EIB PAPERS
Volume 11 No 1 2006

An industrial policy for Europe?

Context and concepts

European Investment Bank

Editor
Armin Riess

Assistant Editor
Timo Välilä

Production
Farrah Baut-Carlier
EIB Graphic Shop

Editorial Policy

The EIB Papers are published each year by the Economic and Financial Studies Division of the European Investment Bank. The journal is divided into two issues and is aimed at encouraging high-quality economic research and debate on matters of European interest. As such the *Papers* are intended to be accessible to non-specialist readers and emphasise policy dimensions rather than technical issues. They present the results of research carried out by Bank staff together with contributions from external scholars and specialists.

EIB PAPERS

An industrial policy for Europe?

Context and concepts

European Investment Bank

Contents

Preface

Philippe Maystadt
President

Industrial policy has a tendency to resurface from time to time as a fashionable topic. In the past decades, it has been evoked in a wide array of different contexts. They include – just to list a few examples – the so-called de-industrialisation in Europe and other developed parts of the world; protection of infant industries, especially in developing countries; promotion of high-tech industries; and creation of national or European champions that are to be made strong and large enough to be world leaders.

Quite often in these contexts, 'industrial policy' has suffered from a bad connotation. It is portrayed as a futile attempt by the public sector to outsmart the private sector in assessing which sectors or individual companies will do well in the future. Or worse, industrial policy is seen as public support of inherently economically unviable but politically profitable undertakings. Either way, the sceptics see little or no useful role for the public authorities in affecting the sectoral composition of the economy.

Unsurprisingly, there is also another, more favourable view of industrial policy. According to this view, there are in some cases good economic arguments for the public authorities to be concerned about certain sectors or economic activities. A case in point is public support for innovation as, so the argument goes, private firms left to themselves would invest too little in innovation. If the public sector did not intervene in this case, economic efficiency and, ultimately, growth would be compromised.

The different views of industrial policy and the arguments underlying those views are of keen interest to the European Investment Bank. As a significant lender to the industrial sector, the Bank is interested in following the debate on industrial policy, as it directly affects an important group of the Bank's clients. But beyond that, the EIB has also an interest and a need to understand the role of public policies and public institutions in facilitating the transformation of the European economy towards a knowledge-intensive and service-dominated economy.

The contributions to this volume of the *EIB Papers* are set against this background. Drawing on presentations made at the *2006 EIB Conference on Economics and Finance*, the contributions address a wide variety of issues, including the history of industrial policy in Europe, de-industrialisation, mainstream and alternative economic arguments for and against industrial policy, economic pros and cons of coordinating national industrial policies (all in Volume 11, Number 1), conflicts between industrial and other economic policies, especially competition policy, empirical evidence of the impact of horizontal and vertical industrial policy support in Europe, lessons from the Asian experience with industrial policy, and the European Commission's approach to industrial policy (all in Volume 11, Number 2).

To start with, it is useful to put industrial policy in a historical perspective and consider changes in the economic landscape where the European industrial policy has taken shape. The past century has seen two fundamental structural transformations in European economies – the shift from agriculture to manufacturing and from manufacturing to services – so one would expect industrial policy to have undergone fundamental paradigm shifts, too. The latter transformation, from manufacturing to services, is still very much in progress, and a sound understanding of its causes and consequences is key to assessing also contemporary industrial policy.

The definition and delineation of the scope for industrial policy is not a straightforward exercise. Many different policy measures have been labelled 'industrial policy', and many different arguments have been put forward to justify them. In order to base policy making on a solid footing, this maze of arguments needs to be sorted out first.

So the assessment of what exactly constitutes economically desirable industrial policy is fraught with difficulties and unanswered questions. But this has not, for sure, prevented industrial policy from being put into action. The rather long track record of industrial policy action permits an assessment of what has worked in practice and what has not. Here we can benefit from insights not only from Europe but also from other parts of the world. For instance, when considering our industrial policy options here in Europe, we should make sure to benefit from insights from East Asia's experience with industrial policies.

All in all, despite the long history of industrial policy, it seems that we still do not understand its underpinnings and consequences too well. I am confident that this volume of the *EIB Papers* will improve our understanding by bringing some clarity and economic rigour to the debate about industrial policy, and I am happy that we can share it with you.

An industrial policy for Europe?

Context and concepts

The *2006 EIB Conference on Economics and Finance* – held at EIB headquarters in Luxembourg on January 19 – examined industrial policy, with a special focus on the European context. Presentations covered some conceptual issues, investigating – among other things – the history of industrial policy and its theoretical underpinnings according to different schools of thought, as well as lessons from real-world experiences with different types of industrial policy.

Speakers included:

Ha-Joon CHANG,
of the University of Cambridge, UK

Elie COHEN,
of the Centre National de la Recherche Scientifique, France

Olivier DEBANDE,
of the EIB

Charles EDQUIST,
of Lund University, Sweden

James FOREMAN-PECK,
of the University of Cardiff, UK

Jordi GUAL,
of "La Caixa" & IESE Business School, Spain

Gert-Jan KOOPMAN,
of the European Commission

Philippe MARTIN,
of the University of Paris-1, Panthéon-Sorbonne, France

Andreas STROHM,
of the European Commission

Otto TOIVANEN,
of the University of Helsinki, Finland

Timo VÄLILÄ,
of the EIB

ABSTRACT

Recognising and discussing the elusiveness of industrial policy as a distinct policy concept, *this paper argues against what probably is the most extreme type of so-called 'vertical' industrial policy, that is, support for national or European champions. It also critically reviews the rationale for one of the economically most appealing so-called 'horizontal' industrial policies, that is, support for research and development. Although not disputing that there is a rationale for such support, we reason that it is not as strong as commonly assumed. In this context, we find that while competition is key for spurring innovation and growth, there is room for industrial policy – interestingly enough, not so much to encourage firms to extend the technological frontier, but to catch up with it. The paper also previews the other contributions to this volume of the EIB Papers.*

Armin Riess (a.riess@eib.org) and **Timo Välilä** (t.valila@eib.org) are, respectively, Deputy Head and Senior Economist in the Economic and Financial Studies Division of the EIB.

The authors would like to thank Harald Jahn, Eric Perée, and Patrick Vanhoudt for useful comments and suggestions. The views expressed are strictly personal.

Industrial policy: a tale of innovators, champions, and B52s

The trouble with the world is not that people know too little, but that they know so many things that ain't so.
Mark Twain (1835-1910)

1. Introduction

Armin Riess

Timo Välilä

Europe's economy continues to disappoint. Since the start of the new millennium, economic growth in the pre-enlargement European Union (EU-15) has averaged 1.6 percent a year. During the same period, other advanced industrial economies have been steaming ahead vigorously: in the United States, Australia, and New Zealand, for instance, economic growth has averaged 2.6 percent, 3.1 percent, and 3.4 percent, respectively. Europe also performs poorly in terms of total factor productivity. More specifically, over the last decade, productivity in the EU-15 is estimated to have grown at an annual rate of 0.7 percent, while it increased by 1.1 percent a year in the United States – and it has always been higher there to begin with. Productivity is key for ensuring the material wellbeing of Europe's citizens, especially in an era of population ageing. Equally, if not more important are jobs – again a field where Europe performs badly. Unemployment in the EU-15 has remained stubbornly high, currently amounting to some 8 percent of the labour force, and it is especially in industry where jobs disappear without enough new ones emerging elsewhere in the economy. To be clear, a number of EU countries (and regions) are doing nicely: growing fast, innovating steadily, and creating jobs. Alas, this does not apply to the large continental European countries, and without progress there, sustaining prosperity in Europe as a whole will remain elusive.

Europe's policy makers are fully aware of the challenge. In March 2000, the European Council announced the so-called Lisbon strategy, which aims at making the EU the "world's most competitive and dynamic knowledge-based economy, capable of sustaining economic growth with more and better jobs and greater social cohesion" by 2010. To this end, the strategy calls for a variety of actions by Member States, notably measures to promote knowledge creation and innovation and investment in physical and human capital. Halfway into the journey, the Council acknowledged in March 2005 lack of progress in meeting the Lisbon goals, refocused the strategy on growth and employment, and called on Member States to step up their efforts.

There are many reasons for lack of progress towards Lisbon, including too many and conflicting goals (for details see, for instance, High Level Group (2004), Sapir *et al.* (2004), and Pelkmans and Casey (2004)). Perhaps more fundamental: while the actions for achieving the Lisbon goals seem innocuous, they require a variety of reforms (of product and labour markets, for instance), which – although beneficial for society at large – create losers, not only winners. This makes implementing the Lisbon strategy politically risky, a risk well summarised in the famous quip attributed to Jean-Claude Junker, Prime Minister of Luxembourg: "We all know what we need to do, but we don't know how to win elections after we have done it."[1]. But do they really know what to do? Or is it possible, perhaps, that policy makers, like other people, "know so many things that ain't so"?

This paper and the other contributions to this volume of the *EIB Papers* certainly do not intend to answer this question. This would be presumptuous anyway. Rather, the purpose is to find out what is known about the role of industrial policy in creating a dynamic, equitable economy and to what extent misconceptions about the workings of the global economy lead to overly ambitious, if not erroneous, industrial policy propositions.

1 Financial Times, February 2, 2005.

Depending on how industrial policy is defined, it can achieve a great deal or precious little, or result in a waste of resources.

Before embarking on this task, it is more than useful to clarify upfront that the verdict on what industrial policy can achieve very much depends on what we think industrial policy is. Depending on how one defines industrial policy, or the school of thought one adheres to, it can achieve a great deal or precious little, or result in a waste of resources. The B52s mentioned in the title of this paper refer to a school of thought that sees industrial policy, as defined by this school, in a rather positive light.[2] Likewise, believers in national or European champions (that is, firms big and strong enough to take on other big players in the global economy) see industrial policy as essential for creating and nourishing them. And then, inventors and innovators seem to merit industrial policy support under all schools of thought. Although this is true, it is also true that some see a need for considerable budgetary support for innovators whereas others argue that getting the fundamentals right suffices to foster innovation.

The remainder of our tale of innovators, champions, and B52s unfolds as follows. Section 2 sets the scene: it highlights the elusiveness of industrial policy and sketches the evolution of state aid, which is perhaps the most visible and easiest to measure industrial policy instrument, though it is not necessarily the most important one. Section 3 previews key findings of the various contributions to this volume of the *EIB Papers*. Section 4 puts the spot on what we have chosen to call the 'beauty' and the 'beast' of industrial policy. The beauty is support for research and development – innovation for short. Promoting innovation is perhaps the industrial policy tool that all schools of thought consider worthy. The justification for it is the perceived failure of the market mechanism to deliver as much innovation as society wants. We admit that we, too, have fallen for the beauty, but we have come to learn that the market is much better at stimulating the creation and diffusion of innovation than we thought. In contrast, we were never fond of the beast of industrial policy, which we consider to be the creation and nourishment of national champions. With this view, we are in good company, as few economists find national champions a useful policy tool in practice, and none of the contributors to this volume comes out strongly in favour of them. Nonetheless, we plan to meet the beast because many policy makers and the wider public seem to find it attractive. Section 5 further develops a theme related to the beauty of industrial policy, namely the effect of competition on innovation and growth. Section 6 concludes.

2. Setting the scene

2.1 Elusiveness of industrial policy

Industrial policy is something of an oddity among the various areas of economic policy. On the one hand, industrial policy is usually considered as just another policy area, on par with monetary, fiscal, competition, trade, and other economic policies. On the other hand, as opposed to those other policy areas, industrial policy lacks a clearly identifiable set of goals, policy instruments, and institutions, such as a legislative framework to delineate the scope for industrial policy or designated public agencies to execute it. In other words, while denoted a 'policy', industrial policy lacks most defining features thereof.

Perhaps as a result of its oddity, industrial policy has never developed into a distinct area of economic analysis and research. For sure, many economic papers and books carry the concept 'industrial policy' in their title. Even the classification system of the Journal of Economic Literature

2 To spill the beans now: the term 'B52s' could be associated with something rather terrifying (bombers), entertaining (the "world's greatest party band"), or intoxicating (cocktails) – and possibly more. Here it simply refers to the classification system used by the economics profession to identify the subject matters of published work in economics.

(JEL), universally used to identify the subject matters of published work in economics, has a code for 'Regulation and industrial policy' (L5), with the sub-codes for 'Industrial policy; sectoral planning methods' (L52) and 'Government promotion of firms' (L53). However, economists using these codes to classify their own work tend to be trade economists, competition specialists, or scholars of the microstructure of markets. To label oneself as an 'industrial policy economist' is unheard of.

The ambiguity of industrial policy as a field of economic policy making and of economic analysis has, of course, not prevented the emergence of rival schools of thought regarding the scope and impact of industrial policy. This volume is a testimony to such rivalries, but it is also a testimony to the seldom-articulated common ground underneath the apparent differences of opinion. In what is to come, we hope to attain at least some convergence not only by including contributions that are non-mainstream in character, but also by including contributions that explicitly seek to identify differences and similarities across the schools.

As it will turn out, it is practical to frame the discussion about the different schools of thought around the labels 'mainstream' and 'non-mainstream'. Mainstream economists writing on industrial policy would likely use the JEL-codes cited above to classify their work, thus including it among the contributions to the neoclassical, industrial organisation literature. Non-mainstream economists, in turn, would more likely use JEL-classification codes like B5 ('Current heterodox approaches') or B52 ('Institutional, Evolutionary').

To narrow down the difference between the rival schools of thought to the choice between L52 and B52 is, of course, excessively crude and unfair (especially to the B52s), so let us take a first, introductory glimpse beyond the codes.

'Mainstream' economists judge industrial policy against the neoclassical notion of optimality. Many 'non-mainstream' economists consider this notion irrelevant.

It is fairly easy to delineate the scope and impact of industrial policy according to the mainstream view. For such an intervention to be economically sensible, it has to address a failure of free markets to allocate resources optimally, and the economic benefit from the intervention has to exceed its cost. Prime examples of market failures warranting public 'industrial policy' intervention include spillovers between firms from knowledge creation or location choices, and the coordination of structural change in the capital stock and the labour market. As these examples illustrate, the distinction between industrial policy and more general public sector intervention is somewhat blurred; after all, the criteria are the same for both. Thus, the primary difficulty in analysing industrial policy in a neoclassical set-up is one of identifying how industrial policy differs from other public intervention.

In contrast, the 'non-mainstream' label lumps together a wide variety of fundamentally different approaches. As will be elaborated in this volume, they include everything from 'pragmatic' interpretations of the fundamentally neoclassical new trade and new growth theories to systems-of-innovation (SI) approaches, which focus on the institutional environment for knowledge creation and dissemination. While the former operate within the mainstream optimising framework, the latter reject the notion of optimality altogether, emphasising instead that an economy evolves constantly along a path, and while it is meaningless to talk about an equilibrium or an optimal path, as they do not exist, the public sector does have a role to play in determining the economy's actual development path.

The juxtaposition of the 'pragmatic' and SI approaches is just meant to give a flavour of how different approaches can be hidden behind the JEL-code B52. This diversity makes it meaningless to try to summarise how non-mainstream industrial policy analysis would differ from or be similar to the neoclassical industrial policy analysis. Instead, suffice it to conclude for the time being that

the starting point for the economic analysis of industrial policy is common to all schools considered: there is a role for the public sector to play in determining the production structure of the economy. Against this starting point, the interesting question then becomes, what are the circumstances under which the public sector should exercise that role, and what it should aim at in so doing.

Having considered a few alternative ways to view industrial policy, it should be obvious that the concept of industrial policy itself is as elusive as the alternative ways to view it. Many authors before us have concluded that there is no universally accepted definition of industrial policy, and simply considering how the contributors to this volume have delineated the concept shows that there might be as many industrial policies as there are contributors.

One way to span the universe of definitions is to consider some of its extreme points. Some contributors would undoubtedly sign off on the JEL-classification code L52 ('Industrial policy; sectoral planning methods') or L53 ('Government promotion of firms'), as their industrial policy is primarily preoccupied with supporting selected individual sectors or firms. Others, including both neoclassical economists concerned about knowledge spillovers and proponents of the SI approach, would define industrial policy in terms of public support for selected economic activities (knowledge creation and dissemination and innovation) rather than specific economic sectors or firms. And yet others see merit in applying the Humpty-Dumpty principle when nailing down industrial policy (see Baldwin and Martin, this volume, for details).

While there is no agreement on what exactly industrial policy is, there is some consensus about what types of industrial policy exist.

While there is thus no universal agreement on what exactly industrial policy is, there is some consensus about what types of industrial policy exist. Thus, it is quite customary to use the concepts of 'horizontal' and 'vertical' industrial policy. Horizontal industrial policy is primarily concerned about supporting selected economic activities, such as innovation, without any selectivity regarding economic sectors. Conversely, vertical industrial policy is primarily concerned about supporting specific economic sectors, such as shipbuilding, coal mining, or aerospace.

One merit of the horizontal-vertical split is that it allows a classification of different types of intervention in a way that is relatively neutral *vis-à-vis* different schools of thought and definitions of industrial policy. Mainstream economists would hardly have a problem if intervention to address knowledge spillovers were called horizontal or if intervention to smooth out structural change in a particular sector were called vertical. Similarly, a proponent of the SI approach would likely accept that innovation support be labelled horizontal.

Although there is some agreement about the concepts of horizontal and vertical industrial policy, some scholars dispute the practicality of that split, arguing that most of the time even horizontal support is, in fact, specific, as not all sectors and firms will end up receiving it. Nevertheless, the split is commonly used and useful as a conceptual benchmark, even when its practical use can be disputed.

2.2 Evolution of state aid

With the horizontal-vertical split in mind, let us now turn to examining the significance of industrial policy in practice. To this end, we use data on state aid from DG-Competition of the European Commission. The data cover national state aid as defined in the EC Treaty. Consequently, state aid refers to a transfer of public resources to grant economic advantage on a selective basis, thereby affecting competition and trade. The data focus on fiscal support, which is easy to measure. Structural policy measures (such as tax, trade, or competition policy), while important as industrial policy instruments, are excluded due to difficulties in quantifying them.

This definition of state aid encompasses aid to agriculture and fisheries; manufacturing and services (to promote both horizontal objectives and vertical, sector- or firm-specific objectives); and regional aid. Horizontal objectives include, for example, research and development (R&D); environment; support for small and medium-sized enterprises; and training aid. Sectors included among the recipients of vertical aid are steel; shipbuilding; other manufacturing; tourism; financial services; media and culture sectors; coal mining; and transport[3]. Notably, sectoral aid also comprises so-called *ad hoc*, or rescue and restructuring aid extended to individual firms in difficulties. Below, the term vertical aid is used to denote the sum of sectoral, rescue, and restructuring aid.

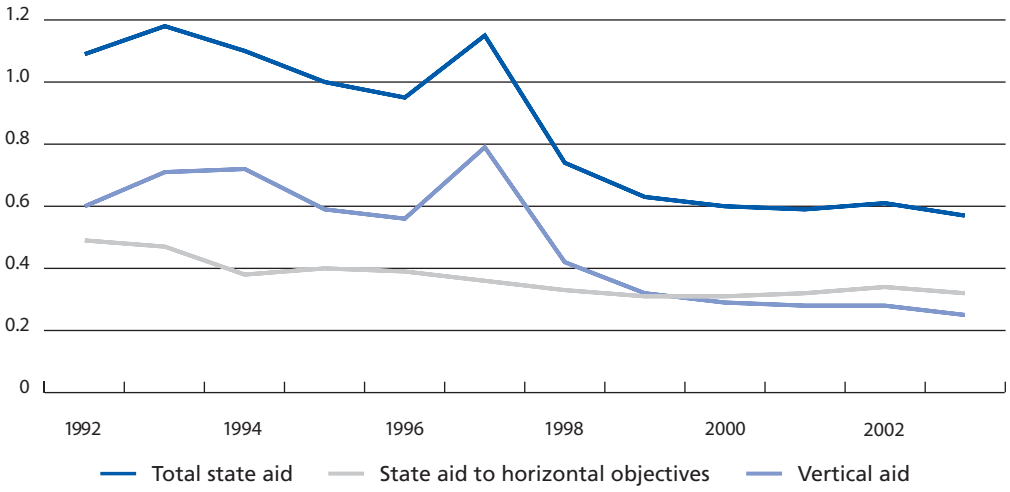
In contrast, aid not covered by the data includes aid to recipients other than enterprises (households, educational institutes, and so on); aid from supranational organisations (such as the EIB); European Commission funds and instruments; and general aid measures (differences in national tax systems or technical standards). Also, national state aid that does not need to be reported to the Commission is excluded.

