end of the decade, from the European Commission.

Of the three largest European countries, the UK and France were the most active practitioners of industrial policy in the first thirty years after the war. In the UK, much of the intervention took place under Labour administrations, although the Conservatives were by no means as non-interventionist as their rhetoric suggested. In France there was no alternative in the conditions which prevailed at the end of the war but for the government to supervise and finance the reconstruction of the economy, as it had done after the First World War.[7] There was a long tradition in France of state support for industry, going back to Jean-Baptiste Colbert in the seventeenth century and a "Colbertist" approach was followed by post-war French governments, especially in the 1960s and 1970s. Another factor in the UK and France was that both countries were in the throes of losing overseas empires; part of the motivation for active industrial policy was the desire to preserve their status as world powers.[8]

West Germany was in a different situation after the war, and adopted different policies. In a fundamental break with the autarkic, state-controlled policies of the Nazi era, the Christian Democrat party that won power in the first federal elections in 1949 was committed to the principles of Ordo-liberalism – a belief in free markets, a vigorous competition policy and a limited role for government. Although there were some deviations from this stance, especially in the 1970s when the Social Democratic party entered government, state intervention in industry was much less than in the UK or France in the first thirty years after the war. Moreover, because of the restrictions imposed by the Allies after the war, West Germany was

barred from involvement in defence-related industries such as aerospace and computers until the mid-1950s. Even after that date these industries never had as high a political profile in Germany as they did in the UK and France.

2.1. THE UK

The first Labour government which held office from 1945 to 1951 set in train a massive expansion of state control of the economy through nationalisation. New state corporations were created in electricity, gas, coal, railways and (near the end of the government's term) steel.[9] Telecommunications, which was part of the Post Office, was already in the public sector, as was the principal airline, British Overseas Airways Corporation.[10] Outside these "commanding heights" of the economy, Labour had no long-term plan for industry as a whole (the main focus was on increasing production in the short term, especially in exporting industries[11]), but it took a close interest in two high-technology sectors – aircraft and computers – which were to become major recipients of state support under subsequent governments.

The aircraft industry had been greatly expanded during the war, and the government had to find a way of scaling it back while at the same time preserving what was seen as one of Britain's great industrial assets. Several factories were closed, but a substantial military programme was maintained, and the government provided funds for the development of a wide range of civil aircraft.[12] These included the De Havilland Comet, which when it entered service in 1951 was the world's first jet airliner. However, any hope that the Comet would be a commercial success was dashed when a design flaw caused two fatal crashes. The aircraft had been rushed into production too quickly, and De Havilland soon lost ground to the big American companies, led by Boeing and Douglas. While avoidable mistakes were made on the British side, the American industry had two advantages which were lacking in the UK; a large domestic market and the presence of several competing private-sector airlines which put pressure on the manufacturers to design efficient and economical aircraft.

British companies, whether making civil or military aircraft, had shorter production runs than their American counterparts, and hence higher costs. This problem was partially addressed through an enforced rationalisation of the industry which took place at the insistence of the Conservative government in 1959, creating two large airframe groups, British Aircraft Corporation (jointly owned by Vickers and English Electric) and Hawker Siddeley (which included De Havilland). At the same time, in order to support the industry's efforts on the civil side, the government introduced a system of launch aid; companies that undertook new civil aircraft and aero-engine projects were eligible for grants, with repayment linked to sales.

During the second half of the 1950s, scientists in the industry and in government research laboratories began to examine the feasibility of a supersonic jet airliner. If such an aircraft could be built, the British manufacturers might be able to regain the lead that they had lost to their US rivals in subsonic jets. By 1959 detailed design studies were under way and the supersonic project had gained some political momentum, but the cost was too high for the UK to undertake alone. The French aircraft industry, which was also struggling to keep up with the Americans, was a logical partner, and in 1962 the two governments agreed to share the development costs of what became the Concorde airliner. It was a decision that was to prove enormously costly for the British taxpayer, as well as diverting resources from other parts of the market where British manufacturers had better prospects of earning a commercial return.[13]

In computers the starting point in 1945 looked promising, since British technology was about on a par with that of the US. But American computer manufacturers gained an advantage in the formative years of the industry through development contracts from the Department of Defense. Government-funded technology gave IBM and others useful experience as they planned their entry into commercial data processing.[14] The defence market in the US was far bigger than in the UK, and despite support from the National Research Development Corporation (an agency set up in 1949 to promote the commercialisation of publicly funded research), the R & D effort in the UK bore no comparison with what was going on in the US.[15] Moreover, like the aircraft industry, the British computer industry was fragmented, and it was not until 1958 that two of the larger companies got together (without government direction or support) to form International Computers and Tabulators (ICT). By pooling forces in research and development the two companies hoped to compete more effectively against IBM, which was emerging as the dominant player in the world market.[16]

In another high-technology sector – nuclear power – the UK's position seemed strong in the early post-war years, and here too, there was a strong desire to maintain an independent British capability. Using technology derived from work on the atomic bomb, the Atomic Energy Authority (AEA) developed a nuclear reactor that used gas as the coolant and graphite as the moderator.[17] Its Calder Hall reactor, which went on stream in 1956, was the first nuclear reactor in the world to be connected to a power grid. The AEA's gas-graphite technology, known as Magnox, was the basis for the UK's first nuclear power stations. By 1960 nine Magnox stations were in operation or under construction and the UK had the largest nuclear power programme in the world. Although the principal motive was to reduce the electricity industry's dependence on coal and oil, there were hopes that the companies involved would generate a sizeable export business.

Large sums of public money were spent in these three sectors, but neither the first Labour government nor its Conservative successor, which held office from 1951 to 1964, can be said to have had a policy for high-technology industries. Their main preoccupation was with trying to reconcile their macro-economic objectives – full employment, low inflation and balance of payments equilibrium. It was only in the closing years of Conservative rule that attention switched to the supply side of the economy. The UK was growing more slowly than West Germany and France, and British industry was losing ground in export markets. Because the government had stood aside from the first moves towards European economic integration, British industry had not benefited from the expansion of intra-European trade that had begun in the 1950s and accelerated in the 1960s. (The first application to join the Common Market, made by Harold Macmillan in 1961, was vetoed by General Charles de Gaulle.) But the bigger problem was seen to lie in poor management, antiquated production methods and dysfunctional industrial relations.

Out of this reappraisal came the creation of the National Economic Development Office in 1962, followed by industry-level Economic Development Committees. These new agencies were modelled on the French planning system, which included sector-based Modernisation Commissions, bringing together businessmen, trade unionists, outside experts and civil servants to discuss the future of key industries.[18] The practical achievements of "Neddy" and the "little Neddies" were meagre, but they represented a step towards supply-side reform which was taken much further by the Labour governments that held office between 1964 and 1970. These years saw "a dramatic increase in the pace of microeconomic intervention, and also in the trend towards selectivity in industrial policy".[19]

Two new Whitehall departments were created, the Department of Economic Affairs (DEA) and the Ministry of Technology (Mintech). Much of the DEA's energies were devoted to the National Plan, which the government hoped would provide the basis for faster growth. However, the Plan was unrealistic in its projections and was thrown off course by Britain's continuing balance of payments problems. Potentially more promising were Mintech's efforts to accelerate the process of technical change in industry. The aim was to redirect the government's spending on research and development from defence to civilian uses, to cut back on prestige projects which had no prospect of generating a commercial return, and to identify key sectors where faster technological progress was needed.[20]

Computers was one of the targeted industries, and soon after the election the government had to deal with a financial crisis in ICT, the UK's leading computer company. This was due, not so much to competition from IBM (although the American company had increased its share of the British market to about 40 per cent), as to the mismanaged launch of a new family of computers and the unexpectedly rapid decline in sales of its older punched-card equipment.[21] Mintech officials believed that ICT was too small and pressed for a merger with the second largest supplier, the computer division of English Electric.[22] This was finally achieved in 1968 with the creation of International Computers Limited (ICL), in which the government took a 10.5 per cent stake. It also provided a £13.5m grant for the development of a new range of computers, and instructed government departments to buy their computers from ICL unless there were strong technical reasons for not doing so.[23]

Labour ministers were less inclined to support the aircraft industry which they believed had absorbed too much of the country's engineering and scientific resources. Several military projects were cancelled, including an advanced fighter, the TSR2, which was scrapped in favour of an American aircraft. The government also considered pulling out of Concorde, but France was determined to continue with the project, and the terms of the 1962 agreement made the costs of unilateral withdrawal appear unacceptably high.[24] In 1967 the government agreed to cooperate with France in developing a new subsonic airliner, the Airbus, but withdrew two years later on the grounds that the new aircraft was unlikely to be economic and its specification made it unsuitable for British European Airways. One of the few bright spots in the aircraft industry was Rolls-Royce, the aero-engine manufacturer. This company had been an early leader in jet engines for military aircraft, and it built on this experience, with support from the government, to launch a successful attack on civil markets. [25]

In nuclear power the first-generation Magnox stations were nearing the end of their life, and for the next generation a choice had to be made between the Advanced Gas-Cooled Reactor (AGR), which had been developed by the Atomic Energy Authority and, like Magnox, was based on gas-graphite technology, and the American light water reactor which had gained wide acceptance around the world. The AGR was chosen, apparently on the grounds that the technology was safer and had greater long-term potential. [26] This decision, announced in 1965, was regarded on all sides as a triumph for British technology, but it turned out to be a serious mistake. The Atomic Energy Authority had under-estimated the problems involved in scaling up the pilot reactor, and the AGR programme was plagued by technical problems and cost over-runs.

Alongside its support for (preferably home-grown) advanced technology Labour's industrial policy was influenced by its belief in scale. Ministers and their advisers considered that many British industries were too fragmented and that the necessary rationalisation was unlikely to take place without government intervention. The Industrial Reorganisation Corporation

(IRC) was set up for this purpose, and it helped to restructure several industries.[27] In electrical engineering, for example, the three largest companies were brought together under the leadership of the General Electric Company (GEC) to create a British group capable of competing against international companies such as Siemens in Germany and General Electric in the US. Although no government finance was provided in this case, GEC became in effect the UK's national champion in the electrical industry; it had also had a strong position in telecommunications equipment and in several branches of electronics.

An even more complex merger brought virtually all the British-owned car and truck manufacturers into the hands of a single organisation, British Leyland Motor Corporation. Part of the motivation for this deal was to prevent further inroads by American companies into the British market; Ford and General Motors were already well established in the UK, and one of the smaller companies, Rootes, had recently been acquired by Chrysler. The hope was that the new group would match the economies of scale enjoyed by the leading American and European companies.

The need for scale was also the justification used by Labour for the decision to re-nationalise the steel industry in 1967, although in this case politics played as big a part as economics. Having been nationalised in 1951 and privatised by the Conservatives two years later, steel had become a shuttlecock in the ideological contest between the two main parties. Labour argued that the newly created British Steel Corporation would bring about the structural changes that the private sector had been unwilling to undertake.

As later events were to show, the government vastly underestimated the difficulties of making these large mergers work. More generally, its industrial policies did little to improve the UK's economic performance. When Labour lost the 1970 election to the Conservatives, the stage seemed set for a shift away from state intervention. One of the first acts of the new government, led by Edward Heath, was to close down the Industrial Reorganisation Corporation. The Ministry of Technology was also disbanded, with most of its functions going to the Department of Trade and Industry. In practice, however, four years of Conservative rule brought little change in the conduct of industrial policy. A series of industrial crises forced the government to retreat from its non-interventionist stance.

The first was the near-collapse of Rolls-Royce. The company had developed an innovative engine, the RB211, and had persuaded Lockheed of the US to install it in a new airliner. However, development costs proved far greater than had been anticipated, and by 1970, despite launch aid from the government, the company was close to bankruptcy. Because of the importance of the company as defence contractor and exporter the government felt obliged to intervene. As Edward Heath wrote later, "we were conscious that the engine (the RB211) was a potential market leader in just the kind of high-technology field which we were keen to encourage".[28] In 1971, after receivers had been called in, the government took over the aero-engine side of the company; the Rolls-Royce cars business was detached and floated on the stock market.

Problems in shipbuilding and other ailing sectors prompted further assistance from the state, and in 1972 the government passed an Industry Act which "gave more or less carte blanche for crisis-driven intervention, although it lacked much in the way of a strategic orientation".[29] One of the companies that received assistance under the Act was ICL, in the form of launch aid for a new range of computers. Despite their rhetorical belief in market forces, the Conservatives were as anxious as their Labour predecessors to preserve a strong British player in this industry. Some consideration was given to merging ICL with a European or

American company, but the government was insistent that control of ICL should remain in the UK. It was also impressed by the fact that the French and German governments were supporting their computer industries on a more lavish scale than in Britain. [30]

When Labour returned to office in 1974, its enthusiasm for industrial policy was undiminished; it sought "a closer, clearer and more positive relationship between government and industry".[31] The promotion of mergers was no longer seen as a high priority, but the successor to the IRC, the National Enterprise Board (NEB), was given wide powers to invest in companies, to provide funds for new product development and to create new ventures in sectors that were thought to be of strategic importance. However, Labour's hope that the new agency would play a central role in modernising British industry was dashed by the recession which followed the quadrupling of world oil prices at the end of 1973. As the recession deepened, the NEB came to act mainly as a hospital for wounded companies. [32]

The biggest of the "lame ducks" was British Leyland, which was badly hit by the fall in car sales and had to turn to the government for financial support. After the government had agreed to stand behind the company's debts, Lord Ryder, head of the NEB, was asked to work out a plan for restoring British Leyland to health. Ryder's proposals, which were accepted by the government, called for an injection of over £1bn into the company over an eight-year period, with most of the money coming from the taxpayer.[33] The Ryder plan was based on the assumption, unsupported by evidence or analysis, that a revived British Leyland would be able to compete profitably in all segments of the car and truck market.

Several other troubled companies came into the NEB's fold, including Alfred Herbert, the country's largest machine tool maker, and Ferranti, a leading electronics firm. The NEB also inherited the government's shareholding in ICL, which was increased to 25 per cent through the purchase of shares from the two private-sector shareholders, GEC and Plessey. The company performed better during this period, and, although it continued to benefit from preferential procurement and from R & D grants, there seemed a reasonable prospect that it might be able to wean itself off government support. The share price in 1979 rose to its highest level since the company's creation in 1968.

The NEB took responsibility for the state-owned Rolls-Royce, which had recovered from the Lockheed crisis and, with the help of continuing launch aid from the government, was developing derivatives of the RB-211. Although the technical risks with this engine had been underestimated, the basic design was sound, and Rolls-Royce was beginning to gain ground against its two main US rivals, Pratt & Whitney and General Electric. [34]

On the airframe side of the industry, little progress had been made in civil airliners since withdrawal from the Airbus, and the case for further public investment was weakened by the fact that very few of the projects supported by launch aid since the policy had been introduced had earned a commercial return. [35] For reasons that had more to with politics than economics the government nationalised the industry in 1977 – Labour claimed that the manufacturers' dependence on public funds made private ownership anomalous – but that did nothing to improve its performance or to clarify its strategic direction.

Shortly before the 1979 election the government had to decide whether the newly nationalised British Aerospace should take up an offer from Boeing to share in the development of the new 757 airliner, or rejoin the Airbus. The government initially favoured the Boeing proposal on the grounds that a US link would strengthen British Aerospace and make it less dependent on public funds. Although orders for the first Airbus, the A300, were picking up after a

slow start (it had made a crucial breakthrough in the US in 1978 when it won an order from Eastern Airlines), Ministers were doubtful whether the project would ever show an adequate return. However, they were under pressure from other European governments to show their commitment to European collaboration, and from British Aerospace, which feared that if it accepted the Boeing proposal it would be reduced to the status of a sub-contractor. The government rejoined the Airbus consortium as a full partner, and provided £100m in launch aid for British Aerospace's contribution to the next member of the Airbus family, the A310.

The UK's policy towards civil airliners had been erratic, and the same was true of nuclear power. By 1970 it was clear that the decision to go for the British-designed AGR had been a mistake, and the principal operator, the Central Electricity Generating Board, was pressing for a switch to the American light water reactor. This marked the start of a lengthy debate about reactor choice, the outcome of which, in 1978, has been described as "a truly British compromise". Two more AGRs would be ordered and at the same time the government would examine the option of introducing the light water reactor in the early 1980s.[36] The effect of the AGR debacle and the long period of uncertainty was to destroy any hope that nuclear power might be the basis of a successful British export industry.

The threat of US domination was a powerful influence on government policy towards high-technology industries during this period, but Ministers were wrong to suppose that America's competitive strength derived mainly from very large companies such as IBM. Much of the dynamism of American industry, especially in high-technology sectors, came from new entrants – entrepreneurial firms that were often better able than old-established companies to understand and exploit new technological opportunities. A classic example was Intel, founded in 1968, which within a decade became the world's leading producer of semiconductor memories. Another was Genentech, one of the first and most successful biotechnology companies. To its credit, the NEB recognised that, if the UK was to make headway in this type of industry, the initiative would have to come from new entrants.

Two such ventures which at first seemed to have a chance of success were Celltech in biotechnology and Inmos in semiconductors; they were set up as independent companies, largely funded by the NEB but with private sector participation. [37] The reluctance of established British companies to invest in these two industries was seen by the NEB as a market failure which could only be tackled by government intervention. The NEB was willing "to take risks and to back a radically different course from the received wisdom of the industry". [38]

The NEB might have gone further in this direction had it not been for Labour's defeat in the 1979 election. The new Conservative government, led by Margaret Thatcher, reluctantly agreed that Celltech could go ahead, as long as a majority of the shares were held by private investors. As for Inmos, the NEB was instructed to find a private sector buyer; it was sold first to Thorn-EMI, a British electronics group, and later re-sold to SGS-Thomson, the Franco-Italian semiconductor company. As Mrs Thatcher saw it, the National Enterprise Board was based on the false premise that government officials could identify and nurture promising technologies and companies; she was determined to dismantle it as quickly as possible.

