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ABSTRACT

Highlighting the revival of industrial-policy thinking in an era of globalisation and disenchantment with free trade, this paper reviews alternative and, in part, competing theoretical foundations of industrial policy: neoclassical foundations, structuralist approaches, and pragmatic approaches inspired by new growth and development theories. One of the main conclusions is that the industrial-policy debate is no longer between advocates of horizontal and vertical policies, but between those who deny any potential for state intervention to make economies more dynamic and those who seek to clarify the specific conditions for appropriate intervention. Another salient conclusion is that state intervention is especially important in a knowledge-based economy, as witnessed by successful industrial policies in – for instance – the United States, Germany and France, and Finland.

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Theoretical foundations of industrial policy

1. Introduction

The return of industrial policy as a subject of theoretical reflection and of public debate is a sign of growing political concerns associated with globalisation, of new theoretical misgivings over the benefits of free trade, and of the end of the ideological disputes on the role of the state in a market economy. No one any longer claims that planning and nationalisation give better results than competition and regulation by the market. But, conversely, no one any longer believes that liberalising markets and abolishing government involvement in the allocation of resources is sufficient in itself to generate growth and prosperity. Failures in development policies inspired by the Washington Consensus and in European competition policies that reject sectoral industrial intervention have paved the way for work that pays greater attention to institutions, agents, and contexts.

Industrial policy has never given rise to a specific theoretical corpus, even though the foundations for such a corpus have existed since List and Hamilton, and history has taught us that the visible hand of the state has played a significant role every time the economy has taken off. Economists have often taken part in debates on industrial policy, they have applied some branch of the discipline or other, they have debated the effectiveness and the legitimacy of government action, but they have rarely undertaken the empirical work needed to corroborate their opinions. Neoclassical theory accepts industrial-policy measures only where the market allocates resources inefficiently. This has inspired a body of literature on market failures. Since public intervention has flourished in adjustment policies and policies to protect nascent industries, a new stream emerged dealing with the state's failures and the deadlock in the policy on national champions. However, in the 1980s, a number of economists attempted to establish a theoretical foundation for public intervention by borrowing from a variety of advances in economics such as evolutionary theories of economic change, new trade theory, and new economic geography.

In this paper, we will distinguish three approaches to industrial policy corresponding to three eras of industry policy: the neoclassical approach where the debate is over market failures (Section 2), the structuralist approach (Section 3) where the debate is over the conditions for global competitiveness, and the pragmatic approach (Section 4) where the debate is over the practical conditions for making public and private actors better able to face the challenges of the new economy. Each approach is defined by an inventory of public policies, a theoretical advance in the economic discipline and, where these two worlds meet, new questions about industrial policies.

Before commencing, let us delineate what exactly is meant by industrial policy in what is to come. In contrast to general business environment policies that have an indirect impact on industry – including macroeconomic and social policies, as well as capital equipment and national defence policies – industrial policy in the strict sense is a sectoral policy; it seeks to promote sectors where intervention should take place for reasons of national independence, technological autonomy, failure of private initiative, decline in traditional activities, and geographical or political balance. Depending on the country and the variety of capitalism there, any existing sectoral policy is the responsibility of the state (directly or indirectly), public banks, or local authorities. For example, in the United States the Secretary of State for Industry and High Technologies is in fact the Secretary of State for Defence. In Japan, industry has been protected by trade policy and certain sectors have been promoted through financing operations, exchange allocations and support for large



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commercial undertakings. In Germany aid to businesses is essentially paid through the *Länder* under the auspices of technology policies, whilst it is the banks' responsibility to rescue businesses that are in difficulties.

Understanding industrial policy therefore means addressing questions about theoretical foundations, but also about institutional contexts and phases of development.

2. The neoclassical approach to industrial policy

Neoclassical theory justifies public intervention by market failures.

Neoclassical theory justifies public intervention by market failures, largely arising from information asymmetries and incomplete markets, externalities, and increasing returns to scale. Let us look at each of these market failures and examine how they might justify public intervention. In this context, it is useful to briefly discuss the value of distinguishing between horizontal and vertical industrial policies.

2.1 Asymmetric information and incomplete markets

A market is said to be incomplete when goods or services demanded are not available even if consumers are prepared to pay a higher price. In addition, consumers are unable to perfectly evaluate the quality of goods on offer because the markets are characterised by asymmetric information, which might give rise to two types of behaviours: adverse selection and moral hazard. Adverse selection implies that it is impossible to evaluate the quality of goods on offer on an individual basis. The evaluation is therefore based on an average for comparable goods or services. In this situation there is a possible risk that businesses offering goods above the average quality will fall out of the market. Moral hazard implies that it is not possible to observe the behaviour of a contracting agent. Opportunistic (or hazardous) behaviour occurs, which means that the agent does not perform the terms of the contract precisely.

While neoclassical theory identifies these factors as market imperfections, they are prominent features of real-world economies. Obviously, in such economies companies do not have equal access to information and there are many techniques that can restrict competition. Indeed, some businesses develop strategies that create imperfections in market conditions. The public authorities therefore have two options as far as intervention is concerned: either they formulate a strong competition policy in order to restore conditions of fair competition in a situation close to full information or they put in place a strategic industrial policy through which they play an active role in encouraging non-opportunistic behaviour in the industries concerned.

2.2 Externalities

The second case of market failure arises from externalities. A positive externality occurs when an agent gains an advantage from the activity of another agent without rewarding the latter for the advantage he created. In essence, positive externalities entice free-riding behaviour and result in a less-than-optimal level of the activity creating the externality. Research and development (R&D) are prime examples: the production of new knowledge generates positive externalities – called 'technological externalities' – and its optimal production is especially important as it has a direct positive effect on the economy as a whole. But since a free-market economy does not reward companies for the technological externalities they generate, R&D activity turns out to be lower than what is optimal from the society's perspective.

Problems created by externalities relate to the problems of transaction and information costs. More specifically, the Coase theorem shows that externalities can be internalised and thus do not result in an inefficient allocation of resources if there are no transaction costs and if property rights are well defined. Technological externalities foster economic growth and development. From a policy viewpoint the challenge is then to help internalise such externalities by defining property rights and introducing mechanisms that limit transaction costs.