Total state aid handed out by EU member states has trended down due to a decline in vertical aid.

As shown in Figure 1, state aid has trended down, at least when measured in relation to GDP. Consequently, total state aid has more than halved, from a peak of 1.2 percent of GDP in the early 1990s to 0.6 percent of GDP in recent years. Excluding aid to agriculture, fisheries, and transport would reduce these figures by 0.2 percentage points – a difference that has slowly shrunk. Note that the jump in 1997 is aid from the French government to Crédit Lyonnais, with a smaller contribution from *ad hoc* support to the financial sector in Portugal.

Breaking down total state aid into horizontal and vertical aid, as is also done in Figure 1, suggests two conclusions. First, the downtrend in total aid is due to a downtrend in vertical aid, which has declined from 0.7 percent of GDP in the early 1990s to 0.3 percent in the 2000s. Meanwhile, horizontal aid has remained flatter. Second, the current levels of horizontal and vertical aid are close to identical at about 0.3 percent of GDP.

Figure 1. Horizontal and vertical state aid in the EU-15 (in % of GDP), 1992-2003



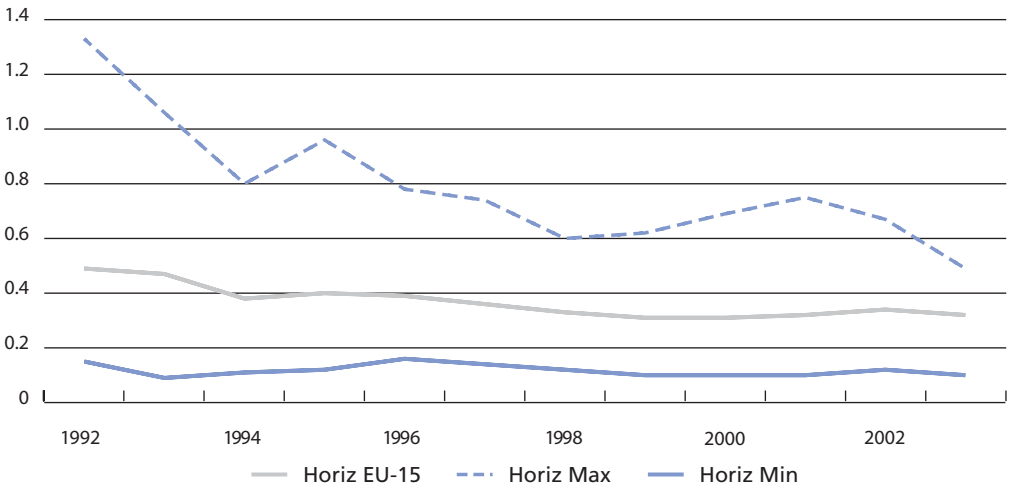
Source: European Commission, DG-Competition.

The stability of horizontal aid at the aggregate level reflects a fairly small degree of variability across countries, as shown in Figure 2, with the bottom line depicting the lowest and the upper line its

3 Transport sector comprises rail, airlines, inland waterways, maritime, and road sectors.

highest level in any individual country among the EU-15. Countries at the upper end of the interval have in recent years included Denmark and Germany (both at or over ½ percent of GDP). At the lower end are the Netherlands, Portugal, and the United Kingdom (all below 0.2 percent of GDP).

Figure 2. Average, highest, lowest horizontal aid in the EU-15 (in % of GDP), 1992-2003

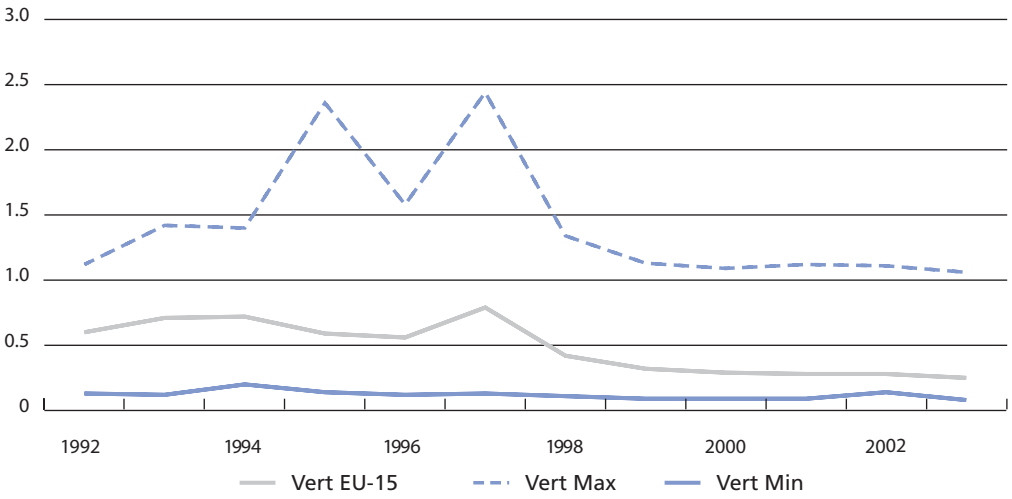


Note: 'Horiz EU-15' denotes average horizontal aid; 'Horiz Max' denotes highest; and 'Horiz Min' denotes lowest among EU-15 countries.
Source: European Commission, DG-Competition.

Vertical aid varies much more across EU countries than horizontal aid.

Vertical aid, in contrast, has varied much more across countries (Figure 3). While the countries with the smallest vertical aid in relation to GDP have kept it at 0.1 percent, countries with the highest vertical aid have constantly extended more than 1 percent of their GDP in such aid. Countries at the upper end of the interval include Portugal and Finland (both over 1 percent of GDP), with aid to agriculture accounting for the bulk of vertical aid in Finland. On the other hand, Belgium, Italy, and the United Kingdom all report vertical support below 0.2 percent of their GDP.

Figure 3. Average, highest, lowest vertical aid in EU-15 (in % of GDP), 1992-2003



Note: 'Vert EU-15' denotes average vertical aid; 'Vert Max' denotes highest; and 'Vert Min' denotes lowest among EU-15 countries.
Source: European Commission, DG-Competition.

The twin peaks in vertical aid shown in Figure 3, reaching 2.5 percent of GDP of the respective countries, represent the Finnish support to its financial sector during the crisis of the early 1990s and the French support to Crédit Lyonnais in 1997 mentioned above.

In sum, while state aid extended by EU-15 has been on a downtrend for the past decade – owing to a downtrend in vertical aid – one should not jump to the conclusion that industrial policy, too, would be declining in importance. We saw that horizontal state aid has remained stable. But going beyond reported state aid, the past year alone has seen a significant number of initiatives by national governments that most observers would classify as vertical industrial policy, including support for national champions, an issue to which we return in Section 4.

The decline in state aid does not necessarily suggest a decline in the importance of industrial policy.

Thus, at least some types of industrial policy are clearly *en vogue*. How the different schools of thought regard different types of industrial policy is, of course, a central theme of this volume. To give a broad idea, let us make a brief tour through the contributions.

3. A guided tour of the contributions to this volume

The contributions to this volume address three broad issues, including the historical background to industrial policy, its conceptual underpinnings, and evidence about its effectiveness. In addition, given our ambition to study industrial policy from a distinctly European perspective, the European Commission's new industrial policy initiative is summarised.

Starting with an analytical overview of the history of industrial policy in Europe, **James Foreman-Peck** identifies several distinct phases in industrial policy over the past century. Following a period of relatively liberal industrial policies in the early years of the 20th century, the inter-war period was characterised by nationalist, interventionist, and autarkic economic policies. After World War II, the combination of high economic growth, expanding world trade in manufacturing goods, and improving public finances all contributed to a steadfast belief in state promotion of industry. This gave rise to state-led *grands projets*, including the development of jet aircraft, nuclear energy, and computers. But this optimistic and proactive view of industrial policy was radically transformed by the oil shocks of the 1970s, followed by a decline of many traditional industries. The oil shocks, subsequent growth retardation, and financial stringencies prompted both privatisation policies and more modest policy aspirations. Summarising both macroeconomic and case study evidence, Foreman-Peck concludes that industrial productivity has gained most from policies creating an environment favourable to competition, notably policies that have encouraged openness to trade and investment.

Olivier Debande considers industrial policy in its historical context, too, but zooms in on the last few decades. This period has been characterised as one of de-industrialisation, with reference to the steadily declining share of manufacturing in total output and employment in many industrialised countries, despite continuing high output growth. This relative de-industrialisation has been driven by a number of supply-side factors, such as improving labour productivity, trade liberalisation, and changing comparative advantage of countries. Demand-side factors have also played a role, with consumption patterns changing as a result of higher incomes and population ageing in advanced countries. Debande quotes empirical studies suggesting that factors internal to advanced economies, notably labour productivity growth and changing consumption patterns, explain as much as 70 percent of the downtrend in European industrial employment. External trade, including with low-wage countries, is less important, although its impact seems to have been strengthening in the past decade. All in all, Debande concludes that de-industrialisation has not been caused by

market failures, so it should not be resisted. However, its transitory negative economic and social impact may well warrant public intervention.

Having put industrial policy in a proper historical perspective, it is opportune to move on to consider its conceptual underpinnings. In an overview presentation covering various schools of thought on this topic, **Elie Cohen** presents the key arguments for and against industrial policy. Highlighting the revival of industrial-policy thinking in an era of globalisation and disenchantment with free trade, Cohen 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 the government and the private sector should work together to discover where countries should specialise, as neither has an obvious advantage in picking winners; rather, the key difference between them is the private sector's superior ability to terminate bad projects. In Cohen's view, the role of industrial policy is thus to facilitate technological breakthroughs and the creation of national comparative advantages.

The systems-of-innovation approach offers an alternative to the neoclassical view of industrial policy.

Offering an alternative to the neoclassical view of industrial policy, **Charles Edquist** and **Cristina Chaminade** look at it from the perspective of systems of innovation. They stress that because systems of innovation are evolutionary, an optimal or ideal system of innovation cannot be specified *ex ante*. From a systems-of-innovation perspective, industrial policy should only focus on promoting new activities, serving as a midwife for new innovative activities. Markets and firms perform the least efficiently with regard to new activities, where uncertainty and risks are large. Historically, large-scale and radical technological shifts have rarely taken place without public intervention. Such government support can take many forms, including financing, research facilities, a supportive regulatory environment, and investment in higher education. However, selecting the right set of industrial policy tools remains a challenge for governments, since their relative importance and effectiveness have never been properly determined.

Broadening the perspective from national to international aspects of industrial policy, **Richard Baldwin** and **Philippe Martin** address the question of whether there is a need for coordinating national industrial policies in order to take into account spill-over effects. Using the mainstream toolkit to tackle this issue, they suggest that spillovers from national industrial policies can cause helpful or harmful competition among policy makers and helpful or harmful interactions among the targeted industries. As a result, it is not in general possible to say whether industrial policy coordination is good or bad. However, Baldwin and Martin are convinced that reaching agreement at the EU level on any type of policy is very costly in terms of time and political goodwill. Thus, the contrast between the uncertain benefits of coordination and the surety of the decision-making costs suggests that the EU has no need to set up a new structure for coordinating industrial policy. In the few cases where the merits of coordination are obvious, they will be obvious to all and *ad hoc* cooperation will work.

Continuing in the mainstream line of reasoning, **Timo Välilä** considers industrial policy from the perspective of other economic policies and asks how the interaction between different policy areas affects the scope for economically sensible industrial policy. He assesses the goals of different industrial policies – such as innovation support, horizontal mergers, strategic trade policy, and structural adjustment policies – from the perspective of competition and trade polices, concluding that there is clear scope for conflict between the goals of industrial policy with free domestic

competition and free international trade. Moreover, Välilä argues that another potential source of conflict between industrial and other policies is the fact that industrial policy does not possess a set of independent policy instruments but has to 'borrow' instruments from fiscal, trade, or competition policies. But using for instance tariffs to achieve industrial policy goals will also compromise free trade. The policy maker will thus have to consider first whether the goals of industrial policy are so valuable as to justify compromising other policy goals. Such trade-offs make industrial policy a particularly fine balancing act.

Andreas Strohm zooms in on the role of EU competition policy as an important complement to, if not substitute for, industrial policy. The European Commission's competition policy has seen quite significant changes over the past years, most notably the reform of merger control and the application of an 'effects-based, economic approach'. The 'economic approach' is being extended to two other areas of competition policy as well, namely to state aid control and to the application of Article 82 (abuse of a dominant position). Strohm reviews the neoclassical underpinnings of the Commission's 'economic approach', and he also points out problems in applying the theory to real-world cases.

Otto Toivanen shifts the focus from concepts to evidence by reviewing the effectiveness of horizontal industrial policies, more specifically R&D subsidies. As a starting point, he suggests that there is plenty of evidence for market failures that motivate public innovation and R&D support. However, the empirical evidence for the effectiveness of such support is generally mixed, partly due to pervasive methodological problems. To cast some further light on possible determinants of the effectiveness of innovation support, Toivanen considers Finland and Norway as case studies. Both have relied extensively on R&D subsidies, but Finland seems to have succeeded while Norway has failed. Different approaches to supporting R&D may account for some of this divergence. Finland's innovation system has been more horizontal in nature, with unsolicited applications and a review process that aims at achieving commercial applications of publicly supported R&D efforts. In Norway, by contrast, public support for innovation has been more vertical, concentrated on selected sectors and firms. This suggests that governments may have difficulty 'betting on the right horse' when concentrating resources to a few technologies whose success is uncertain.

Finland and Norway have both relied extensively on R&D subsidies, but Finland seems to have succeeded where Norway has failed.

Jordi Gual and **Sandra Jódar** analyse the effectiveness of vertical industrial policy in the EU. They define vertical industrial policy as government support of specific firms or industries ('picking winners' or 'supporting losers') and measure it as state aid granted by Member States to their manufacturing sectors. Gual and Jódar seek to analyse empirically to what extent this government intervention affects the growth of multifactor productivity (MFP) in manufacturing. The analysis is conducted with both sectoral and horizontal aid, since in many cases vertical aid is disguised as aid pursuing horizontal objectives. Controlling for the potential endogeneity of state aid policy, their results suggest that vertical state aid contributes positively to MFP growth. However, including other aspects of public intervention (administrative regulation and employment protection) in the specification lessens the magnitude and significance of the positive effect of vertical state aid on MFP growth, suggesting that a challenge for future work in this area will be to specify and estimate a structural model of vertical state aid.

East Asia has a long history of active industrial policy, some of which brings useful lessons for Europe. For this purpose, **Ha-Joon Chang** discusses the experiences of Japan, South Korea, Taiwan, and Singapore. While all these economies have had active industrial policies, the characteristics of these policies have not been identical. This makes it more difficult to draw strong general conclusions from these experiences, or to speak of a distinct Asian model for industrial policy. Still, there are a few general lessons to be learned. First, state-supported industries have often turned successful only after a very long time of questionable performance. Hence, one must be careful

not to make judgements about the effectiveness of industrial policy too quickly. Second, while governments do make mistakes in conducting industrial policy, it is still noteworthy that all the Asian economies with such policies have, at the end of the day, demonstrated impressive growth performances. Third, successful industrial policy has typically been part of an export-oriented strategy rather than one focussing on import substitution. And finally, Chang concludes that several East Asian countries demonstrate that active industrial policy continues to be useful even when they have already reached the technological frontier.

This volume ends with a description of the European Commission's new industrial policy, authored by **Chris Allen, Didier Herbert,** and **Gert-Jan Koopman**. While manufacturing industry remains a key building block of the European economy, it faces a number of challenges – as well as opportunities – in the form of rapid technological change; increasing trade and financial integration of the world economy; and the rise of new emerging market competitors. Some sectors are performing strongly, but the overall industrial structure of the EU economy makes it less than ideally positioned to face these challenges. The new industrial policy articulated by the Commission is to help the European economy adapt to the new circumstances. In contrast to old policies that sought to pick winners, the new approach starts from the screening of horizontal policies and framework conditions in terms of their implications for specific industrial sectors. Moreover, the Commission has integrated policy by bringing different policy dimensions of key relevance to various industries more closely together. Finally, the new approach attempts to achieve a greater consensus over policy, through the involvement at an early stage of key stakeholders and Member States in policy making.

Against the background of all these contributions, what can one conclude about the scope and effectiveness of industrial policy?

It is an ambition of this volume to bring together various views on the definition, conceptual underpinnings, and effectiveness of industrial policy.

A rather obvious and by no means novel conclusion is that industrial policy is elusive on several accounts. There is a wide variety of views on its definition, conceptual underpinnings, and real-world effectiveness. While it is fairly common to make this observation in the literature, it is rather uncommon to actually bring together the various views in order to examine the key differences between them – one ambition of this volume.

It is, however, difficult to be more precise about the impact of different industrial policies. Horizontal measures, such as R&D support, appear to be beneficial, but not massively so. Vertical measures, such as selective state aid, do not appear as negative as their reputation would have it. The bottom line of the empirical evidence reviewed is that no specific type of industrial policy is a safe bet but, at the same time, one cannot show that some type of industrial policy would be systematically harmful either.

We now turn to two issues where this paper wants to broaden the perspective offered by the contributions reviewed above. One concerns support for national champions and *grands projets*, that is, the vertical industrial policy *par excellence*. The other concerns support for research and development, that is, the horizontal industrial policy *par excellence*.

4. The beauty and the beast of industrial policy

4.1 The beast: support for national champions and grands projets

Diverting from the classic script, let us meet the beast first. Government support, financial or otherwise, for the creation of national champions – boldly called 'European' when they involve

firms from more than one EU country – is perhaps the most extreme vertical industrial policy aimed at picking winners: the support goes to one firm – existing or to be created, from scratch or through mergers and acquisitions. While national champions have always been popular with policy makers and the general public, their charm seems to have increased lately and, ironically, in many cases their goal is to block the formation of European champions.

The push for national champions seems to have increased lately, ironically often with the intention to block the formation of European champions.

This is most obvious in the energy sector. For example, E.ON – a German energy company – has encountered resistance in its attempt to acquire Endesa – Spain's leading electricity utility, where the government apparently favours a merger of Endesa with Gas Natural, Spain's biggest gas distributor. Across the border in France, a feared bid by Enel – the biggest Italian electricity firm – for Suez – the French water and electricity utility – seems to have given new impetus to a merger of Suez with Gaz de France. And then, the recently announced though quickly shelved merger between Austria's oil company OMV and its electricity utility Verbund illustrates that the longing for champions is not the prerogative of big countries, but that small countries want to have them, too.

A run for national champions takes place in other sectors as well. In the pharmaceutical industry, for instance, a prominent case in recent years was the merger, promoted by the French government, of Sanofi-Synthélabo, a French company, with Aventis, a Franco-German firm. In essence, this merger put off a possible marriage between Aventis and Novartis, a Swiss firm. Controversy also surrounded the rescue deal in 2004 for Alstom, a French engineering firm, which effectively obstructed an interest by Siemens, a German competitor, to buy Alstom's turbine business. The banking sector also had its cases – for instance, the failed attempt to prevent foreign banks from making inroads into Italian banking and recurring calls for the creation of a truly global German bank with Deutsche Bank at its core. Finally, one may mention the desire of Luxembourg and France to see Arcelor, the second largest steel producer in the world, to remain a European champion rather than to be taken over by Mittal, the world's largest steel maker.

But efforts to form global players are not limited to forging them out of existing companies. There are also ideas about new *grands projets*, as Foreman-Peck (this volume) calls them, to repeat the 'success' of European Aeronautic Defence and Space (EADS) in lines of businesses that governments consider promising or of strategic importance. Perhaps the best-known recent venture in this regard is the creation of the Industrial Innovation Agency by France, proposed by Jean-Louis Beffa, chief executive officer of St Gobain, in a report on renewing French industrial policy. The agency is expected to provide grants or loans to around ten industry-led R&D programmes, each aimed at developing new products. In April 2006, the agency launched its first major projects, including Quaero, a Franco-German undertaking to develop an advanced Internet search engine to challenge Google and other non-European companies.

How could one explain the renewed interest in national champions and *grands projets*? Proponents of national champions in the energy sector emphasise the crucial importance of energy in any economy, thereby insinuating that one cannot leave the provision of energy to firms from other EU countries. However, given the large energy dependence of most EU countries on supplies from non-EU countries, it is a mystery why the conversion and distribution of imported energy by a national champion should be safer than the supply of energy by firms from EU partner countries.