Even allowing for the exceptionally difficult economic situation which prevailed in the second half of the 1970s, Labour's industrial policy had done little to strengthen British industry. It had created national champions on the basis of unrealistic assumptions of what these companies were likely to achieve. It had exaggerated the importance of scale as a source of competitive advantage.[39] It had failed to inject new dynamism into technically backward industries. [40] Where whole industries had been taken into public ownership the effect had

been to politicise decision-making and to delay adjustment to market changes.[41] Unlimited access to public funds, as in the British Leyland case, had the effect of insulating managers and employees from the realities of the market.

2.2. FRANCE

Among European countries France is the one which has most consistently used the power of the state to support selected industries and companies, especially those linked to national defence and infrastructure. This was especially true in the first thirty years after the war. After the mid-1980s the extent of state intervention was greatly reduced as France adopted more liberal policies. Even today, however, the concept of the state as the protector of the nation's industrial assets has not gone away.

In 1945 French industry, after two decades of under-investment, urgently needed modernisation, and the private sector was in no state to finance it. To remedy these weaknesses the first post-war governments used two principal instruments: nationalisation, bringing most of the basic industries, including coal, electricity and gas, into public ownership; and a system of indicative planning through which the government targeted high-priority sectors and ensured that funds were made available, mostly through state-owned banks, to support new investment. The only large manufacturing company to be taken over was Renault. This was not done for industrial or economic reasons, but in retaliation for the owner's alleged collaboration with the Nazis during the war; the managers of Renault, though appointed by the state, were allowed to run the business with a high degree of autonomy. [42]

There were also moves to strengthen the country's capabilities in scientific research. The Centre National de la Recherche Scientifique (CNRS), which had been set up just before the war, was reorganised and given a mandate to develop and coordinate all French science. New technical agencies were created to undertake research in telecommunications, aeronautics and energy. Research into nuclear power, and later nuclear weapons, was entrusted to the Commissariat à l'Énergie Atomique (CEA). These institutions helped to offset the weakness of research in universities and the absence in France of the large, company-owned laboratories which existed in Germany and the US. [43]

By the early 1950s, despite political instability and chronic inflation (leading to several devaluations of the franc), the economy was growing at a satisfactory rate. Outside the public sector, however, there was little change in the structure of industry, much of which consisted of small, family-owned firms. Such firms could prosper as long as they were protected by high tariffs, but that situation came to an end with France's decision to join with Germany in creating the Common Market in 1957. As tariff barriers came down French industry was forced to adapt to a more demanding market, made all the more competitive by the presence of American companies that were stepping up their operations in Europe. The 1960s saw a wave of mergers and acquisitions, some of them promoted by government. The objective was to achieve economies of scale, but concentration also made it easier for the planners in Paris to establish a close rapport with the leading companies in each industry. "To a degree present in few other nations, the management of French industrial strategy became a cooperative endeavour between civil servants and industrialists". [44]

This was the era of national champions and grands projets, driven by General de Gaulle's determination, after he had returned to the presidency in 1958, to lift France into the front rank of industrial nations. As one commentator has written, De Gaulle's mission, brooded

over for twelve years, was to save France. "This meant military independence, without which no state was truly sovereign; economic independence, without which no state was master of its own house; and technological revolution, without which no state could maintain the first two conditions". [45]

On the military side, work on developing an atomic bomb had begun in 1954, and the programme was accelerated after de Gaulle's return to power. The early years of his presidency saw heavy investment in military aircraft and missiles, creating an American-style military-industrial complex which included private sector firms such as Dassault, the principal manufacturer of military aircraft, and Matra, a specialist in defence electronics, as well as several nationalised concerns. Government support took the form of public procurement, subsidised research, subsidised exports and industrial diplomacy, together with long-term research and production contracts from the Ministry of Defence. [46]

The French government was no less determined to build up the civil side of the aircraft industry. The state-owned Sud Aviation (later part of Aérospatiale), which had enjoyed some success with the Caravelle jet airliner in the 1950s, was the French partner in the Concorde project. It was also the prime mover, along with Snecma, the state-owned aero-engine manufacturer, in the establishment of the Airbus consortium. Although the Airbus project was to go through many difficulties before it established itself as a credible rival to Boeing, the French government never wavered in its support for civil airliner development. Here, as in other areas, there was a consistency in French industrial policy which was lacking in the UK.

Some of the same companies were involved in the development of space technology, which began in 1961 with the creation of a government research institute, the Centre National d'Études Spatiales (CNES). CNES built a launching base in French Guyana and undertook projects for civilian and military uses in cooperation with Aérospatiale and Matra. Work on the Ariane launcher began shortly after de Gaulle had left the presidency, and although this became part of a collaborative European space programme most of the funding came from France.[47] Mastery of space technology was another illustration of de Gaulle's determination not to be dependent on the US.

Unlike the UK, France had not been in the forefront of computer technology in the 1950s and the authorities had been slow to recognise the importance of the industry. Two events in 1964 prompted a change of policy. [48] The first was the acquisition of Bull, the largest French computer company, by General Electric of the US; the government sought to frustrate the deal by encouraging two French companies to take over Bull, but they declined to do so. The second was the launch by IBM of the System 360 family of computers, a move which threatened to reinforce its already dominant world market position. In the following year the case for an independent French capability was underlined by the US government's decision to block the sale of two Control Data computers to the French Atomic Energy Commission.

The response was the Plan Calcul, an attempt to foster a French-owned computer company capable of withstanding American competition. [49] Three firms were merged to form Compagnie Internationale pour l'Informatique (CII), which would be supported by subsidies and by preferential procurement on the part of government agencies. These firms were subsidiaries of electrical groups - Compagnie Générale d'Électricité (CGE), CSF and Schneider - all of which became shareholders in the new company. The government also took steps to ensure that CII had access to an indigenous source of electronic components. Subsidies were made available under the Plan Composants to a semiconductor producer, Cosem, which was then part of CSF. Control of CSF was later acquired by Thomson, and the enlarged semiconductor

business, Sescosem, became the national champion in what was seen as a vitally important sector of the electronics industry.[50]

The principle behind the Plan Calcul, as of other *grands projets* initiated during de Gaulle's presidency, was what Élie Cohen has described as offensive protectionism. "The sovereign state creates the means of accumulation of scientific and financial resources. It provides future national champions with grants, secure markets through public procurement policies, and prevents foreign entry." [51] The effect was to create close ties between the government and a group of favoured companies which depended on the state for a large part of their business.

One of the beneficiaries was CGE, which through a series of mergers and acquisitions lifted itself into the front rank of French industry; the number of its employees rose from 33,000 in 1960 to more than 100,000 in 1971. A key event was the so-called Yalta agreement in 1969 with Thomson, through which CGE acquired control of Alsthom, the principal supplier of power engineering equipment, while ceding to Thomson its interests in defence electronics and domestic appliances. Thomson also agreed not to compete in telecommunications equipment, leaving CGE to dominate this sector through its Alcatel subsidiary. Shortly before the CGE agreement, Thomson had acquired control of CSF, which had been an early leader in radio and TV broadcasting and had later established a leading position in military electronics. CSF was an important supplier to the Ministry of Defence, and the acquisition brought Thomson more closely into the world of *grands projets*. [52]

Typically run by *énarques* [53] who had the same educational background as the government officials with whom they dealt, CGE and Thomson formed part of the oligopolistic core of French industry. By the end of the 1960s, as a result of mergers and acquisitions, most major industries had become more concentrated, with two or three companies emerging as clear leaders. Some of France's largest firms, such as Michelin and Peugeot, were family-controlled and had few direct links with the state. Others depended on the patronage of government, as participants in *grands projets* or as suppliers to public sector agencies.

De Gaulle's approach to industrial policy was broadly maintained under his successor, Georges Pompidou, who held office from 1969 until his death in 1974, but Pompidou was more pragmatic than his predecessor and less obsessed with French independence vis-à-vis the US. An early decision was to accept the recommendation from the French electricity authority, Électricité de France (EDF), to base France's nuclear power programme on the light water reactor designed by Westinghouse in the US. This was opposed by the CEA which wanted to stick with France's indigenous gas-graphite technology, but EDF and its suppliers feared that if France became technologically isolated from the rest of the world the potential export market would rapidly disappear.[54]

The investment in nuclear power, begun under Pompidou and accelerated after the first oil shock in 1973/74, was an example of a state-led project based on cooperation between two government-owned agencies, CEA and EDF, and two contractors, Framatome (then jointly owned by Schneider and the CEA), and the CGE subsidiary Alsthom. Another French project which started during Pompidou's presidency was the Train à Grande Vitesse (TGV); here, too, a CGE subsidiary, Alsthom was the main private sector contractor to SNCF, the state-owned railway company. The TGV, which became a symbol of France's technical and engineering prowess, was typical of the French approach to large-scale infrastructure projects, "driven through by small but highly influential and well-trained technological elite, mostly top graduates of a single institution whose members move smoothly between the political, administrative and corporate worlds".[55]

With both nuclear power and the TGV the customer was the government or a government agency, and it was in industries of this kind where French industrial policy was most effective. In industries where the end-users were dispersed and less influenced by the state, the French approach worked less well. Nowhere was this clearer than in computers. By 1971 the ambitions set for CII, the computer company, were a long way from being achieved. It still had a very small share of the French market, which was dominated by IBM, and it was barely represented in other European countries.

To renew its product range, further government support was necessary, and this was provided under the second Plan Calcul, launched in 1971. At this point a possible European solution emerged. Siemens in Germany had entered the industry with its own computers, but by the early 1960s these machines were becoming obsolete; its share of the German market was not much more than 5 per cent. In 1964 it signed a licensing and supply agreement with RCA in the US, and began selling RCA's Spectra line of computers under the Siemens name. However, RCA was struggling to keep pace with IBM, and in 1971, after IBM announced enhancements to its System 360 family, it decided to withdraw from the industry. Siemens then turned to CII as an alternative supplier. It put to the French government a plan for a partnership which was later enlarged to include Philips of the Netherlands. The alliance, known as Unidata, seemed a promising venture in European cooperation, but was dogged from the start by disagreements among the partners about product strategy and about organisation. One solution might have been to convert the loose alliance into a separately managed, free-standing company, but since the French share of such a company would be not much more than 25 per cent, this was not acceptable to the French authorities. Unidata was dissolved in 1974.[56]

The French authorities were then able to negotiate what appeared to be a more satisfactory arrangement – a rapprochement with Bull. This company had been owned by General Electric since 1964, but like RCA, GE had found it impossible to compete profitably against IBM, and in 1970 it sold its computer division, including Bull, to another American company, Honeywell. Honeywell was willing to participate in a new French company in which French interests would hold a majority of the shares. Under an agreement signed in 1975 (after Valéry Giscard d'Estaing had taken over the presidency of the Republic) CII-Honeywell-Bull was formed, with Honeywell holding 47 per cent and the balance by the French government and by CGE. (The two other shareholders in CII, Thomson and Schneider, withdrew). The Giscard administration was less enamoured of national champions than its predecessors, and although the government agreed to support the new company over a four-year period the expectation was that it would then be able to stand on its own feet.

When Giscard entered office in 1974 he was determined to break with the interventionism of previous governments and to reduce the French industry's dependence on financial support from the state.[57] The goals of industrial policy were scaled back, with more focus on what was called *la politique des crénaux* – identifying particular sectors where French companies had a realistic prospect of gaining a worthwhile share of the world market. The Giscard administration was also willing to promote cooperation with American companies where it made industrial sense to do so. In semiconductors, for example, instead of relying wholly on Thomson, the government brought in other players, several of whom formed joint ventures with American producers. Two of the newcomers were Matra, one of Thomson's rivals in defence electronics, and St Gobain, a large industrial group best known as a manufacturer of glass and building materials. (This was St Gobain's first entry into an industry in which it had no previous experience, but which offered better growth prospects than its traditional activities.)

The new emphasis on competition did not imply a radical reordering of relations between industry and the state. Giscard was willing to invest in *grands projets*, using much the same approach as his predecessors had done. An outstanding example was the modernisation of the telephone system. Thanks to development work in the government research organisation, CNET, France had been the first country to install a fully electronic telephone exchange, the E10, and this technology, manufactured by the CGE subsidiary, Alcatel, became the basis for the transformation of what had been one of the most backward telephone systems in Europe. "As in other *grands projets* the state played the dominant role. It conducted R & D in a public research institution, financed a commercial prototype and provided a market through public procurement".[58] It was one of the great triumphs of Giscard's presidency. [59]

Giscard might have gone further in a liberalising direction had it not been for the recession which followed the oil price increase in 1973/74. The government found itself under pressure to assist older industries which were in a dire financial situation because of falling demand. The worst crisis was in steel, still privately owned but heavily dependent on support from the government. In 1978 Giscard was forced to take effective control of the two biggest steel companies, Usinor and Sacilor, in order to save them from bankruptcy. With shipbuilding and other distressed sectors pressing for government assistance, "a state which had groomed national champions was now feeding 'lame ducks' ". [60]

The government was also faced with another crisis in the computer industry. CII-Honeywell-Bull had made progress in the first few years after its creation, but in 1979 disagreements among the shareholders threatened to destabilise the company and the government was obliged to intervene. The outcome was the removal of CGE as the principal non-government French shareholder and its replacement by St Gobain. Although a newcomer to computers, St Gobain had the great attraction for the government of being strong enough financially to support CHB through to commercial viability. However, St Gobain's arrival was almost immediately followed by a sharp fall in CHB's profits, prompting the need for further government assistance.[61]

With several other national champions also in financial trouble, French industry was not in a healthy condition at the time of the 1981 elections, which were won by a coalition of the Socialist and Communist parties. The leader of the coalition, François Mitterrand, was able to persuade a majority of the electorate that the solution to France's industrial problems lay, not in more market, but in more state.

France was not alone among European countries in facing economic difficulties in the second half of the 1970s, and it was not surprising that the party in power during that period should suffer the electoral consequences. Yet the disappointing record of the Giscard presidency did not detract from the progress which the French economy had made since the 1950s. France was now a formidable industrial power, as De Gaulle had intended, and some strong national companies had been created.

How much credit for the improvement in France's industrial performance can be attributed to the "Colbertist" policies pursued by de Gaulle and Pompidou? Some economists believe that the crucial policy changes came at the end of the 1950s, with the creation of the Common Market, which for the first time exposed French industry to Europe-wide competition, and the adoption of a more rigorous approach to macroeconomic policy through the Rueff-Pinay reforms. [62] The opportunities and pressures arising from a more competitive European market forced French industries to adapt, and some of them did so with notable success. The motor industry, for example, made a great leap forward during this period, with Renault

emerging as Volkswagen's strongest competitor at the high-volume, low-price end of the market. Although Renault was owned by the state, this achievement cannot be attributed to industrial policy. Some mergers and acquisitions took place during this period (notably Peugeot's purchase of Citroen, and its later takeover of Chrysler's European operations), but, in contrast to the creation of British Leyland in the UK, they were not orchestrated by the government. Some left-wing politicians hoped that Renault and Peugeot might get together to form a French General Motors, but there was never any possibility that the fiercely independent Peugeot family would contemplate becoming absorbed into a state-owned group.[63]

Where the government did intervene to create a national champion, the results were mixed, with failures such as computers and machine tools[64] offset by some successes as in telecommunications. Most of the successes were in infrastructure and defence-related projects where the French administrative system worked better than its British counterpart. Henry Ergas has suggested that part of the reason for French success in projects of this kind was "the great political legitimacy, operating autonomy and technical expertise of its end-user agencies, combined with the strong incentives for success built into the highly personalised nature of power and careers in the French public administration".[65] By contrast, the British system of public administration emphasised anonymity, committee decision making and administrative secrecy. Governments in the UK were "reluctant to devolve major projects to reasonably autonomous entities, so that responsibilities are tangled, decision making is cumbersome and the organisational and cultural context is inappropriate for developing new technologies". [66]

There were, however, two disadvantages to the French approach. First, most of the national champions were heavily dependent on state-controlled markets which were insulated from international competition; how well would they perform if that protection was removed? Second, the bias in favour of large, nationally-owned companies distorted the allocation of the nation's technical and human resources, and diverted attention from the need to nurture a strong tier of small- and medium-sized enterprises. This was a weakness in France's industrial structure, and one that "Colbertism" was ill-designed to correct.

2.3. GERMANY

"If industrial policy is taken to mean a government's active shaping of the industrial structure of a country and attempting to direct its permanent modernisation, then such a policy could not be said to exist in West Germany".[67] There were some departures from this non-interventionist stance, notably the decision to shield Germany's high-cost coal industry from international competition[68], and pressure for a more active industrial policy increased after the Social Democrats entered government in the 1970s. There were also some instances of intervention by Land governments to protect or support local companies. In general, however, state involvement in industry in the first thirty years after the war was considerably less than in France or the UK.

The Christian Democrat government which took power in 1949 did not seek to extend the public sector through nationalisation. It inherited some state-owned companies, such as Volkswagen, from the Nazi regime, but most of them were later wholly or partially privatised. The railways (Deutsche Bundesbahn) and the telephone system (part of Deutsche Bundespost) were in the public sector, but, in contrast to the UK and France, electricity and gas were largely in the hands of private sector companies.

The German economic miracle that began in the 1950s was not the result of industrial policy, but underpinned by a broader set of policies of which the promotion of competition and openness to foreign trade were probably the most important. To a much greater extent than France or the UK, Germany was the pace-setter for trade liberalisation in Europe.

Some of Germany's institutions, such as the vocational training system and the close cooperation between banks and industry, had deep historical roots. There was continuity, too, in science policy. There had been a long tradition of state support for scientific research, in universities and in government research laboratories, through the Max Planck Society. These arrangements were reinforced after the war by the creation of the Fraunhofer Society, which acted as a bridge between basic research in public laboratories and applied research in industry.[69] After a slow start it grew into a substantial organisation, closely linked to universities but mainly carrying out applied research on behalf of clients in industry and government. It was part of Germany's diffusion-oriented technology policy, aimed at encouraging widespread access to technical expertise and reducing the costs which small- and medium-sized firms faced in adjusting to change.[70]

The industries which made the biggest contribution to Germany's export success were for the most part ones in which Germany had a long-established competitive advantage. German entrepreneurs had been the leaders in the development of the modern, science-based chemical industry in the second half of the nineteenth century, and this sector continued to be a source of strength after the Second World War. When the three big companies that had been part of I G Farben – Bayer, Hoechst and BASF - were set up as independent enterprises in the early 1950s, they soon re-established a leading position in the world market, alongside DuPont, Dow and Monsanto in the US and ICI in the UK. In electrical engineering Siemens and AEG quickly recovered from the war, and although AEG was later to enter a prolonged period of decline, Siemens became a European leader in power engineering, telecommunications equipment and some branches of electronics.