Externalities create a need for public intervention, as illustrated by Arrow (1962), who showed that the costs of obtaining scientific information can be prohibitive, but when the information becomes accessible, its unit cost drops to almost nothing once the information has been widely disseminated. He also noted that the incentive for private-sector agents to spend on R&D is extremely low because of the difficulties in appropriating the knowledge created. In other words, the market fails in providing appropriate research incentives. In these circumstances, the state can play a role in getting incentives right, for instance, by subsidising R&D spending. Indeed, many authors (Coriat 2000) have legitimised public intervention by regarding public aid as rewarding innovating firms for some of their contribution to public wellbeing.

2.3 Economies of scale

The third case of market failure stems from economies of scale, which can lead to monopolies or oligopolies and thus market power. Brander and Spencer (1986) and Krugman (1986) have shown that in an industry characterised by high fixed costs (and, thus, economies of scale) the first firm in a market enjoys a crucial first-mover advantage that prevents another firms from entering that market. In essence, high fixed costs and economies of scale constitute entry barriers behind which the first mover captures rents to the detriment of potential entrants and consumers. Brander and Spencer then justify public intervention in the form of a subsidy to allow another firm to enter the market.

Zysman *et al.* (1990) provide another rationale for public intervention. They argue that intervention is effective and legitimate where its purpose is to establish favourable conditions for the development and dissemination of new technologies. For example, they report that the Japanese government set up infrastructure to encourage the development of high-technology industries. This policy has not only fostered the development of the industries in question, but also made it possible to disseminate the technology throughout the entire economy at a lower cost. This process means that innovating firms generate high profits as a direct result of scale economies created by them in later-stage industries using the spin-offs of the innovation. Consequently, the authors consider public support for high-technology industries justified not only because it enables countries to reap scale economies but also on account of the positive technological externalities.

2.4 Vertical vs. horizontal industrial policies

After the Second World War, many countries launched industrial policies and developed specific policy tools. A considerable body of writing has been devoted to these issues, but two of them stand out: the rationale for public policy aimed at enhancing a nation's competitiveness and the contrast between horizontal policies, justified under neoclassical theory, and vertical or sectoral policies, discarded by neoclassical economists.

Nester (1997) rejects this contrast: "Every nation has industrial policy whether they are comprehensive or fragmented, or whether officials admit the practice or not". As far as the United

After World War II, economic literature has contrasted horizontal against vertical industrial policies.

States is concerned, “every major industry in America is deeply involved with and dependent on government. The competitive position of every American firm is affected by government policy. No sharp distinction can validly be drawn between private and public sectors within this or any other industrialised country; the economic effects of public policies and corporate decisions are completely intertwined”.

Nester’s definition of industrial policy includes both horizontal and vertical measures, where industrial policy means the coordination of government activities in support of economic development in general and industrial competitiveness in particular. He also points out that industrial policy can be justified by its greater capacity to promote economic development compared with any other force. This view may seem radical, but it summarises the debates between those who, out of realism, recognise the existence of industrial policies and, out of strategy, advocate their development and those who, often against all evidence, deny the reality of the policies pursued and their effects.

The contrast between horizontal and vertical industrial policies conceals the vertical effects of horizontal policies.

The contrast between horizontal and vertical industrial policies, although well founded to some extent, conceals the vertical effects of horizontal policies; mention only need be made here of Irish fiscal strategies, Finnish education strategies, or German regional strategies following reunification to understand that the broadest horizontal policies have clear sectoral effects. However, this frequently made observation has not dispelled the distinction drawn between horizontal and vertical policies, perhaps with the intention of stressing the discriminatory nature of vertical policies rather than the knowledge effects they facilitate.

The standard criticism levelled against sectoral industrial policies is that the state has neither the necessary information nor adequate incentives to make better choices than the market. Since it also obeys a political rationale, it tends to prefer spectacular and demonstrative actions to effective and selective ones. As it follows a sequential logic, it tends to misestimate the aggregate effects of its action, and in particular the negative long-term effects of the protection granted to certain firms and the negative impacts of the benefits granted to promoted sectors on other sectors. This three-fold criticism has for a long time brought condemnation on the policy of national champions. Library shelves have been given over to this criticism, and it is easy to see that politicians like big projects and high-tech – both often being ‘white elephants’ – and that they are prepared to promote them through grant financing, derogations, and public procurement.

But as recent experience has shown, large businesses are susceptible to the same criticisms and they are no more clear-sighted than states when it comes to the future states of markets in new technologies. What is more, some countries have successfully modelled their specialisation through successful big projects.

Let us elaborate on the ‘white elephants’ criticism in respect of private enterprise operating on the open market. The recent cases of Enron, Worldcom and Vivendi-Universal, to take only the best-known examples, bear full witness to the fact that large businesses are, like states, seduced by high-tech, grand projects, and media communication. This mimetic strategy may well go beyond public communication. When financial analysts in the new economy base their recommendations on ‘equity stories’ and ‘newsflow’, are they not moving into the realms of political communication? Of course, the financial risks taken by a private-sector operator are more limited from the outset than those taken by the state. Of course, private shareholders and not taxpayers pay for failures and slippages, but it cannot just be claimed that a business operating in changing sectors is better informed than the public authorities. The only argument that, at this stage, makes it possible to resolve the issue of national champions comes from the empirical work by Cohen (1992) or Seabright (2005): states alone can undertake major programmes with very high initial fixed costs,

such as Airbus. On the other hand, businesses are better able than states to terminate failing projects.

3. The structuralist approach to industrial policy

The field of industrial policy theory was reinvigorated during the 1980s and 1990s with the interface of the new theories on the knowledge-based economy, international trade, and corporate behaviour, on the one hand, and new questions about competitiveness, specialisation, and regional integration, on the other. Among the forces stimulating a fresh look at industrial policy is EU integration, which has raised important questions about incentives to cooperate, the role played by R&D in the organisation of a production system, and the geographical and sectoral impact of establishing the Single European Market. At the same time, European disengagement in high-tech industries, the persistence of regional and non-national specialisations within the single market, and the new challenges posed by globalisation and the knowledge-based economy are leading European authorities to shift the focus of their action and to give it a theoretical and practical foundation. That is why the European Commission is so big on economic speeches and why economists are brought in to give a theoretical foundation to new policies.

Structuralist approaches to providing such a foundation have different theoretical underpinnings. In what follows, we will focus on five theoretical frameworks that have helped structure the new challenges of industrial policy, namely: (i) evolutionary economics, (ii) theories on incentives to cooperate, (iii) new trade theory, (iv) new economic geography, (v) and theories of sectoral production systems and clusters.