More generally, proponents of national champions often argue their case on the basis of strategic trade theory, which is briefly discussed in this volume by Cohen and Välilä. Suffice it to note that, in principle, strategic trade theory supports policies in favour of national champions. However, the information needed for making strategic trade policy a success in practice is formidable, and surveys

suggest that such policy fails more often than it succeeds (Monopolkommission 2004). What is more, possible gains from strategic trade policy are liable to come at the expense of other countries, triggering foreign retaliation that might offset the initial gains of such policy.

But 'strategic' reasons aside, there is the much simpler and more influential belief that countries need national champions to prosper in an environment of mounting global competition. In what follows, we will briefly explain where this belief comes from and why it is wrong, costly, but nonetheless popular. In setting out the argument, we draw on Krugman (1994) and Monopolkommission (2004).

The belief in national champions rests on the fallacy that countries compete with each other in the same way as firms do.

The belief that countries need national champions reflects the view that a country competes with other countries in the same way as a firm competes with other firms.[4] Arguably, a firm prospers only if it outperforms its competitors and, in fact, its very survival is at risk if it is uncompetitive. It is also true that a country's aggregate output is simply the sum of the production of all its firms. In this logic, then, a country competing with other countries needs internationally competitive firms that succeed in selling their output at home and abroad and, so the logic continues, big national firms surely have a better chance in taking on foreign firms, notably if they are big too. All this seems to be common sense, boiling down to the observation that a country is just a big firm. The trouble is that common sense can be wrong, and here it is.

The analogy between firms and countries is wrong because, in contrast to firms, countries do not compete with each other. Rather, they exchange – or trade – goods and services. To illustrate the difference between competing firms and trading countries, consider the soft drinks Coke and Pepsi. Undoubtedly, Coca-Cola and PepsiCo are competing in the same market and an increase in the sales of Coca-Cola largely comes at the expense of PepsiCo – and *vice versa*. Thus, although the market for soft drinks may grow over time, the competition between the producers is a zero-sum game for them (though not for consumers).

A classical insight of economics – theoretically sound and empirically well tested – is that trade between countries is not a zero-sum game but an exchange that makes all participating countries better off. What is more, the only reason for a country to export is to import from other countries. True, imports might not come from the country's export market or take place at the same time as exports,[5] but the ultimate rationale for countries to sell goods abroad is to buy goods from abroad. This is in stark contrast to the situation Coca-Cola and PepsiCo are in. PepsiCo is not selling its soft drink to Coca-Cola with a view to buying Coke, and neither is Coca-Cola interested in buying Pepsi.

Another fact demonstrates the fallacy of the firm-country analogy and the notion that countries are just big firms. While countries sell part of their output abroad, most of them – certainly the larger countries – sell the bulk of their output at home. If the firm-country analogy were true, Coca-

4 This belief and the corollary that countries are rivals rather than partners in international trade clearly shine through many statements of European policy makers. To take just one of the most recent examples, here is an excerpt from the speech of President Chirac at the presentation of the Industrial Innovation Agency's projects mentioned above (April 25, 2006): *"Dans un monde où la compétition s'accélère, entre les entreprises, entre les nations, entre les continents, la science et l'innovation sont les clefs du progrès, de la croissance et de l'emploi. … Les États-Unis et le Japon sont engagés dans une course mondiale à la primauté dans le domaine des nouvelles technologies. Ce grand défi, nous nous sommes mis en situation de le relever avec une politique nouvelle fondée … avec la capacité d'investir dans des projets de dimension mondiale et hautement technologiques."* Further on in his speech, President Chirac expressed concerns that *"La Chine aura demain un million de chercheurs: cinq fois plus que la France."* (http://www.ambafrance-uk.org/article.php3?id_article=7147)

5 In addition to trade in goods and services there is then the acquisition of financial claims (liabilities) by net exporters (importers).

Cola and PepsiCo would each have to sell the bulk of their output to their own employees, which obviously they do not. Besides, uncompetitive firms will go out of business, countries never do.

The erroneous belief that countries, like firms, compete with each other would be harmless if it did not lead to costly policies aimed at helping specific firms or industries to compete internationally. Support for national champions or *grands projets*, for instance, might crowd out productivity-enhancing government spending – on education for example. Even when not absorbing public resources, public support for national champions is not costless.

The false belief that countries, like firms, compete with each other would be harmless if it did not lead to costly policies aimed at helping specific firms or industries to compete internationally.

Consider, for instance, government approval of a merger between two firms aimed at creating a global player. While this merger may enhance the international competitiveness of the enlarged firm, it is liable to reduce competition in the domestic market, possibly leading to higher prices. Not only does this hurt consumers, it also weakens the international competitiveness of firms for which the output of the national champion is an input. The German Monopolies Commission has stressed this adverse impact on the domestic economy in the context of the 2002 merger between E.ON and Ruhrgas (Monopolkommission 2004). The German Cartel Office ruled against this merger, the Monopolies Commission argued against it too, but the German government approved it nonetheless on the grounds that it would strengthen the security of energy supply while not hampering competition in the gas market.[6]

But why, then, has the belief in national champions gained so much currency given that they do not strengthen a country's competitiveness (an erroneous concept in the first place) and, worse, might undermine its productivity? One reason is that policy makers may truly believe in the merits of national champions, a belief reinforced through their interaction with businessmen, who have a natural inclination to think of a country as a big firm. But even if policy makers do not believe in national champions, they might consider support for them a politically expedient way of showing concern for the wellbeing of a society that perceives itself in competition with others. To the extent that national champions grow, create or maintain jobs, and take over foreign competitors, reality even seems to vindicate support for champions – at least as long as the economic costs discussed above remain out of sight. Likewise, even businessmen cognisant of the difference between competing firms and trading countries may have a vested interest in lobbying for support in favour of national champions. What is truly remarkable about the false firm-country analogy and its mercantilist implication is that Adam Smith and David Ricardo debunked it as economically illiterate some 200 years ago. That the fallacy lives on so vigorously clearly shows that economists have failed in explaining it well.

To conclude, support for national champions and *grands projets* is unlikely to raise living standards of European citizens and, in fact, considering the opportunity cost of such support, it is liable to be welfare reducing. Therefore, unlike in Leprince de Beaumont's *La belle et la bête*, the beast considered here remains wild and treacherous to the end of the story. That policy makers, businessmen, and a wider public often view them as key to the success of a nation rests on the mistaken belief that countries engage in a competitive race in which innovation, productivity growth, and employment of one country come at the expense of other countries. There are concerns that other countries, notably in the developing world, are beginning to succeed in producing talented people and sophisticated products. But there is no reason to worry about smart people and economic progress

6 The Monopolies Commission also discusses calls for a merger between German banks to create a 'strong' German bank. Government-sponsored mergers in banking are of greater concern than in other sectors since the economic costs of such mergers are likely go beyond adverse effects on domestic competition. In general, there is a risk that national banking champions are perceived as 'too big to fail'. But when they emerge with a little help from the state, 'moral hazard' possibly resulting from the too-big-to-fail perception is bound to rise.

elsewhere in the world. On the contrary, while it will require EU countries to adjust, it will raise the demand for European products given that the only reason to export is to import.

The wording of the Lisbon strategy, that is, to make Europe the most 'competitive' economy in the world, might have led policy makers astray.

It seems that the wording of the Lisbon strategy, that is, to make Europe the most competitive economy in the world, has led policy makers astray.[7] But the Lisbon objective can be interpreted in a meaningful way. From a policy perspective, the only thing that really matters is domestic productivity – not productivity relative to other countries. Raising productivity and employment can be achieved through a combination of measures such as product and labour market reforms and policies that remove obstacles to investment in physical and human capital. In addition, creating an environment conducive to research and development promises to be productivity enhancing. This takes us to industrial policy's apparent beauty.

4.2 The beauty: support for research and development

The contributions to this volume leave no doubt that some economists are more sympathetic to industrial policy than others. There is one type of industrial policy, however, that even sceptics consider favourably: support for R&D, provided it addresses and mitigates failure of the market to bring about the socially optimal level of innovation, new knowledge, or new technology.[8] Leaving aside the important question of whether governments can mitigate this market failure (a question discussed in this volume by Toivanen and Välilä), let us critically review how much of a failure there really is. Our sketch follows Baumol (2002).

Concerns that markets fail in delivering the optimal level of innovation rest on various arguments. To begin with, it is argued that the fruits of innovation cannot be fully captured by the innovator but spill over to the economy at large, including competitors of the innovator. While the spillovers themselves are welfare enhancing, the innovator is not rewarded for creating them, implying that he underinvests in research compared to a situation where he would be rewarded for such spillovers. In these circumstances, the purpose of public R&D support is to raise innovators' return on R&D spending and thereby get such spending closer to its social optimum.

Second, the case is made that proprietors of innovations (i.e., the innovators) deny the use of their innovations to others, notably competitors. As a result, new knowledge does not disseminate through the economy as much as it could. And as there is no rivalry in the use of new knowledge, societies would certainly gain if it spread freely. As Cohen (this volume) observes, the market provides insufficient incentives not only for the creation but also the dissemination of new technology – a shortcoming an incentive-creating industrial policy tries to address.

Third, even if innovators make their technologies available to others – through licensing, for instance – they might overcharge other firms for using them, again causing a sub-optimal level of knowledge dissemination. But it is also possible that the license fee an innovator could possibly fetch is too low, thus providing too little incentive to license the technology.

Fourth, inefficiencies are suspected to arise if R&D is a 'winner-takes-all' innovation and patent race. To elaborate, suppose a number of firms pursue similar lines of research that result in the same product or process innovation. But obviously one firm gets there first, or at least is first in

7 Note the title of Krugman (1994): "Competitiveness – a dangerous obsession."

8 Strictly speaking, one should distinguish between invention (that is, the act of finding something new or better) and innovation (that is, the act of bringing inventions to the market or improving existing products and production processes). For the issues discussed here, the distinction is not crucial, and we thus use the terms invention, innovation, new knowledge, and new technology interchangeably.

getting a patent for the innovation. The efforts of the runners-up then turn out to have been in vain. This creates two problems: for one thing, since firms know that they may finish the race empty handed, they have too little incentive to spend on R&D; for another, with hindsight, the spending of the runners-up has been wasteful. Overall, the winner-takes-all view suggests that markets left to themselves result in too little R&D spending by individual firms but nonetheless excessive spending by the economy as a whole.

Fifth, an innovation possibly destroys the market value of existing products and processes. This possibility could distort incentives for innovation in different ways. For instance, the proprietors of current technologies may be reluctant to spend on R&D because the profit that R&D spending could generate would merely replace the profit associated with the use of current technologies. Of course, there are potential innovators other than the proprietors of current technologies, and their incentive to engage in R&D is not weakened by the effect that their innovation may have on current-technology owners. However, if firms see innovation as resulting in only a temporary lead over competitors, they may consider R&D futile and devote fewer resources to it than socially optimal. In sum, the possibility that profits from innovating are dissipated quickly may undermine incentives to innovate in the first place.

Market-failure arguments in favour of R&D support are not as compelling as commonly presumed.

How compelling are these market-failure arguments? Let us look in one go at the first and second, that is, the observation that markets provide insufficient incentives for the creation (first argument) and diffusion (second argument) of new technology.

The problem of insufficient incentives to develop new technologies is partly solved through the granting of patents, which give innovators a temporary monopoly for their innovations. The incentive problem is only partly solved because, in practice, patents give the innovator primarily the right to litigate over patent infringements rather than a guarantee for the exclusive use of his innovation. Another reason why patents only partly mitigate the incentive problem is their temporary nature. Obviously, the longer the life of the patent, the larger the incentive to innovate. But the longer the life of the patent, the slower the dissemination of new knowledge. There then seems to be a trade-off between increasing incentives to innovate and fostering the dissemination of new knowledge. Or – to put it differently – the more effective patenting is in reducing the first market failure (sub-optimal innovation), the more relevant seems to become the second one (sub-optimal dissemination of knowledge). On closer inspection, however, it turns out that the market itself contributes to relaxing this trade-off. This is largely for two reasons.

First, the proprietary right to an innovation is an asset the innovator can license to others, including competitors. Loosely speaking, licensing can be worthwhile for the innovator and licensees if the value of this asset to the innovator is smaller than its value to licensees.[9] More specifically, for an innovator, licensing is profitable as long as the license fee exceeds the value of the innovation when used by him.[10] For other firms, acquiring technology licenses is profitable as long as the license fee is lower than the value of the innovation when used by them. To illustrate, suppose an inventor of a new production technology (e.g., a new technique for manufacturing computer chips) is less efficient in using this technology than his competitors. Competitors are then able to generate a higher profit, by using the new technology, than the innovator could and there is, thus, scope

9 In sectors where technology changes fast (in information technologies, for instance), innovators may license their technology to other firms irrespective of what is discussed here because by the time other firms can use this technology it may not be state of the art any longer.

10 To be a little more precise here, as the licensing decision is not binary (i.e., to license or not to license), the comparison to be made is between the license fee and the marginal value to the innovator of using new knowledge himself. All other things being equal, this value declines with an increase in the use of this knowledge by other firms.

for a mutually beneficial transfer of technology from the innovator to his competitors. Licensing would thus foster the dissemination of new knowledge and, perhaps more important, channel new technologies to those firms in the economy that can make best use of them. And then, the fact that innovators might find it more profitable to exclusively let others use their innovation gives rise to firms that specialise in the creation and licensing of technologies. Obviously, the incentive for such firms to come up with something new is considerable, as they will go out of business if they do not.

The second reason why markets contribute to relaxing the trade-off between knowledge creation and knowledge dissemination is that it is profitable for firms to establish joint ventures in research and to create and exchange technologies in the framework of technology-exchange consortia. The motivation for doing this is twofold. For one thing, firms sharing knowledge might stand a better chance of discovering new products and processes than firms struggling alone. For another, joint ventures and technology-exchange consortia can be seen as arrangements that insure participating firms against the risk of missing out on an innovation that will give its owner competitive superiority.

Technology licensing, sharing, and exchange are profit-seeking business activities that help in bringing about an optimal level and allocation of innovation.

In sum, technology licensing, sharing, and exchange are profit-seeking business activities that help in bringing about an optimal level and allocation of innovation. Thus, market failures in the creation and diffusion of innovation might not be as serious as commonly presumed. That said, it remains unclear how close technology licensing and sharing get the economy to the state of bliss. A key issue here is the pricing of technology transfers – in cash, in the case of licensing, or in kind, in the case of technology-sharing consortia. This takes us to the third market-failure argument, namely that license fees could be too low, thereby stifling knowledge creation, or too high, thereby hindering knowledge dissemination.[11]

In shedding light on this issue, two questions need to be answered. First, is there an efficient price for licensing new knowledge, that is, a price that provides the right incentives to innovate and allocate the innovation to different firms so that each firm contributes optimally to the production of goods using the innovation? Second, does the market mechanism lead to such a price?

The answer to the first question is affirmative. In setting out why, Baumol (2002) draws on the so-called efficient-component-pricing rule (ECPR), which helps determine efficient access prices for natural-monopoly bottlenecks in network industries (see, for instance, Laffont and Tirole (2000) and Baumol and Sidak (1995)). The rationale for drawing on this rule is straightforward: a patented innovation is a monopoly-bottleneck input in the production of other goods – just like tracks, pipelines, and transmission lines are in the provision of rail transport services, gas, and electricity, respectively. In network industries, ECPR-based access prices ensure the right incentives for investments in the network (tracks, pipes, and lines) and an optimal output of each final-good producer, which might include the owner of the network. In technology markets, ECPR-based license fees provide the right incentives to innovate and bring about the optimal output of each final-good producer, which might include the innovator.

There is also a fair chance, though no guarantee, that the market mechanism results in license fees not too far away from their efficient level. Suffice it to give an intuitive explanation. Licensing at the ECPR fee generates an extra profit for the innovator and licensees, or at least does not make them worse off than without licensing. In principle, the innovator could further increase his profit

11 We skip pricing issues in the case of technology-exchange consortia and a discussion of why members of such consortia have strong incentives to comply with its agreement (see Baumol 2002, Chapter 7).

by raising the license fee above the ECPR level. But raising it too much drives out potential licensees, thereby destroying a profit opportunity. Likewise, in principle, licensees could further increase their profits by trying to push down the license fee below the ECPR level. But at too low a license fee, the innovator decides not to license, leaving potential licensees with no extra profit at all. In fact, the ECPR sets a price floor at which the innovator gains as much from licensing as from using his innovation; at a lower fee, it is not profitable for him to licence; hence, the ECPR fee is the lowest fee that could result from voluntary negotiations between innovators and potential licensees.

Therefore, concerns that the market mechanism might result in license fees too low to provide sufficient incentives for innovators are unwarranted. It is possible, however, that fees are too high, thus preventing an efficient dissemination and allocation of innovation to different uses and users. An outright refusal of an innovator to license can be considered an extreme version of an excessive license fee. Clearly, innovators asking for excessive license fees would act against their best long-term interest – an outcome we would not expect if innovators act rationally. But do they?

A look at the market for technology provides some hints. Arora *et al.* (2001) and Baumol (2002) describe the growing importance of markets for technology and their drivers. Specifically, there is evidence for an increase in intra-industry technology flows (i.e., 'horizontal' transactions – in cash or in kind – between competing firms) and a division of innovative labour (i.e., 'vertical' transactions between firms not competing with each other).[12] Interestingly enough, the supply of innovation comes not only from small firms but from big ones, too. Small firms often lack downstream financing, manufacturing, and marketing capabilities and, thus, licensing knowledge to firms that can make more out of it is especially profitable for small firms. In fact, there is evidence that small innovative firms with limited downstream capabilities evolve into providers of general-purpose technologies, i.e., technologies serving as inputs into a variety of applications. In fact, suppliers of general-purpose technology are not new on the scene. Noteworthy is the emergence of specialised chemical engineering firms in the 1950s and, more recently, biotechnology firms specialising in the development of general-purpose tools for a variety of applications in the pharmaceutical industry. That large firms, which have the capacity to turn their inventions into marketable products or processes, trade their technologies as well suggests that the positive revenue effect of licensing often outweighs its negative rent dissipation effect even for big firms. Indeed, the emergence of firms specialising in the supply of general-purpose technologies seems to force big, established producers that use such technologies as inputs to license their own technologies, too, rather than – as conventional wisdom suggests – treat them as 'family jewels'. All this being said, Arora *et al.* (2001) also point to surveys showing that many firms fail to see the virtue of marketing their technologies. Moreover, one of the authors' overall conclusions is that despite the growing importance of markets for technology, one should not expect external technology flows to largely replace the in-house creation and use of new knowledge.

Evidence suggests a growing importance of markets for technology, but they will not replace the in-house creation and use of new knowledge.

A variety of policy measures could enhance the efficiency of technology transfers and thus the diffusion of new knowledge (for details see Arora *et al.* 2001). Many of them relate to the protection of intellectual property rights, but there are also competition policy responses that we will sketch when discussing the link between competition, innovation, and growth in the next section. But for now, we continue our critical review of market failures commonly invoked to justify government support for innovation, and we turn to the 'winner-takes-all' argument.

12 As to the exchange of technologies between competing firms, Baumol (2002) fittingly quotes from an advertisement by Novell in The Economist of September 21, 1991: "Conventional business wisdom says: Never let the competition know what you're doing. But at Novell, we believe the secret of success is to share your secrets. So we established the Novell Labs program to openly share our networking software technology with other companies."

Arguably, there have been inventions where the winner has taken all. Baumol (2002) reminds us of Alexander Graham Bell who defeated his rival, Elisha Gray, in the invention of the telephone by a few hours. But this example also indicates that the winner-takes-all problem is especially relevant for homogenous inventions, which are perfect substitutes. While Bell's and Gray's devices for transmitting speech electrically might have been perfect substitutes, this can hardly be said of many of today's inventions, or modifications to them – the variety of gadgets incorporated in modern telephony equipment being a good example. More generally, there is reason to believe that research efforts aimed at very similar goals lead to similar but not identical inventions. There is thus scope for product (or process) differentiation that exploits differences in users' taste or willingness to pay. The long and short of all this is: the race for discovering and marketing something new offers many prizes, not just one, and worries about too little R&D spending by individual firms are perhaps not as justified as they appear at first glance.

What, then, about concerns that, in aggregate, firms spend too much on R&D in cases where the winner takes all? It is true that there will be duplication of research effort. But whether this is wasteful from society's viewpoint is not clear because it increases the probability that firms will make privately and socially profitable discoveries.