A third area of strength was non-electrical machinery, and here the dynamism came mainly from small- and medium-sized firms – the Mittelstand. Their success was based on technical excellence, a highly skilled workforce, and specialisation in particular segments of the market. This was a decentralised industrial order in which firms "enjoyed dense and overlapping ties with a whole array of institutions dedicated to providing them with technological and market information, highly trained people, and contact with other producers with complementary expertise". [71]

The motor industry, which had been something of a laggard before the war, was one of the principal beneficiaries of the opening-up of the European market, thanks in part to the spectacular success of Volkswagen. Owned until 1960 by the state but managed without political interference, this company applied Fordist mass-production techniques with such success that the Beetle became by the mid-1960s the world's best-selling car. The government had no direct influence on Volkswagen's strategy [72], or on the policies pursued by the two leading producers of luxury cars, BMW and Daimler-Benz. Some of the smaller car makers were absorbed by the large groups during the 1960s, but the rationalisation of the industry took place without government involvement.

In all these industries, industrial policy as practised in the UK and France was virtually non-existent. They were also industries which fitted well with the distinctive characteristics of the German business system: close links between companies and banks; limited recourse to equity markets; continuous investment in workforce skills; and patient, long-term invest-

ment in the development of new products and processes. By contrast, Germany did not provide a conducive environment for industries such as computers and semiconductors where there was much greater technological uncertainty.

Germany made a slow start in high-technology industries after the war because of the restrictions imposed by the Allied authorities. These controls were lifted in 1955, and at that point the government sought to recover the ground that had been lost. A new government department – the Ministry for Atomic Questions – was created to support development work in nuclear energy; its responsibilities were later extended to encompass space research. In 1962 it was converted into the Ministry of Research and Technology (BMFT).

An early target was the computer industry. Several German companies, including Siemens, had introduced their own computers in the late 1950s, but they were making little headway against IBM. The BMFT launched its first Data Processing Programme in 1967, providing financial support for R & D in computer hardware. Most of the money went to Siemens and AEG, and the Ministry tried without success to persuade the two companies to merge their computer operations. As noted earlier, Siemens formed an alliance with RCA, and later helped to set up the short-lived Unidata partnership. When that venture collapsed it turned to Fujitsu of Japan as the supplier of IBM-compatible mainframe computers at the top end of the range.

The only genuine German success in computers during this period came from an entrepreneurial newcomer, Nixdorf, which specialised in small business systems, a largely uncontested market which Siemens had neglected. Although Nixdorf received some support from the BMFT in the second half of the 1970s, it was not dependent on the patronage of the state.[73]

In nuclear power the two principal contenders were again Siemens and AEG, both of which entered the industry by obtaining licences from US companies and later developing their own technology. Although they received some support from the BMFT, most of the Ministry's efforts were devoted to reactor types – principally the fast breeder reactor – which turned out to be of little commercial value. The companies were sceptical about the fast breeder, and reluctant to invest in it. [74] Siemens's subsequent success in nuclear reactors owed little to government support.

In the aircraft industry, German companies which had been among Europe's leading manufacturers before the war were eager to get back into the market as soon as the restrictions were lifted. They had a powerful supporter in Franz-Josef Strauss, who as Federal Minister of Defence from 1956 to 1962 and later as Minister President of Bavaria (where several of the companies were based) worked hard to revive the industry. The first step was to negotiate an agreement with the US for the manufacture under licence of the Lockheed Starfighter. Government support for civil aircraft projects began in 1962, but progress was slow, partly because of the fragmentation of the industry; there were seven independent aircraft builders in the 1960s. One of them, VFW, formed a partnership with Fokker in the Netherlands to make a short-haul airliner, the VFW 614, but it was not successful; the programme was cancelled after costing the taxpayer some DM1bn.

The first moves towards rationalisation came at the end of the 1960s with the creation of Messerschmidt-Bölkow-Blohm (MBB), and it was this group, together with VFW and Dornier, that became the German partner in the Airbus consortium. A new company, Deutsche Airbus Gmbh, was formed, with Strauss as chairman of the board. The German aircraft industry relied on support from the Federal and Land governments; apart from coal mining, it was the most heavily subsidised sector of German industry.

As Otto Keck has written, "the federal government was hesitant in assuming responsibilities for science and technology, and where it did, as in nuclear power, aerospace and electronic data processing, its programmes for supporting industrial technology were ineffective".[75] But if Germany's forays into interventionist industrial policy between the 1950s and the 1970s were mostly unsuccessful, they were too small to have much impact on the wider economy. Germany avoided the mistakes made in France and the UK, and its industrial strength continued to be based on medium-technology sectors in which interventionist policy had played no part.

2.4. INDUSTRIAL POLICY AT THE EUROPEAN LEVEL

Throughout the 1960s and 1970s the industrial policies pursued in the UK, France and Germany were largely national in character. Although there was some cross-border cooperation, as with Concorde and Airbus and the abortive Unidata venture, these were intergovernmental arrangements which did not involve the European Commission. The Treaty of Rome had said nothing about industrial or technology policy. The separate treaty that set up the European Atomic Energy Community (Euratom) was intended to provide a coordinating framework for nuclear research, but virtually all Europe's research in this area was conducted outside Euratom by national governments.[76]

The first steps towards a European technology policy came in the mid-1960s with the creation by the Commission of a committee known as Prest (Politique de Recherche Scientifique et Technologique) to explore the possibility of a common research policy among member states. This was a time of growing concern over the failure of European countries to fund scientific and technical research on the same scale as the US.[77] Various plans were put forward at this time, including a proposal from Harold Wilson, the British Prime Minister, for a European technological community, to which the UK would contribute its expertise in areas such as aerospace and electronics. Without action on this front, Wilson warned that Europe faced the prospect of an "industrial helotry", with European industry producing "only the conventional apparatus of the modern economy, while becoming increasingly dependent on American business for the sophisticated apparatus which will increasingly call the tune in the 70s and 80s".[78] Wilson hoped this argument would strengthen the case for British membership of the Common Market, but his application, like that of his predecessor Harold Macmillan, was vetoed by General de Gaulle, and his ideas on research won little support from other European countries.

Some progress was made in the Prest committee, and the appointment of Altiero Spinelli in 1970 as the Commissioner responsible for industry and for research and technology led to more ambitious plans for cooperation in this area. Although nothing much came of Spinelli's initiative, which involved a greater degree of centralisation than was acceptable to member states, his successor, Ralf Dahrendorf, brought a more pragmatic approach, and by the early 1970s a new framework had been established in the form of COST (European Cooperation in the Field of Scientific and Technical Research) through which European governments, together with the Commission, funded a number of collaborative research projects.[79]

The principal obstacle to progress was the reluctance of governments, especially in the larger countries, to subordinate their national interests to those of Europe as a whole. As one observer wrote, "European technological cooperation failed in the 1960s because European governments wanted to have their cake and eat it. They wanted the benefits of technological cooperation without paying the political costs necessary for these benefits to be reaped.

These political costs were the removal of protection for national firms in public markets for 'strategic' technologies, an explicit willingness to become more dependent on European neighbours and a revision of the habit of turning to the USA when national technological programmes failed".[80]

These obstacles to cooperation were evident in the largely abortive attempt to develop a European approach to space technology. In 1961 six European countries – the UK, France, Germany, Italy, Netherlands and Belgium – set up the European Launcher Development Organisation, followed a year later by the European Space Research Organisation, but there was a lack of clarity about objectives and little progress was made. By the end of the decade "the European space programme was a shambles". [81]

By this time officials in Brussels were beginning to make the case for a European industrial policy. One of the first Commission documents on this subject, the Colonna memorandum of 1970, noted the surge of US investment in Europe, especially in high-technology industries, and warned that European-owned firms could find themselves limited to "traditional", that is, low-technology, activities.[82] The memorandum pointed out that the main beneficiaries of the reductions in tariffs within the Common Market had been consumer goods producers. "Industries which make use of the major new technologies do not feel the same benefit of the customs union inasmuch as – since their development depends on public funds and orders – they cannot so easily break out of their national market". The report proposed that the creation of cross-national European companies should be made easier through changes in company law.

No concrete action resulted from the Colonna memorandum, but in the second half of the 1970s the case for a European approach to some industrial problems became stronger as a result of the crisis in steel. This was an industry over which the Commission, through the European Coal and Steel Community, had supervisory powers. The collapse in demand that followed the 1974/75 recession created a very difficult situation for the steelmakers to which the Commission had to respond. Under the 1977 Davignon Plan, named after the Commissioner for Industry, Étienne Davignon, the steel companies were made subject to strict controls on pricing, and restrained from adding new capacity. The aim was to stabilise the market and to bring capacity into line with expected demand.

Steel was one of several troubled industries that looked to the Commission for help during this period. As one commentator remarked, European companies and their governments were evidently prepared to look for Europe-wide solutions in the so-called "sunset" industries such as steel and shipbuilding, while keeping firm national control over "sunrise" industries such as computers.[83] However, Davignon, a powerful figure on the Commission between 1978 and 1982, believed that Community action to help growth industries was as important as the restructuring of industries in trouble. "In the aerospace industry, in data processing and in other areas", he said, "opening up markets and pooling industrial capacity will be necessary to reach the scale required by international competition".[84] Davignon was the prime mover in establishing the new framework for technological cooperation which was to take shape in the early 1980s.

2.5. EUROPEAN INDUSTRY AND ITS COMPETITORS IN 1980

The first thirty years after the war saw a surge in European productivity growth; by the mid-1970s GDP per hour worked in Europe was just under 80 per cent of the US level, com-

pared to 44 per cent in 1950.[85] The improvement owed a great deal to trade liberalisation and a generally favourable international environment, but little if anything to interventionist industrial policy. The country which intervened least, West Germany, did best. Moreover, whether or not the desire to catch up with the US in high-technology industries was a legitimate objective – and on this issue politics and national prestige weighed at least as much as economics - little progress had been made. In aerospace and computers, which had been heavily subsidised by European governments, American firms were still far ahead. At the same time attempts to ease the problems of depressed industries through government intervention had tended to slow down necessary change, at considerable cost to the taxpayer.

The clear lesson from European industrial policy in the 1960s and 1970s was that governments had overrated the risks and costs of market failures and underestimated those associated with government failures. As an OECD study pointed out, an apparent market failure – for example, the reluctance of firms to invest in risky high-technology projects – did not in itself justify government action. "It is necessary to ascertain beforehand that such action can be more effective than the market solution, however imperfect, and that the appropriate means can be mobilised".[86]

There had also been a dubious assumption, especially in France and the UK, that there were technologies which a country somehow needed to have and which in the absence of concerted government action it would not acquire; that these technologies could be discovered by administrative process; and that they would be more effectively secured by centralised effort than through the "duplication" and "waste" which characterised competitive markets.[87]

Anxiety about US domination had been a strong influence on policy-makers throughout this period, but the response failed to take account of the special features of the US market. Part of the explanation for the American lead in computers and semiconductors was that in the early post-war years, when these industries were in their formative stage, US manufacturers benefited from a large demand arising from military and space exploration programmes. In civil aerospace, the size of the US market, and the existence of numerous competing airlines, gave US manufacturers an advantage that was not available to their European counterparts. No less important were supportive policies and institutions, including a financial system that gave start-up and early-stage firms ready access to capital. Another factor was the willingness of the Federal government and its agencies, including the military, to encourage new entrants, instead of relying on large, established companies as their European counterparts generally did.

American success could not be ascribed to industrial or technology policy. "Historically US technology 'policy' has been the outcome of loosely coordinated and often inconsistent decisions made in diverse policy areas designed to further the missions of individual federal agencies. These policies were motivated more by national security concerns than by any comprehensive economic strategy".[88] In general the US government did not try to plan and coordinate broad civilian technologies, and where it did so the results were disappointing.[89] Where mistakes were made, the US was usually quick to acknowledge them; for example, development work on a supersonic airliner, begun in direct response to Concorde, was discontinued in 1971 before expensive commitments had been made.[90]

European governments might have done better if they had focused less on the size of US companies and more on the institutional framework in which they were operating. But towards the end of the period there was another model which was beginning to attract interest in Europe.

2.5.1. THE RISE OF JAPAN

When the Japanese economic miracle began in the 1950s it was first attributed to low labour costs. Then, as companies such as Sony and Toyota increased their share of Western markets, attention focused on Japanese management practices – lean production, continuous improvement, just-in-time supply systems. But there was also a perception that, in catching up with the US in high-technology industries, the Japanese had developed an industrial policy that avoided the mistakes made in the UK and France.[91] In computers, for example, the Japanese authorities, instead of creating a single national champion, had encouraged the established companies in the industry to cooperate in pre-competitive research but to compete fiercely against one another in the market. This policy, known as controlled competition, had originated before the war in telecommunications, and was applied after 1945 to other high-technology industries.[92]

Japan's experience, and that of other late-industrialising East Asian countries which partially imitated Japan, suggested that industrial policy could be a source of competitive advantage if it was well designed and skilfully implemented. A distinctive feature of the East Asian approach, especially in Korea and Taiwan, was the focus on exports both as an objective and as the criterion which determined whether or not companies would receive support from the state. In Europe governments tended to continue supporting their national champions in the hope that they would become competitive but without making support contingent on performance.

The rise of Japanese industry seemed unstoppable at the end of the 1970s, prompting some extravagant predictions such as those contained in Ezra Vogel's best-seller, Japan as Number One. In the blurb to this book a former US ambassador to Japan wrote: "Japan has a more smoothly functioning society and an economy that is running rings round ours". The supposed advantages of the Japanese model prompted several initiatives in European industrial policy during the 1980s.

3. THE SECOND PHASE: FROM THE 1980S TO THE EARLY 2000S

In the early 1980s the term "eurosclerosis" came into common use. Most European countries were suffering from rising unemployment and high inflation; it was clear that new policies were needed to inject greater dynamism into the European economy. This period coincided with a shift in macroeconomic policy away from Keynesian demand management towards a stronger focus on monetary stability and low inflation. In microeconomic policy the disappointing results of direct intervention in industry in the earlier post-war decades strengthened the argument for a greater reliance on markets.

At the European level the change in thinking about how economies should be organised was reflected in a series of measures aimed at removing the remaining barriers to the cross-border movement of goods and capital. But alongside the drive for a more integrated European market there was also a revival of interest in European industrial policy. While the "technology gap" with the US was still a matter of concern, Japan seemed to have evolved an approach to industrial competitiveness which could usefully be imitated in Europe. In high-technology industries, in particular, Japanese-style inter-company collaboration was seen as one of the ways in which European industry could recover lost ground.

Admiration for Japan was not confined to Europe. During the 1980s several economists in the US, worried about the inroads which Japanese companies were making in industries

previously dominated by American firms, argued that an industrial policy along Japanese lines was essential if a continuing decline in high-technology sectors was to be avoided.[93] In 1987 the Department of Defense agreed to fund a consortium of semiconductor producers, known as Sematech, in the hope that through cooperative research the industry could develop cutting-edge technologies which would put them ahead of their Japanese competitors. Sematech did not achieve what its sponsors had hoped, partly because the participants could not agree on what the research programme should consist of.[94] The organisation continued to exist, but its role became one of encouraging closer cooperation between semiconductor producers and their equipment suppliers. The subsequent revival of the US semiconductor industry owed little to inter-firm collaboration or to support from the federal government. [95]

Whether industrial policy contributed significantly to Japan's economic success in the 1970s and 1990s remains a matter of controversy[96], but by the early 1990s the attractions of the Japanese model were in any case fading as that country entered a period of economic stagnation that was to last for more than a decade. The pendulum swung back to the US. From the mid-1990s onwards there was a remarkable surge in US productivity growth, and the principal source of the improvement was the speed at which American firms were exploiting the latest advances in information technology, including the internet. After a long period in which Europe had been getting steadily closer to US productivity levels, the gap began to widen; Europe seemed stuck in the slow lane while the US was roaring ahead.[97] The strength of the US was now seen to lie, not in the existence of giant companies such as IBM or General Motors, but in a set of institutions and policies that encouraged the exploitation of new technologies and the rapid redeployment of resources from low-growth to high-growth sectors of the economy.

Although the enthusiasm for the "new economy" went too far, creating a stock market bubble in the shares of internet-related companies which collapsed in 2000, this did not undermine the attractions of the US model. In the years leading up to the financial crisis of 2008-09 the US lead in high-growth, high-technology industries seemed unassailable, prompting European governments to try to reshape their institutions along American lines.

3.1. THE UK

Margaret Thatcher, who became Prime Minister in May 1979, is generally seen as the standard-bearer for the "neo-liberal" philosophy which had a profound influence on economic policy, in developing countries as well as in the industrial world, during the 1980s and 1990s. Although the continuities with previous British administrations were greater than is often supposed, it is certainly true that in some key areas "Thatcherism" involved a reordering of economic priorities. The focus was on controlling inflation and on keeping public expenditure under control, even at the expense of higher unemployment. At the micro-economic level, competition was to be the principal instrument for improving industrial efficiency. Most of the industries that had been nationalised by Labour, including steel, shipbuilding and aerospace, were privatised. More striking was the decision to privatise and deregulate state-owned utilities which had previously been regarded as natural monopolies and unsuitable for private ownership. The most spectacular success was the privatisation of British Telecom in 1984.[98]

An important consequence of privatisation was that the utilities were no longer obliged to buy equipment from British suppliers; what had been a cosy supplier/customer relationship became a much more competitive market. In telecommunications, for example, British Telecom

brought in a Swedish company, Ericsson, to compete against the British suppliers of switching equipment. After electricity privatisation in 1990, Siemens and other Continental power engineering companies became major suppliers to the newly privatised generating firms.