Structuralist approaches to industrial policy include many different theoretical frameworks.

3.1 The evolutionary approach to technological trajectories and national innovation systems

The frequently made observation that countries with a variety of institutions pursuing different policies are able to achieve comparable results challenges the idea of an 'optimal' way to achieve a desired result – a point very much emphasised by Edquist and Chaminade (this volume). The concepts of national innovation systems or technological trajectories highlight countries' particular institutional characteristics, the role played by organisational interactions, the uniqueness of each nation's history.

Evolutionary theory makes a major contribution to understanding the importance of country-specific features for innovation. The concepts of national innovation system and technological trajectory highlight countries' particular institutional characteristics and the uniqueness of each nation's history. The richness of this theory lies in the fact that it emphasises organisational flexibility and capacity for adaptation and that it stresses the fact that compartmentalisation and institutional rigidity are sources of systemic inefficiency. From this perspective of national specificity and institutional dynamism, industrial policy gains a new legitimacy.

Evolutionary theory renews the Schumpeterian approach, staying faithful to it in so far as innovation and technological change lie at the heart of growth. Since the economy is constantly evolving, the levels of R&D and innovation do not offer a static explanation of competitiveness as such, but the real determining factor in competition is dynamism in the production of knowledge, transformed into new products.

Dosi (1988), a theorist in the school of evolutionary thought, applies the notion of paradigm to technology, which he defines as all techniques used in order to create, develop, produce and sell

a product or a service. He suggests the existence of a framework, the paradigm, within which there is a problem, a method of research, and a solution to that problem. Innovation is present at all levels of the paradigm and actually represents the sum of the improvements. Behind the idea of improvement lies the notion of constant evolution along a technological trajectory on which technological progress emerges within the economic and technological constraints defined by the paradigm.

Nelson *et al.* (1994) explain the nature of these economic constraints, placing particular emphasis on institutions, which prior to their work had not been taken into account when explaining differences in economic growth between nations. The role of institutions, notably their capacity to anticipate trends and cope with systemic change, determines economic effectiveness. The evolutionary idea can therefore be defined as follows: technological changes, by transforming the material bases for existence and instrumental modes of behaviour, produce conflicting tensions over the predominant institutional characteristics – practices and representations, organisational forms, and social relations – thus fostering the emergence of institutional innovations.

'National innovation systems' comprise the social and economic institutions that determine the effectiveness of innovation.

Theorists of national innovation systems have taken up this idea. The first step was taken by David (1975), who defined a country's national innovation system as the capacity to develop a technological trajectory based on local characteristics and on learning effects. Subsequently, Freeman (1982) developed the concept of National Innovation System (NIS). Generally, the concept of NIS places innovation in the context of social and economic institutions that determine the effectiveness of innovation. This approach is particularly interesting because it helps explain the differences between nations or between companies embodied in technological trajectories. Freeman (1995) uses the concept of NIS to account for international differences in institutions' capacity to adapt to technological change and to dissemination of technology. He defines NIS as a set of institutions, routines, and structures that manage the process of innovation and dissemination of new knowledge and technological change in a context characterised by the presence of externalities and learning effects. Freeman (1988) and Freeman and Perez (1988), extended the notion of NIS and looked at the institutional trends resulting from the appearance of innovation clusters.

A second definition of NIS emerged with the work of Abramovitz (1986), who argued that the innovation capacity and technological potential of a country depend on local development and not on technological globalisation. Stiglitz (1991) challenged this view, stressing that local development as defined by Abramovitz was not sufficient to explain the specificities of national innovation systems, since competition policy and the financial system are other variables affecting the innovation process, specialisation and learning, and the capacity to adapt to technological change.

Nelson (1993) extended the list of factors shaping the evolutionary process with 'coherence of interrelationships' and defined technological NIS as a set of institutional interrelationships whose coherence will determine a country's performance in innovation. But he also observed that such national performance is influenced by the unique history of each nation. In 1995, he applied the concept of NIS to R&D policy and to the way in which R&D can be influenced by political institutions managing science and technology and by legal institutions regulating intellectual property (Nelson 1995).

Although preceding Nelson (1993, 1995), the climax – so far – of this lengthy reflection on NIS came with the contributions of Lundvall (1992) and Johnson (1992). Lundvall examines the role of institutions in the growth of nations. More specifically, using a microeconomic approach, he attempts to show a relationship between innovation and social organisation and stresses the

notion of 'institutional learning'. He also emphasises that the dynamic, but also obstructive nature of institutions must be taken into account in understanding innovation dynamism. He puts forward a number of explanatory factors, such as social relations and relationships between producers and users that need one another for their effective operation. Whilst Lundvall stresses institutional learning, Johnson underlines the negative effect of rigidity and the failure by institutions to react to signals from markets, which he regards as factors in the slowdown of economic growth. Nevertheless, he points out that institutions are privileged information carriers for the circulation of knowledge through learning systems. The author therefore takes the view that the notion of technological paradigm is an institutional notion since it conveys the idea of a common representation of the nature of problems and the means for their resolution. The key message transpiring from Lundvall (1992) and Johnson (1992) is that understanding the operation of an NIS is essential to any technology policy.

Duby (2000), wishing to improve French technology policy, attempted to mobilise the contributions made by this theory. On the basis of practical observations made in ten countries, he defines four sets of determining factors for national innovation systems, namely national culture, consensus among participants, coherence, and continuity of actions. These four sets of elements allow the author to analyse the role played by each factor in explaining differences between national innovation systems. The author places particular emphasis on the importance of a high degree of administrative coherence between different political actors, public agencies, and local authorities in order to implement an effective technology policy.

All in all, while various contributors to the evolutionary approach emphasise different aspects of national innovation systems, they all attach great importance to the notion of 'capacities' and 'competences' for the effectiveness of the innovation processes. It is around this notion that contemporary approaches to explaining micro- and macroeconomic competitiveness are being developed, in particular with regard to an economic system's capacity to produce innovation.