We finally get to scrutinise the fifth market-failure argument, namely that fear of rapidly dissipating rents from new knowledge undermines incentives to innovate. The implicit assumption here is that firms succeed in the marketplace as nicely without as with innovations. While this may be so in some markets, it is not at all typical for the majority of them. On the contrary, in free markets and with increasing global competition among firms, discovering new products and processes – thereby gaining a competitive edge, if only temporarily – "becomes mandatory, a life-and-death matter for the firm" (Baumol 2002, p. 1). To escape death and competition, at least for a while, firms need to continuously invest in research and development and, in fact, make such investment a routine feature of their business strategy. Interestingly enough, the pressure to discover or go under seems to be particularly high in oligopolistic industries – that is, industries often perceived by layfolk as cosy settings in which firms collude to make profits at the expense of consumers.

Markets seem to be quite innovative in overcoming their own failures.

What shall we then take away from our review of market failures in the creation and diffusion of innovation? It is probably fair to conclude that support for innovation remains the beauty of industrial policy – though she might not be as stunning as often claimed. The market failures that there may be are perhaps not as grave as often feared. Indeed, economic reasoning and empirical evidence suggest that markets are quite innovative in trying to overcome their own failures. With reason, the title of Baumol's book is: "The free-market innovation machine". In the next section, we will examine whether this machine always spurs innovation and growth, under which circumstances it might not, and what this all means for industrial policy.

5. Competition, innovation, and growth

If competition makes innovating a matter of life-and-death for the firm, as put forward in the previous section, the path to prosperity is fairly clear: keep firms sufficiently exposed to competition, and innovation and growth will fall into place! Although this Darwinian view of welfare creation is compelling, things are obviously more complex. Output in many countries grew rapidly when they pursued more protectionist and interventionist economic policies than today. This applies, for instance, to Latin America in the 1960s, Southeast Asia and Japan until the mid-1990s, and Europe until the early 1980s (Aghion and Griffith 2005). Of course, economic growth depends on factors other than competition – the level of output, saving and investment, and growth of the labour

force, for instance. Moreover, even without innovating, countries can grow rapidly by adapting and imitating technologies of more advance countries. Still, is it not possible that competition while fostering innovation and growth in some circumstances might stifle it in others? What is more, when less competition is better than more, is there a rationale for industrial policy to promote innovation and growth?

The purpose of this section is to shed some light on these questions. Our sketch is an incredibly short synopsis of Aghion and Griffith (2005), which itself is a summary of the theoretical and empirical literature on the link between competition, innovation, and growth – a literature to which both authors have contributed (as co-authors) sixteen papers over the last decade or so. We will proceed in two steps: we will take a brief look at various factors that determine the degree of competition and then describe structural features of an economy and their role in influencing the impact of competition on innovation and growth.

The degree of competition in an economy depends on a variety of aspects. For our purpose, it is convenient to arrange them in two groups: one comprises factors that shape what the literature has labelled 'product market competition'; the other includes factors that influence how fast the competitive edge of an innovator erodes.

Factors determining the degree of product market competition include: policies that protect firms against domestic or foreign competitors, state control of businesses, legal and administrative barriers to entrepreneurship, market behaviour regulations (such as shop closing hours, warranty regulation, and advertising regulation), impediments to market exit and entry (other than those resulting from policies and regulations mentioned so far), market concentration, pricing power of firms, and so on. An increase in product market competition is expected to result, for instance, from removing administrative barriers to competition, opening up domestic markets to the entry of foreign firms and products, and antitrust measures that succeed in reducing market concentration and pricing power of firms.

Factors determining the speed with which the competitive edge of an innovator erodes largely reflect laws governing the use of intellectual property such as patents, copyrights, trademarks, and so on. All other things being equal, competition is the less intense, the more generous the protection of intellectual property rights – patent protection for short – and *vice versa*. In fact, patent protection essentially grants a time-limited monopoly to the innovator and, thus, lowers the degree of competition.

To condense the typology pertaining to the degree of competition: competition rises (falls) as a result of measures that strengthen (weaken) product market competition or weaken (strengthen) patent protection. Note that real-world competition policy usually combines measures aimed at enhancing product market competition (e.g., through antitrust and removal of barriers to foreign entry) with competition-reducing patent protection. We will see soon why the co-existence of apparently contradictory policy measures could make sense.

Competition rises as a result of measures that strengthen product market competition or weaken patent protection.

Let us then take the second step. Implicit in the life-and-death argument of innovation is that firms innovate to escape their competitors. One of the insights from Aghion and Griffith (2005) is that the strength of the escape-competition motivation depends on certain structural features of the economy in question. In fact, in some circumstances, the escape-competition motivation might be very weak or non-existent. In what follows, we describe three such features, and for each of them, we outline how it affects the competition-innovation-growth nexus.

The first structural feature is the relative importance of two types of firms in an economy: profit-maximising firms and 'satisficing' firms. The meaning of profit maximising is self-explanatory, and it is reasonable to assume that an economy comprises largely profit-maximisers if firms are managed by their owners or if owners succeed in making firm managers act in the profit-maximising interest of owners. By contrast, in satisficing firms, managers do not act in the profit-maximising interest of owners, but simply try to meet a minimum profit target, avoid bankruptcy, and otherwise have a reasonably quiet life.[13] Managers are the more likely to be satisficing rather than profit maximising, the less control owners have over managers.

The impact of competition on innovation depends on the type of firm, whether or not firms in an industry are technologically similar, and on the economy-wide importance of industries with technologically similar firms.

What, then, does the distinction between profit-maximising and satisficing firms imply for the role of competition in spurring innovation and growth? The theoretical models reviewed in Aghion and Griffith (2005) predict that growing competitive pressure discourages innovation by profit-maximising firms while encouraging innovation by satisficing firms.[14] The intuition behind this hypothesis is as follows: competition reduces the rents from innovating; this makes innovation less profitable for profit-maximising firms; for satisficing firms, however, growing competition increases the risk of bankruptcy and an end to the quiet life of satisficing managers; to counteract this risk, they need to become more innovative. The empirical evidence suggests a positive link between competition and the efficiency of satisficing firms; competition thus reduces slack. However, there is only weak evidence that competition fosters innovation by satisficing firms. In any case, even if it did, this would stimulate overall economic growth only if the economy largely consisted of satisficing firms. It is probably fair to surmise that this is so in the large continental European countries, implying that, on the Continent, enhanced competition would raise efficiency and, possibly, innovation and growth.

The second structural feature with a bearing on how competition affects innovation and growth is the technological similarity (or dissimilarity) of firms. To elaborate, firms in an industry can be at roughly the same level of technological development, or there can be large gaps between leading and lagging firms. If firms are similar, an increase in product market competition tends to foster innovation and growth. By contrast, if there is great variety in firms' technological development, an increase in product market competition is detrimental to innovation and growth.

It is beyond the scope of this paper to detail the logic behind this hypothesis[15], but here is the gist of it, which is easiest to explain for a closed economy. To recall, innovation is a means to escape competition. For each firm in an industry, the incentive to use this escape route is the higher, the more it feels its competitors breathing down its neck, which is rather likely if firms in that industry are technologically similar. In contrast, in an industry with large technological gaps between leaders and laggards, there is less need for leaders to innovate and, thereby, escape competition, because they are comfortably ahead anyway. More important, increasing product market competition stifles the incentive for technologically backward firms to invest in research and development. The reasons are as follows. Faced with a decline in innovation rents following from increased competition, backward firms reckon that it is not worth trying to close the technological gap with domestic front-runners, a gap that backward firms might consider insurmountable anyway. What is more, growing competition increases the probability of backward firms going out of business and, thus, reduces the expected return on R&D spending. Overall, in industries with large gaps between technologically leading and lagging firms, and in countries with a large share of such industries,

13 The concept of satisficing firms, more precisely: satisficing managers, was introduced by Hart (1983).

14 More specifically, theory predicts that (i) strengthening product market competition encourages (discourages) innovation by satisficing (profit-maximising) firms and (ii) weakening competition through better patent protection discourages (encourages) innovation by satisficing (profit-maximising) firms.

15 For details, see Chapter 3 of Aghion and Griffith (2005).

more competition does not entice leading firms to innovate more, but it might cause backward firms to innovate less and resign to supplying products that are not state of the art, but for which there might be nonetheless demand at lower prices.

Empirical studies support the hypothesis that product market competition fosters innovation and growth in technologically homogeneous industries, but stifles it in heterogeneous industries. The policy implications of this are twofold. First, enhancing product market competition in industries with similarly well-advanced firms promises to foster innovation and growth. The stimulus can be increased through appropriate patent protection. The latter would also help mitigate the possibly negative impact of product market competition on innovation in industries with technologically diverse firms. Second, there is a rationale for industrial policies aimed at helping laggards to upgrade technologically as this would lead to more industries that respond positively to stronger product market competition.

Industrial policy aimed at helping backward firms to upgrade technologically could strengthen the positive impact of competition on innovation and economic growth.

Let us finally turn to the third structural feature that affects the workings of competition on innovation and growth, namely the distance of a country (and its firms) from the world technological leader. As this global benchmark suggests, we now consider the exposure of domestic firms to foreign competition. More specifically, the question is how liberalising foreign entry affects innovation and growth. Again, the escape-competition motivation to innovate takes centre stage, with innovation by domestic firms now being a means to escape foreign competitors or to foil their plans to enter the domestic market.

The hypothesis is that foreign entry, or the threat of entry, stimulates innovation in countries that are close to the world technological leader – the frontier for short. Being close to the frontier themselves, domestic firms reckon that while growing foreign competition tends to reduce innovation rents, innovating is nonetheless the best response as they stand a chance to leap ahead and escape their foreign competitors. What is more, not innovating would be penalised by the market. The response of firms far from the frontier is likely to be very different, however. For them, innovating with a view to escaping foreign competition seems futile given the far bigger technological gap they would have to close. Even worse, anticipating bankruptcy after stronger foreign competitors have entered the domestic market, technologically lagging firms might innovate less than they would have without the threat of foreign entry. In sum, economic reasoning suggests that increasing openness to foreign competitors boosts innovation in advanced domestic firms and dampens it in lagging firms. This also implies that lowering barriers to entry promises to spur innovation and growth in countries close to the technological frontier, while it might have a negative impact on countries far from the frontier.

Empirical studies corroborate this hypothesis. They show a significant effect of reducing barriers to foreign entry on overall productivity growth of the liberalising economy. The positive effect has been found to be especially large for firms and industries already close to the technological frontier. With increasing distance from the frontier, the effect dwindles and, in fact, might become negative for firms and industries far below the frontier. In sum, the closer countries are to the frontier, the more they have to gain from reducing barriers to foreign entry, but even when a country benefits overall, there will be losers and not only winners.

In addition to the obvious policy lesson that countries close to the technological frontier have a lot to gain from keeping their firms exposed to foreign entry, it seems opportune to support the technological upgrading of lagging firms and industries – not only to minimise the number of losers, but also to maximise the overall positive impact of liberalising on innovation and growth.

The stimulus of foreign entry on innovation might vary across the EU, and the need for technological upgrading, aimed at enhancing the positive impact of competition on innovation, is larger in the least advanced countries of the EU.

Moreover, there is a normative implication that links the case in favour of enhancing competition through open markets with the discussion of national champions and markets for technology of the previous section. In that section, we have stressed that the emergence of firms specialising in the supply of general-purpose technologies is instrumental for creating and disseminating new knowledge. In their study on markets for technology, Arora *et al.* (2001, p.166) note that "the 'closed' domestic markets of many European countries often feature only few large producers, especially in basic industries (e.g., the so-called national champions)" and they go on to emphasise that this hinders the creation and efficient utilisation of such technologies.

The role of foreign entry (or threat thereof) on innovation and growth invites another distinct European interpretation, notably in light of EU enlargement. The distance from the technological frontier differs across the EU, with some countries being relatively close and others further away from it. This implies that the stimulus of foreign entry on innovation and growth might vary across EU countries, too, and could in fact be negative in the technologically least advanced countries. A corollary of this is that the scope and justification for policies to support the technological upgrading of lagging firms and industries is larger in the least advanced countries, and possibly minimal in others. We shall leave it at this and offer a few concluding remarks next.

6. Conclusion

One of the observations of this paper has been that the very concept of industrial policy is difficult to pin down and that it means whatever its friends (or foes) want it to mean. To illustrate, bearing in mind the risk of government failure in designing and implementing industrial policy, a plausible interpretation following from the previous section is that competition policy – intelligently blending measures that strengthen product market competition with patent protection – is all it takes to foster innovation and growth. Indeed, this is precisely the view of the German Monopolies Commission: "Experience proves that the classical dictum which states that active competition policy is the best form of industrial policy is absolutely correct" (Monopolkommission 2004, p.580). With this interpretation, industrial policy and competition policy would be one and the same, rather than at war with each other – a possibility raised by Strohm (this volume).

An equally plausible though less radical reading of the previous section (and of Section 4) suggests that while competition in and for markets is crucial, there remains a rationale for government intervention, such as encouraging backward firms to catch up with the technological frontier, reinforcing firms' incentives to carry out R&D and to license and trade new knowledge, and helping the private sector to coordinate standards.

An even greater role for the state would follow from what Cohen (this volume) has labelled the pragmatic approach to industrial policy, which is inspired by new growth and development theories. According to this approach, the key tasks of industrial policy are: first, to elicit information from the private sector on significant externalities and their remedies and, second, to help firms and the government to learn about a country's underlying costs and opportunities and, thus, identify economic activities that are more promising than others (Rodrik 2004).

All in all, industrial policy continues to be hotly debated, with different schools of thought disagreeing on the extent to which governments should directly influence the allocation of resources. But despite controversy about what the state can and should do, it is fair to say that economists have reached some consensus on what it should not do. For example, attempts at

picking winners seem to have fallen out of favour, though the idea of creating such winners on a grand scale in the form of national champions lives on among policy makers and the public at large. There is also some consent that government support must not be too generous in scope and duration (notably when aimed at rescuing, restructuring, or upgrading firms), and that the state should refrain from interfering when the risk of government failure seems to be unusually big. Finally, the state should resist throwing good money after bad. Indeed, as Rodrik (2004) emphasises, both the private sector and the state inevitably make mistakes, but the state, for political-economy reasons, scores far worse in terminating failed projects and policies.

The last point worth highlighting is that the ultimate purpose of industrial policy, however defined, is to raise domestic productivity – not productivity relative to other countries. In other words, to promote economic growth and create jobs, Europe must become more innovative and productive even if it was the only place in the Universe. Against this background, the focus on growth and employment of the re-launched Lisbon strategy signals a sensible departure from the obsession to make Europe more 'competitive' than the rest of the world. Whether industrial policy can contribute to stimulating growth and employment remains contentious. Assuming that it can, still leaves the question whether we need "An industrial policy for Europe?"

The refocused Lisbon strategy signals a sensible departure from the obsession to make Europe more 'competitive' than the rest of the world.

Writing an overview paper always involves the risk of pre-empting the messages of subsequent contributions. We shy away from taking too much risk and, thus, from here on let the other contributors speak, including on the question we have left unanswered.

References

Aghion, P. and Griffith, R. (2005). *Competition and growth*, MIT Press, Cambridge, USA, and London, UK.

Arora, A., Fosfuri, A., and Gambardella, A. (2001). *Markets for technology – the economics of innovation and corporate strategy*, MIT Press, Cambridge, USA, and London, UK.

Baumol, W.J. (2002). *The free-market innovation machine*, Princeton University Press, Princeton, USA, and Oxford, UK.

Baumol, W.J. and Sidak, J.G. (1995). *Transmission pricing and stranded costs in the electric power* industry, AEI Press, Washington, D.C., USA.

Hart, O. (1983). "The market mechanism as an incentive scheme." *Bell Journal of Economics,* (14), pp.366-382.

High Level Group (2004). "Facing the challenge – the Lisbon strategy for growth and employment". Report from the High Level Group chaired by Wim Kok.

Krugman, P. (1994). "Competitiveness: a dangerous obsession". *Foreign Affairs*, (March/April), pp.28-44.

Laffont, J.J. and Tirole, J. (2000). *Competition in telecommunications*, MIT Press, Cambridge, USA, and London, UK.

Monopolkommission (2004). *Hauptgutachten 2002/2003 – Wettbewerbspolitik im Schatten 'Nationaler Champions',* Nomos-Verlag, Baden-Baden, Germany.

Pelkmans, J. and Casey, J-P. (2004). "Can Europe deliver growth? The Sapir report and beyond". CEPS Policy Brief No. 45.

Rodrik, D. (2004). "Industrial policy for the twenty-first century." CEPR Discussion paper series, No.4767.

Sapir, A., Aghion, P., Bertola, G., Hellwig, M., Pisani-Ferry, J., Rosati, D, Vinals, J., and Wallace, H. (2004), *An agenda for a growing Europe: the Sapir report*, Oxford University Press, New York, USA, and Oxford, UK.

ABSTRACT

This survey outlines the characteristics and drivers of the phases of European industrial policy over the last century and attempts some conclusions about policy impacts. *The first liberal phase and the second, ultimately autarkic, phase were ended by war. The third phase terminated with the oil price shocks of the 1970s at the high tide of interventionism. These shocks, and the associated economic growth retardation, contributed to the financial stringencies in the fourth phase that eventually prompted both privatisation policies and more modest policy aspirations. The historical record is consistent: policies that encouraged openness to trade and investment, by creating an environment favourable to competition, also enhanced industrial productivity.*

James Foreman-Peck (foreman-peckj@cardiff.ac.uk) is Director of the Welsh Institute for Research in Economics and Development at the University of Cardiff.

Industrial policy in Europe in the 20th century

1. Introduction

James Foreman-Peck

This paper reviews industrial policies in Europe over the past century, with a focus on their drivers, instruments, and impact during different episodes and in various countries[1]. The purpose is to draw policy lessons, including an assessment of the circumstances under which industrial policy appears to have been successful and those under which it has failed.

The first step in organising a history of industrial policy must be to delimit the subject matter – however much the attempt to do so trespasses upon the subject matter of other contributions to this volume of the *EIB Papers*. Industrial policy is concerned with an aspect of industry as an objective, and sometimes as an instrument. Broader supply-side policies also may have (the productivity of) industry as an objective among others, though advocates of such policies typically would not be keen on advocating 'industrial policy', at least in the United Kingdom. Regional policy often attempts to use industry as an instrument for boosting regional employment; it is in this sense an industrial policy too.

Most researchers and practitioners favour a definition based on the objective. Chang (1994, p.66) proposes that an industrial policy is one "... aimed at particular industries (and firms as their components) to achieve the outcomes that are perceived by the state to be efficient for the economy as a whole." For Pack and Saggi (2006, p.2), an industrial policy is "any type of selective intervention or government policy that attempts to alter the sectoral structure of production towards sectors that are expected to offer better prospects for economic growth"[2]. Both these definitions and that of Pelksman (2006) exclude unintended policy effects. Pelksman distinguishes two types of policies which influence industry, yet are not part of industrial policy, namely, policies not for industry which affect industry and policies which directly help or constrain industry but are not meant (only) for industry. Omitting the second type from the definition can be problematic for a historical understanding of industrial policy, as we discuss below.

A wider, but implicit, definition of industrial policy may be found in European Community Treaty Article 157 (130) (modified by the Maastricht Treaty), which requires the EC and Member States to "ensure that the conditions necessary for the competitiveness of the Community industry exist". The European Commission's industrial policy focus is on the competitiveness of manufacturing industry, on the grounds that most innovations take place in this sector (European Commission 2002 and 2004). However, all these recent conceptions exclude the most important historical motivation for industrial policy – the desire to enhance security, using industry as an instrument. Defence and nationalism remain powerful justifications for interventionist industrial policy.

Industrial policy will therefore be defined as 'state intervention that affects, or is intended to affect, industry but not other economic activities directly'[3]. The idea is to exclude monetary and

1 This paper draws on Foreman-Peck and Federico (1999).

2 Both these definitions exclude 'horizontal' policies towards industry, such as competition policy, because these are not intended to alter industrial structure, even though they will do so. Consider a constant returns to scale economy with two sectors, one monopolised and one perfectly competitive. Introduction of an effective competition policy would expand the former monopoly sector, as prices and returns to capital are forced down, and contract the competitive industry as resources are bid away from it.

3 Here the state includes the central government, local authorities, and the EC, as well as independent agencies following government directives and using primarily public funds.

macroeconomic policies, so that for instance interest rate impacts are not considered. 'Industry' here includes manufacturing and infrastructure industries. The term might reasonably be extended to any source of employment – mining, agriculture, and services – particularly because the classification of jobs can be arbitrary[4]. Be that as it may, government policies towards agriculture and services generally have differed from those towards industry more narrowly defined, and the field must be limited if it is to be manageable.