Whereas Labour had sought to nurture and protect British-owned firms in supposedly strategic industries, the Thatcher government was only too pleased to sell off loss-making national champions to foreign acquirers. The Prime Minister raised no objection when Ford bought British Leyland's Jaguar subsidiary in 1984, and two years later she might have sold the rest of British Leyland to Ford and General Motors had there not been a sudden upsurge of patriotic fervour on the Conservative back benches which forced her to withdraw the proposal. [99] Rover, the successor company to British Leyland, was sold to British Aerospace and later re-sold to BMW of Germany in 1994.[100] The Leyland truck business was bought by Paccar of the US in 1998.

Mrs Thatcher wanted to make the UK more attractive to foreign investors, and she was indifferent as to whether their investment took the form of building new factories or acquiring British companies. There was a warm welcome for the three Japanese companies, Honda, Toyota and Nissan, when they decided to build factories in the UK as the base for supplying European markets. Thanks to Mrs Thatcher's reforms the labour relations climate had become more stable and the Japanese companies achieved productivity levels in their British factories comparable to their domestic plants.

The government also sought to encourage home-grown ventures, but to do so not by supporting particular industries or firms but by creating an environment that would be more supportive of entrepreneurs. The growth of the venture capital industry was stimulated by tax changes, and the government persuaded the London Stock Exchange to improve the supply of equity finance for young, fast-growing firms. A partial success was the rise of new biotechnology firms, seeking to commercialise the results of academic science. (This group included Celltech, now wholly owned by private investors.) Although none of these firms were as successful as their counterparts in the US, they reflected a shift away from the earlier focus on creating bigger industrial groups. In information technology the 1980s saw the emergence of a promising cluster of innovative firms around Cambridge University, in the area that became known as Silicon Fen.[101]

The hands-off policy towards industry did not preclude some continuing support for investment in advanced technology. In information technology, for example, the government accepted the argument that some injection of public funds might be necessary to strengthen a sector in which British firms were lagging behind their American competitors. The Alvey programme, aimed at encouraging collaborative projects between industry and academia, was set up in 1983 with a budget fixed at £350m over five years of which £200m was to come from the taxpayer.[102] The programme increased the amount of spending on information technology research, in both public and private sectors, but did little to improve the international competitiveness of British companies.[103]

The Thatcher government sold the NEB's shareholding in ICL soon after taking office, but it was still willing to support the company, on a strictly limited basis. ICL was faced with a widening gap between its profits and the amount of R & D expenditure that was necessary to keep its products competitive. With private investors reluctant to put up more funds, the government agreed to provide a two-year guarantee for a £200m loan which ICL had negotiated with the banks.[104] The loan was subsequently repaid without the guarantee having to be used, and the government was not involved in ICL's subsequent decisions. In 1984 Standard

Telephones and Cables (STC), a telecommunications equipment company, took over ICL, which thereby became part of a diversified electronics group. The merger did not work well, and in 1990 STC sold 80 per cent of ICL to Fujitsu of Japan. Under Japanese control the company shifted the balance of its business towards information systems and services, with only a limited involvement in hardware.[105]

Several other branches of the electronics industry passed into foreign control during this period. In consumer electronics, several TV set producers had formed alliances during the 1970s with the increasingly dominant Japanese manufacturers, and the National Economic Development Office had hoped that these alliances might provide the basis for a modern, competitive industry with a substantial British component. By the end of the 1980s, however, these joint ventures had passed into the control of the Japanese partners, while Thorn-EMI, the largest British manufacturer, sold its TV set business to Thomson, the state-owned French electronics group. "The prospect of a government-backed and subsidized modernisation programme which NEDO had envisaged in 1978 had given way to a non-interventionist policy in which the Thatcher government left adjustment almost entirely to the firms". [106]

In semiconductors, as noted earlier, Inmos was sold to SGS-Thomson, the Franco-Italian group, leaving GEC as the only significant British-owned producer. GEC did not compete in the high-volume segments of the semiconductor market, specialising mainly in devices used in military applications. The bulk of the market was supplied either by imports, principally from the US and Japan, or by the local subsidiaries of non-British firms such as Siemens and Fujitsu. The argument on which the creation of Inmos had been based, that the UK needed a nationally-owned producer of semiconductors competing in the mainstream of the industry, no longer carried weight with the government.

The only industry where the Thatcher government deemed national ownership to be essential, on grounds of national security, was aerospace. British Aerospace and Rolls-Royce were privatised, but they were protected from foreign takeover by special provisions in their articles of association. The government did not seek to influence their strategy, but they continued to enjoy close links with Ministry of Defence and to receive launch aid for civil projects.

Outside aerospace, the government was content to allow the structure and ownership of industry to be determined by the market. Some observers criticized this approach on the grounds that it neglected "the central importance of building durable technological capabilities".[107] Not only was government spending on R & D cut back, but "by privatising high-technology producers (mainly in aerospace) and users (utilities) the government lessened, by choice, its direct influence over technological decisions". Its acquiescence in the sale of Inmos and ICL to non-British companies reflected "a growing reluctance to play a part in identifying and supporting the technologies that may have strategic value, whether in terms of supply security or their potential economic importance in the future". These arguments carried no weight with the Thatcher government.

After Mrs Thatcher resigned in 1990 – the Conservatives remained in office, led by John Major, until 1997 – there was a brief renaissance of industrial policy when one of Mrs Thatcher's fiercest critics, Michael Heseltine, was put in charge of the Department of Trade and Industry. Heseltine, an admirer of what he saw as Japanese industrial policy, sought to rebuild that department as a driver of industrial modernisation; his role, as he saw it, was to "help British industry to win". However, although the DTI strengthened its links with industry and introduced some new support schemes the amounts of money involved were small. Heseltine's period at the DTI did not represent a significant departure from Thatcherite policies.

More surprisingly, the Labour government which took office in 1997 did not reverse Mrs Thatcher's reforms. By this time the Labour Party, thanks to Tony Blair and Gordon Brown, had shed its traditional aversion to markets. "New Labour" had no intention of recreating the National Enterprise Board, still less of taking major industries into public ownership. In a White Paper published in 1998 the government declared that it would not resort to the interventionist policies of the past. "In the industrial policy-making of the 1960s and 1970s, to be modern meant believing in planning. Now, meeting the requirements of the knowledge-driven economy means making markets work better".[108]

The need to catch up with the US had been part of the rationale for the creation of large industrial groups in the 1960s and 1970s. Now the emphasis was on horizontal policies – improving the supply of finance for entrepreneurs, providing tax incentives for research and development, encouraging investment in training – rather than support for individual firms. There was also a greater emphasis on competition. The 1998 Competition Act gave the authorities stronger powers to root out anti-competitive practices, with heavier penalties for companies found guilty of breaking the rules; competition policy was tightened further in the 2002 Enterprise Act. Labour also built on what the Conservatives had done in deregulating the public utilities; in the telecommunications, the Communications Act of 2003 made it easier for new entrants to challenge the incumbent.[109]

Did this mean that competition policy had taken precedence over industrial policy? The Labour government wanted to encourage high-value-added sectors of industry, and this involved some support for particular sectors - for example, biotechnology – but on a modest scale. Technology policy mostly took the form of horizontal measures, including the introduction of a tax credit for research and development and an increase in the science budget. To the dismay of some business leaders, there was no attempt to slow down the shift of employment from manufacturing to services; indeed, the shift accelerated during Labour's period in office. The government also continued to welcome inward investment, even if it led to major industrial companies passing into foreign control.[110]

An example of Labour's hands-off stance – and one which highlights the difference between the French and British approach to industrial policy – was the demise of GEC. Created by the IRC-influenced mergers of the late 1960s, this company had been built up by its long-serving managing director, Lord Weinstock, into one of the country's largest and most profitable industrial groups. In 1996, when Weinstock retired, it had three main businesses: power engineering, which since 1989 had been part of a joint venture, known as GEC-Alsthom, with the French company, CGE; telecommunications equipment, in which Siemens had a 40 per cent stake; and defence electronics, which was wholly owned by GEC. Weinstock's successors took the view that GEC was too diversified and should concentrate on the business which seemed to have the best growth prospects, telecommunications. Between 1998 and 2001 the company divested defence electronics; floated GEC-Alsthom as an independent company (it was renamed Alstom); bought Siemens's 40 per cent stake in the telecommunications company and acquired, at a high price, two telecommunications equipment suppliers in the US. The name of the company was changed to Marconi to signal its new vocation.

The US acquisitions were justified on the grounds that the demand for telecommunications services, driven by the internet, would continue to increase at a rapid rate. This was a period of euphoria about the "new economy", with shares in internet and telecommunications companies being driven to extravagant heights on European and American stock markets. When the boom collapsed in 2000, Marconi was in a difficult situation. For the next few years

it tried to resuscitate its telecommunications business, but without success. The final blow came in 2005 when BT (the new name for British Telecom), which had been one of GEC's biggest customers, excluded Marconi from a large contract for the modernisation of the British telecommunications network; all the orders went to non-British firms. A few months later what was left of Marconi was bought by Ericsson of Sweden.

The British side of Alstom, the Anglo-French power engineering company, had also been losing ground, partly because of a dearth of orders from British electricity companies. Alstom itself ran into a serious crisis in 2002, and would not have survived as an independent company had it not been rescued by the French government. Thanks to this support, Alstom survived the crisis and continues to be an international player both in power engineering and in railway equipment. Its former British partner, GEC, no longer exists. [111]

It is doubtful whether the British government could have done anything to save GEC even if it had wished to do so, but some observers in the UK saw this episode as another example of the apparent indifference of successive governments to the demise of some of the country's important industrial companies. Yet calls for a French-style industrial policy were ignored by Labour, as they had been by the Conservatives before 1997. The case for persisting with a market-based, non-interventionist approach to industrial change was strengthened by the fact that, since these policies had been adopted, British economic performance had improved. As an American study pointed out, "the evidence shows that the United Kingdom made greater market reforms than most other advanced countries (in the 1980s and 1990s); arrested the nearly century-long trend of economic decline relative to its historic competitors, Germany and France; and improved the place of the United Kingdom in the economic league tables".[112] A later paper noted that by 2007, shortly before the financial crisis, GDP per head in the UK was just above French and German levels. The biggest single reason for the improvement in performance, according to the author, was the replacement of the pre-1980 policies of protection by a new emphasis on competition.[113]

What was also true was that, since the 1980s, the structure of the economy had evolved in a different way from that of comparable European countries, with a faster decline in manufacturing than, for example, in Germany and a greater reliance on financial and other business services as a source of employment and of foreign earnings. A positive view of these developments was that the UK was shifting resources into activities where it had a competitive advantage. But could services, especially tradable services, grow fast enough to offset the continuing decline of manufacturing? Anxieties on this score, already apparent before the financial crisis, were intensified by the events of 2008 and 2009. The issue that then came to the fore was whether the economy needed to be "rebalanced", and, if so, whether there might be a role for industrial policy.

3.2. FRANCE

In France the 1981 elections brought into power a left-wing government, led by François Mitterrand, whose approach to industrial policy, and to the management of the economy as a whole, could not have been more different from that of the Thatcher government in the UK. Its first step was to set in train a programme of "redistributive Keynesianism"[114] - reflating the economy through increased government spending, new measures to create jobs for the unemployed and more generous benefits for low-income families. Then came a sweeping programme of nationalisation, which gave the government full control of thirteen of the country's twenty largest industrial companies, including CGE, Thomson, Rhône-Poulenc

and St Gobain, and a majority stake in several others. The plan was to use the state sector as *le fer de lance*, a means of strengthening the ability of French companies to compete in international markets. Detailed plans were drawn up for individual industries; in the case of electronics no less than eleven branches of the industry were identified as worthy of support, including not only computers and semiconductors, but TV sets, industrial automation, scientific instruments and medical electronics. [115] This was *la politique de filière*, aimed at strengthening the selected industries at all stages in the value chain – much more ambitious than Giscard's *politique des crénaux*.

Nationalisation allowed the government to inject much-needed new capital into companies which had been weakened by the recession.[116] The authorities were also able to bring about some asset swaps, so that the state-owned companies could focus on a narrower range of businesses. In the electrical/electronics sector, for example, Thomson ceded its telecommunications business to CGE, while taking over CGE's interests in defence electronics and electronic components. St Gobain was required to abandon its newly acquired interests in computers and semiconductors and to return to its traditional activities. Rhône-Poulenc withdrew from petrochemicals and acquired additional businesses in pharmaceuticals and fine chemicals.

At a time when the world economy was still recovering from the second oil shock, Mitterrand's dash for growth in 1981-82 was risky, and it was not long before the French economy began to suffer strains. The balance of payments went into deficit, the franc came under pressure in the foreign exchange markets, and inflation increased. In 1983 Mitterrand was forced to make a historic U-turn in the direction of financial orthodoxy. As Jonah Levy has written, "a leftist administration that had been elected just two years earlier on a campaign to intensify *dirigisme* began instead to dismantle *dirigisme*."[117]

The decisions taken in 1983 marked the start of a reorientation of French industrial policy which was to be taken further by the right-wing government led by Jacques Chirac which held office between 1986 and 1988. (This was the first of several periods of "cohabitation", with the presidency in the hands of one party and the government in the hands of the other.) The new government promptly set about a privatisation programme, drawing up a list of sixty five enterprises that were to be returned to the private sector. Some of them, including CGE and St Gobain, were successfully floated, but the process was put on hold by the stock market crash of October, 1987. Only two more companies were privatised before the right-wing government lost power in the 1988 elections; in the same year Mitterrand was elected to a second presidential term.

Scarred by the experience of 1981-83, the Socialists had no intention of reviving their nationalisation programme. Instead, they pursued the so-called ni-ni policy – neither privatisation nor nationalisation – although they did allow state-owned firms to raise capital from the market in the form of non-voting shares. Both the privatised companies and those that remained in the public sector were for the most part free to develop and implement their strategies without interference from the state. Most of them opted for specialisation and internationalisation, concentrating on their stronger businesses and giving them a global dimension, often through acquisitions in the US as well as in Europe.

CGE, for example, focused on two areas: telecommunications equipment through Alcatel, and power engineering and rail transport through Alsthom. After the acquisition of Thomson's telecommunications interests in 1983, CGE's next step was what came to be known as the deal of the century, the purchase of ITT's European subsidiaries. Completed in 1987,

this purchase lifted CGE into the front rank of the world's telecommunications equipment manufacturers, not far behind A T & T in the US. In power engineering, CGE formed a 50-50 partnership with its British counterpart, GEC; GEC-Alsthom, was established in 1989. The French parent was renamed Alcatel Alsthom in 1991.

The name of the company was changed again to Alcatel in 1998 after the power engineering business was floated on the stock market. Now specialising mainly in telecommunications equipment, Alcatel continued to expand outside Europe. In 2006 it concluded one of the biggest trans-Atlantic transactions when it merged with Lucent Technologies in the US. (Lucent, previously known as Western Electric, had been the manufacturing arm of American Telephone and Telegraph, but had been hived off as a separate company in 1996.) The name was changed yet again to Alcatel-Lucent.

CGE's traditional rival, Thomson, was not included in the first wave of privatisations; its portfolio contained some loss-making businesses which would not be attractive to the private sector. Thomson made most of its money in defence electronics through CSF, but it also had stakes in electronic components and in consumer electronics. Since the Plan Calcul of the 1960s the semiconductor industry had been regarded by successive governments as strategically important, and under the Socialist administration between 1981 and 1986 Thomson's semiconductor subsidiary was given substantial support in the hope that through acquisitions and new investment it would lift its share of the world market to at least 3 per cent, regarded as the minimum necessary for viability. But Thomson's strategy, which included the takeover of an American company, Mostek, in 1986, was over-ambitious, and the semiconductor division continued to lose money. Finally, in 1987, it was put into a joint venture with an Italian state-owned component producer, SGS Microelettronica. For the French government this was "an unprecedented acceptance of the view that international market share was important enough to justify dilution of national control".[118] Over the course of the 1990s SGS Thomson Microelectronics, later renamed ST Microelectronics, established itself as a profitable merchant producer, supplying mainly application-specific integrated circuits to European customers such as Bosch in Germany and Alcatel in France. It was floated on the stock market in 1994, allowing the French and Italian governments to reduce their stakes.[119]

Thomson's consumer electronics arm, battling against intense Japanese competition, posed even more problems. Here, too, the Socialists hoped that, through acquisitions, Thomson could achieve the economies of scale that were thought to be necessary to counter Japanese domination.[120] Several takeovers were made, including Thorn's Ferguson subsidiary in the UK and RCA in the US, but at the end of the 1980s the division was still losing money. In 1991 the Socialist Prime Minister, Edith Cresson, devised a scheme whereby this business, together with Thomson's stake in SGS-Thomson, would be taken over by the non-nuclear arm of CEA, the state-owned nuclear group. The model for this bizarre scheme was Cresson's desire to create a French version of Toshiba, the Japanese conglomerate which included nuclear technology as well as TV sets in its portfolio. However, this attempt at what the French called "*meccano industriel*" was not pursued, and the consumer electronics business continued to be a drain on Thomson's finances.

The 1993 parliamentary elections brought the return of a right-wing government; this was a second period of cohabitation that lasted until 1995, when the candidate of the right, Jacques Chirac, won the presidential election. The new government announced that it would privatise twelve industrial companies that had been on the original 1986 list, including Bull, Thomson, Pechiney and Rhône-Poulenc. More controversially, it added nine new candidates,

including Renault, Aérospatiale, Snecma and the steel group Usinor Sacilor.[121]

The inclusion of Renault, which had long been a trade union stronghold, was a shock for the left, and regarded as risky by some economists.[122] The government argued that Renault's ability to participate in the alliances and acquisitions that were transforming the world motor industry would be inhibited as long as it remained wholly owned by the state; an earlier partnership with Volvo had broken down, mainly because Volvo shareholders did not want the Swedish company to become part of a group dominated by the French state. In a concession to the left the government agreed to retain majority control of Renault, at least for a period. At the time of privatisation the state held 53 per cent of the shares, reduced two years later to 46 per cent. In 1999, when Renault formed an alliance with Nissan, the government shareholding came down to below 30 per cent.[123]

The Renault/Nissan agreement was an example of the internationalisation strategies which leading French companies were pursuing during the 1990s. The break-up of Rhône-Poulenc, France's largest chemical company, was part of the same trend. After privatisation in 1993 the management chose to focus on pharmaceuticals, and it made several acquisitions in this field. In 1997 it announced that its chemical businesses would be hived off as an independent company, to be called Rhodia, while at the same time the pharmaceutical side would be merged with Hoechst in Germany; the enlarged group, Aventis, became one of the biggest pharmaceutical companies in Europe.