3.2 Theories of incentives to cooperate

The second theoretical framework within the structuralist approach to industrial policy focuses on incentives for cooperation, in particular between businesses in sectors of industrial innovation. The primary role attributed to the state in this framework is not to intervene directly in the innovation process but to help implement an incentive structure conducive to firms' cooperation in innovation. But to play this role effectively, policy makers have to understand both the mechanisms for effective cooperation between heterogeneous agents seeking to maximise the return on their cooperative investment and the mechanisms by which policies can influence the effectiveness of industrial cooperation in general and R&D cooperation in particular.

Let us start with firms' incentives to cooperate. In principle, they stem from the need to pool agents' financial resources and complementary competences, in particular for research where the level of cooperation needed is constantly rising as new technologies become more complex and more expensive. However, the market is not able to provide such an incentive because of the existence of positive externalities and the difficulties involved in appropriating the results of research. As a result, cooperation might not happen – or, if it does, it might be too little – and, hence, the production of knowledge and its dissemination remain suboptimal.

Against this background, economic agents must be encouraged to pool their knowledge so as to improve the collective wellbeing and promote better circulation of information that is essential if industries are to flourish. An industrial policy can therefore be based on the findings

In another view, the state should just create incentives for firms to cooperate in innovation.

from contract theory with respect to incentives to cooperate – in particular between research centres and universities, and the state and industry – so that such cooperation is able to boost the competitiveness of businesses and of the economy as a whole. It is only by identifying the interests and needs of each party that it is possible to set up an effective production system based on equitable sharing of the gains of cooperation.

The rapid rise of new technologies has been a major stimulus for R&D alliances and cooperation. Economic theory suggests that business cooperation agreements can be a crucial factor in the capacity to innovate. Whilst they offer greater flexibility and access to information, they also lead to lower costs, allowing complementary competences to combine effectively. As cooperation reduces competition, it may be criticised by the competition authorities. Industrial policy authorities must therefore intervene to promote it, at least in the earlier stages of production, and try to reach an acceptable balance between competition and innovation objectives.

Firms' cooperation in R&D saves them time and spreads the risk of failure.

Let us look at incentive policies to encourage efficient cooperation. The importance of scientific knowledge as one of the factors in competitiveness calls for new means of intervention. States must increasingly practice incentive policies to promote technological developments, information transfers, and industrial cooperation. Nevertheless, the complexity of technology and its constant evolution give rise to considerable investment costs linked to learning curves. The state can promote cooperation between companies by helping them to internalise positive externalities. Cooperation is especially important since the pooling of knowledge competences saves time and spreads the risks of failure. It is therefore understandable why the state intervenes by financing some of the transaction costs linked to companies' collective learning. Watkins (1991) stresses that cooperation between independent businesses entails coordination and communication costs that the companies alone cannot afford.

One of the simplest and most effective mechanisms is a financial incentive for cooperation, making the granting of public funding contingent on different forms of cooperation between businesses. This is, for instance, the case of Sematech, a US association of semiconductor manufacturing companies cooperating pre-competitively in key areas of semiconductor technology. In general, some partners in the cooperation might seek to benefit from cooperation without contributing to it, which is described as free-riding behaviour and must be avoided at all costs. The state's role is therefore to act as guarantor of cooperative behaviour for each of the partners. To illustrate, in Japan, the Ministry of International Trade and Industry brings businesses together in projects and guarantees that each partner acts fairly.

In addition to limiting free riding, other challenges arise when trying to pool complementary knowledge through R&D cooperation and alliances. One source of weakness could be opportunistic behaviour, that is, the desire of individual partners in the cooperation to benefit from complementary assets (i.e., the knowledge of other partners) without maximising their own efforts. The positive externalities generated by innovation are then counterbalanced by companies' strategic negative externalities. Companies make sure the results of their research effort are kept secret in order to secure a competitive advantage. Again, leaving innovation to the 'invisible hand' alone would ignore the collective dimension of innovation that requires the sharing of technological information.

All this means that for cooperation to be effective, it is important to put in place incentive systems that encourage fair behaviour and maximise disclosure of complementary individual knowledge. Here we have a typical case of market failure where the public authorities can intervene through various measures in order to optimise cooperation and minimise opportunism. Let us elaborate

on this and look at how certain authors have described the need for cooperation to deal with market failures in innovation.

Spence (1984) was one of the first to point out that government action to promote the dissemination of new knowledge and access to existing information increase the likelihood of producing novel technical solutions. Katz (1986) stresses the importance of government-sponsored cooperation between competing companies. In his view, permission to share costs is an incentive to cooperate. In this scenario, the internalisation of technological externalities occurs where two companies merge certain activities, one being behind the innovation, the other using the results. In some cases government action must recognise the benefit of liaisons between companies. Katz also stresses the positive impact of information sharing and innovation quality, which are essential in a knowledge-based economy. He also emphasises the positive effect of cooperative research that eliminates costly duplication of research efforts. In addition, cost sharing is also an incentive for research, since it allows risks to be spread. Lastly, the author calls on the public authorities to consider cartels to be 'socially beneficial' when result sharing is technologically relatively easy and when, in the absence of cooperation, R&D externalities would be particularly large. Geroski (1992) picks up the idea developed by Katz and proposes substituting *ex ante* upstream/downstream cooperation, allowing the creation of a knowledge market, for *ex post* cooperation, i.e., the patent system. The author notes that new technological knowledge must be associated with various other inputs. However, these complementary assets certainly exist upstream and downstream of the innovating company.

To conclude, the economic case for public intervention aimed at fostering R&D cooperation rests on three pillars: first, innovation is key for the competitiveness of firms in knowledge-based economies; second, cooperation of innovating firms spurs innovation and its dissemination throughout the economy; third, markets provide insufficient incentives for firms to cooperate (in fact, competition policy curbs such cooperation) and, as a result, the level of innovation and the speed with which new knowledge spreads through the economy is suboptimal – and it is this shortcoming that an incentive-creating industrial policy tries to address.

3.3 New trade theory and strategic trade policy

Although the concept of strategic trade policy is usually associated with new trade theory (i.e., trade theory that accounts for economies of scale and other reasons for imperfect competition), it reflects an old debate: is free trade really the optimal form for international trade?

Strategic trade policy is also industrial policy.