'Intervention' covers the official endorsement of private agreements such as cartels. Policy makers may be institutions rather than individuals, and policies may be implicit rather than articulated. The impact of policy includes consequences that are unforeseen or unintended.

With these definitions duly noted, let us preview the rest of the paper. Section 2 sketches the origin, types, and drivers of industrial policy. Having set the scene in this way, Section 3 zooms in on different phases of industrial policy in the 20th century. Section 4 attempts to identify the impact of industrial policy. Section 5 draws some lessons from history.

2. Industrial policy: types and drivers

2.1 Types

Two broad types of industrial policies can be distinguished: sector- or firm-specific (vertical) policies and general (horizontal) policies.

Two broad types of industrial policies are generally distinguished: sector- or firm-specific (vertical) policies and general (horizontal) policies. Horizontal policies can be divided into those influencing the legal and institutional framework on the one hand, and those modifying technology and markets for inputs and outputs on the other. Vertical policies are structural, intended to alter the relative importance of industries and firms.

An essential component of a suitable framework is clearly defined and enforced private property rights, including intellectual property. This requirement was generally fulfilled in all European countries by the beginning of the 20th century (in some of them it had been fulfilled for many centuries already by then) – even if enforcement was not always complete. In Central and Eastern Europe, however, private property rights were later abolished by communist regimes and needed re-establishing after 1989. Company law continued to be subject to modification throughout the century.

Industrial policy can try to foster technical progress by supporting either innovation or the diffusion of existing techniques, possibly imported from abroad. To this end, states have directly undertaken research and development (R&D), usually for military purposes, or simply subsidised private R&D, often by granting tax concessions. The state might spread information about new technology through the specialist press, or through subsidised programmes. Industrial policy can also enhance competition in the market for products with the appropriate legislation about anti-competitive practices and mergers.

Another horizontal policy, widely used in the second half of the 20th century, aimed at boosting capital accumulation in manufacturing with tax incentives for savings or investment, and low-interest loans. Possibly one of the most dramatic cases in recent decades has been Ireland's low tax on profits, apparently immensely successful in drawing in export-oriented foreign direct investment (FDI) during the 1990s. Support for education and training, in turn, increases the supply of skills,

4 To illustrate, in 1997, more than half of the employment by Siemens was indirect and, therefore, could be considered as services. But since Siemens is a manufacturing company, these jobs were classified to manufacturing.

and lowers their 'price', although this may be classified as active labour market policy as much as an industrial policy. In both the cases of capital and labour market policies, reducing the input price to industry is intended to increase output.

Governments can also regulate the prices of other inputs – such as energy and water – to support industry at the expense of utility companies, taxpayers, or private consumers. In addition, the efficiency with which the state supplies the infrastructure services for which it has accepted responsibility – such as roads and sometimes utilities – might substantially influence the business environment (Lynde and Richmond 1993).

By contrast with the foregoing horizontal or general policies, vertical or structural policies – which redistribute resources among sectors, industries, and firms – are the core of classical industrial policy. With some exceptions (notably the attempts at general planning of the 1950s and 1960s), these policies have targeted single firms or industries according to two different principles. One is 'picking winners' – supporting those industries or businesses that the authorities deem to have great potential. The other principle is 'helping losers', firms and industries in trouble. The crisis of the 1930s and the oil shocks of the 1970s initiated bursts of this second type of assistance.

2.2 Drivers

Industrial policy has generally been concerned with economic 'catching up' and with the economic basis for national security. The world productivity leader therefore has no need for a policy, only followers do. Hence there has been little discussion of an industrial policy in the United States, except during the period of American anxiety about Japanese overtaking in the 1980s. By contrast, throughout the 20th century and into the present period, European states have attempted to close a perceived gap or to recover a lead.

Industrial policy has generally been concerned with economic catching up and, thus, the world productivity leader does not need a policy, only followers do.

Four political economy drivers of intervention are prominent: promotion of national defence and order, 'capture' by special interest groups and lobbies, budgetary stringency, and prevailing views about the efficacy of intervention. Let us look at each in turn.

Ensuring an industrial base capable of supplying advanced technology weaponry explains the Spanish and Russian support for shipbuilding in the first decade of the 20th century, after respective defeats by the United States and Japan. The same motivation powered British and French support for nuclear and aerospace industries from 1945. Closely related to national security as an industrial policy driver has been the desire to maintain civil order and market functioning. To this end, states have bailed out, nationalised, or reorganised major employers or important defence contractors in attempts to prevent their closure. Such support might then continue for decades because of the electoral difficulties of running it down.

A principle of profit maximisation, forced on firms by market competition, is that all activities should be undertaken up to the point where the marginal revenues balance the marginal costs. Corporate activities include lobbying for state support – not merely for subsidies and tax concessions but also for the elimination or exclusion of rivals. The returns to spending on corporate lobbying (and how much it is worth undertaking) will be greater the more pervasive the role of the state in the economy. 'Regulatory capture' is a payoff to firms when government departments or agencies regulate in the interest of firms rather than, as they should, in the interests of users of firms' outputs.

Rational lobbyists are unlikely to find general industrial policies worth pressing for. Instead they would push for sector- and firm-specific support. Tariffs or other foreign trade controls are the most studied

instruments of historical industrial policy. These were typically instruments of vertical policy and often a response to industry lobbying. The transparency of national political/budgeting systems therefore was likely to influence the sector/general pattern of tariffs and other support between countries; greater opaqueness increased opportunities for special interests to get their way (Neven 1994).

Turning to budgetary stringency as a driver of industrial policy, the need to balance government budgets prompted the 19th century nationalisation of German railways and the municipalisation of British electricity supply. Ironically, a century later, privatisation was driven by mounting budgetary cost of subsidising nationalised industries and by the need to mobilise more resources for their investment programmes.

Belief in the effectiveness of state intervention, peaking from the 1940s to the 1970s, also played an important role in driving industrial policy. Confidence that state-owned industry could operate more efficiently, and better advance the interests of society than private firms, underlay many nationalisations of this period, triggered by the market economies' depression of the 1930s and the contemporaneous industrial success, so it seemed, of the centrally planned Soviet economy.

These drivers influence the character of the phases – or epochs – of industrial policy. As we see next, four distinct phases of industrial policy in the 20th century can be distinguished for Western Europe.

3. Phases of industrial policy in the 20th century

Shocks to the economy and society, together with policy responses to change, created different phases of industrial policy.

Shocks to the economy and society, together with policy responses to changed circumstances, created different phases of industrial policy. They altered the institutional framework and prevailing beliefs, changing the opportunities for the policy drivers.

3.1 Phase 1 – the period to 1914: liberal industrial policies

At the beginning of the 20th century, when it was becoming clear that US productivity was generally higher than in Britain and that in many branches of manufacturing Germany was overhauling Britain, elements of British industry began to feel a need for a policy, signalled by tariff reform agitation. In much of the rest of Europe, the demand for an industrial policy had arisen even earlier.

Despite far higher transport and communications costs than today, trade, capital movements, and migration tightly enmeshed European markets. 19th century European economic liberalism favoured markets and 'hands-off' policies. This liberalism was generally underwritten by limited political franchises and the accompanying respect for private property. The archetype was British industrial policy, the model for 19th century Belgium and the Netherlands. Scandinavian policies by and large encouraged trade and free enterprise, too. Although Italy and France pursued economic strategies that were liberal in comparison to later stances, when compared with other countries they were interventionist. In marked contrast to phases 3 and 4, cartels were legally enforceable and widespread in German industry.

Much of continental Europe leaned against the wind of international competition at the beginning of the 20th century, both in industry and agriculture, by imposing protectionist tariffs. But viewed from the end of the 20th century, most noticeable is that before 1913 all European governments were usually rather modest in their peacetime industrial policy aspirations and in their selection of policy instruments, by comparison with the years after 1945. We turn now to the four key policy areas: trade controls, infrastructure policy, state ownership of manufacturing firms and state purchases of industrial goods, and technology and patent policy.

Tariffs were preferred to subsidies as instruments of industrial policy simply because they did not consume tax revenues but brought money into state treasuries. Moreover, those who appeared to bear their burden were foreigners. The richest countries – Britain, Belgium, and the Netherlands – maintained low tariffs, and the poorest economies in Europe – Portugal and Russia – were the most protected.

Government involvement in creating a productive infrastructure constituted one of four key policy areas in the liberal phase of industrial policies.

Government involvement in creating a productive infrastructure constituted another policy aimed at supporting industrial activity. Direct state spending focused on communications and transport infrastructure, vital for the competitiveness of manufacturing and the effectiveness of national armies. 19th century technology determined that infrastructure business dwarfed the scale of manufacturing enterprises, and of these businesses the most expensive was railways. Railways and roads were needed to carry troops to the frontiers, and telecommunications to tell them what to do. The state therefore was interested as a user of services in which private monopolies were likely to emerge. For security reasons, communication networks, the postal service, and roads were traditionally state monopolies, as were electric telegraph and telephone, except when finance was not available.

By the end of the 19th century, state monopoly was being extended to railways in much of continental Europe. Most ambitious of state infrastructure investments was the French *Plan Freycinet* of 1879, but like the successor *Plan Baudin* of 1903 it was ended prematurely for financial reasons. Commitment to free trade did not rule out state ownership of infrastructure. For instance, despite a generally liberal stance on economic policy, Sweden's state railways in 1913 transported 60 percent of goods travelling by rail (Sweden also established a state-owned electricity generator to exploit hydroelectricity). Other liberal states, notably Britain, opted for arms-length regulation of railways. Even so, that did not necessarily leave the cheaper telegraph and telephone networks safe for private enterprise in these countries.

Local government imitated national infrastructure policy, supplying water, electricity, and gas in European cities. Dissatisfaction with private monopoly was a prominent motive, for instance in the German cities of Stuttgart and Stettin. As the most essential service, water was most likely to be municipalised, but the 28 largest German cities also took over gas supply between 1860 and 1896 (Batson 1933).

State buying was a long established and vital element of national demand for advanced technology industries. In the 20th century, a common argument was that civilian 'spin-offs' from such purchasing benefited and modernised the economy. Four major arms manufacturers employed 2,000 men in Turin in 1862, working with the most advanced machinery. Later they were the source of skilled labour for Ansaldo and Fiat (Saul 1978). The weakness of many spin-off claims is that the opportunity cost of the resources expropriated is ignored. What useful things might these workers have produced other than armaments, and how rapidly might 'raw' labour have been trained for civilian manufacture when the demand arose?

And then, one may ask whether these favoured industries could attain a minimum efficient size merely supplying one national market and what problems arose from the contractual relations with the state purchaser. To make the point, Sweden's L M Ericsson, now a world player in the telecommunications market, failed to receive Swedish state telephone contracts in the later 19th century and was forced to look for buyers abroad, especially in Russia. By contrast, the cosy relationship of Belgium's state telephone company with Bell Telephone Manufacturing Company raised its costs and reduced competitiveness.

To conclude the sketch of Europe's industrial policies in the period to 1914, we turn to technology policy. A classic liberal industrial policy was protection of technological property rights with patents. But economies with little patentable domestic innovation could choose to provide limited or no patent protection in order to acquire foreign innovations without payment. The Netherlands and Switzerland took a free ride on the innovative efforts of larger countries, to the advantage of some of their own manufacturers. Because German firms were unable to patent their processes in Switzerland, the Swiss chemical industry could employ German technology for free in the production of specialty dyes. The Netherlands lacked any patent law at all from 1869 to 1910. This helped the Jurgens brothers develop a French process for manufacturing margarine after 1870. The absence of patent laws was also very useful for Gerard Philips, who established an incandescent lamp factory at Eindhoven in 1891, making essentially Edison's carbon filament lamp with only minor modifications. Not burdened by royalty payments to Edison (and Swan), Philips was one of the largest manufacturers in Europe by 1913 (Schiff 1971). Once domestic technical progress in these sectors became self-sustaining in the early 20th century, both Switzerland and the Netherlands chose to join the International Patent Agreement so as to gain protection for their own technologies.

3.2 Phase 2 – 1914-50: the spread of interventionism in an era of disintegration

The shock of wars and economic disturbances sparked the second phase of 20th century industrial policy, with aggressive nationalism becoming a pervasive basis for European industrial policy.

The shock of mobilisation and war in 1914 coupled with economic disturbances, especially the slump of the early 1930s, and with the Versailles Treaty, sparked the second phase. Aggressive nationalism, more powerful because of lengthened boundaries, became a pervasive basis for European industrial policy.

Military demands and bankruptcy of large employers (Citroen was bailed out in 1934, for instance), together with a discrediting of free markets in the slump, raised the proportion of national income that the state directly influenced. Mussolini's IRI holding company for large bankrupt manufacturers, taken over by the state in the 1930s, became the model for Franco's INI, the core of Spanish industrial policy from the 1940s for a generation.

By 1950, the Italian state controlled 80 percent of shipbuilding, 40 percent of rolling stock production, 60 percent of pig iron, and 43 percent of steel, mainly as an interwar period inheritance. Unlike Britain's newly nationalised industries, Italy's state enterprises were run as if they were separate private businesses, and priced accordingly (UNECE 1953).

Most of Europe fell back relative to the United States in the autarkic conditions of the time. Britain was unusually able to participate in the relatively free trade of the British Commonwealth. Like other continents, Europe expanded industrial employment and reduced exports during the 1930s by adopting strong protectionist policies. Import quotas assumed prominence as policy instruments in the early 1930s because, with falling prices, tariffs could not guarantee the desired import volume protection. The quotas remained when more prosperous times returned.

The collapse of the 19th century liberal economic order in a welter of trade and currency controls was matched by political changes. Dictatorships in Germany, Italy, Spain, Russia, and perhaps Portugal aimed at economic control by the state, but so did democratic France. While private property and peace persisted, dictators' industrial policies were unlikely to differ markedly from those that might be pursued by a corporatist democracy. However, in Soviet Russia during the 1930s, private property was virtually abolished and Stalin's industrial policy, based on central direction rather than markets, was therefore far more draconian than elsewhere.

Wealthier countries were more likely to be policy leaders, but strong ideology – in the case of Russia between 1917 and 1991 or maybe Portugal in the mid-20th century – could still allow policy makers to eschew the example of their richer neighbours. Most notably, Soviet Russia's avoidance of the Great Depression, which began in 1929, added prestige to central planning as an industrial policy and encouraged milder imitations later, even in capitalist countries.

More liberal states tried to deal with the impact of the world economic crisis by moral suasion rather than nationalisation. Thus, the Belgian government put pressure on the Société Générale to save the bankrupt carmaker Minerva, and the formally independent Bank of England began an anaemic interventionist industrial policy to prevent the Labour government of 1929-31 from taking more forceful action.

Electricity in the early 20th century, like steel in the later 19th century, was a basic industry for any state that aspired to military independence. That electricity transmission and distribution networks, like railways tracks, were natural monopolies, offered another reason for state intervention, often at the municipal level. Lenin's famous 1920 claim to the All-Russia Congress of Soviets that "Communism is Soviet Power plus electrification of the whole country" reflected the belief in a number of states that industrial development and competitiveness required the full exploitation of the new power source.

The European legacy of the traumatic period 1914 to 1945, or perhaps to 1953[5], was a far greater role for the state in directing national resources. Industry was affected both intentionally and unintentionally by the extension of governmental economic power. In Britain and France, greater social spending went hand in hand with higher peace-time military outlays after 1945 as they tried to resume their traditional roles as world powers.

The European legacy of the traumatic period 1914-1945 was a far greater role of the state in directing national resources.

The 'displacement effect' of the war was most apparent in these countries (which were also the most heavily taxed) and their defence industries, especially aircraft and shipbuilding, accordingly gained. Britain also gave specific help to cotton and nationalised a considerable proportion of industry. Ambitious state finance for investment in France under the *Plan Monnet* was as nationalistic as any earlier policy, an attempt to restore France to pre-eminence in Western Europe. West Germany's policy was not so different in intention. But unlike in France, it did not lead to an increase in taxes as a proportion of income, mainly because central and local taxes had already been high before the war. Generally, subsidies had fallen by 1950 in all countries, though their course was more erratic in Greece and Ireland.

3.3 Phase 3 – 1950-73: industrial-policy heyday in an era of re-integration

Phase 3 began with the rebuilding of the now divided European economy. The West benefited from new liberal international market institutions plus US cold war hegemony. These European economies expanded at unprecedented rates. International capital, trade, and migration flows increased more than proportionately with the growth of production. Beginning with the European Coal and Steel Community (or perhaps with the European Payments Union), institutions of European cooperation and coordination underpinned these flows and the ensuing economic growth. Yet, independent national industrial policies were still pursued, supported by greater state expenditure on a wider range of policy instruments – investment grants or tax rebates, including those intended to attract FDI, research and development subsidies, training investment, competition policies, and institutions

5 The later date allows the inclusion of the Berlin Blockade, the beginning of the Cold War, and the Korean War as economically traumatic events that should be included with the World Wars and the Great Depression.

to fill gaps in existing market provision (Milward 1992). Costs of military and defence-related technologies – jet aircraft, computers, nuclear reactors – soared. These *grands projets* increasingly offered strong reasons for European cooperation to share costs too large for individual states.

The United States favoured a single Western European market with supranational institutions as a bulwark against Soviet influence. To ensure that Marshall Aid was spent in accord with US intentions, the first European organisations after the Second World War were brought into existence: the Organisation for European Economic Cooperation (later the OECD) and the European Payments Union. Thereafter a succession of treaties widened and deepened supranational arrangements in Western Europe. Formally, these treaties curtailed industrial policy powers of national governments but, in practice, national policies and policy objectives were awarded priority over supranational arrangements. In what follows, we look at the salient features of industrial policy in the context of European integration in the period to 1973.

A natural first step is to consider the European Coal and Steel Community (ECSC), established in 1952 by the Treaty of Paris and consisting of Belgium, France, Germany, Italy, Luxembourg, and the Netherlands (the 'Six'). One way to interpret the willingness of these countries to create the ECSC is that purely national policies for coal and iron ore came closest to the self-defeating prisoners' dilemma and, by extension, coordination could help countries to better exploit their deposits. A supranational coal and steel community was the obvious answer – if almost a century of hostility on different sides of frontiers could be put aside. In 1950, the French foreign minister, Robert Schuman, advanced a proposal that did exactly that. The resulting Treaty was contradictory in a way that became characteristic of European Union policy. Under certain conditions, the ECSC High Authority (in a sense a forerunner of the European Commission) could impose minimum prices, determine production quotas, and order import restrictions. Yet at the same time, the Authority was supposed to stimulate and enforce competition. The Authority never managed to dismantle the Ruhr coal cartel under Article 65 of the Treaty, nor was it able to put an end to collusive practices in the steel industries (Spierenberg and Poidevin 1994).

Intra-Community trade in steel nearly doubled in the four years after 1953, whereas production rose by only one-half. Intra-Community trade in non-treaty products increased by almost as much as steel, however, which at first sight suggests little effect of the ECSC. But considering the wrangling over the coal and steel resources that had bedevilled international relations earlier, the implicit counterfactual, or base case scenario, may be too optimistic. If so, a greater impact must be attributed to the ECSC.

Unlike the Treaty establishing the European Coal and Steel Community, the Treaty of Rome creating the European Economic Community unambiguously embraced economic liberalism.

Unlike the ECSC, the 1957 Treaty of Rome creating the European Economic Community (EEC) unambiguously embraced economic liberalism[6]. Underlying the Treaty is the doctrine that free movement of goods, services, and production factors will enhance competitiveness. Industrial policy was not mentioned explicitly. Reducing formal trade barriers between members (initially the 'Six') was the major achievement of the early years of the Community. Britain remained outside the EEC and formed a free trade area (EFTA)[7], without a common external tariff and the supranational elements of the Treaty.

Implicit in the Treaty was the proposition that markets are largely self-regulating as long as they are in their competitive, 'natural', state. Enforcement of this proposition during the heyday of interventionist industrial policy was low and erratic. Through to the 1970s, much of the industrial

6 The Treaty also established the European Atomic Energy Community.

7 The original partners with Britain were Norway, Sweden, Denmark, Switzerland, Portugal, and Austria.

subsidies went to state industries that were key policy instruments of Western European states, which were not prepared to tolerate interference from the Commission.

Besides constraints imposed by key national governments, EEC policy was subject to internal pressures and contradictions. For instance, the Industry Directorate favoured big European companies as a means of strengthening European industries and, hence, there was always some potential tension with the Competition Directorate.