Not all national champions could become world leaders, and the French governments of the 1990s were willing to accept that, in some cases, the best solution for a poorly performing business might be to sell it to a foreign acquirer. Bull, no longer burdened with a global mission, was partially privatised in 1996, with some 40 per cent of the shares going to Motorola of the US and two Japanese companies, NEC and Dai Nippon Printing. Bull is now principally a supplier of IT services.

The case of Thomson was more problematic. In 1996 the government put the company, which by then had two main businesses, defence electronics and consumer electronics, up for sale. Two offers were submitted. One was from Alcatel Alsthom, which was prepared to buy both businesses, the other from Matra, which was only interested in the defence side. Under Matra's plan, consumer electronics would be sold (at a nominal price) to Daewoo of South Korea. There was fierce opposition from employees to the Daewoo deal and the sale process was aborted. The government then split Thomson into two, Thomson-CSF and Thomson Multimedia (which included consumer electronics) and both were privatised in 1999; the consumer electronics business was later sold to a Chinese company. This allowed Thomson-CSF (renamed Thales in 2000) to do what Alcatel had done in telecommunications equipment - to build a worldwide business in defence electronics. [124]

The freedom to pursue international strategies was also a factor in the government's decision to introduce private capital into the public utilities. France Telecom (successor to the Direction Générale des Télécommunications) was partially privatised in 1997, EDF in 2005; both have been active acquirers of businesses outside France. In privatising the utilities, however, France did not go as far as the UK had done. In the case of EDF, the government retained a substantial shareholding, and there was no question of breaking the electricity industry into smaller pieces and allowing those pieces to be bought by foreigners, as happened in the UK. The government also kept control of Areva (formerly Framatome), the nuclear engineering company.

These were infrastructure industries and the companies were seen as too important to be exposed to the threat of takeover. The same applied to aerospace and defence. The government retained a stake in EADS, the Franco-German group formed in 2000 by the merger between Aérospatiale and the Daimler subsidiary, DASA. It also had a minority shareholding in Thales and in Safran, the company formed by the merger between Snecma and Sagem in 2004.[125]

Even outside infrastructure and defence the ownership of large industrial companies remained a sensitive issue for the French authorities. When the privatisation programme began in 1986 the government ensured that a large minority shareholding in the privatised companies would be in the hands of a stable group of French shareholders – the *noyaux durs*. This was designed to provide protection against unwelcome takeovers. However, during the 1990s most members of the *noyaux durs* sold their shares, and the buyers were often foreign, mainly Anglo-American, investors. As the shareholder base became more widely spread, these companies became vulnerable to takeover.

The first to suffer this fate was Pechiney, the aluminium company, which was bought by Alcan in 2003, an event which caused unease in the government but was not actively opposed. In the following year Aventis, the Franco-German pharmaceutical group formed by Rhône-Poulenc and Hoechst, was the subject of a takeover offer from another French pharmaceutical company, Sanofi. The Swiss company, Novartis, then indicated that it might make a higher bid, prompting the French government to make it clear to all the parties that it would not permit control of Aventis to pass into non-French hands.

A striking example of France's concern to preserve its national champions was the Alstom affair in 2004. As noted earlier, this was the company formed by GEC and CGE and later floated on the stock market. In 1999 Alstom bought a gas turbine business from ABB, the Swiss-Swedish engineering group. ABB had won a large number of orders for this equipment in the US and elsewhere, but the performance of the gas turbines fell short of what had been promised, and it became apparent that there was a serious technical fault. By the end of 2001 Alstom was facing financial penalties from some of its US customers, and, with other parts of the group also performing poorly, there was uncertainty about whether the company could survive.

The French government observed these events with growing concern. There was no question of allowing the group to go under, yet direct assistance from the state would run into opposition from the competition authorities in Brussels. Consideration was briefly given to a break-up of the group, but in the summer of 2004 the government reached an agreement with the Commission whereby, in return for asset sales and cost reductions, the state would participate in the financial restructuring of the group. The government took a minority stake in Alstom, with the promise that the stake would be sold not later than 2008.

The Alstom rescue did not imply a general retreat from the more liberal policies which successive French governments had pursued since the 1980s. There was no longer an appetite for *grands projets*, and much of the apparatus of state intervention had been dismantled.[126] "Looking across the wealthy democracies", Jonah Levy has written, "one would be hard pressed to find any country that shifted so far from its post-war economic strategy as the France of François Mitterrand and Jacques Chirac".[127] But there were some aspects of free-market capitalism - not least the hostile takeover - about which French policy-makers were distinctly uneasy. There was also a continuing attachment to idea of the state as the protector of the nation's industrial assets. Nicolas Sarkozy, who as finance minister played a central part in the Alstom affair, frequently referred to this episode in his successful presidential

campaign in 2007. He presented himself as a stalwart defender of French industry against marauders from overseas, and determined to resist de-industrialisation. This was a theme that would figure prominently during his presidency.

3.3. GERMANY

In contrast to France and the UK, there were no drastic changes in German economic policy in the 1980s, but the economy was slow to recover from the two oil shocks and unemployment remained high. The growth rate of productivity fell far below what had been achieved in the 1960s and early 1970s, raising concerns that institutional rigidities, especially in the labour market, were holding back Germany's adjustment to industrial change. Then came unification, a hugely important political event but one that imposed heavy costs on the West German economy. After a brief post-unification boom, economic growth slowed down again and by 1997 unemployment had risen even further to 4.5m, more than 11 per cent of the workforce. There was a widely held view, inside the country and outside, that the German economy had become over-regulated, and that the earlier emphasis on competition had been weakened by the trend towards protection and subsidy; the "social" element in the social market economy had taken precedence over the "market" element.[128]

German industry was also poorly equipped to take advantage of the new technologies – especially information technology and biotechnology – which looked certain to grow faster than the mature industries such as automobiles and mechanical engineering that constituted the bulk of Germany's exports. There was an inertia in Germany, some commentators argued, which made it difficult to shift financial and human resources from traditional industries into high-technology sectors.[129]

The Ministry of Research had based its initial support for information technology on established companies such as Siemens and AEG, and this continued in the 1980s. In semiconductors, for example, Siemens was the principal recipient of government grants, but it could not match the Japanese producers in developing ever smaller and more powerful devices. With the German government's support, Siemens formed a joint venture with Philips of the Netherlands to develop the one megabit chip which would store over one million bits of information. The partnership was later extended to include the Franco-Italian group, SGS-Thomson. The existence of this partnership did not prevent Siemens from negotiating a separate licensing agreement on semiconductors with Toshiba and later with IBM. While these decisions were criticised in Germany, Siemens believed that international alliances with the world's leading producers were essential if it was to keep its technology up to date.

In computers, the 1980s saw the start of a transformation of the industry stemming from the shift from proprietary to open operating systems. Nixdorf was slow to respond to these changes and its financial performance deteriorated; it was taken over by Siemens in 1990. Siemens, for its part, had achieved some success with its mainframe computers (some of them based on Fujitsu technology) and had increased its share of the German market. Following the takeover of Nixdorf, the enlarged group – Siemens Nixdorf Information Systems – was the largest European-owned computer manufacturer, but it faced a formidable task in integrating two incompatible ranges and in adapting to the rise of the personal computer.

What Germany lacked was the flow of entrepreneurial start-up firms which had been such a source of dynamism in the US. Nixdorf had been an exception, and there were a few others such as SAP, a software firm set up by ex-IBM engineers in 1972. SAP found a profitable

niche in enterprise resource software and eventually became a major international supplier, although its growth was slower than that of Microsoft in the US. The initial public offering of SAP shares on the German stock market came in 1988, much later in its history than Microsoft's debut on NASDAQ in 1985.[130] Starting and building this sort of business was harder in Germany than in the US because of the absence of supporting institutions, including a venture capital industry that was willing to back untried entrepreneurs and a stock market that allowed early-stage investors to exit.

The same obstacles held back the biotechnology industry. This sector had been targeted by the BMFT in the 1970s and Federal support for biotechnology research increased sharply during the 1980s and 1990s, but German performance remained poor, mainly because of the absence of the specialised biotechnology companies which were driving the growth of the industry in the US. Direct intervention by the BMFT could not make up for the absence of the supportive institutions and policies which were vital to the success of the American biotechnology industry.[131]

A high-technology industry that did make progress, with the aid of generous state subsidies, was aerospace.[132] As noted earlier, a group of German aircraft manufacturers had got together to form Deutsche Airbus, which became the German partner in the Airbus consortium. In 1989 these companies, together with Dornier, were taken over by Daimler-Benz, which at that time was trying to reduce its dependence on cars and trucks by diversifying into high-technology industries. The acquisition was opposed by the Cartel Office on the grounds that it would lead to too much concentration of power, but for the Federal government – and for the Land governments which were part-owners of several of the companies – it had the attraction of putting the German aircraft industry into the hands of a large, well-financed company which should, over time, no longer need to be subsidised.

The aircraft industry was a special case, not least because it had strong political support both at the Federal and at the Land level. Other high-technology industries were still lagging, and there were some calls in Germany for a Japanese-style industrial policy, based on close cooperation between government and industry.[133] By the mid-1990s, however, the Japanese model was out of fashion as the country's economy entered a prolonged period of stagnation. Instead, attention turned to the US.

In Germany, as in other European countries, policy makers were impressed by the extraordinary success of American companies in exploiting the opportunities created by the internet. It was clear that, if Germany was to catch up with the US in the industries of the "new economy", institutional reforms were necessary, especially in the capital markets. US-style entrepreneurial start-ups were unlikely to flourish unless they had access to funds from venture capitalists, and the venture capitalists in turn needed to be able to exit their investments through a stock market flotation. Given the absence in Germany of a shareholding culture, German citizens had to be persuaded that buying shares on the stock market was a worthwhile investment.

The government took two steps in the second half of the 1990s to promote greater interest in equity. One was the privatisation of Deutsche Telekom in 1996. The other was the establishment in 1997 of the Neuer Markt, a new trading arm within the Frankfurt Stock exchange which was specifically designed to attract young firms that needed equity finance.

The first of these was in part a response to the European Commission moves to liberalise the European telecommunications market. Privatisation was "an important step in converting

a government-run telephone monopoly into a nimble competitor in the emerging European and world telecommunications market". [134] As a shareholder-owned company Deutsche Telekom would have greater freedom to acquire, or make alliances with, overseas telecommunications companies. But privatisation of a large, high-profile company was also a means of encouraging wider share ownership. The flotation of Deutsche Telekom was the largest-ever initial public offering of a European company. Nearly 2m Germans subscribed to the offer, including 400,000 who had never previously owned shares.

The Neuer Markt was intended to match some of the features of Nasdaq in the US, with more liberal listing rules so as to allow young companies, even if loss-making, to obtain a public quotation. The market got off to a slow start – only twelve IPOs took place in 1997 – but the momentum increased as a few high-flyers, such as Mobilcom, a mobile telecommunications company, attracted investor interest. In 1999, when the boom was at its height, more than 130 new companies were floated.[135]

Other initiatives were taken during this period to improve the environment for high-technology start-ups. In 1995 the Ministry of Research launched the BioRegio competition, the purpose of which was "to encourage local biotech communities to interact more closely, to create an entrepreneurial spirit among scientists and to help them in the setting up of their own businesses".[136] The aim was to enable Germany's lagging biotechnology industry to overtake its British counterpart and to become the leader in Europe.

One commentator, writing in early 2000, hailed these moves as an example of a new type of technology policy. "The unexpected has happened. The federal government has assumed a leadership role, and is responsible for the turnaround in biotech and venture capital".[137] There was certainly a remarkable surge in the creation of new biotechnology companies, but the collapse of the stock market boom exposed the frailty of some of these firms, which had vastly inflated their profit expectations. Although all stock exchanges were hit by the share price collapse, the Neuer Markt suffered most; it was closed at the end of 2002.

A sober review of the German biotechnology industry, written in 2003, noted that the "maturation process of the German biotechnology industry has been abruptly stopped"; most German companies lacked the critical mass for sustainability.[138] Although some biotechnology firms survived the crash and established themselves as viable concerns, the growth of the industry during the 2000s has been disappointingly slow, as it has been in other European countries.[139]

For some German observers the collapse of the Neuer Markt came about because the German business system did not lend itself to the kind of high-risk, high-reward form of capitalism that flourished in the US. The late 1990s, according to this view, were something of an aberration. "Prior to 1997, Germany was located in a conventional company equilibrium in which both investors and employees had a low-risk profile. In the late 1990s there was a significant increase in the amount of risk capital. The surge in high-tech IPOs on the Neuer Markt was attributable to this brief surge in the availability of risk capital. Since 2001, however, the supply of risk capital has reverted to levels corresponding more to the norms of the 1980s and first part of the 1990s".[140]

Even if this judgement is correct, the rationale that lay behind the flotation of Deutsche Telekom and the creation of the Neuer Markt remained valid. The German business system needed to move at least some of the way towards the American model and to provide a more conducive environment for start-up firms. It was no longer enough to rely on giants such as

Siemens, Bayer and Daimler-Benz; some way had to be found of injecting greater entrepreneurial vitality into German industry.

Meanwhile some of those giants were becoming increasingly reluctant to devote large sums of their own money to high-technology businesses which showed no prospect of earning an adequate return. This was in part the consequence of a change in German share ownership. During the 1990s, as in the French case discussed earlier, foreign investors, mostly American and British financial institutions, became significant shareholders in large German companies. This coincided with a loosening of ties between companies and their banks, and a partial unwinding of the cross-shareholdings which had effectively insulated companies from shareholder pressure.[141] Managers found themselves dealing with investors who were primarily interested in shareholder value – a concept that had previously been almost unknown in German industry. Anglo-American shareholders were particularly critical of diversified groups which were subsidising bad businesses out of profits made in good ones.

Siemens was one such group, and it was attacked by investment analysts for sticking too long with loss-making businesses. The company had invested in semiconductors in the belief that as a large producer of computers and other electronics-based equipment it would be at a competitive disadvantage if it did not have an in-house source of semiconductors. But the semiconductor business was not profitable. As an analyst in a British investment bank noted in 1991, "by taking on the Japanese head-on in memories the semiconductor division has become and remains a painful example of how the Siemens style of running a business can leave the group with a burden no competitor would countenance". [142] This analyst was also doubtful about Siemens Nixdorf, the computer business, which had a strong position in Germany but little presence elsewhere. Although Siemens continued to invest in both these sectors during the 1990s, at the end of the decade it decided to pull back. The semiconductor division was divested as a separately quoted company (Infineon) and Siemens Nixdorf was put into a joint venture with Fujitsu. [143]

The restructuring of Siemens was one of several cases where German companies divested poorly performing subsidiaries, and part of the motivation was to make themselves more attractive to non-German investors.[144] A partial Americanisation of German business was under way.[145] But the other much-admired feature of the US business system – fast-growing entrepreneurial firms in high-technology industries – was still lacking.

In a report on the German economy published in 2004 the OECD noted that the number of new entrants in high technology was relatively low in Germany. "The closure of the Neuer Markt stock exchange segment for young technology firms in 2003 was a blow to the venture capital industry as the Neuer Markt provided about 75 per cent of the initial public offerings for VC-backed firms between 1998 and 2000". Similar points were made in a later European Commission study, which argued that Germany's innovative capacity needed to be reinforced. The main weakness, according to this study, was that innovation appeared to be concentrated in a relatively small number of large companies and geared towards rationalisation and cost reduction rather than developing and introducing new products. "Small- and medium-sized companies clearly lag behind the industrial leaders and their position has apparently weakened over time. It is they who are most constrained in their access to venture capital, especially since the Neuer Markt had been closed".[146]

In response to these concerns the Ministry of Education and Research introduced in 2006 a new "high-tech strategy". Described as "the first national strategy to show how Germany can become and remain a global leader in the most important cutting-edge technologies", it was

accompanied by an increase in government support for R & D. The government also set up an expert commission on science and innovation to assess Germany's progress and to make recommendations for policy changes. In its first report, published in 2008, the commission drew attention to the country's continuing lag in new technologies.[147] "The driving force for radically new forms of value creation is provided by new enterprises. However in Germany there are no signs of a drive to start up new companies in cutting-edge technologies and knowledge-intensive services".

3.4. INDUSTRIAL POLICY AT THE EUROPEAN LEVEL

The 1980s saw two initiatives at the European level aimed at improving European industrial performance. One was what became known as the European Strategic Programme for Research in Information Technologies (ESPRIT). The other was the Single Market Programme, an attempt to create an integrated European market by removing the remaining obstacles to the cross-border movement of goods, capital and people.

The starting-point for ESPRIT was the dialogue that began in 1980 between Étienne Davignon, Commissioner for Industry, and the heads of Europe's leading computer and telecommunications equipment manufacturers.[148] Agreement was soon reached on a pilot phase, consisting of a range of projects that would be funded jointly by industry and the Commission; the first call for responses in 1983 prompted applications from two hundred companies, including many small- and medium-sized firms. Work then began on a five-year ESPRIT programme, to run from 1984 to 1988. The focus was on pre-competitive research, ensuring that the participants would not contravene the Community's rules on competition.

Part of the rationale for ESPRIT was the belief that collaborative research, bringing together companies, universities and research institutes across Europe, would improve the quantity and quality of European research and help European industry catch up with its Japanese and American competitors. "European policy makers had allowed themselves to become convinced that the Japanese had become so successful in microelectronics because the Ministry of International Trade and Industry (MITI) had engineered the coordination of government, industry and universities to be innovative in microelectronics. Indeed when ESPRIT was launched the Commission had grand ambitions to be the European MITI".[149]

The immediate spur for ESPRIT, as it was for Alvey in the UK, was Japan's Fifth Generation Computer programme, announced by MITI in 1981 and aimed at enabling Japanese computer manufacturers to overtake IBM in the next generation of computer technology.[150] The contribution of collaborative research to Japanese competitiveness was almost certainly exaggerated[151], but in the early 1980s Japan was riding high and Japanese electronics companies looked set to dominate the world market.