Many authors have pointed out imperfections in international competition. A number of sectors undergoing constant technological change may justify public intervention. Around this renewed 'acceptable' protectionism, which applies specifically to 'strategic' industries, there emerges a new legitimacy for industrial policy. The theoretical foundations for this approach can nevertheless be found in traditional international trade theory, reflecting a simple idea: certain industries promise large rents, high profit margins, and higher-than-average salaries – all boosting national wellbeing. Recognising that international competition is imperfect and that certain sectors are strategic gives a realistic view of international trade. Brander and Spencer (1986) even stress the beneficial effect of public intervention through aid to such industries. They note positive global welfare effects because subsidies tend to reduce the monopolistic distortions stemming from imperfect competition.

Siroën (1994) has given this idea a more radical spin, considering any trade policy as strategic that seeks, outside the market, to predetermine the conditions of trade, whether they relate to volume, price, or any other characteristic. This policy is described as a 'managed' trade policy, which takes

the form of unilateral measures (e.g., countervailing duties, anti-dumping measures, sanctions, and sectoral protection) but also bilateral instruments (negotiated direct restrictions) in a competitive or oligopolistic market situation.

In practice, this idea was championed by the Clinton administration, which took the view that although free trade is a game where, in principle, everyone wins, in certain sectors it takes the appearance of a war: the strength of an economy rests in its capacity to face foreign competition since international competition is the motor for change and innovation (Tyson 1992).

In this approach to international trade, high-technology industries obviously play a key role. They are both strategic and in a situation of imperfect competition. Laussel *et al.* (1988), for example, note that support for strategic technologies or sectors, even though not justified by a static allocative efficiency, could well be justified from a dynamic viewpoint because such sectors are especially important for a country's economic growth, productivity, and its innovation capacity. In the same spirit, Foray *et al.* (1999) stress that the effects of public support to strategic technologies or sectors must be considered in dynamic and not static terms since the very notion of strategic industry recognises a long-term dimension resulting from cumulative effects and increasing returns to scale.

Zysman *et al.* (1990) were the first to have focused on the effects of imperfect competition on industrial sectors characterised by rapid technological change. They argue that strategic trade policy has a real influence on industries operating in an imperfectly competitive world. They further observe that some countries still considered comparative advantages to be the main driver of international trade, thereby ignoring the evolving nature of the concepts that define international competition. One of the sources of international conflict stems from the inherent characteristics of R&D: it comes with large initial fixed costs, but the unit cost of the product (or process) developed on the basis of successful research drops considerably, thereby closing out potential competitors. It follows that, in the case of these industries, imperfect competition (due to economies of scale and or product differentiation) restricts or even eliminates the benefits of free trade.

Strategic trade policy is ultimately no different from protectionism.

Condensing it all, the key policy question, then, is whether it is possible and desirable to subsidise sectors or projects that cannot (fully) be financed by the private sector on its own but that are deemed to be essential for a nations' competitiveness. Strategic trade policy is ultimately no different from protectionism as such – it has simply found a new field of application. What is interesting is that these ideas have influenced not only US policy, but also European policy, with Airbus. But have such policies been successful?

The best test case one could think of is the support of European countries for Airbus. In a recent paper, Seabright (2005) attempts to evaluate the Airbus case, which is indeed the best-known case of strategic trade policy, and to that end seeks to answer two questions: was the support justified and is the Airbus success an accident? As to the first question, Seabright takes the view that Airbus is a profitable company and that the benefit for consumers are real, even though all this has come at the expense of Boeing (e.g., lower profitability). His overall conclusion is that support for Airbus undoubtedly made sense for Europe. Turning to the second question, Seabright notes that the success of Airbus has not been an accident if one takes the comparison of the failure of Concorde. Concorde was an engineer's project, uncomfortable for passengers, and suffered from bad luck (the initial refusal of landing rights for New York's international airport). But this failure notwithstanding, the large fixed costs for any new entrant to the aircraft industry and the need for a sustained, continuous effort make the industry a good case for public intervention. Aeronautical businesses

are concentrated, specialised, and large. This set of characteristics explains both why the support for Airbus has been successful and why it is difficult to replicate this success in other sectors.

3.4 The new economic geography

Industrial policy reflections based on new economic geography try to answer a variety of questions that arise in the context of economic integration in general and European economic integration in particular: what explains the spatial agglomeration of industries, what are the effects of regional integration on specialisations, why do national borders continue to influence economic activities, and is it possible to encourage the creation of industrial districts? Following Fontagné (2000), this sub-section presents two approaches to answering these questions. The first – taking a macroeconomic perspective – seeks to explain why companies from the same country always have a greater tendency to trade with each other than with companies in other countries, even though barriers to trade have been reduced considerably. In other words, this approach examines the persistence of border effects. The second approach looks at the spatial agglomeration of industrial activity. The common thread of both approaches is the notion that firms that are technologically and organisationally close have an interest in moving closer together geographically in order to benefit from economies of scale, to take advantage of public infrastructure support in research and education, and to build up flexible competences.

New economic geography focuses on the determinants and policy aspects of border effects and agglomeration.

3.4.1 The persistence of border effects

A recent report (Maurel 1999) on the effects of European integration on the location of activities illustrates the impact of border effects. Its findings are in contrast with the prediction of Krugman and Venables (1993), who argued that the creation of the Single European Market would result in increased specialisation and asymmetries between European countries, essentially leading to differences between EU countries similar to those between regions in the United States. The Maurel report concludes that a new European economic geography is emerging, which is largely shaped by distance-related transport costs and trade-related transaction costs. The authors of the report point to agglomeration effects that are limited to the national territories of EU member states rather than the EU as whole. One may say that EU countries are under-specialised compared to US regions and the Krugman/Venables prediction. But it is also true that within EU countries regional agglomeration and specialisation has increased. With no increase in specialisation across EU countries, European integration does not seem to have increased the risk of asymmetric shocks. However, with increased regional specialisation and agglomeration, the spread of industrial activity across regions has become more uneven – a phenomenon that regional and industrial policies must take into account to meet the objective of promoting a balanced economic development of Europe.

More specifically, as Europe's long-term competitive advantage rests on the technological specialisation of its regions, new institutions capable of supporting this development must be created. Given the goal of 'cohesion' (i.e., a reasonable degree of spatial equity), the Maurel report highlights a challenging policy dilemma facing such institutions: on the one hand, the spatial distribution of economic activity and income must not become too big; on the other hand, to the extent that agglomeration enhances Europe's competitiveness, policies must not obstruct such agglomeration. A promising way to deal with this dilemma is an application of the conventional principle of subsidiarity: a European technology policy would concentrate policy support on activities of particular importance for Europe's competitiveness and, at the same time, national policies would try to mitigate within-country regional income disparities.