In 1950-73, the EEC and member countries employed two instruments, in particular, to achieve industrial policy objectives: trade controls of the EEC and state ownership in member countries.

The EEC and member countries employed two instruments, in particular, to achieve industrial policy objectives: trade controls of the EEC and state ownership in member countries. To start with trade controls, it is fair to say that besides coordinating coal and steel resources, the principal element of European integration in the period considered was the creation of a customs union. Member countries abolished import tariffs on trade among themselves and introduced a common external tariff and a common commercial policy towards third countries. In the late 1950s and 1960s, import tariffs were cut considerably, in particular on goods imported from EFTA countries. Intra-European trade – both among the 'Six' and larger groupings of European countries, such as the EU of the late 1980s – grew faster than total European trade. Although the theory of customs unions predicts only small gains from such liberalisation, models based on different assumptions – scale economies and imperfect competition – generate larger benefits, more consistent with the strong industrial growth of the period.

Under the General Agreement on Tariffs and Trade (GATT) of 1947, to which all Western European countries were signatories, import quotas, which had been so destructive between the world wars, were forbidden. That said, voluntary export restraints began to replace unilateral quotas. Usually the result of bilateral negotiations, such restraints were politically rather easy to implement because the restricted exporters could earn higher profits. In addition, they were popular with import-competing industries. The cost to the consumer was never made public and rarely included in the measurement of industrial support. One of the best-known voluntary export restraint agreements is the Multi-Fibre Arrangement (MFA) – the EEC signed the first MFA in 1974 – that aimed at protecting the textile industries of advanced countries against competition from newly industrialising countries.

The Soviet Union and the rest of Eastern Europe used the state monopoly of foreign trade to achieve similar ends. The Council for Mutual Economic Assistance (CMEA) was intended to mimic cooperative institutions in Western Europe, enhancing economic integration in the communist bloc. Soviet satellite economies had no choice but to continue with the Soviet model of industrial policy. But, like Western European states, they resisted specialisation within the CMEA bloc when required to lose, rather than to gain, industrial capacity.

Turning to state-ownership and economic planning as industrial policy instruments, it is probably no exaggeration to observe that Western Europe was immune neither to beliefs that wartime resource allocation methods could be equally well employed in a civilian economy nor to the early successes of the Soviet model in boosting industrial production. The Soviet example influenced, in particular, French corporatist industrial policies in the 1950s. This was especially so for economic planning and the *Commissariat Général du Plan*, which were at their zenith in the 1950s and 1960s. The views of Jean Monnet, the first *Commissaire au Plan* in 1946, on the necessity for raising business expectations of growing markets eventually spilled over into Britain in the mid-1960s. The First French Plan focused on heavy industry, which was largely state-owned anyway, so plan implementation merely required directives. Even during the Second Plan of 1954-57, the state wielded considerable direct influence through control of finance and fiscal incentives (Denton *et al.* 1968).

Most other Western European states also had nationalised substantial proportions of industry, especially those with supposed 'natural monopoly' characteristics, like the utilities. By the end of the 1970s, the high tide of interventionism, electricity, gas, coal, airlines, and steel were likely to be owned by the state in most of Western Europe. Moreover, governments held stakes in the motor industries in Austria, France, Britain, Italy, the Netherlands, and West Germany. State ownership of railways and the postal service was complete in Europe, and only Spain broke the otherwise 100-percent nationalisation of the telecommunications sector. These businesses rarely operated on exclusively commercial criteria, but were used to achieve social and political objectives. In some countries, jobs in state industry became means of rewarding the party faithful.

National security continued to motivate a good deal of 'high-tech' development, often by state industry, in Europe during the great post-war boom. Military technology drove the costly British and French nuclear power generating industry. The German nuclear power programme also proved expensive; the SNR 300 Fast Breeder reactor lost DM 11 billion without ever entering service. Eventually, privatisation curtailed nuclear supply in Britain, by bringing into the open the risks and the expense of such technology. Computers and aerospace also absorbed vast sums of state money in the only two European states that continued to see themselves as 'great powers' in the 1950s and 1960s, Britain and France. Twenty-two percent of French state research funding in 1969 was spent on aerospace. British aircraft subsidies masqueraded as 'launch aid', but only one aircraft project ever managed to repay the aid from subsequent sales.

The enormous fixed costs of product development in aerospace singled out the sector as an obvious candidate for transnational collaboration. In the East, there was the R&D cooperation of the Soviet Union with its Warsaw Pact allies. A more equal distribution of the burdens and the benefits was specified in the Anglo-French supersonic commercial airliner project, the Concorde, which begun in 1960. A remarkable technological achievement, the enterprise was commercially misconceived[8]. Germany also had its Concorde – though it was not supersonic – the VFW 614. By the time the project was cancelled, the German taxpayer had spent about DM 1 billion.

3.4 Phase 4 – 1973 and beyond: eurosclerosis, globalisation, and de-industrialisation

Since the early 1970s, rising international capital mobility has increasingly constrained national industrial and other policies.

Phase 4 was ignited by the oil shocks of the 1970s and the apparent failure of most European economies to adjust to the changed circumstances. Productivity growth slowed and government budget deficits increased. Industrial crises once more precipitated state intervention (both of contrasting types and with different results in the cases of the British and German motor companies BL and VW). Manufacturing employment declined and unemployment rose, along with industrial subsidies. The capital controls of much of phase 3 had been largely removed. Consequently, international capital mobility increasingly constrained national industrial and other policies; the newly elected French Socialist government in 1981 was obliged very quickly to adopt more market-sensitive stances in the face of capital outflows.

Some loss of momentum after post-war reconstruction was inevitable, but the rise of Japan and other competitors in the Far East, together with the continuing industrial lead by the United States, triggered concerns that the European slowdown was excessive. Very few of the largest European

8 The cost of Concorde over 14 years, £1 billion, was 500 percent above the 1962 estimate. Similarly, by 1971, the United States had spent $1 billion on their aborted supersonic transport project. Together with the Advanced Gas Cooled nuclear reactor (AGR), the financial loss to the United Kingdom from Concorde amounted to more than $20 billion in 1990 prices, or nearly two years of all British R&D expenditure in the late 1980s (Ergas 1992).

firms were judged particularly competitive in world markets by the 1980s. Instead they were 'sleepy giants', according to critics. Inevitably, European industrial policies were accused of braking industrial change, for much more was being spent than ever before. German economic success allowed huge outlays on industrial subsidies. Before 1914 subsidies paid to German companies were less than 0.01 percent of net national product (NNP). By the 1930s, the figure had risen to around ½ percent, and at the end of the post-war boom (phase 3) subsidies reached some 2 percent of NNP, tilted markedly towards 'sunset industries' (Giersch *et al*. 1992).

Rising unemployment went hand in hand with fewer manufacturing jobs. In the 1980s, Germany, France, Italy, and Britain all employed a smaller proportion of their workforces in manufacturing than in the 1960s (and experienced far higher unemployment – rates not seen since the 1930s). Between 1968 and 1984, the expanding industries in the seven largest OECD countries were services, led by financial services. Technologically sophisticated manufacturing (particularly computers, telecommunications, and semiconductor equipment) followed at a distance. Japan and the United States moved into these 'sunrise' sectors most rapidly, while France, Germany, and Britain pursued at a medium pace. The purging of Britain's manufacturing industry with the rising exchange rate and tight money of 1980-81 brought Britain the second greatest structural change after Japan (OECD 1992).

In the EU as a whole, less than one worker in five was employed in manufacturing in the mid-1990s. For those who saw manufacturing as the fountainhead of prosperity, this last development was ominous. When associated with an absolute fall in manufacturing output for long periods, the trend was especially worrying. In the recession that began around 1990, manufacturing value added declined in the four largest Western European economies.

Western Europe's economic concerns were, however, mere pinpricks compared with the industrial difficulties of the Soviet Union and Central and Eastern Europe. Here above all was a test of a non-market, interventionist industrial policy at its most extreme. In particular, a measure of the adverse impact of central planning is the divergence between the West and East German economies during the period of the Communist regime in the East. Despite remarkable technological achievements, such as the Sputnik satellite launched in 1957 and the Mir space station, Soviet industrial policy largely failed to deliver either sufficiently advanced products or consumer goods in volumes comparable with those of Western Europe. Moreover, the record of environmental pollution in centrally planned economies was abysmal. By 1991, the Soviet empire collapsed under the weight of its misconceived economics, beginning a fifth phase of industrial policy for Eastern Europe.

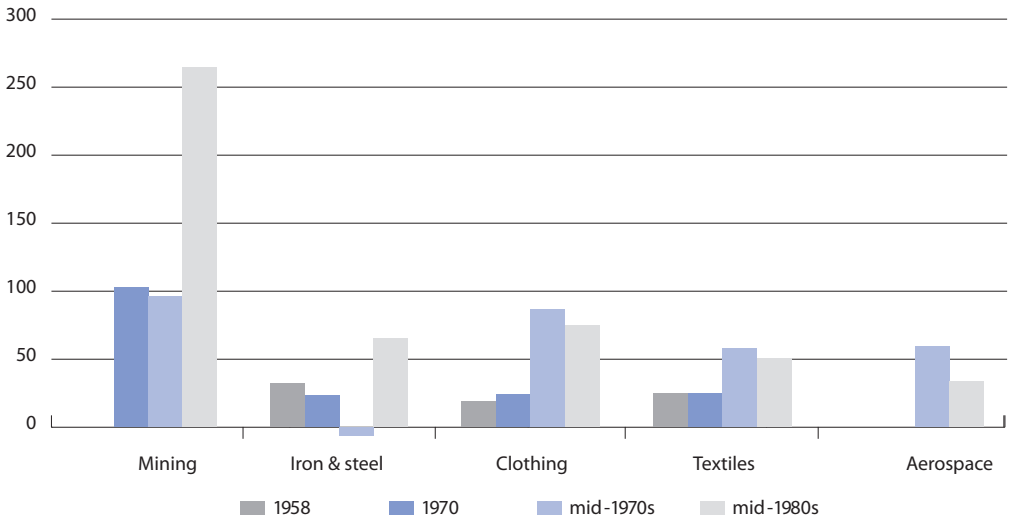
Western Europe's economic concerns in phase 4 of industrial policy in the 20th century were small compared to the industrial difficulties of the Soviet Union and Central and Eastern Europe.

How did these challenges affect industrial policies? Roughly following the template used in discussing earlier phases, we will look at industrial subsidies, trade controls, government procurement, and measures to improve market functioning.

Subsidies continued to be a central element of Western European responses to the problems faced by industry. Figure 1 shows the rise in West German rates of assistance to selected industries from the 1950s to the 1980s. In most cases, subsidies went to sectors with declining employment, but from the 1970s the expanding aerospace industry began to absorb substantial state support. That said, as Figure 2 shows, Germany offered the lowest payments to manufacturing between 1981 and 1986 among the European countries, but adding the enormous coal-mining subsidy would change the picture. German subsidies progressively increased after this period, in contrast to the trend in the rest of Europe. Reconstruction of eastern Germany in the 1990s was burdensome, but the multiple layers of German policy making and implementation created more deep-seated problems. Germany pursued industrial policy at three different levels – federal, state (*Länder*), and local.

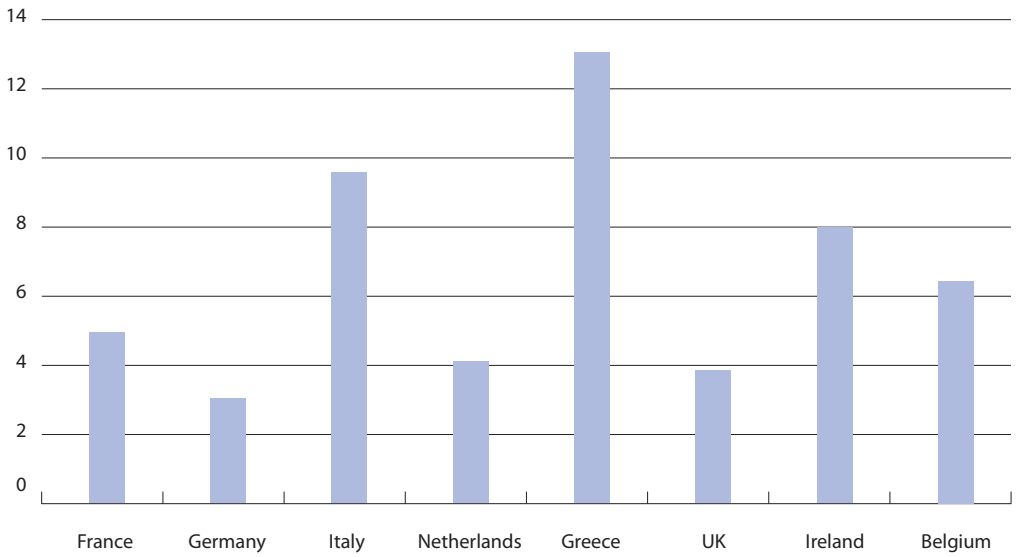
Policy makers at the lower levels supported declining industries to maintain jobs and tried to attract new employment at the expense of their neighbours. The Bavarian and the North Rhine-Westphalian state-bank-industry networks both appeared effective in this respect.

Figure 1. Effective rates of assistance to selected West German industries



Source: Giersch *et al.* (1992)
Notes: Effective rates of assistance include subsidies and protective non-tariff barriers to trade. Import barriers for inputs to an industry will raise that industry's costs and therefore create a 'negative rate of assistance' unless offset by protection or subsidies for the industry's sales.

Figure 2. Manufacturing subsidy as percent of sector value added, 1981-86



Source: Ford and Suyker (1990)

In the late 1990s, Greece's strong desire to satisfy the budgetary requirements for membership in the European Monetary Union provided a motivation for a change in industrial policy. Retrenchment was needed because Greece headed the European subsidy league in the 1980s. In addition, the opening of the Greek market to EU imports of manufactured goods created a crisis of adjustment.

Greece was not unique, for all EU countries with smaller manufacturing sectors tended to offer higher subsidies, perhaps because they were more anxious to encourage them. Steel was a major recipient of financial support everywhere, except in Germany and the Netherlands. Large subsidies hindered the phasing out of unprofitable activities and the search for new products and markets. Once international, and in particular Japanese, competition began to bite, Europe's steel industry declined. Europeans failed to modernise adequately in the more prosperous years before 1973 and suffered political difficulties of adjustment in the collapse after 1975. This was in part due to cartelisation and restrictive practices persisting in the ECSC.

R&D subsidies remained a common form of industrial policy after the switch towards markets and competition in the late 1980s. EU and EFTA governments that provided lower industrial subsidy rates showed some tendency to emphasise research and development support through other elements of their total policy package. Small countries – Denmark, Switzerland, and Finland, for example – favoured R&D subsidies over other forms. Most countries tended to focus assistance on specific new technologies: Norway and Denmark preferred biotechnology and information technology, the United Kingdom microelectronics applications, Spain industrial robots among other fields, and Italy aeronautics (OECD 1986).

R&D subsidies remained a common form of industrial policy after the switch towards markets and competition in the late 1980s.

That smaller subsidisers focused more on R&D support suggests that some political systems were more prone to respond to lobbyists than others. In the 1980s, the fragmentation of Western European political parties was associated with higher state aid to manufacturing industry. Holding other factors constant, highly concentrated industries were apparently more successful at lobbying. Individual country peculiarities, associated with lax procedures and lack of transparency that made capture by business interests easy, were of greatest importance in explaining the pattern of state support (Neven 1994). Belgium and Italy were among the countries that used the least transparent procedures for allocating state aids. Lack of policy transparency also encouraged corruption (Ades and Di Tella 1997).

By the 1980s, many manufacturing activities could afford to pick and choose their locations, especially when operating as subsidiaries of multinational companies. Hence, there was strong inter-government competition with subsidies to attract silicon chip or motor vehicle plants. These policies were 'pro-active' in contrast to the more usual 'reactive' industrial policies of European history. Probably more than 1,000 agencies in Europe competed to attract inward investment in the 1990s. Britain implemented the most effective policy – in the sense that it drew in perhaps 40 percent of all FDI.

Subsidies were often directed at nationalised industries, which continued to account for a large proportion of gross domestic product (GDP) in most European countries. State-owned industries in Portugal and Greece produced over 20 percent of GDP, and France and Italy were not far behind. By contrast, privatisation had radically altered Britain's position in 1991 compared with the 1970s. Most Western European governments disposed of some state assets in the 1980s, but only Britain and France (at a considerable distance) shifted the private-public industrial boundaries (Vickers and Wright 1988). The West German programme was merely symbolic (though Germany's state-owned sector was smaller than elsewhere in Europe) and the Italians moved a labour force of only 100,000 to the private sector. Explanations for the unwillingness of much of the rest of Western Europe to follow radical privatisation include the fragility of coalition politics and constitutional protection of state monopolies. In Eastern Europe during the 1990s, the collapse of the Soviet empire led to massive privatisation programmes. In former East Germany, the *Treuhandanstalt* had privatised 17,000 previously state-owned enterprises (or establishments or plants) by 1994.

Turning to trade controls in support of industries, lobbying ensured that they varied markedly among Western European countries in the 1980s, despite the European common external commercial policy. Voluntary export restraints of Japan's car industry that differed across EU countries were a clear violation of this policy. France allowed these exports no more than 3 percent of its car market, Italy limited them to 2,500 cars, Spain to 1,000 cars, and Britain permitted them up to 11 percent of total domestic car sales. By 1988, of 261 voluntary-export-restraint agreements in the world, 138 were imposed by the EU. Textiles were more regulated by such agreements than any other sector in the world and, in the EU, were second only to agriculture. The most stringent restrictions were imposed on the cheapest foreign exporters. In Britain, the cost of each textile job saved in 1988 was three to four times employee earnings.

International economic interdependence sometimes generated strange industrial policy spillovers, with US restrictions on Japanese car exports benefiting European exporters.

International economic interdependence sometimes generated strange industrial policy spillovers. US restrictions on Japanese car exports in the 1980s allowed European exporters to charge higher prices than they would otherwise, conferring on them a very substantial gain at the expense of US consumers (Dinopoulos and Kreinen 1988).

Government procurement continued to support national defence industries or other 'strategic' suppliers, such as telecommunications. EU directives to open state purchasing to competitors from other member countries seem to have been ineffective. The import content of purchases by governments of large member states was less than 4 percent. This form of trade barrier was of considerable importance since public procurement accounted for 7-10 percent of member countries' GDP (Tsoukalis 1997). Private businesses were unwilling to push for the enforcement of fair procurement procedures for fear that in reprisal they might never receive future state contracts.

Differences in procurement policies could affect national competitiveness. British regulation of safety, pricing, basic research, and FDI created a demanding local competitive market for British pharmaceutical firms, training them in the necessary skills for international competitiveness. By contrast, French pharmaceutical policy protected the local market and French firms therefore lost out internationally (Thomas 1994). Unusually, the Swedish Public Procurement Act required state tenders to be genuinely open to foreign competition. Some observers consider this approach to public procurement, which acknowledges that a small country must specialise and cannot hope to efficiently supply the full range of products, as one reason for low telecoms and electricity prices in Sweden (see Hjalmarsson 1991, for instance).

At the European level, in addition to the common external tariff, industrial policy encouraged European networking in advanced technology sectors, market integration (for example by harmonisation of standards), and market liberalisation. The European Commission tried to extend European technological cooperation by sponsoring pre-competitive research with the ESPIRIT programme of 1984, although funding was low. Similar programmes in other areas followed; Research in Advance Communications for Europe (RACE) and Basic Research in Industrial Technologies for Europe (BRITE).

A possible drawback of such programmes, however, was the creation of European standards that could act as barriers more effective than the common external tariff. A wider market would enhance competitiveness, and common voluntary standards, for instance on safety, could increase the effectiveness of cross-border trade as a stimulus to efficiency. But national standards – for electrical equipment, pharmaceuticals, and food – can be major barriers to transnational competition.

They may also be an effective weapon of protection, for instance by denying competitors access to networks.

The European Commission therefore faced a dilemma. If they tried to impose their own standards, they were in danger of creating 'angry orphans' – standards without business 'parents' and thus which no firm wished to use. On the other hand, a single European market would never be a reality if standards were not harmonised, as the 1985 White Paper on the single market acknowledged (CEC 1985). In the case of pharmaceuticals, firms interested in a position in the world's largest market, the United States, were bound to adopt US standards as a minimum, regardless of those of their country of origin. The Commission therefore attempted to achieve only mutual recognition of national standards. But the complexity and volume of business in enforcement of deregulation meant that officials needed to rely on greater transparency and on 'self-enforcing' regulations where, for instance, aggrieved firms themselves took legal action against governments not adhering to EU regulations.