ESPRIT was followed by other collaborative programmes, including RACE (Research into Advanced Communications for Europe) and BRITE (Basic Research in Industrial Technologies for Europe[152]), and all these activities were brought together in what was called the Framework Programme. The first Framework Programme ran from 1984 to 1987, and it has continued to be the European Commission's principal instrument for channelling funds into collaborative research.[153]

A further step towards cooperation came in 1985 when President Mitterrand of France proposed the creation of a European Research Coordinating Agency, later known as Eureka.

The trigger was the announcement by President Reagan of the Strategic Defence Initiative, an ambitious plan to create a defensive shield against incoming missiles. While many in Europe doubted the technical feasibility of the so-called Star Wars programme, it was recognised that SDI would fund vast amounts of research in technologies that had commercial applications.[154] Whatever the outcome of SDI in terms of defence, the programme was likely to strengthen America's high-technology industries and make it even harder for European companies to catch up.

Eureka was a French initiative, and the initial reaction in the UK and Germany was sceptical. But industrialists in these countries recognised that Eureka, an inter-governmental programme outside the control of the European Commission, might have some advantages; companies could decide whether or not to take part as they wished, and Eureka might usefully supplement national R & D programmes. Eureka projects would also be nearer the market than the pre-competitive research supported by the European Commission. By 1989 nearly 300 Eureka projects were under way, of which about a quarter related to information technology and another 20 per cent to biotechnology and medical technologies. Two of the biggest programmes were the HDTV scheme, designed to establish a European standard for high-definition broadcasting, and JESSI (Joint European Submicron Silicon Initiative) aimed at supporting the development of advanced semiconductors.

As these programmes were taking shape, another initiative, with greater importance for the future of Europe, was under way. Despite the lowering of tariffs that had followed the creation of the Common Market in 1958, there were still numerous non-tariff barriers that prevented companies from competing on a trans-European basis. The removal of these barriers, and the promotion of open competition in sectors which had previously been protected by governments, were seen as essential steps towards re-energising European industry. This was in line with the reforms that were being undertaken by the Thatcher government, and the UK provided much of the impetus that led to the Single European Act in 1986. That Act, the most important step towards European economic integration since the Treaty of Rome, has been described as "Mrs Thatcher's baby".[155] It contained nearly 300 specific measures covering such areas as preferential public procurement and the provision of state aids, with the overriding objective of allowing markets to work more freely.

The architects of the Act believed that it would produce "a dramatically new environment" for consumers and producers alike.[156] The gains would come in four main areas: reductions in costs thanks to economies of scale; improved efficiency within companies, with prices moving downward toward production costs under the pressure of more competition; the reallocation of resources among European countries in response to differences in comparative advantage; and more innovation, generated by the dynamics of the internal market.

These ambitions were only partially fulfilled. Competitive pressure certainly increased, and several companies sought to break out of what were no longer safe domestic havens by merging with or acquiring firms in other parts of Europe. Tighter rules on subsidies prevented governments from cosseting their national champions. In public utility industries such as telecommunications, the Commission forced governments to open up their markets to new entrants and to establish independent regulators charged with ensuring that the former incumbents did not abuse their market power; most European governments, following the lead set by the UK, privatised their telecommunications operators during the 1990s.

One of the biggest successes for the single market programme came in mobile telephony. When mobile telephones were first introduced, using analogue technology, the European

market was fragmented by incompatible national standards. For the next generation of telephones, based on digital technology, the European Commission secured the agreement of member states to establish a Europe-wide standard, known as GSM, which allowed network providers and manufacturers of equipment to compete on a European basis. "The GSM standard put in place a standard for a market – a market that was large enough for leading continental players to achieve the scale necessary to compete globally. Thus, public policy was not protectionism in disguise but rather 'market-creating' in the sense that it established a large enough single market to enable European (as it turned out the winners were Scandinavian, but this was not pre-ordained) to reach scale and be competitive in global markets".[157] The success of GSM showed that the creation of a barrier-free internal market could boost the competitiveness of European industry and provide consumers with better products and services.[158]

Yet the impact of the 1992 programme was not as extensive as its proponents had hoped.[159] Although the number of cross-border mergers and acquisitions increased, the structure of European industry in the mid-1990s was not very different from what it had been ten years earlier. As a later study by the European Commission remarked, "in the wake of the Single European Market the extent of structural change appears to have been somewhat disappointingly slow".[160] There was disappointment, too, over the results of technological collaboration. Although the ESPRIT programmes continued to be supported by governments and companies, they were not translated into greater commercial success. This was also true of Eureka. The biggest of the Eureka programmes, which was also supported by the Commission, was the HDTV project. Pushed by TV set manufacturers such as Philips and Thomson, the plan was to establish a European standard (known as MAC) for satellite broadcasting and thus to prevent the imposition of a Japanese standard that would make existing TV sets obsolete. But the project was dogged by disagreements between broadcasters and TV set manufacturers. By the early 1990s the MAC standard was effectively made redundant by technological advances in the US, leading to the adoption of a fully digital broadcasting system.[161] The JESSI semiconductor project, which ran from 1989 to 1996, was more successful, although two of the three principal participants, Siemens and Philips, later pulled out of the semiconductor business.[162]

Inter-company collaboration on the Japanese model, it seemed, whether in pre-competitive research or closer to the market, could not do much to upgrade Europe's position in high-technology industries. By the early 1990s targeted industrial policy of the sort that had been practised in Japan was out of fashion. In a paper published in 1992 the Commission set out an approach that was almost Thatcherite in tone. "In the 1970s industrial policy was characterised by a dirigiste and sectoral approach. Today it is recognised that public interventions in this area must take the form of horizontal activities to achieve the right climate and balance for maximising the productivity and competitiveness of European industry".[163]

In this context the appropriate model was no longer Japan but the US. As noted in earlier sections, American leadership in the "new economy" prompted European governments to look for ways of reshaping their institutions along American lines. The aim of the Lisbon agenda, adopted by member states in 2000, was to make the European Union "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion". This was to be achieved by action on several fronts: boosting innovation and investment in R & D; faster structural reform by completing the internal market, especially in services; making the labour market more flexible, with the goal of achieving a 70 per cent employment rate (compared to the

current figure of 63 per cent); and sound macroeconomic policies.

The success of the Lisbon programme hinged on the response from national governments, but the commitment of member states turned out to be less than wholehearted. In 2002 a high-level group of economists set up by the Commission and led by André Sapir reported that "substantive outcomes (from the Lisbon process) are so far meagre". The main recommendation of the Sapir report was that that the European Union needed to go faster and further in liberalising the economy. "What is needed now is less vertically integrated firms, greater mobility within and across firms, more retraining, greater flexibility of labour markets, greater availability of external finance, especially equity finance, and higher investment in both R & D and higher education. In other words, what is required is a massive change in economic institutions and organisations, which has not yet occurred on a large scale in Europe."[164]

A later review for the Commission, chaired by Wim Kok, concluded that the failure of Lisbon was due to an overloaded agenda, poor coordination, conflicting priorities and, above all, the lack of determined political action.[165] Europe's problem, according to the Kok report, was partly due to a slowdown in the rate of technological progress, especially in information and communications technologies; there was insufficient investment in R & D and "an indifferent capacity to transform research into marketable products and processes". The Kok report was followed by a relaunch of the Lisbon strategy. The number of priority areas was reduced and the division of responsibilities between the Commission and national governments was made clearer.

Despite these changes there was little evidence in the years leading up to the financial crisis that the reforms set out in the Sapir and Kok reports were being carried through. In particular, the failure to implement the Commission's services directive, which had been seen as a cornerstone of the Lisbon strategy, reflected the lukewarm attitude on the part of some member states towards genuine Europe-wide competition.

3.5. EUROPEAN INDUSTRY BEFORE THE FINANCIAL CRISIS

The shift away from government intervention in the 1980s and 1990s, together with the increase in competitive pressure arising from more open markets and more demanding investors, improved the efficiency of European industry and to some extent corrected the errors caused by ill-judged industrial policies in the 1960s and 1970s. But there were two grounds for concern. The first was the widening productivity gap between the US and Europe which had first become evident in the mid-1990s; after rising to 94 per cent of the US level in 1995, GDP per hour worked in Europe fell back to 85 per cent in 2003.[166] The second was the accelerating transfer of manufacturing capacity, not just in labour-intensive sectors but also in electronics and other high-technology industries, to China and other emerging markets. In Europe, as in other advanced countries, the decline of manufacturing as a proportion of GDP had been under way for some years, but the assumption had been that these countries would retain a sizeable manufacturing sector, concentrating on high-value-added, knowledge-intensive goods which China would be unable to match. With China investing heavily in research and moving up the value chain, that assumption was looking more questionable.

The two issues were related since Europe's lag in productivity was partly due to its failure to keep pace with the US in the production and use of information technology, and that in turn was linked to Europe's over-dependence on older industries. Europe's industrial struc-

ture, it seemed, was not only holding back productivity growth, but also making it difficult for Europe to adapt to the changing international division of labour. The fact that so much of Europe's trade was concentrated in sectors with medium-high technologies and low-to-intermediate labour skills exposed European countries to competition from producers in emerging countries that were upgrading the skill intensity of their exports. "Adaptability and structural change, allowing a more robust situation of comparative advantage, are critically needed if the EU is to maximise the gains from the integration of China, India and other fast growing economies into the world economy".[167]

These were the considerations which, before the financial crisis, were prompting some European governments and the European Commission to undertake a reappraisal of industrial policy. Was it enough to rely on the market to generate the structural changes that were needed, or should governments be more active in steering European companies into industries that were likely to be both high-growth and defensible against low-wage competition?

4. THE CRISIS AND ITS CONSEQUENCES: A REVIVAL OF INDUSTRIAL POLICY?

THE SEVERE RECESSION that followed the banking crisis prompted government intervention on an unprecedented scale. Some of the most spectacular moves came, surprisingly, from the US. In a decision reminiscent of the rescue of British Leyland in the mid-1970s, the Obama Administration provided financial support to two of the country's largest car manufacturers, General Motors and Chrysler, in order to prevent their collapse.[168] As with British Leyland, General Motors' problems were largely self-inflicted – it had been losing ground to Japanese and other foreign manufacturers for many years – but the Obama administration was prepared to override the market in order to preserve an American-owned company because of its importance as an employer.

Employment had also been falling in other parts of the manufacturing sector, not because of mismanagement, but because American companies were moving part of their production to countries where labour costs were lower. Offshoring was not a new phenomenon – in labour-intensive industries such as textiles and clothing it had begun many years earlier – but it was spreading to industries such as electronics and affecting the higher-value parts of the production chain. Two economists, Gary Pisano and Willy Shih, writing in the Harvard Business Review, pointed out that outsourcing in electronics had not stopped with low-value tasks like simple assembly or circuit-board stuffing, but had also affected "sophisticated engineering and manufacturing capabilities in a wide range of products", such as light-emitting diodes, batteries for electric cars and flat panel displays for TVs, computers and hand-held devices.[169] They urged the government to reverse the slide in the funding of basic and applied science and to focus resources on "grand challenge problems" such as climate change where collaboration between the public sector, companies and universities could create new industrial opportunities.

This article provoked a lengthy debate in which some economists argued that Pisano and Shih were too pessimistic. David Yoffie, an influential writer on technology, suggested that the loss of manufacturing capacity in a high-cost country like the US was inevitable and should not be a cause for concern. "The future of US competitiveness in high-tech industries such as computers, software, communications and electronics may depend more on the transition to services than trying to retain the country's manufacturing base". Yet the Pisano-Shih line was supported by several business leaders, including Andrew Grove, former head of Intel, and Andrew Liveris, chief executive of Dow Chemical Company.[170]

The same theme was taken up by Michael Spence, a Nobel prize-winning economist. Spence argued that persistently high unemployment in the US was due in part to the disappearance of manufacturing jobs and that this trend must be reversed.[171] There was not enough incentive for US companies to invest in techniques that enhanced labour productivity in the tradable sectors of the economy. This was not a market failure in the conventional economic sense, Spencer suggested, but it had to be countered by new investment in advanced technologies with public support.

Among European countries France is the one where the deindustrialisation debate has been running most strongly.[172] During his second term as President of the Republic, Jacques Chirac invited Jean-Louis Beffa, the head of St Gobain, to make proposals for a new industrial policy which would ensure that France did not fall behind in the industries of the future. Beffa was asked to examine in which sectors and by what methods France could set in train "*une relance ambitieuse des grands programmes scientifiques et technologiques*" - an echo of the *grands projets* of the past. In his report Beffa called for "mobilising programmes" targeted at large risky projects which needed a state contribution for their financing.[173] These projects would be run by a new agency, Agence de l'innovation industrielle (AII), and would be focused on five main areas: energy, transport, environment, health and information technology.

The new agency was set up in 2005 with a budget of □2bn, and over the next two years some twenty projects were started, most of them jointly financed with French or European companies. One of the first was Quaero, an attempt to create a search engine that would compete with Google in the US. Thomson and France Telecom were the prime movers in this venture, in which German companies also agreed to participate, but it made little progress and the Germans subsequently withdrew. AII was subsequently closed down, after Chirac had left office, and its functions transferred to another government agency, OSEO, which had a wider responsibility for supporting innovation in small- and medium-sized firms.[174]

Another French initiative during the Chirac presidency was the creation of *pôles de compétitivité*, or competitiveness clusters, loosely based on the Silicon Valley model. The idea was to bring together in a particular region firms, research centres and training and education facilities belonging to the same industrial sector, and to encourage them to work together on innovative projects. Some 67 clusters were selected, covering a variety of fields including low-technology industries as well as advanced sectors such as nanotechnology and biotechnology. This programme has been criticised on the grounds that the number of clusters was too large, and that public sector officials were ill equipped to identify the sectors and regions that deserved support.[175]

When Nicolas Sarkozy took over the presidency in 2007, he had already established a reputation as a defender of French industry. His immediate task when the financial crisis hit was to rescue the banks, and this was followed by the provision of low-interest loans to the French car manufacturers to prevent plant closures, together with an incentive scheme to encourage car buyers to replace old models with newer, fuel-efficient vehicles. Sarkozy was also concerned to prevent French companies which had been weakened by the recession from being snapped up by foreign predators. "I will not be the French President", he said in 2008, "who wakes up in six months' time to see that French industrial groups have passed into other hands".[176]

In 2008 President Sarkozy announced the establishment of a Strategic Investment Fund, with a remit to take minority stakes in French companies with high growth potential which needed additional capital. In its first full year of operation the fund made investments total-

ling □1.2bn in twenty-one companies, including Meccano, the toy manufacturer, and Daily Motion, an internet start-up. Critics of the fund were relieved that the fund was not used to rescue "lame ducks". Its operations were for the most part similar to those of a private equity group, but with a strong orientation towards preserving French ownership; in at least one case, when one of the companies in which it had invested was put up for sale, the Fund used its votes to ensure that the buyer was French, despite higher offers from non-French companies.[177]

As Sarkozy explained in a later speech, he was determined to use the power of the state to resist de-industrialisation and to strengthen France's position in key industries, just as his predecessors had done. Where the government was a shareholder in an industrial enterprise such as Renault, it should use its influence to ensure that the company's strategic decisions were in the best interests of the country; it was not acceptable, Sarkozy said, that the privately-owned Peugeot had two thirds of its worldwide employees in France, while Renault had only one third.

How far Sarkozy could go in the direction of interventionist policies was constrained both by budgetary pressures and by European Union rules on state aids; there was no question of reverting to old-style French *dirigisme*.[178] Nevertheless, his activism helped to spark a renewed interest in industrial policy in other European countries, not least the UK

Some British business leaders were increasingly unhappy with the laissez-faire approach towards industrial policy which had been followed by successive governments. In a widely noted speech Sir John Rose, chief executive of Rolls-Royce, the aero-engine manufacturer, deplored the loss of expertise in such industries as railways, power generation and nuclear power, comparing the continued success of French and German companies like Siemens and Areva with the virtual disappearance of their British counterparts. He urged the government to develop a clearer sense of direction for industry. "We need", he said, "a framework, or a business route map, to create context, drive focus and help prioritise public and private sector investment. Unfortunately the fear of returning to anything that remotely resembles centralised industrial planning has resulted in even the discussion of such a framework being off limits".[179]

Sir John's remarks appeared to have little impact on government policy; Labour was sticking to the non-interventionist stance which it had inherited from Margaret Thatcher. Towards the end of the government's term, however, there were signs of a change in thinking. Peter Mandelson, who was brought back to the government in 2008 as Business Secretary, believed that the UK had allowed itself to become too dependent on financial services. Drawing on advice from Rose and other industrialists, he looked for ways of rebalancing the economy, but not by means of old-style intervention. Government needed to help in those areas where businesses "would not or could not take the lead because market signals or incentives were not strong enough".[180] In several speeches and interviews he referred admiringly to the French government's industrial policy, suggesting that the UK could learn from the way the French government took care of high-technology companies.[181] This was warmly welcomed by the Trades Union Congress, which argued that what Sarkozy was doing through the Strategic Investment Fund should be imitated in the UK.[182]

In a White Paper published in 2009, Mandelson called for a "new activism" on the part of government to help business exploit the opportunities that were becoming available, especially in advanced technologies.[183] The government should be willing to consider "targeted intervention" where clear gains could be achieved. In a review of policy published shortly

before the 2010 election, the government reported several examples of sectoral intervention, some of which were directed at individual companies (for example, a grant to Nissan to support a new battery plant and the manufacture of a new electric car) while others were concerned with advanced technologies, including composite materials, plastic electronics and industrial biotechnology.[184]

When the Conservative-Liberal coalition government was formed after the 2010 election some of these grants were withdrawn. The new Business Secretary, Vince Cable, said he had no intention of "trying to micro-manage the economy at the level of individual companies or so-called national champions".[185] On the other hand, he shared Peter Mandelson's view that the manufacturing sector had declined too far and needed to be revived. "Supporting the industries of the future", he said in a later speech, "requires addressing some of the market failures involved". One such failure was in the innovation phase of new technologies, hence the decision to establish a network of Technology Innovation Centres, loosely based on the Fraunhofer model in Germany. The government also set up a Regional Growth Fund to provide limited amounts of seed capital as a catalyst for new investment by the private sector, especially in areas of the country where there had been a historic reliance on the public sector for jobs. With these and other supportive policies in place, Cable was confident "that world-class manufacturing will once again be at the heart of our economy".[186]

Least affected by worries about de-industrialisation was Germany. Thanks in part to labour market reforms and cuts in welfare expenditure carried out between 2003 and 2007, it had come through the financial crisis in relatively good shape. Germany also benefited to a greater extent than the UK or France from the booming demand in China for the capital equipment and other industrial goods in which German industry was especially strong. There was some anxiety in Germany about the continuing failure to match the US in high-technology industries, but no major new initiatives seemed likely beyond the strategy set out by the Ministry of Research and Education in 2006, subsequently revised and relabelled as the High-Tech Strategy 2020.