3.4.2 Agglomeration and the emergence of industrial districts

This approach – well known also in industrial economics – makes it possible to analyse the reasons why firms in the same sector, or in a vertically dependent sector, seek to concentrate in a specific geographical location. According to Barnes (1987), industrial geography as such does not exist; rather, there are many industrial geographies. From this point of view, each local system experiences a unique development, and it is impossible to generalise their specific evolution. Nevertheless, it is useful to look at agglomeration and industrial districts from four different perspectives.

To begin with, there is the Marshallian approach to industrial districts. Economists studying the relationship between geographical concentration and industrial development on the basis of this approach have attributed concentration to positive externalities resulting from proximity and abundance of natural resources. However, these explanations are only partly valid today. For example, Piore and Sabel (1984) – introducing the notion of ‘flexibly specialised industrial districts’ – regard industrial districts as characterised by the presence of many small and medium-sized enterprises specialising in the production of a limited range of products or in one segment of the production process. Each enterprise has access to the specialisation of other enterprises in the same district, and although competing with one another, these enterprises operate in a situation of permanent interrelationship and remain ‘collectively flexible’. Scott (1988) gives a good illustration of this. He defines an industrial district as a network of local producers benefiting from a certain division of labour and having access to the same local labour market. An industrial district is thus characterised by a geographical concentration, the presence of small and medium-sized enterprises interlinked in various sectors, and the availability of a skilled labour force able to meet the needs of manufacturers.

Agglomeration has been viewed, for example, as a result of specialisation, or as a source of innovation.

The second perspective emphasises industrial agglomeration as a generator of innovation. Crevoisier (1994) explains that in the era of knowledge-based economies it would be erroneous to believe that the competitive advantage of a country or region resulted from the resource endowment of that country or region. Rather, national and also local institutional actors can help building up competitive advantages. Similarly, Malecki (1998) points out that industrial development and geographical concentration are correlated. While it is true that historically most industrial sectors have developed in a particular region, today the concentration of companies in the same region can be explained more by the uncertainty stemming from rapid technological change. There is evidence that the successful development of certain regions is driven by their autonomous capacity to generate new products, techniques, and organisations.

Regions each have their own way of integrating knowledge and their own capacity to transform knowledge into new products. First of all, a region is identified with its specialisation in the production of integrated know-how specifically geared to its local production system, which affords it its main competitive advantage. Second, the real success of regions lies in the processing of that know-how and in the capacity to generate and transform innovative ideas. If certain regions with know-how and an outstanding research infrastructure have failed in being attractive as a geographical location or in their industrial development, it is because organisational or social barriers have created insurmountable obstacles for them. Hayter (1997) also adopts this approach when he looks at the reasons for the differences in attractiveness of regions. More specifically, he stresses the role of industrial geography in explaining the location and dynamism of industrial activities and the impact of such industrial dynamism on local development. The success of certain industrial districts stems from the good balance between the degree of competition between companies and their cooperation, not only in activities linked with the production chain (R&D, marketing, and so on), but also in labour management and vocational training.

The third perspective on agglomeration and industrial districts views geographical agglomeration as the result of self-reinforcing cooperation based on geographical proximity. Proponents of this view stress the forces of cooperation and spatial proximity as key conditions for the capacity to adapt to technological and organisational change. Companies must balance the dynamic forces of competition with those of cooperation, as too much competition destroys not only working conditions, but also the incentive for innovation and learning. Lorenz (1992) finds that successful industrial districts are characterised by a particular balance between cooperation and competition among its firms, with cooperation taking two main forms: the provision of collective goods (such as training and education and research and development) and the adherence by firms to trust and norms. The critical role of geographical proximity for cooperation, collective learning, and technology transfers is also noted by Takeuchi (1992). Examining the activities of small-scale industries in Japan, he finds that for cooperation to be effective, partners should not reside more than 15 minutes away from one another. Time savings due to geographical proximity are an informational gain and determine effective mutual exchanges.

The fourth and final perspective on agglomeration and industrial districts – developed by Florida (1995) and Storper (1995), for instance – suggests that regions should be regarded as learning systems and that it should be studied why such systems differ across regions. Each region has its own mechanism of organising learning and innovation, but the successful ones are those that are more flexible and thus more capable of discerning the necessary industrial changes. Ragni (1997) provides a good summary of these mechanisms, pointing to the importance of a flexible division of labour, social and institutional structure that fosters a rapid exchange of information, and agglomeration that bring together activities with considerable scope for technological or financial externalities.

3.5 The theory of sectoral production systems and clusters

The cluster approach is obviously linked to industrial districts, and links between clusters are not unrelated to geographical agglomeration phenomena. However, in what follows we will go beyond the previous sub-section by taking into account that an industrial sub-system develops around a set of specific factors – for example, the tertiary education system, the financial system, and the strength of downstream and upstream links between firms in an industry. Identifying these factors is crucial for developing possible intervention aimed at strengthening the competitiveness of industries.

Identifying the factors around which a production system develops is crucial for policy intervention.

To begin with a definition of a production (sub-)system, Fredriksson and Lindmark (1979) define it as a set of relationships between goods, services, and information that are directly or indirectly linked to the production of the final goods. But the notion of a production system must be used with care, as each product represents a unique production scenario. For example, in high-technology industries, such as the semiconductor industry, there are thousands of separate production operations and functions. In sum, each product requires its own production system; in some industries, the system involves a large number of companies, whereas in others few companies make up the system.

Another definition needed to develop ideas is one for 'industrial clusters'. Camagni (1995) defines a cluster as an environment in which geographical production sub-systems, culture, technology, companies, and institutions are closely related; in this environment, confidence and reciprocity are two fundamental concepts, and institutions operating in it are guided by a set of implicit rules and cultural norms that support innovation and ensure flexibility. The cluster approach is very innovative because it focuses on a set of interdependent relationships between institutions in an

industrial system. The effectiveness of industrial policy can therefore be measured by its capacity to promote the creation of specific institutional arrangements for each industrial cluster; and to be effective, such policy cannot be devised as horizontal national programmes, which – by definition – try to avoid the specificity needed for an industrial policy that aims at supporting clusters.