During the 1980s, the European Commission became increasingly active in promoting competition and deregulation. But even when liberalisation and privatisation gained some momentum in Europe at the national level as a response to insupportable levels of public expenditure and debt, EU policies were obliged to bend pragmatically during recessions, such as the one in the early 1990s. A case in point was the massive subsidy to Air France in 1996.

3.5 The phases summarised

Faith in the market's ability to deliver economic objectives, usually the inverse of belief in the effectiveness of industrial policy, varied between phases. The period to 1914 was the lowest intervention era of industrial policy, but even then state support for infrastructure industries and security-related industries was significant, while structural or vertical policies were commonly implemented by import tariffs. Total war brought more industrial policy, as did the shock of the 1930s and the need for bailouts in phase 2.

Faith in the market's ability to deliver economic objectives, usually the inverse of belief in the effectiveness of industrial policy, varied between the four phases of 20th century industrial policy.

Another world war swept in the high tide of industrial policy after 1945. Phase 3 offered unprecedented opportunities for policy 'capture' – by technologists among others – prominent with *grands projets*, especially in the nuclear and aerospace sectors. Until the crisis of the 1970s, extraordinary economic growth, boosted by new institutions of European and world economic integration, provided both the scope for and, by association, belief in the success of interventionist industrial policy.

Thereafter in phase 4 budgetary pressures prompted less ambitious policies and something of an unwinding of earlier commitments – as witnessed by privatisations. Globalisation increasingly restricted the range of effective industrial policy interventions, at the same time as triggering concerns about foreign competition and de-industrialisation that demanded more policy responses.

4. Industrial policy impacts

How do we judge the effects of these policies? What would have happened without them or if different policies had been pursued? The theory of market failure in principle provides the basis both for estimating the impacts of intervention and for assessing whether intervention is worthwhile.

It does so by indicating the scope for a 'compensated Pareto improvement'.[9] Such an improvement makes some people better off without making anybody else worse off – at least after hypothetical or actual compensation has been paid to any losers.

Market failure may stem from inadequate competition, indivisibilities, incomplete or unenforced property rights, or from missing institutions (and therefore from coordination failures). Information deficiencies are often believed to underlie many of the most important sources of market failure in practice. An effective policy entails addressing these causes. But implementing the 'adjustment of market failure' approach can be problematic. The practical difficulties arise from both quantifying market failures and the costs and possible effectiveness of interventions. A policy to remedy a genuine market failure may do more harm than good if the intervention has side effects or is too expensive: the intention to improve is no guarantee for success.

To assess industrial policy impacts one can study individual interventions or the performance of economies as a whole.

To assess policy impacts there are two broad approaches, neither of which is entirely satisfactory in practice. One is to study individual interventions: particular industrial tariffs, projects such as Concorde, R&D subsidy programmes, investment incentives, or infrastructure regimes such as in electricity generation. The alternative is to attempt to assess the total effect of policy by considering the performance of the economy as a whole.

In the first case ('bottom up'), the studies available may not be representative or of sufficient coverage. The justification for the second approach ('top down') is that a jurisdiction catching up more rapidly with the productivity leader is *prima facie* pursuing more effective and efficient policies than another that lags behind. But other policies, or shocks such as wars or natural disasters, can counterbalance the most effective policies towards industry. And there may be permanent advantages or disadvantages such as climate that limit potential to catch up. Conversely, in a particular period the impact of damaging industrial policies may be more than outweighed by a benign world economy.

4.1 Natural experiments with openness and tariffs as an industrial policy

Bearing in mind these caveats, and taking first the 'top down' approach, we use four natural experiments concerning productivity gaps and industrial policies. The first uses the continental-size integrated US economy at the beginning of the 20th century as a 'control' for the fragmented European economies. This was a period when the most popular industrial policy was the tariff, designed to prevent international market integration. The second contrasts the productivity of the European economy most open to the world economy with the others. The third is a comparison of US and European productivity over a period when European industrial policy first centred on the systematic reduction of intra-European trade barriers. The fourth is a similar comparison for a follow-up European policy, the completion of the single market.

In 1913, US manufacturing industry and the economy as a whole were more productive than the principal economies of Western Europe (Figure 3). A substantial part of the explanation is that the United States was more regionally specialised than was Europe as a whole. Absence of trade barriers allowed tougher competition, more trade, and stronger focus on relatively more productive firms and industries, thereby raising the average productivity of the US economy. The European industrial belt containing the Ruhr, Northern France, and Belgium (originally coal-related) accounted for a large proportion of Western European industry – outside Britain – for the first half of the 20th century.

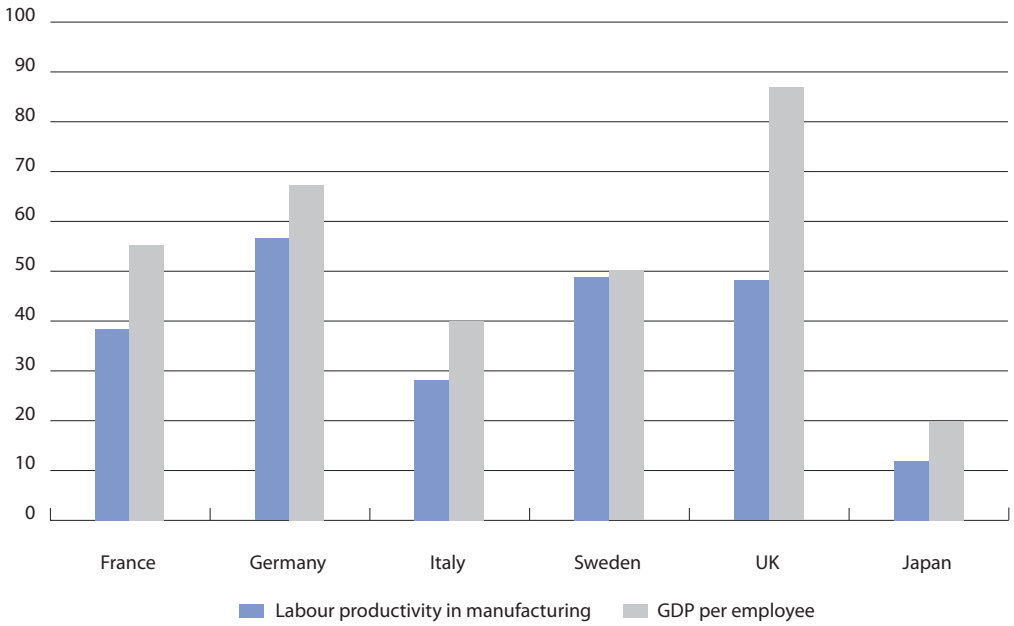
9 The theories of strategic trade policy and of the optimal tariff also indicate that national welfare can be enhanced insofar as the terms of trade can be shifted against trade partners.

But US manufacturing industry was much more concentrated, in a relatively small part of the Northeast and the eastern part of the Midwest, from the mid-19th century to the 1960s (Krugman 1991).

The second point about the early 20th century is that the European economy with the highest income (GDP) per capita was Britain, even though it was not by then a European productivity leader in manufacturing (Figure 3). Free-trade Britain was the most highly specialised economy, capturing by far the largest share of competitive world markets in shipbuilding and cotton textiles. Specialisation and openness to trade implied that some British industries, such as electrical engineering, would be small in comparison to those elsewhere.[10] Again, this natural experiment is consistent with countries pursuing trade openness as an industrial policy being likely to achieve higher productivity than those that did not. But the findings are more nuanced. Clearly, manufacturing industry in Germany and Sweden possessed competencies that British industry lacked, and effective policies to address such shortcomings would have been in British interest.

The experience of free-trade Britain in the early 20th century suggests that trade openness enhances the chances of achieving high productivity.

Figure 3. Comparative labour productivity in 1913 (US productivity = 100)



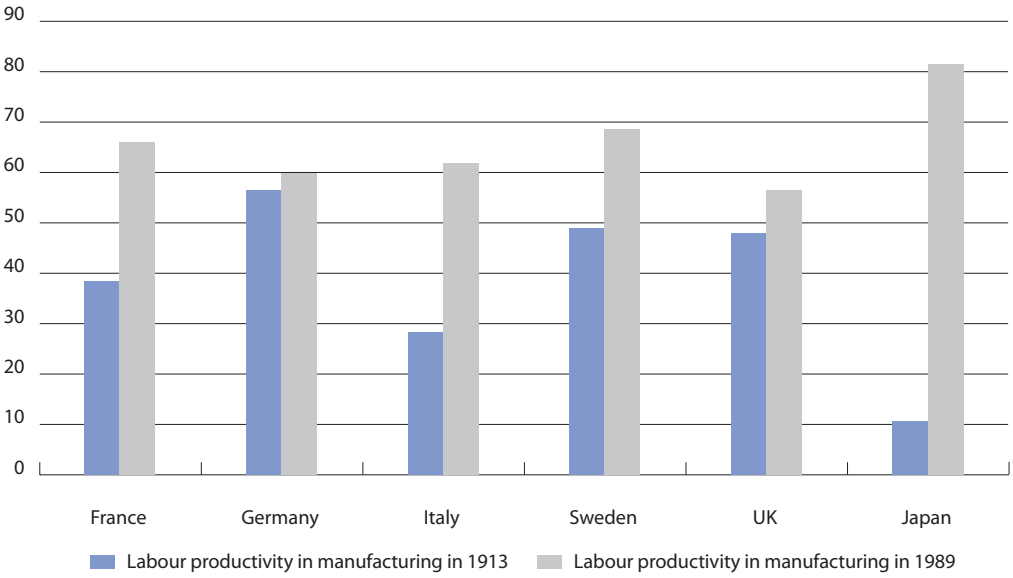
Source: Broadberry (1997)

The third natural experiment concerns the catch up of Europe with the United States after 1945. Figure 4 shows that major European economies all closed the gap with the United States over the 20th century in manufacturing (though not as spectacularly as Japan)[11]. This was also the period when European economies were increasingly able to take advantage of a continental market, thanks to the larger free trade area created by the new European and international institutions. The smallest and most open European economy shown in Figure 4, Sweden, caught up the most.

10 Germany tended to dominate in Europe in steel and sulphuric acid and in chemicals more generally. France was pre-eminent in the still tiny motor and aircraft industries.

11 Note that the 1989 productivity figure for Germany is for West Germany.

Figure 4. Comparative labour productivity in manufacturing in 1913 and 1989 (US productivity = 100)



Source: Broadberry (1997)

With globalisation and free international movement of capital, even large European economies are constrained in the way smaller ones have always been.

Why did Sweden prove so precocious? When international competition and factor mobility are limited, there will be greater capital rents in larger countries. Prices and returns to capital can be driven up without losing too much business. In this sense, earlier 20th century Britain, France, Germany, Italy, and Russia could afford to drive up costs and prices through more interventionist policies than smaller countries (though they did not necessarily use this opportunity). Larger countries could also more easily cover the largely fixed costs of high-tech defence. With greater free trade zones behind their protected national borders, industrial policies to defend national markets cost less than in smaller economies. Liberalisation or an industrial policy of openness mattered more for these smaller countries. Sweden recognised that its industries needed to compete in world markets and could not afford policies that did not contribute to this end. Not all smaller European states have recognised their constraints, however. Whereas Scandinavia and the Low Countries typically did so, and achieved higher productivity, Portugal and Greece did not. Ireland moved from the second to the first camp, with remarkable economic growth results. With globalisation and free international movement of capital, rents disappear and by the late 20th century even large European economies were constrained in the way smaller ones had been from the beginning.

The final European experiment is the Single European Market drive. The Cecchini Report (European Commission 1988) predicted the level of GDP to rise by 4½ percent thanks to a better exploitation of scale economies. European productivity growth was high relative to the United States until the mid-1990s. Most of the measures proposed by the 1985 White Paper (European Commission 1985) were in fact implemented, albeit with delays and national differences of interpretation. So there is reason to believe that some of the catch up stemmed from this industrial policy of opening up national European markets. On balance it seems that while trade restrictions could be effective in switching demand from foreign to home production, in general they failed to boost long-run productivity.

4.2 Industrial policy phases and productivity growth

The second type of information in the 'top down' impact assessment is European time series evidence. As a first approximation, GDP per capita can be regarded as a labour productivity measure. In phase 1 of European industrial policy (1870-1913), productivity on this measure grew more slowly than in the United States (Table 1). Less competition and specialisation in Europe might account for differences in levels of productivity but less obviously for growth rates. The 'closing of the frontier', as massive waves of migrants and foreign capital were flooding into the United States, seems a more likely explanation.[12]

During Europe's traumatic phase 2 (1913-1950), the advantage of the United States increased, with US productivity growing twice as fast as the European average. Here the divergence is more readily attributable to the shocks Europe suffered, for during the US depression of the 1930s the gap somewhat narrowed, although the policy stances provoked by these shocks may have contributed.

Phase 3 (1950-73) began with the reconstruction boom but, unlike the 1920-38 period, continued into sustained economic growth. The contrast with the interwar years, both internationally and European, seems more than coincidental, and a powerful impact stemming from the institutional support for trade and investment openness is consistent with the openness natural experiment described above. European industrial policy was more interventionist than ever, though with considerable variations between countries. Was it a significant contributor or did growth take place despite the policies? Supplementary evidence is necessary to reach a credible conclusion.

During the post-war boom, European industrial policy was more interventionist than ever, though with considerable variations between countries.

The fourth phase (1973-98) shows US and Western Europe productivities, proxied by GDP per capita, growing at approximately the same, now slower, pace. Eastern European growth is more sluggish than in any other period due to, first, the shortcomings of central planning after reconstruction and, second, the pains of transition to market economies. Western European productivity actually grew faster than that of the United States between 1970 and 2000 according to Blanchard (2004).[13] Can we infer that Western European industrial policies after 1973 were at least as effective as different US policies? They might both have been ineffective, damaging, or too small to be noticed.

Table 1. Real GDP per capita (annual average growth rates in percent)

	1870-1913	1913-1950	1950-73	1973-98
Western Europe	1.32	0.76	4.08	1.78
Eastern Europe	1.31	0.89	3.79	0.37
United States	1.82	1.61	2.45	1.99

Source: Maddison (2001) Table B-22

Western European policies were not homogenous, and indeed diverged from each other in the late 1990s (Nicoletti and Scarpetta 2005). Most common law countries, including the United

12 The United States pursued a tariff-based industrial policy against other economies in response to industrial pressure groups. Was this the reason for its advantage? More likely it was the opening up to European settlement and development of the hinterland, together with the abundance of natural resources that drove US growth in this period.

13 Output per capita in Europe at the end date was 30 percent lower than in the United States because fewer people worked and employees worked fewer hours. One third of this gap was due to taxation – and minimum wages and employment protection contributed as well. But Blanchard concludes that around two thirds of the output per capita gap was a matter of preferences, a reflection of a European view that work was not as important as Americans believe (possibly because of the European social safety net).

States and the United Kingdom, had relatively light product market regulation, for instance. Large continental EU countries were subject to heavy administrative regulation and also imposed onerous requirements upon firms. They tended to invest less in information and telecommunications technologies and to lag behind the United States and the United Kingdom in investing in vital non-manufacturing industries. Nicoletti and Scarpetta (2005) estimate that aligning the overall regulatory stance of continental EU countries with that of the most liberal OECD country could increase their annual productivity growth rates by 0.4 percent to 1.1 percent over ten years.

There is evidence that regulation that inhibits competition reduces productivity, and conversely, regulation that enhances competition raises productivity.

The proposition that openness raises productivity appears to hold true also for a sample of most of the world's economies after 1960 (Hoover and Perez 2004). Openness policies include removing any barriers to trade and competition, not all of which would count as industrial policies. They might involve adopting common currencies, for example, as well as harmonising standards for consumer durables or eliminating tariffs and quotas. As the complexity of products increased over the 20th century, the volume and intensity of product market regulation increased. For the most recent period there is evidence that regulation inhibiting competition reduces productivity, and conversely, regulation that enhances competition raises productivity. An industrial policy of openness now requires more than in the simpler world of phase 1.

4.3 Case studies

To supplement the 'top down' analysis, we now turn to the 'bottom up' approach, that is, to case studies. This 'bottom up' approach to evaluating the impact of industrial policy is restricted to elements rather than taking it as a whole. For the earliest phase, the central policy instrument of tariffs must be assessed. The answer to the question what would have happened either without tariffs, or if the level or structure of protection had been different, depends on the model employed. With constant returns to scale and no spillovers, the conclusion must be consistent with the top down analysis; tariff protection lowers output and productivity. Cross-European correlations confirm a negative association between productivity and tariff protection before 1914.[14]

The second principal policy instrument of the first two phases is infrastructure provision. In contrast to tariff protection, infrastructure indivisibilities and network effects offer a *prima facie* case that this industrial policy instrument could enhance labour productivity. But such projects can always be mismanaged or conducted on excessive scales so that society loses from the investment. The Baudin and Freycinet plans seem to fall into this category. Few cases have been systematically evaluated, but the introduction of a national electricity network in the 1930s (phase 2) is an exception. The British use of a 'public interest' arms-length company to coordinate both municipal and private electricity generators through the network has been modelled. The new organisation provided benefits by 1937 of around 0.3 percent of GDP, or alternatively, cut generating costs by one third (Foreman-Peck and Hammond 1997).

This example shows that filling gaps in markets and institutions efficiently was possible. Another likely case is the creation of specialised financial institutions. Probably falling into this category are the two British organisations created in 1945 to lend to firms not large enough to acquire finance from the stock market but too large to obtain adequate finance from local banks. The activities of these institutions survived and expanded in a successor organisation, the 3i. By 1991, 10 percent of all manufacturing workers in Britain were employed by companies financed by 3i.

14 A statistical analysis (Foreman-Peck 1995) suggests that Spain might have raised output per capita in 1910 by perhaps one fifth if it had adopted tariffs at British levels. Positive cross-country correlations between tariffs and productivity may stem from sample selection (O'Rourke 2000). Higher productivity, 'New World', countries had better data and happened to favour high tariffs at the beginning of the 20th century. They are more likely to be included in data samples, but their productivity derived from an abundance of natural resources.

A shortcoming of the bottom up approach to evaluating industrial policy as a whole is that while the above two examples had positive effects, their impacts might have been more than offset by other costly and inefficient interventions. *Grands projets* are very expensive in all epochs and rarely efficient even when effective. Concorde, VFW 614, and the AGR nuclear programme are clear examples (Ergas 1992). Even Airbus from the world's viewpoint, but not Europe's, did not produce a social surplus (Neven and Seabright 1995).

State ownership of industry, a widespread instrument of European industrial policy in phase 3 and much of phase 4, typically prevented private sector competition with state enterprises. Trade union membership tended to be higher than in the private sector and organisations were usually required to pursue a variety of objectives. As a policy for enhancing the productivity of industry it was therefore rarely effective – with a few exceptions – perhaps the municipal development of Schipol in the Netherlands, the early phase of Volkswagen's growth in Germany, and Italy of the 1950s, where Mattei (natural gas) and Singaglia (steel) were successful innovators. However, state-owned firms in Spanish manufacturing industry during phase 4 were less efficient than private sector businesses (Hernandes de Cos *et al.* 2004).

In network industries, less susceptible to competition, the evidence is mixed. For international samples, water does not seem to have gained from privatisation (Conti 2005). Finding the appropriate regulatory regime to encourage yardstick competition is likely to be especially challenging in this sector. In contrast to the water sector, productivity in telecommunications did improve when subject to full privatisation (Li and Xu 2004). During phase 4 more use of franchise bidding has been made in this sector to encourage 'competition for the field' (as first suggested by Chadwick 1859). A study of 12 British privatisations noted an improvement in productivity in the run up to privatisation and a better labour productive performance in a slight majority of cases. There was no evidence that competition made a difference in the sample (Parker and Martin 1995). The decisive advantage of privatisation for Western European governments was usually obtaining revenue and reducing subsidy costs. Eastern Europe proves more challenging to evaluate because privatisation was linked to economy-wide changes on a massive scale.

Investment grants and tax concessions to enhance capital formation, particularly in manufacturing industry, must have contributed to the rapid growth of the capital stock in phase 3. But in phase 4, when European unemployment rose, the likely stimulus to substitute capital for labour was identified as a drawback. Grants for setting up plants continued to be employed to attract FDI, as did investment to regions identified as experiencing employment problems. Insofar as the policy was effective, it was not undertaken, in Britain at least, with sufficient strength to make much difference (Wren 2005).