As for the European Commission, the relaunch of the Lisbon agenda in 2005 was followed by several initiatives aimed at encouraging European industry to exploit new technological opportunities. Although the Commission supported some expensive projects such as Galileo, the satellite navigation programme, and Iter, the nuclear fusion reactor, much of its activity was devoted to improving the environment for entrepreneurial firms in high-technology industries. Two particular areas of attention was the absence of a unitary patent in Europe, which increased the cost of protecting intellectual property compared to the US, and public procurement.

The Commission continued to support collaborative research, launching a series of Joint Technology Initiatives in such fields as innovative medicines, computing systems (the Artemis project) and nanoelectronics; all these were joint ventures between the Commission and the relevant industrial sector. The Commission also launched a "lead market" initiative, identifying markets which had high growth potential and in which European companies were well placed to compete. The first six were eHealth, protective textiles, sustainable construction, recycling, bio-based products and renewable energy.[187]

Some of these programmes were brought together in a revised version of the Lisbon strategy which was launched in 2010. Known as Europe 2020, it was made up of several "flagship initiatives", one of which was "an integrated industrial policy for the globalisation era". As with the Lisbon agenda, the main goal was to improve the framework conditions for European

business in a way that would be more conducive to innovation. But it was recognised that general policies – for example, in the area of standardisation or patents – affected different sectors in different ways, and that industrial policy was more likely to be effective if it took account of these sectoral differences. This has been described as the matrix approach, based on an understanding "that the effects of broad horizontal measures can vary significantly from industry to industry, that competitiveness needs specific policy mixes for specific sectors, and that some sectors may require complementary measures that are not necessary or relevant in other sectors".[188]

Whether Europe 2020 will be more successful than Lisbon will depend much more on decisions taken in member states than on the activities of the Commission itself. As things stood at the end of 2011, when this paper was written, European governments were too preoccupied with the future of the euro and the weakness of the financial sector to devote much attention to industrial policy. But the issue of industrial competitiveness, and what governments could do to enhance it, remained a matter of pressing concern, both in Brussels and in national capitals.

5. CONCLUSION

The events described in this paper throw up some clear lessons about what governments should not do in the field of industrial policy. What they should do is a more difficult question to answer.

Most of the errors relate to the first phase, between the 1950s and 1980s, although some of them were still being committed in the second. They stemmed from an exaggerated belief in the ability of governments to identify and correct market failures, and the consequent tendency to substitute the judgement of politicians and bureaucrats for that of entrepreneurs and business managers. There was also a failure to recognise that medium-sized European nations could not realistically expect to compete in all major industries and technologies. Attempts to create competitive advantage through government direction and support were generally unsuccessful, while intervention in distressed industries, to arrest the decline or to make it less painful for employees, served little purpose other than to delay the shift of resources to more viable sectors.

Of the three large European countries discussed in this paper, the UK made the worst mistakes during the first phase, and suffered accordingly. The best performing economy was that of West Germany, where the use of interventionist policies was too limited to cause much damage. France's experience was mixed, with expensive failures such as the Plan Calcul offset by some successes as in nuclear power and telecommunications. A weakness in French policy was the preoccupation with national champions, which created some strong companies but had a distorting effect on the allocation of resources.

The second phase, from the 1980s to the early 2000s, saw a shift away from selective intervention towards horizontal policies. The creation of a more open and more competitive European market, with stricter prohibitions on the ability of governments to protect and support their national companies, put pressure on firms to raise their productivity and to concentrate on businesses where they could earn an adequate return. The restructuring of European industry was also influenced by fiercer international competition, and by changes in the capital markets - more demanding investors, more hostile takeovers and more focus on shareholder value.

The drive for a more integrated market has undoubtedly improved Europe's economic performance. According to European Commission estimates, the first two decades of reform generated a permanent rise of about 2 per cent in the level of EU GDP and boosted employment by just under 1.5 per cent. But, as the OECD noted in 2009, these benefits were less than half of what could be achieved if the single market was to be completed more fully.[189] This applies particularly to services, where the barriers to intra-European competition remain unnecessarily high. It is paradoxical, as a recent report from the European Commission has pointed out, that the principal beneficiaries of the single market programme have been manufacturing companies even though the manufacturing sector accounts for an ever smaller share of the European economy. Providers of services, by contrast, continue to be hampered by national restrictions. "For instance, the innovative small digital-services companies cannot access the single market and therefore have great difficulties in growing. They usually introduce their innovations in their national market first and then move to the US because the cost of accessing the US market is no more than the cost of accessing other national markets in Europe. This is creating large costs for Europe."[190]

As David Encaoua among others has argued, part of the reason for Europe's productivity lag vis-à-vis the US, and for the technology gap, is that the creative destruction process – the replacement of old firms by new ones, and the shift of resources from slow-growing to fast-growing sectors – is slower in Europe than in the US.[191] In high-technology industries, in particular, the US has a larger number of innovative small- and medium-sized enterprises, some of which grow to challenge and displace the incumbents. The solution, in Encaoua's view, lies not only in a more vigorous competition policy but also in a range of other supply-side measures including labour market reform and a strengthening of the higher education system.

Selective industrial policy is not part of that reform agenda. Others take a different view, arguing that, in the face of competition from China and other emerging economies, sector-based policies can play a role in strengthening European industry. In a recent paper three European economists call for an end to the "laissez-faire complacency" which, in their view, has led several countries to allow the uncontrolled development of non-tradable sectors, especially property, at the expense of tradable sectors.[192] European authorities, they believe, have underestimated the danger of a specialisation whereby the most advanced countries concentrate on upstream R & D and services, while outsourcing everything else to emerging economies. The concept of sectoral industrial policy should be revisited, but without repeating the mistakes of the past. Sectoral aid should not seek to create European champions but should be allocated evenly within the targeted sector, rather than to one or several pre-selected firms.

How should the sectors be chosen? This question is at the heart of the industrial policy debate. Ha-Joon Chang, drawing on the experience of Japan and other East Asian countries, emphasises the need for target industries to be selected "realistically", in the light of each country's technological capabilities and world market conditions; the success of East Asian countries such as South Korea owes a lot, in his view, to the fact they did not try to make too big a leap.[193] These economies were in a catch-up stage and thus in a different situation from the advanced countries of Western Europe. But Chang believes that even in a frontier economy there are industries that firms do not enter because of high entry costs, and government support can play a critical role. He instances the Airbus as an example of what a well-executed industrial policy can achieve.

Many people in Europe, especially in France, would like to see the Airbus model replicated in other industries[194] When the A380, the super-jumbo airliner, was unveiled in Toulouse in 2005, President Chirac hailed the Airbus as a triumph for European industrial policy. "Let us pursue the success of Airbus on other fields" he said. "Let us achieve the same outcome for the energy of the future, for tomorrow's transport and telecommunications, for the medicines of the future. Let us do it together, with a truly European ambition".[195]

No one could dispute that the Airbus project is a remarkable demonstration of European industry's ability to match the US in an exceptionally demanding sector. Yet it has been immensely costly to the European taxpayer, and the gains to consumers have probably been quite modest.[196] Moreover, as Paul Seabright has pointed out, the economic and technical characteristics of the aircraft industry make the Airbus a special case.[197] Fixed costs of production are very high, as are economies of scale; variable costs fall sharply as the volume of production increases. Unlike some other high-technology industries such as computers, customer requirements are relatively easy to define, and relatively stable. As Seabright notes, "designing new aircraft is largely a matter of throwing money at the challenge of carrying a given number of passengers for a given distance at reasonable speed and safety and minimum fuel cost. Paradoxically, this is one of those industries where an open cheque-book....may actually be a recipe for success."

Another European industry from which more useful lessons can be learned is mobile telephony. As noted earlier in this paper, the creation of the GSM standard created a Europe-wide market in mobile communications and generated substantial benefits for consumers in the form of better quality and lower prices. One of the winners from that process was the Finnish company, Nokia; until its recent troubles Nokia has been regarded as one of Europe's few successes in high technology. Yet, as Christopher Palmberg and Pekka Ylä-Anttila have explained, the rise of Nokia was not the result of a government master-plan, or of "picking winners". What the Finnish government sought to do during the 1990s was to create an environment which would encourage investment in knowledge-based industries, especially those linked to information and communications technology. The government focused on education, R & D and innovation with the overall aim of making Finland an attractive location for internationally competitive firms. This involved an increase in public spending on R & D and an enhanced role for the National Technology Agency (an arm of the Ministry of Trade and Industry) in setting up technology programmes in government laboratories and in industry; the agency also promoted partnerships between public research institutes and the private sector.

An important lesson is that policies towards industry must be consistent over the long term and not dictated by short-term cyclical or political considerations. As Palmberg and Ylä-Anttila conclude, "it is our overall judgement that the Finnish policies were able to find a proper balance between activism and non-interference. The role of government was to act strongly enough where the market was not working, i.e. in R & D and education, and to create and communicate a common vision of future national strengths without intervening too much in the functioning of markets".

A consequence of the Finnish government's policies, as these two authors acknowledge, is that Finland may have become too dependent on the ICT sector and on Nokia in particular. "The central policy challenge today is to find an appropriate balance between a strong focus on ICT on the one hand and a diversified industrial base on the other". Nokia itself has been struggling in recent months to adapt to unexpected changes in its market; its slow reaction

to the threat posed by "smartphones" from Apple and other suppliers led to a sharp fall in the company's share price and raised questions about its future.

The wider question that arises from the Finnish case is how far governments can steer their national industries towards particular technologies and what instruments of policy are available for them to do so. Some writers believe that the state can and should play an entrepreneurial role. Mariana Mazzucato uses US experience to support her argument that the government, far from stifling innovation and being a weight on the system, has "fostered innovation and dynamism in many industries, with the private sector often taking a back seat".[198] She points to the contribution made by the Defense Advanced Research Projects Agency (DARPA) to the development of the US computer and semiconductor industries. A similar role, she thinks, could be played by the Technology Strategy Board in the UK if it was given sufficient resources.[199]

It is true that US success in some high-technology industries stems in part from investments made by the Federal government. But many of these investments were aimed at military rather than commercial objectives, and the subsequent success of US companies in non-military markets was not the direct consequence of government support. In semiconductors, for example, the Department of Defense provided an early market for American firms and gave them R & D contracts to develop designs for military applications, but "the major technological achievements of the 1950s were in most cases accomplished by companies using their own funds and following avenues very different from those the DoD was following".[200] In computers the persistence of US leadership, long after military orders had ceased to be significant, was due to other aspects of the American environment, including a venture capital industry which supported a constant flow of new entrants. In the case of biotechnology, government support for biomedical research through the National Institutes of Health is only one (very important) ingredient in a set of policies and institutions which have included many different agents such as research universities, venture capital firms, patenting offices and regulatory agencies.[201]

In drawing conclusions from their study of industrial leadership in seven industries David Mowery and Richard Nelson emphasise the uncertainties involved in the evolution of new technologies. The winners and losers are extraordinarily difficult to predict, so that government policies that involve placing large bets on particular paths of development or particular firms are likely to fail. One exception, they suggest, is when public policies are used to catch up with a clear leader whose characteristics can be evaluated and targeted. Even there, as shown by the Japanese experience in mainframe computers, the leader that provided such a clear target may have been surpassed by another technology by the time the follower has caught up. "If the objective is to achieve or maintain leadership the only reasonable way to accomplish it is to encourage pluralism and competition".

The US economy has benefited from government support for basic research and from effective arrangements for the diffusion of technology from publicly financed research into industry. But the dynamism of America's high-technology industries is underpinned by other institutions and policies, including a stringent antitrust policy and a financial system that facilitates new entry. The fact that most of the world's leading internet firms are based in the US is partly due to the earlier development of the relevant technologies within the Department of Defense, but, as Shane Greenstein has written, the commercial era of the internet played to the strength of US-style market-based innovation. "Once released to commercial interests, the internet became the springboard for a dizzying area of applications that were not envisioned by the sponsoring government agencies". [202]

A feature of the US innovation system is that the supportive institutions have for the most part remained in place over a long period. In analysing the sources of US success in pharmaceuticals and biotechnology Iain Cockburn and Scott Stern point out that the returns to life sciences investments by both private and public entities have taken decades to pay off and are only now coming to occupy a central role in the delivery of new therapeutics. "These payoffs reflect the slow-and-steady evolution of a complex set of institutions and technologies, supported by sustained and relatively stable public investments".[203]

Industrial policy cannot be a "quick fix" for short-term economic or political problems. As decisions taken during and after the recent financial crisis have shown, governments come under pressure during recessions to protect employment in failing companies, and to bend the rules on public procurement in order to favour national suppliers. At the European level there are some indications that the rules on state aid for industrial restructuring are being applied more flexibly in order to give member states more freedom of action. Although there is no sign of a general retreat into Fortress Europe, some of the new financial regulations appear to discriminate against non-European firms. There is also some concern about the Commission's proposals for a new policy on public procurement, which include the suggestion that access to EU markets will be made more difficult for countries that do not themselves have reciprocal open tendering systems.[204] At the national level the recent controversy in the UK over the closure of the Bombardier train-making factory in Derby – attributed by some critics to an over-rigid application by the British government of the European Union rules on public procurement – reflects a resurgence in protectionist sentiment as the economic crisis persists.

The principal lesson from the events described in this paper are that industrial policy should be horizontal rather than sectoral, and embedded in a broader set of institutions and policies which promote competition, encourage innovation and facilitate industrial change. The ability of governments to steer the process of change in a way that favours their national companies is limited, and intervention of this kind can have damaging consequences. In the drive to create a more innovative Europe, public policy has a role to play but governments should be wary about trying to predict which particular technologies are more "promising", and more worthy of support, than others. If industrial policy is used to channel resources into favoured sectors and away from less favoured ones, politicians and bureaucrats will be assuming a degree of foresight which they do not possess, and taking on a task which they are ill-suited to perform.

1. Henry Ergas, The importance of technology policy, in Partha Dasgupta and Paul Stoneman (eds), Economic policy and technological performance, Cambridge, 1987.

2. A further distinction can be made between technology policy and innovation policy, with the latter often linked to the concept of national systems of innovation, embracing all the policies and institutions that affect a country's innovative capacity. The term "science policy" covers measures taken by governments to support scientific research in universities and public laboratories, and the training of scientists. See Bengt-Åke Lundvall and Susana Borrás, Science, technology and innovation policy, in Jan Fagerberg, David C. Mowery and Richard R. Nelson (eds), The Oxford Handbook of Innovation, Oxford, 2005.

3. Kenneth J. Arrow, Economic welfare and the allocation of resources for invention, in Richard R. Nelson (ed), The rate and direction of inventive activity: economic and social factors, Princeton University Press, 1962.

4. Ruggero Ranieri, The wide strip mill in Western Europe after 1945: transferring American technology, in Dominique Barjot (ed), Catching up with America: productivity missions and the diffusion of American

economic and technological influence after the Second World War, Presse de l'Université de Paris-Sorbonne, 2002.

5. This was discussed in a series of reports by the OECD, starting in 1966 with a general report on the technological gap, followed by studies of particular industries, including computers and electronic components. The danger that European industry would soon be dominated by giant US corporations was the theme of a best-selling book by Jean-Jacques Servan-Schreiber, Le Défi Américain, Éditions Denoel, Paris, 1967.

6. In the case of steel, these problems stemmed in part from ill-judged decisions by governments to expand capacity in the late 1960s and early 1970s.

7. Jean-Pierre Dormois, France: the idiosyncrasies of voluntarisme, in James Foreman-Peck and Giovanni Federico (eds), European industrial policy, the twentieth-century experience, Oxford, 1999.

8. Henry Ergas, Europe's policy for high technology: has anything been learnt? OECD, Paris, 1993.

9. The steel industry remained in the public sector for little more than two years; it was privatised by the Conservative government in 1953.

10. A second state-owned airline, British European Airways, was set up in 1946. The two companies were merged in 1974 to form British Airways, which remained in state ownership until privatisation in 1987.

11. Martin Chick, Industrial policy in Britain 1945-1951, Cambridge, 1998.

12. Keith Hayward, The British aircraft industry, Manchester University Press, 1989.

13. For an analysis of the Concorde project and the almost equally disastrous Advanced Gas-Cooled Reactor programme, see P.D. Henderson, Two British errors: their probable size and some possible lessons, Oxford Economic Papers, 29, 2, July 1977.

14. Timothy F. Bresnahan and Franco Malerba, Industrial dynamics and the evolution of firms' and nations' competitive capabilities in the world computer industry, in David C. Mowery and Richard R. Nelson (eds), Sources of industrial leadership, Cambridge, 1999.

15. John Hendry, Innovating for failure, government policy and the early British computer industry, MIT Press, 1989.

16. Martin Campbell-Kelly, ICL a business and technical history, Clarendon Press, Oxford, 1989, p189.

17. The three principal reactor types competing for the nuclear power market were light water, heavy water, and gas-graphite. Robin Cowan, Nuclear power reactors: a study in technological lock-in, Journal of Economic History, 50, 3, September 1990, pp541-567.

18. John Beath, UK industrial policy: old tunes on new instruments? Oxford Review of Economic Policy, 18, 2, 2002.

19. M. W. Kirby, Supply-side management, in Nicholas Crafts and Nicholas Woodward (eds), The British economy since 1945, Oxford, 1991, p250.