For Doeringer and Terkla (1995) spatial proximity is at the heart of a clusters-based industrial policy. The emergence of industrial clusters begins with geographical proximity and then gains dynamism through specific systematic relations. Held (1996) emphasises that a policy aimed at developing integrated production systems must take account of the singular relations between the businesses eventually forming a successful cluster. Here it is important to note that an integrated production system needs more than a region composed of a large number of companies.

On similar lines, an OECD study (1999) highlights the characteristics of an integrated production system. What makes a group of businesses an integrated production system is the intensity of their relations and the degree of collaboration on both the range of competences within the group and the acquisition of competences outside the system and their transformation into local competences (Belussi 1996).

The semiconductor industry is a good illustration of the importance of institutions, organisational structures, and industry-specific factors.

Nelson (1999) has given the theory of clusters a new dimension. He argues for a new approach to industrial policies geared to production sub-systems characterised by certain identifiable specificities. Intrigued by the upheaval of market structures and firms' corporate hierarchies following from technological advances, Nelson tries to understand what made possible the ascendance of new entrants to the market. A comparison of the semiconductor industry of the United States with that of Europe and Japan suggests some answers. US companies, which have dominated integrated circuit production since the 1970s, are independent companies specialising in semiconductors. By contrast, their European and Japanese competitors are integrated into companies that generally specialise in the electronic equipment industry. This shows the importance of institutions, organisational structures, and factors specific to each individual industry. All in all, Nelson attributes the success of industries to various factors: research capacity (both quantity and quality); abundance of specialised venture capital finance – a factor explaining the dominance of US firms in electronics and biotechnology; a university education system that offers applied learning; and the existence of strong upstream and downstream industries.

This theoretical perspective makes it possible to explain the horizontal geographical movements of industrial activity (i.e., movements from one developed country to another) and vertical movements (i.e., from developed countries to newly industrialised countries). Taiwan is a good example in that it now produces highly competitive RAM chips. This perspective also allows us to understand industrial dominances, the decline of certain firms that are unable to detect technological change, and the ascendance of new firms that are able to take advantage of this situation. These clusters of industries, isolated in their own industrial logic, appear to form the most relevant level of analysis for industrial policy, not only because they emerge around sectors of activity that make a significant contribution to creating national wealth and are therefore strategic, but above all because they are healthy industrial growth systems based on broad and effective dissemination of knowledge and on a capacity for cooperation between firms competing in sectors where financial and human resources have to be pooled.

Nelson suggests a number of lessons for industrial policy, which essentially involve a synthesis between vertical and horizontal industrial policies. To recall, vertical industrial policy advocates sectoral, or specific, state intervention because of the highly strategic nature of a number of industries, but also on account of the effectiveness of specific, targeted actions for each industry.

By contrast, horizontal industrial policy advocates intervention aimed generally at creating a favourable environment in which competitive industries and new technologies emerge and thrive. Nelson gives two examples of sectoral policies to show the highly varied effectiveness of these two types of policies. The first – a clear failure – is the support to the European information technology industry; creating this industry required substantial subsidies and protectionist barriers. The second example is the successful sectoral intervention of the Japanese government in the semiconductor industry. This situation calls for a policy tailored to each individual case, in this instance to each individual sector. Sectoral policies with unequal results combined with increasing liberalisation and globalisation of markets have fostered the idea of a horizontal industrial policy whose role is to get the basics right, so that firms and industries can emerge and prosper. But this does not mean that Nelson is calling for the competitive environment long desired by the European Commission. He is proposing horizontal policies tailored to a specific industrial sub-system.

For Nelson, the new industrial policy could resemble a pooling of policies, namely monetary and fiscal policy stimulating investment, competition policies encouraging structural dynamism, aid policy avoiding supporting failing companies, and education policy favouring applied learning closely based on corporate research principles. This set of ideas constitutes a policy whose chances are not reduced by the formulation of additional pointless regulatory constraints. Nelson calls for great care in putting these elements into practice. To illustrate, in the case of education and training, it is not enough *per se* to create additional university departments or to develop complex research programmes because each industry evolves in its own specific way. That is why horizontal action will probably not produce the desired results. An effective industrial policy has a concrete sectoral orientation that promotes specific infrastructure for each sector, but not individual companies. Understanding the specific nature of institutional arrangements in each sector will enable appropriate regulatory systems to be developed. If national industry as a whole is to remain on a sound footing, these specific institutions must take on an effective support role.

Taking up the notion of tailoring horizontal policies to a specific industrial sub-system, Tucker (1998) examines the relationship between specific institutions for sectoral sub-systems and industrial competitiveness in various US industries. The results are striking. Such specific institutions exist in all US industries studied. These institutions have a greater capacity for evolving in step with the technological changes affecting the sectors in question, unlike national and general institutions. An active sectoral policy can therefore be effective since industries with their own specific characteristics need institutional support tailored to their system. Moreover, there is good reason for an active policy because there is a strong case for building up competitive advantages through specialisation. In other words, the purpose of industrial policy is to enable firms to take risks, hedge them, and change course in light of new developments.

Consequently, this type of industrial policy never has a direct, automatic effect on companies. On the contrary, it depends on the actions taken by the companies themselves. Thus, the success of a policy to protect nascent industries depends more on the determination of the individual companies than on the means used to implement the policy. If a firm decides to use the protection of its markets to do nothing, the effect will be different than if it decides to take advantage of that protection and develops strong competences. In other words, a policy will be even more effective when implemented in collaboration with companies; the policy must be bottom-up, as companies in a sector will then see it positively and it will follow the direction sought by the political encouragement.

All told, these different cluster-based approaches lead us to conclude that an industrial policy based on 'general' policy instruments cannot encourage and promote the development of competences

The different cluster-based approaches suggests that 'top-down' policies are inferior to 'bottom-up' policies.

specific to the sector and location of firms. In contrast, a bottom-up industrial policy – based on sectors and attentive to industry needs – has a greater chance of success in improving the competitiveness of industries.

4. The pragmatic approach to industrial policy

New growth and development theories have given rise to a 'pragmatic' approach to industrial policy.