20. David Edgerton, The 'White heat' revisited: the British government and technology in the 1960s, Twentieth Century British History, 7, 1, 1996, pp53-82.

21. Martin Campbell-Kelly, ICL, a business and technical history, Oxford, 1989, pp249-250.

22. English Electric was one of the UK's three leading electrical/electronics groups, the others being Associated Electrical Industries (AEI) and the General Electric Company (GEC).

23. The two largest private-sector shareholders in ICL were English Electric (later acquired by GEC) and Plessey, each of which held 18 per cent.

24. The Concorde entered service in 1976 with the two state-owned airlines, Air France and British Overseas Airways Corporation. Only twenty aircraft were built.

25. Keith Hayward, British aircraft industry, Manchester University Press, 1989, p50.

26. Robin Cowan, Nuclear power reactors: a study in technological lock-in, Journal of Economic History, 50, 3, September 1990.

27. Douglas Hague and Geoffrey Wilkinson, The IRC, an experiment in industrial intervention, George Allen & Unwin 1983.

28. Edward Heath, The course of my life, the autobiography of Edward Heath, Hodder & Stoughton, 1998.

29. Jim Tomlinson, Government and the enterprise since 1900, Oxford, 1994, p301.

30. Martin Campbell-Kelly, ICL, a business and technical history, Oxford, 1989, p299. Despite its protective attitude towards ICL, the Heath government was generally eager to encourage inward investment, especially from Japan, as a means of strengthening weak British industries.

31. The regeneration of British industry, Department of Industry, White Paper Cmd 5710, August 1974.

32. Daniel C. Kramer, State capital and private enterprise, the case of the UK National Enterprise Board, Routledge 1988.

33. British Leyland: the next decade, The Ryder report, March 1975.

34. Rolls-Royce is one of the few British companies which appears to have improved its performance during the period when it was controlled by the state. Following privatisation in 1987 it has done well both in profitability and in market share.

35. N.K.A. Gardiner, The economics of launching aid, in Alan Whiting (ed), The economics of industrial subsidies, HMSO, 1976.

36. Simon Taylor, Privatisation and financial collapse in the nuclear industry, Routledge, 2007, p32.

37. Inmos was set up in 1978. Celltech was conceived in that year, but the formation of the company did not take place until after Margaret Thatcher's victory in the 1979 election.

38. W.B.Willott, The NEB involvement in electronics and information technology, in Charles Carter (ed), Industrial policy and innovation, Heinemann, 1981.

39. A successful British industry in the 1960s and 1970s was pharmaceuticals, where the government made no attempt to create a national champion. When Boots and Beecham made rival bids for Glaxo in 1972, the Monopolies Commission ruled that all three companies were large enough to compete profitably in the industry, and that a reduction in the number of competing sources of innovation would be against the public interest. Beecham Group and Glaxo Group, Boots and Glaxo Group, A report on the proposed mergers, Monopolies Commission, HMSO July 1972.

40. One example was the abortive attempt to rejuvenate the machine tool industry; none of the policy instruments, including grants for developing new machines and the promotion of mergers, prevented the continuing decline of the industry. Anne Daly, Government support for innovation in the machine tool industry; a case study, in Charles Carter (ed), Industrial policy and innovation.

41. The steel industry was an outstanding example, although the British Steel Corporation's problems in the late 1970s stemmed in part from the unwise expansion of capacity that had taken place under a Conservative government earlier in the decade.

42. "Industry officials and outsiders seem to be in agreement on one central point: the fact that Renault belongs to the government has not significantly affected its market behaviour", John Sheahan, Promotion and control of industry in post-war France, Harvard, 1963, p117.

43. François Chesnais, The French national system of innovation, in Richard R. Nelson (ed), National innovation systems, a comparative analysis, Oxford, 1993.

44. Peter Hall, Governing the economy, Polity Press, 1986, p167.

45. Walter A McDougall, Space-age Europe: Gaullism, Euro-Gaullism, and the American dilemma, Technology and Culture, 26, 2 April 1985 pp179-203.

46. Christian Stoffaës, Industrial policy in the high-technology industries, in William J. Adams and Christian Stoffaës (eds), French industrial policy, Brookings, 1986.

47. "Without France, the European commitment (to space) would not be of the scale it now is, nor Arianespace a viable competitor of the main US launchers." François Chesnais, The French national system of innovation, in Richard R. Nelson (ed), National innovation systems, Oxford, 1993.

48. Pierre E. Mounier-Kuhn, Rappel sur les origines du Plan Calcul, in Entre Plan Calcul et Unidata, Institut d'Histoire de l'Industrie, Éditions Rive Droite, 1998.

49. John Zysman, Political strategies for industrial order: state, market and industry in France, University of California Press, 1977, pp74-77.

50. J. Nicholas Ziegler, Governing ideas: strategies for innovation in France and Germany, Cornell University Press 1997, p170.

51. Élie Cohen, France: national champions in search of a mission, in Jack Hayward (ed), Industrial enterprise and European integration, Oxford, 1995.

52. Alan Cawson, Kevin Morgan, Douglas Webber, Peter Holmes and Anne Stevens, Hostile brothers, competition and closure in the European electronics industry, Oxford, 1990, p265.

53. Graduates of France's most prestigious graduate school, École Nationale d'Administration.

54. Robin Cowan, Nuclear power reactors: a study in technological lock-in, Journal of Economic History, 50, 3, September 1990.. See also Dominique Fino and Carine Staropoli, Institutional and technological co-evolution in the French electronuclear industry, Industry and Innovation 8, 2 August 2001.

55. Andrew Jack, The French exception, Profile Books, 1999, p85.

56. Jean-Pierre Brulé, L'Informatique Malade de l'État, Les Belles Lettres,1993, p147.

57. Peter Hall, Governing the economy, Polity Press, 1986, pp186-7.

58. J. Nicholas Ziegler, Governing ideas: strategies for innovation in France and Germany, Cornell University Press 1997, p41. In planning this project the Direction Générale des Télécommunications (DGT) sought to encourage competition with Alcatel by arranging for Thomson to re-enter the industry; with the DGT's encouragement, Thomson acquired control of the French subsidiaries of Ericsson and ITT.

59. By contrast the Minitel, planned and financed by the Direction Générale des Télécommunications (DGT), is generally regarded as a failure, and one which delayed the take-up of the Internet in France. One of the reasons for the failure was the DGT's desire to make Minitel a completely French instrument, ignoring the huge international potential of telecom-related activities in both hardware and software. See Patrick Messerlin, France, in Benn Steil, David G. Victor and Richard R. Nelson (eds), Technological Innovation and Economic Performance, Princeton University Press, 2002.

60. Peter Hall, Governing the economy, Polity Press, 1986, p191.

61. For an account of these events, see Jean-Pierre Brulé, L'Informatique Malade de l'État, Les Belles Lettres,1993.

62. Pierre Sicsic and Charles Wyplosz, France 1945-1992, in Nicholas Crafts and Gianni Toniolo (eds), Economic growth in Europe since 1945, Cambridge 1996. See also Patrick Messerlin, France, in Steil, Victor and Nelson (eds), Technological innovation and economic performance, Princeton University Press, 2002.

63. Jean-Louis Loubet, Automobiles Peugeot, une réussite industrielle 1945-1974, Economica 1990, p352.

64. The machine tool industry consisted mainly of small and medium-sized firms and did not lend itself to the top-down policies, including the promotion of mergers and state-supported research programmes, favoured by the French authorities. J. Nicholas Ziegler, Governing ideas: strategies for innovation in France and Germany, Cornell University Press 1997, p153.

65. Henry Ergas, The importance of technology policy, in Partha Dasgupta and Paul Stoneman (eds), Economic policy and technological performance, Cambridge 1987.

66. In contrast to the French success in telecommunications, the introduction of digital exchanges into the British telephone system was hampered by commercial rivalries and an unclear division of responsibilities between the operator (the Post Office, later British Telecom) and its principal suppliers. One consequence was that GEC, the principal UK manufacturer, lost ground in export markets. Cawson et al, Hostile brothers, pp106-113.

67. Heidrun Abromeit, Government-industry relations in West Germany, in Martin Chick (ed) Governments, industries and markets, Edward Elgar, 1990.

68. This was a case where the social and political strains arising from a precipitate run-down of the coal mines were deemed unacceptable, see Martin F. Parnell, The German tradition of organised capitalism: self-government in the coal industry, Oxford, 1994.

69. H Norman Abramson et al, Technology transfer systems in the United States and Germany, National academy press,1997, pp320-332.

70. Henry Ergas, The importance of technology policy, in Partha Dasgupta and Paul Stoneman (eds), Economic policy and technological performance, Cambridge, 1987.

71. Gary Herrigel, Industrial constructions, the sources of German industrial power, Cambridge, 1996, p181.

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74. Otto Keck, A theory of white elephants: asymmetric information in government support for technology, Research Policy 17 (1988) pp187-201.

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76. Margaret Sharp and Claire Shearman, European technological cooperation, Routledge & Kegan Paul, 1983, pp28-33. In scientific research, some trans-European institutions were set up in the early post-war decades, of which the most successful was CERN (The European Organisation for Nuclear Research). CERN, the world's largest particle physics laboratory, has remained outside the purview of the European Commission.

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78. John W. Young, Technological cooperation in Wilson's strategy for the EEC, in Oliver J Daddow (ed), Harold Wilson and European integration, Frank Cass, 2003.

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80. Keith Pavitt, Technology in Europe's future, Research Policy Vol 1 (1971/1972) p266.

81. McDougall, Space Age Europe. This author notes that in Britain "budgetary pressures and bungling seemed always to prevent a coherent policy on the French model. Officials responsible for space suffered from a bureaucratic minuet that shifted them among nine different ministries over the space of a decade. Having cancelled its national missile programs, the British government revived scientific rocket research in 1964 and finally launched a single, home-made satellite on the Black Knight booster in 1971. After 1957 the British depended on the United States for strategic missiles and were the most willing to rely on NASA for access to space, earning them in European space councils the epithet 'the delegates from America'".

82. Industrial Policy in the Community: memorandum from the Commission to the Council, European Commission 1970.

83. Alan Butt Philip, European industrial policies: an overview, in Graham Hall (ed), European industrial policy, Croom Helm 1986. See also Stephen Woolcock, Information technology: the challenge to Europe, Journal of Common Market Studies, 22, 4, June 1984.

84. Quoted in "The Community's industrial policy", Commission of the European Communities, February, 1979.

85. Angus Maddison, The world economy, a millennial perspective, OECD 2001, Table E-9.

86. Structural adjustment and economic performance, OECD 1987, p234.

87. Henry Ergas, Europe's policy for high technology: has anything been learnt? OECD, Paris, 1993.

88. Rose Marie Ham and David C Mowery, Enduring dilemmas in US technology policy, California Management Review, 37, 4 summer 1995.

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92. Martin Fransman, Japan's computer and communications industry, Oxford, 1995, p22. See also Marie Anchordoguy, Mastering the market: Japanese government targeting of the computer industry, International organisation, 42, 3, summer 1988 pp509-543.

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94. Richard N. Langlois, Computers and semiconductors, in Benn Steil, David G. Victor and Richard R. Nelson (eds), Technological Innovation and Economic Performance, Princeton University Press, 2002.

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107. William Walker, National innovation systems: Britain, in Richard R. Nelson (ed), National Innovation Systems, Oxford, 1993.

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vity and jobs, Centre for Economic Performance, London School of Economics, November 2011.

110. Among the companies that passed into foreign control was Celltech, bought by UCB of Belgium in 2004; Celltech had been regarded as the flagship of the British biotechnology industry.

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112. David Card, Richard Blundell, and Richard B. Freeman, Seeking a premier economy: the economic effects of British economic reforms 1980-2000, Chicago, 2004, p55.

113. Nicholas Crafts, British relative economic decline revisited, Centre for Economic Policy Research, Discussion paper No 8384, May 2011.

114. Peter Hall, Governing the economy, Polity Press, 1986, p194.

115. Jean-Pierre Brulé, L'Informatique Malade de l'État, Les Belles Lettres, 1993, p 226.

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117. Jonah D. Levy, The return of the state? French economic policy under Nicolas Sarkozy, APSA 2010 Annual Meeting Paper.

118. J. Nicholas Ziegler, Governing ideas: strategies for innovation in France and Germany, Cornell University Press 1997, p182.

119. The French government shareholding (through France Telecom and CEA-Industrie) was later reduced to 13.5 per cent, and the same proportion was held by the Italian government. The rest of the shares were widely held.

120. Alan Cawson, Kevin Morgan, Douglas Webber, Peter Holmes and Anne Stevens, Hostile brothers, competition and closure in the European electronics industry, Oxford, 1990, p285.

121. Usinor Sacilor, later renamed Usinor, was privatised in 1995. After further acquisitions in Belgium and Spain it was renamed Arcelor in 2002.

122. A leading economist, François Morin, warned that privatisation could lead to Renault passing into foreign control. "If one wants to imitate Anglo-Saxon liberalism", he wrote, "one should be aware of the risk: the British motor industry has completely disappeared and the American car manufacturers are in serious difficulty". L'Express, June 3, 1993.

123. In 2005 the government reduced its stake to 15 per cent.

124. One of Thomson-CSF's biggest purchases, in 2000, was that of Racal, a leading British defence electronics company.

125. This merger, which was criticised by some observers as lacking in industrial logic, enabled the government to reduce its stake in Snecma from 62 per cent to 36 per cent.

126. Philippe Mustar and Philippe Laredo, Innovation and research policy in France (1980-2000) or the disappearance of the Colbertist state, Research Policy 31 2002, pp55-72.

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130. Horst Siebert and Michael Stolpe, Germany, in Steil et al (eds), Technological innovation and economic performance, Princeton University Press, 2002.

131. Susanne Giesecke, The contrasting roles of government in the development of the biotechnology industry in the US and Germany, Research Policy, 29, 2, February 2000.

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133. One of the strongest advocates of the Japanese model was Konrad Seitz, a former diplomat who wrote a best-selling book on the subject. See Konrad Seitz, The case for a Federal Government high technology policy, Intereconomics, May/June 1992. John Gillingham, European integration 1950-2003, Cambridge 2003, p395.

134. Jeffrey Gordon, Pathways to corporate convergence? Two steps on the road to shareholder capitalism in Germany: Deutsche Telekom and DaimlerChrysler, Columbia Journal of European Law, 5, 219, spring 1999.

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136. Dirk Dohse and Tanja Staehler, BioRegio, BioProfile and the rise of the German biotech industry, Kiel Working Papers No 1456, October 2008.

137. Karen E. Adelberger, Semi-sovereign leadership? The state's role in German biotechnology and venture capital growth, German Politics, 9, April 2000.

138. Siegfried Bialojan and Julia Schuler, Commercial biotechnology in Germany: an overview, Journal of Commercial Biotechnology, 10, 1, September 2003.

139. The UK had seemed in the 1990s to be most likely of the European countries to develop a strong biotechnology industry, but hopes that a core of large, world-class biotechnology companies would emerge have not been fulfilled. A list of the world's top hundred biotechnology companies in 2010 contained only three British companies and one German; seventy-one of the companies were based in the US. MedAdNews June 2011.

140. Sigurt Vitols and Lutz Engelhardt, National institutions and high tech industries: a varieties of capitalism perspective on the failure of Germany's "Neuer Markt", Working Paper WZB February 2005.

141. An important tax change, which took effect in 2002, removed the capital gains tax that had discouraged banks and other financial firms from selling their shares in industrial companies. The effect was to transfer the banks' shares into the hands of more active investors and "to force inefficient firms to respond to shareholder concerns and to either become competitive or face market disapproval", John Gillingham, European integration 1950-2003, Cambridge 2003, p395.

142. Study of Siemens by S G Warburg Securities May 1991.

143. In 2009 Siemens sold its half share in this venture to its Japanese partner.

144. A notable case was that of Hoechst, which divested all its chemical businesses in order to focus on pharmaceuticals.

145. One German manager who made a much-publicised commitment to shareholder value was Jürgen Schrempp, chief executive of Daimler-Benz from 1995 to 2005. After taking over the leadership of the company, he divested all its recently acquired non-automotive interests except aerospace. Schrempp was also responsible for the merger between Daimler-Benz and Chrysler, which proved to be an expensive mistake.

146. Raising Germany's growth potential, Occasional Paper No 28, Directorate-General for Economic and Financial Affairs, European Commission, February 2007.

147. Research, innovation and technological performance in Germany, 2008 Report by Expert Commission on Science and Technology.

148. Wayne Sandholtz, High-tech Europe, the politics of international cooperation, University of California Press, 1992, p163.

149. Dimitris Assimakopoulos, Rebecca Marschan-Piekkari and Stuart Macdonald, ESPRIT: Europe's response to US and Japanese domination in information technology, in Richard Coopey (ed), Information technology policy: an international history, Oxford, 2004.

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165. Facing the challenge: the Lisbon strategy for growth and employment, Report from the high level group chaired by Wim Kok, November 2004.

166. OECD Economic Outlook, December 2003, Table 13.

167. Christopher Allen, Didier Herbert, Gert-Jan Koopman, The European Commission's new industrial policy, EIB Papers 11,2, 2006.

168. This intervention was handled very differently from the British Leyland case; General Motors and Chrysler were forced to make drastic cuts in capacity and in employment, and by 2011 they seemed to be in a healthier financial state, no longer needing government support. Steven Rattner, Overhaul: an insider's account of the Obama Administration's emergency rescue of the auto industry, Houghton Mifflin Harcourt, 2010.

169. Gary P. Pisano and Willy C. Shih, Restoring American competitiveness, Harvard Business Review, July-August 2009.

170. Andrew Grove, How to make an American job, Bloomberg Businessweek, July 5-11, 2010. Andrew Liveris, Make it in America: the case for reinventing the economy, John Wiley, 2011.

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186. Vince Cable, Speech at Policy Exchange, October 26, 2011.

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202. Shane Greenstein, Nurturing the accumulation of innovations: lessons from the internet, National Bureau of Economic Research Working Paper 15905, April 2010.

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