This approach draws on insights from new theories of growth and development put forward over the last fifteen years. To start with new growth theories (Romer 1990, Aghion and Howitt 1992, 1998), four insights stand out. The first is that innovation and technological adaptation are the main engines of productivity growth and therefore per capita GDP growth. Innovation and adaptation take the form of new products, new production processes, and new organisational forms within businesses and markets. Second, innovation and technological adaptation take place largely within firms and they depend on firms' incentives to innovate, which are – in turn – influenced by economic policies and economic environment (patent and intellectual property policy, R&D subsidies, competition policy, availability of skilled workers, and so on). Third, the Schumpeterian idea of 'creative destruction' is a key driver of productivity growth: before too long, any new innovation replaces existing technologies as well as the capital goods and human qualifications associated with them. Consequently, innovation contributes to increasing disparities between those who adapt quickly to technical progress and those who do not; in particular, it generally tends to widen the income differential between skilled and unskilled labour. The fourth insight is that the human capital stock of a country determines its capacity to innovate and to narrow the gap with richer countries, or to move ahead of them. In essence, the idea that the fruits of education can be assessed above all by technical progress takes us back to the writing by Nelson and Phelps (1966). What is more, the differences across countries in per capita GDP and productivity growth are largely due to differences in R&D systems and policies and differences in education systems, in so far as those systems influence the supply of skilled labour capable of making technical advances.

Education and research are key drivers of economic growth in all countries, whatever their level of technological development. In countries close to the technological frontier, education increases the number of potential researchers and therefore reduces the cost of R&D; as a result, it is liable to reinforce the incentive effects on innovation of any direct innovation support policy. In technologically less advanced countries and sectors, education and R&D enable new technologies already introduced in more advanced countries to be adopted and to be adapted to local geographical and economic situations (an innovation in itself), thereby allowing a higher level of factor productivity to be achieved. This complementarity between education and research in discovering and applying new technologies has important practical implications for economic policy. In particular, it suggests that growth-enhancing policies combine subsidies for R&D and laboratory equipment used principally by innovating businesses, well-defined intellectual property rights, well-targeted infrastructure investments, efforts to improve the quality of the education system, and the provision of information to firms on the availability of skilled labour and to researchers and technicians on developments in innovative sectors.

Turning then to new development theories (notably Rodrik 2004), the main industrial-policy message is that specialisation is acquired (and not given) and that active industrial policies can be successful. In particular, an export strategy geared to high-quality products makes it possible to improve the balance of trade and stimulate growth because it provides an incentive to develop entrepreneurial activity. Let us look at these different points in greater detail.

Rodrik stresses that a country's economic fundamentals (that is, its endowment of natural resources, physical and human capital, and good institutions) determine relative costs and, thus,

its specialisation. Attempts to alter them are likely to fail and hamper economic performance. However, he immediately adds that these fundamentals are to some extent undetermined and may therefore be shaped by idiosyncrasies. A country might take a selective approach to the type of products it promotes and exports, reflecting the possibility that specialising in some products will bring higher growth than specialising in others. But how could policy makers identify economic activities that are more promising than others?

Rodrik's answer reflects extensive studies carried out on developing countries and it revolves around the notion of 'cost discovery'. According to him, entrepreneurial activity is not limited by cultural aptitudes so much as by high risks of failure in less developed countries. The incentive to start up innovative businesses has the particular merit of showing the limits of national productive supply and of local demand. Overcoming the uncertainties related to this situation, as well as leading to individual success, allows collective learning and dissemination of results. Innovating for export will also stimulate productivity gains in the domestic economy and therefore set in motion a healthy process heralding growth in per capita income.

So what, then, is 'good' industrial policy? Rodrik emphasises that industrial policy should not focus so much on tax incentives and subsidies for activities that are believed to spur economic development. Rather, it should help establish a strategic collaboration between the private sector and the government, with the aim of identifying and removing main impediments to economic development. He also stresses that industrial policy should not focus too much on policy outcomes – which are unknowable *ex ante* – but on getting the policy process right. The merit of industrial policy is not only in rectifying market failures in terms of technological externalities, but also in dealing with two other types of failure, which relate to information (how to show participants the cost structure of an economy) and to coordination (how to encourage participants to reap the benefits of economies of scale made possible by coordination). Recognising the usefulness of industrial policy does not mean to overlook its risk, particularly the risk of creating undesired distributional effects and of protecting rents. On the contrary, it is an additional incentive to define processes rigorously and to evaluate them regularly.

5. Conclusions

There is no shortage of arguments against industrial policy: there are doubts about the ability of the state to pick winners, concerns about state capture and corruption, far from convincing results of past policies, and so on; but there is no shortage of responses to these criticisms either (Rodrik 2004). The important thing is to see industrial policy as a strategic process of discovery – coordinated by public and private actors and based on relevant information and business opportunities – that results in appropriate measures being taken by the public authorities.

A key conclusion is that competitive advantage is built over time, and the idea of an initial endowment of factors and a specialisation as a result of free trade simply does not tally with economic history or even with more recent developments. This suggests that state intervention to influence a nation's specialisation can be successful. Nevertheless, attempts should not be made to reproduce what has been successful in a highly capital-intensive sector with strong R&D and strong barriers to entry in sectors that do not have these but different characteristics.

And it is also clear that the private sector is not necessarily better informed than the state and, as in the case of the state, its decision-making might be biased in favour of high-tech, big, glamorous projects. The real difference in behaviour seems to reside in businesses' greater aptitude to terminate bad projects.

The state may play an important role in influencing a nation's specialisation.

State intervention is especially important in a knowledge-based economy. Providing education necessary for such an economy, delivering high-quality infrastructure, protecting intellectual property rights, and giving incentives for innovation, cooperation, and knowledge transfer are all crucial elements of a growth-enhancing policy. What is more, the presence of a particular production process in a specific location and effective sectoral policy makes it necessary to coordinate public and private, industrial and educational, and financial and business initiatives. The roles played by incentives, institutions, and regulations (and, of course, the quality of public intervention) are all crucial.

The debate is now between those who deny any role for the state and those who seek to specify when state intervention can be appropriate.

All told, the debate is therefore no longer between advocates of horizontal and vertical policies, or between supporters of national champions and competition, it is between those who deny that the state has any competence and those who seek to clarify the specific conditions for appropriate intervention. The role played by the US federal state in the formation of clusters in new information and communication technology, the French and German governments in the launch of Airbus, Chinese government in providing incentives for technology transfer by regulating foreign direct investment, and the Finnish government to promote mobile communication technologies provide successful examples of industrial policies along the lines of the approaches described in this paper.

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