Investment grants and tax concessions support capital accumulation. However, when European unemployment rose, the likely stimulus to substitute capital for labour was identified as a drawback.

In the high capital mobility environment of phase 4, taxation of capital simply raised the cost of capital to domestic industry, and to foreign business located in the domestic country. Economies with lower corporation taxes, or tax breaks, were likely to achieve larger industrial sectors. Not surprisingly then, among the most effective fiscal policies to encourage industry was Ireland's low corporation tax rate in phase 4 (Barry 2004). Ireland's FDI stock and living standards soared; how much at the expense of the destinations to which the FDI would otherwise have flown remains to be shown. If Ireland's tax cut had been matched throughout Europe, Ireland would have gained less and the rest of Europe would have acquired more investment, but the critical magnitudes are a matter for conjecture.

Incentives for research and development, justified by supposed beneficial knowledge spillovers (a market failure), appeared to boost R&D spending between 1979 and 1997 (Bloom *et al.* 2002). Yet, whether such extra investments increased output significantly is not entirely clear. On the

one hand, the social rate of return to R&D in the United Kingdom has been estimated at around 90 percent (Griffith *et al*. 2001). On the other hand, greater R&D spending may not necessarily have raised R&D output. The supply of R&D personnel, expenditure on which constitutes the bulk of outlays, is inelastic. Tax credits or subsidies then may have primarily enhanced R&D personnel's wages, rather than increased output (Goolsbee 1998).

5. Lessons

While the scope and intensity of industrial policy has expanded along with the power and pervasiveness of the state, over the last century, it is not obvious that the social benefits from industrial policy have increased at the same rate. Market failures are typically difficult to quantify, as are the costs and effectiveness of interventions.

The most prominent message of European history for industrial policy is that freer trade and competition, rather than state intervention, enhance productivity.

Lessons have been learned from the high tide of industrial policy optimism in the great boom after 1945 – as the comparison of Concorde with Airbus shows. But the most prominent message of European history for industrial policy is that freer trade and competition, rather than state intervention, enhance productivity. Differences between US and European productivity and industrial geography at the beginning of the 20th century support this position. So does the intra-European experience. Britain leaned the least against the wind of market specialisation and reaped the highest gains from trade before 1914. Greater proportions of workers were employed in higher productivity sectors. Moreover, the US-Europe productivity gap narrowed when Europe integrated and national markets opened up during phase 3.

Markets are social arrangements dependent on a variety of institutions, some of them might be improved and others might need to be created. In infrastructure provision, competition in the 'natural' markets of phase 1 was limited because of indivisibilities and network effects. A common policy response was nationalisation or municipalisation, but in phase 4 many of these were reversed. In such cases, interventionist policies are especially warranted, establishing or restructuring institutions to encourage yardstick competition, or perhaps 'competition for the field', such as periodic franchise or licence bidding rounds.

High capital mobility in the absence of capital controls did not appear to be a constraint on policy in phase 1 because policy was much less interventionist than in the remainder of the century. Taxation of imports of goods was the principal instrument. In much of phases 2 and 3, capital in larger European economies could earn rents because of the lack of international competition, and this rent could be redistributed by industrial and other policies. In phase 4, capital mobility became a tighter constraint, as capital controls were completely removed. Industrial policies that restricted profits were therefore met by capital outflows. Ultimately this implies either tax harmonisation by inter-governmental agreement or restructuring of European taxes so that the most mobile factor, capital, bears the least tax.

Interventionist industrial policies can be expensive and historically often were abandoned for want of sufficient resources. Even with the enhanced tax powers of governments in phases 3 and 4, subsidies to state industries often proved too high from the 1970s. One of the attractions of privatisation was the budgetary relief, if only temporary, rather than productivity improvement. However, where there were competitive pressures, the simplification of corporate objectives generally ensured private-owned businesses were more efficient than state-owned enterprises.

Shifts between industrial policy regimes have been triggered by shocks; in Eastern Europe most recently by the fall of the Soviet Union, and in the West by the oil price hikes of the 1970s, together

with the worldwide slowdown in economic growth. The state must be expected to intervene when there are major industrial crises to maintain confidence in the system. Failure to maintain employment above critical levels can trigger retreats from pro-competitive policies of openness, as in the 1930s. But the successful policy is one that ensures 'emergency' subsidies taper off rapidly. Much of Western Europe after the oil shocks has been rather slow in readjusting appropriately.

The growing power of the state over the last century has increased the need for transparency in the formulation and implementation of industrial policy, for it has raised the incentives for firms to lobby for state support rather than to engage in productive activities. Thus special interests, rather than the general interest, may become drivers of industrial policy. There is evidence that product market regulation and administrative burdens on business in the large continental EU economies are retarding productivity growth, instead of promoting consumer interest. The general interest is likely to be better served by industrial policies of openness, creating an environment that encourages competition, and thereby enhances industrial productivity growth.

The most prosaic lesson of this survey is that the definition of industrial policy continues to create challenges for history. It is entirely possible that the principal objective of much industrial policy – i.e., to raise industrial productivity – might be better achieved indirectly. Human capital or active labour market policies, directed to training and labour force participation, could perhaps deliver what is required, rather than industrial policy instruments (unless human capital policies are defined to fall within the ambit of industrial policy). Yet, a study of industrial policy must almost inevitably ignore such factors in order to keep the size of the project manageable.

References

Ades, A. and Di Tella, R. (1997). "National champions and corruption: some unpleasant interventionist arithmetic". *Economic Journal,* (107), pp. 1023-1042.

Barry, F. (2004). "Export platform FDI: The Irish experience". *EIB Papers,* (9:2), pp. 8-37.

Batson, H.E. (1933). *The price policies of German public utility undertakings*, Oxford University Press, London, UK.

Blanchard, O. (2004). "The economic future of Europe". *Journal of Economic Perspectives,* (18:4), pp. 3-26.

Bloom, N., Griffith, R., and Van Reenen, J. (2002). "Do R&D tax credits work? Evidence from an international panel of countries 1979-1997". *Journal of Public Economics,* (85:1), pp.1-31.

Broadberry, S. (1997). *The productivity race: British manufacturing in international perspective, 1850-1990,* Cambridge University Press, Cambridge, UK.

Chadwick, E. (1859). "Results of different principles of legislation and administration in Europe: Of competition for the field as compared with competition within the field, of service". *Journal of the Royal Statistical Society,* (22), pp. 381-420.

Chang, H.-J. (1994). *The political economy of industrial policy*, St Martins Press, New York, USA.

Conti, M. (2005). "Ownership relative efficiency in the water industry: a survey of the international empirical evidence". *Economia Internazionale/International Economics*, (58:3), pp.273-306.

Denton, G., Forsyth, M., and Maclennan, M. (1968). *Economic planning and policies in Britain, France and Germany,* Allen and Unwin, London, UK.

Dinopoulos, E. and Kreinen, M. (1988). "The effects of the US-Japan auto VER on European prices and US welfare". *Review of Economics and Statistics,* (70:3), pp.484-491.

Ergas, H. (1992). "A future for mission-oriented industrial policies? A critical review of developments in Europe". (OECD unpublished).

European Commission of the European Communities (1985*). Completing the Internal Market: White Paper from the Commission to the European Council,* Office for Official Publications of the European Communities, Luxembourg.

European Commission (1988). "The economics of 1992". *European Economy,* (35).

European Commission (2002). "Industrial policy in an enlarged Europe". COM(2002) 714 final paper.

European Commission (2004). "Fostering structural change: an industrial policy for an enlarged Europe". COM(2004) 274 final paper.

Ford, R. and Suyker, W. (1990). "Industrial subsidies in OECD economies". *OECD Economic Studies,* (15), pp. 37-80.

Foreman-Peck, J. (1995). "A model of later nineteenth century European development". *Revista de Historia Economica,* (13:3), pp. 441-471.

Foreman-Peck, J. and Federico, G. (1999). *European industrial policy: The twentieth century experience,* Oxford University Press, Oxford, UK.

Foreman-Peck, J. and Hammond, C.J. (1997). "Variable costs and the visible hand: the re-regulation of electricity supply 1932-37". *Economica,* (64), pp.15-30.

Giersch, H., Paque, K-H., and Schmieding, H. (1992). *The fading miracle: Four decades of market economy in Germany.* Cambridge University Press, Cambridge, UK.

Goolsbee, A. (1998). "Does government R&D policy mainly benefit scientists and engineers?". *American Economic Review*, (88:2), pp. 298-302.

Griffith, R., Redding, S., and Van Reenen, J. (2001). "Measuring the cost-effectiveness of an R&D tax credit for the UK". *Fiscal Studies*, (22:3), pp. 375-99.

Hernandez de Cos, P., Argimon, I., and Gonzalez-Paramo, J.M. (2004). "Public ownership and business performance in the Spanish manufacturing sector, 1983-1996". *Public Finance Review*, (32:2), pp.148-82.

Hjalmarsson, L. (1991). "The Scandinavian model of industrial policy", in Blomström, M. and Meller, P. (eds.), *Diverging paths: Comparing a century of Scandinavian and Latin American economic development*. Inter-American Development Bank, Washington DC, USA.

Hoover, K.D. and Perez, S.J. (2004). "Truth and robustness in cross-country growth regressions". *Oxford Bulletin of Economics and Statistics*, (66: 5), pp. 305-349.

Krugman, P. (1991). *Geography and Trade,* MIT Press, Cambridge, USA.

Li, W. and Xu, C.L. (2004). "The impact of privatization and competition in the telecommunications sector around the world". *Journal of Law and Economics*, (47: 2), pp. 395-430.

Lynde, C. and Richmond, J. (1993). "Public capital and long-run costs in UK manufacturing". *Economic Journal,* (103: 419), pp. 880-893.

Maddison, A. (2001). *The world economy: A millenial perspective,* OECD, Paris, France.

Milward, A. (1992). *The European rescue of the nation state,* Routledge, London, UK.

Neven, D.J. and Seabright, P. (1995). "European industrial policy: the Airbus case". *Economic Policy*, (Oct.), pp. 313-44.

Neven, D. (1994). "The political economy of state aids in the European community: Some econometric evidence". CEPR Discussion Paper, No. 945.

Nicoletti, G. and Scarpetta, S. (2005). "Regulation and economic performance: product market reforms and productivity in the OECD". OECD Economics Department Working Paper No.460.

O'Rourke, K.H. (2000). "Tariffs and growth in the late 19th century". *Economic Journal,* (110), pp. 456-483.

OECD (1986*). Industrial policies, developments and outlook in OECD countries: Annual Review*, OECD, Paris, France.

OECD (1992). *Structural change and economic performance; a seven country decomposition study.* OECD, Paris, France.

Pack, H. and Saggi, K. (2006). "The case for industrial policy: a critical survey". World Bank Research Working Paper No. 3839.

Parker, D. and Martin, S. (1995). "The impact of UK privatisation on labour and total factor productivity". *Scottish Journal of Political Economy,* (42:2), pp. 201-220.

Pelksman, J. (2006). "European industrial policy" in Bianchi, P. and Labory, S. (eds.) *International handbook of industrial policy,* Edward Elgar, Cheltenham, UK.

Saul, S.B. (1978). "The nature and diffusion of technology", in Youngson, A.J. (ed.), *Economic Development in the Long Run.* Allen & Unwin, London, UK.

Schiff, E. (1971). *Industrialisation without national patents*, Princeton University Press, New Jersey, USA.

Spierenberg, D. and Poidevin, R. (1994*). The history of the high authority of the European Coal and Steel Community,* Weidenfeld and Nicolson, London, UK.

Thomas, L.G. III (1994). "Implicit industrial policy: the triumph of Britain and the failure of France in global pharmaceuticals". *Industrial and Corporate Change,* (3:2), pp. 451-490.

Tsoukalis, L. (1997). *New European economy revisted,* Oxford University Press, Oxford, UK.

U.N. Economic Commission for Europe (1953). *Economic survey of Europe since the war,* UN Department of Economic Affairs, Geneva, Switzerland.

Vickers, J. and Wright, V. (1988). *The politics of privatisation in Western Europe,* Cass, London, UK.

Wren, C. (2005). "Regional grants: Are they worth it?". *Fiscal Studies*, (26:2), pp. 245-275.

ABSTRACT

This paper observes that de-industrialisation has been mostly relative in Europe, with industrial value added and employment shrinking in relative terms, but industrial value added growing in absolute terms – at least until recently. *Qualitatively, this relative de-industrialisation has been the result of a number of supply-side factors, including improving labour productivity; changing comparative advantage of countries; and trade liberalisation. Demand-side factors have played a role, too, as rising income levels and population ageing in developed countries have led to changing consumption patterns. Quantitatively, factors internal to advanced economies, such as productivity growth and changing consumption patterns, explain 70 percent of the downtrend in European industrial employment. External trade, including with low-wage economies, is less important, although its role has shown some signs of strengthening in the past decade. All in all, the causes of de-industrialisation do not reflect market failures, and the process should not be resisted. However, it may have transitory economic and social pain as a consequence, which may well warrant public intervention.*

Olivier Debande (debandeo@eib.org) is Senior Economist in the Projects Directorate of the European Investment Bank. He would like to thank, without implicating, Constantin Christofidis, Eric Perée, Armin Riess, and Timo Välilä for their helpful comments and suggestions on preliminary versions of this text. This contribution has also benefited from comments of participants at the 2006 EIB Conference on Economics & Finance. The opinions expressed in this paper are solely those of the author and do not necessarily reflect the views of the European Investment Bank.

De-industrialisation

1. Introduction

Olivier Debande

The transition towards a service-dominated economic structure in high-income countries has, by implication, involved a retreat of their industrial sectors. Industrial employment and output have been losing ground, as service sectors have become increasingly dominant in employing workforce and driving national income growth. The transition from an industrial to a service-dominated economy has been very gradual, stretching over decades in countries of the European Union, Japan, the United States , and elsewhere.

At the same time, especially labour-intensive manufacturing production has increasingly been moved away from high-income countries to middle- and low-income countries. This relocation of industrial production has accelerated in the last decade or two, alongside greater liberalisation of trade and capital flows, as well as rapid growth and development in emerging market economies.

These two developments have been associated with the concept of 'de-industrialisation' in high-income countries, often taken loosely to imply a wholesale demise of industry. The roots of de-industrialisation may vary from country to country, with the 'pull' from services more important in some countries and the 'push' by more profitable production in low-income countries more important in others. Nevertheless, the end result in either case is the retreat of the industrial sector.

The aim of this paper is to document the character and extent of de-industrialisation in the EU, Japan, and the United States, to examine the driving forces behind it, and to discuss possible future developments and the scope for policy intervention. Section 2 details the characteristics of the de-industrialisation process in Europe, Japan, and the United States. Section 3 identifies the factors driving de-industrialisation and examines their relative importance. To give the analysis a forward looking spin, Section 4 discusses the comparative advantage of European industry and expected changes therein. Section 5 concludes and draws policy lessons.

2. Characteristics of de-industrialisation

It is customary to distinguish between two different types of de-industrialisation: relative and absolute. Relative de-industrialisation refers to the reallocation of productive resources among economic sectors, with the share of industry in economic activity declining relative to other sectors, notably services. Absolute de-industrialisation, in turn, refers to industrial decline in absolute terms, characterised by a downtrend in real industrial activity over time.

Output and employment are the most common indicators of industrial activity used to assess de-industrialisation. Thus, relative de-industrialisation would be characterised by a declining share of industrial output, or value added, in total value added and a declining share of industrial employment in total employment. Absolute de-industrialisation would mean that industrial output and employment trend down in absolute terms. Note that relative de-industrialisation can well be associated with an absolute increase in industrial output and employment; it is just that their growth rates are lower than the growth rates of output and employment in other sectors, which lowers the share of industry in the economy.

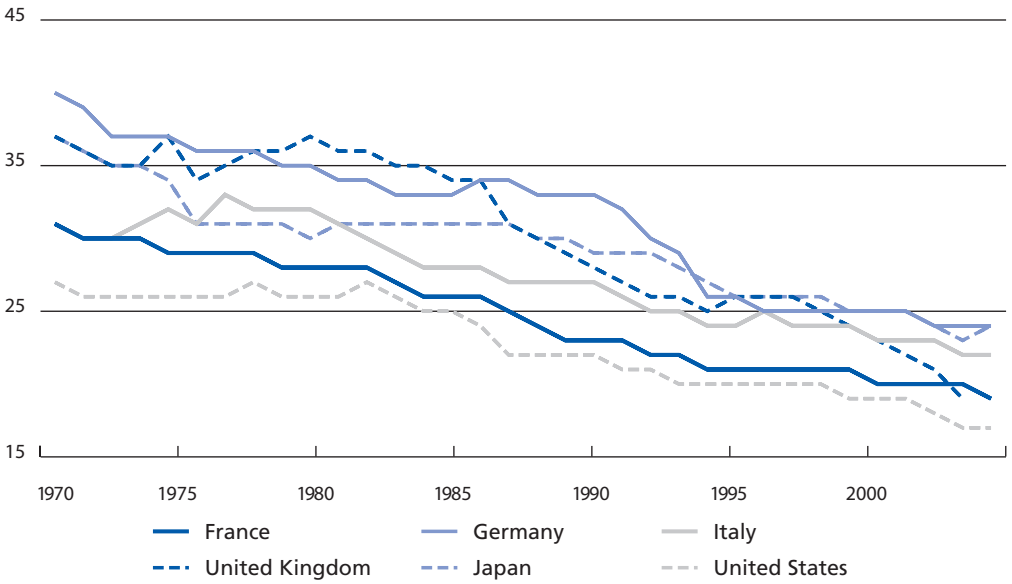
Against this background, the aim of this section is to examine whether the de-industrialisation process in Europe has been relative or absolute in character in the past three to four decades and whether the European experience is similar to or different from that in Japan and the United States.

So let us start by considering the evolution of industrial output and employment in relative terms. As shown in Figure 1, industrial value added as a share of total value added has declined from

The share of industry in total value added has declined by almost half in Europe since the early 1970s.

30-40 percent in the early 1970s to 20-25 percent now in European countries and in Japan. The share of industrial value added in the United States was at this level already in the 1970s, and it has declined further since then, to below 20 percent now.

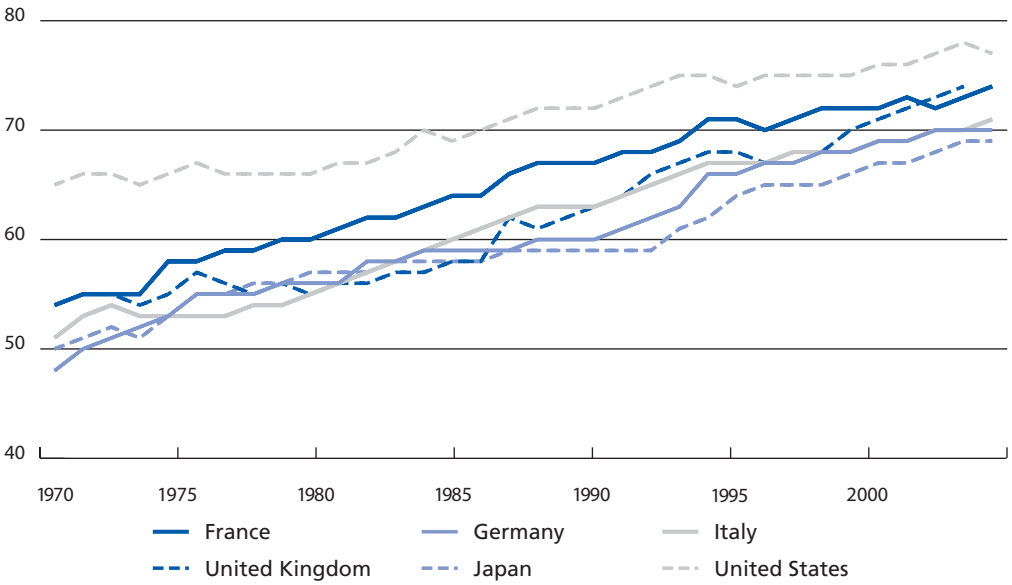
Figure 1. Industrial value added relative to total value added (%), 1970-2003



Source: OECD STAN database.

At the same time, as shown in Figure 2, the share of services in Europe and Japan has increased from 50-55 percent of total value added to around 70 percent now, thus occupying the ground lost by industry. Again, the United Sates is somewhat different, with services at 65 percent of total value added already three decades ago, reaching more than 75 percent now.

Figure 2. Value added in services relative to total value added (%), 1970-2003

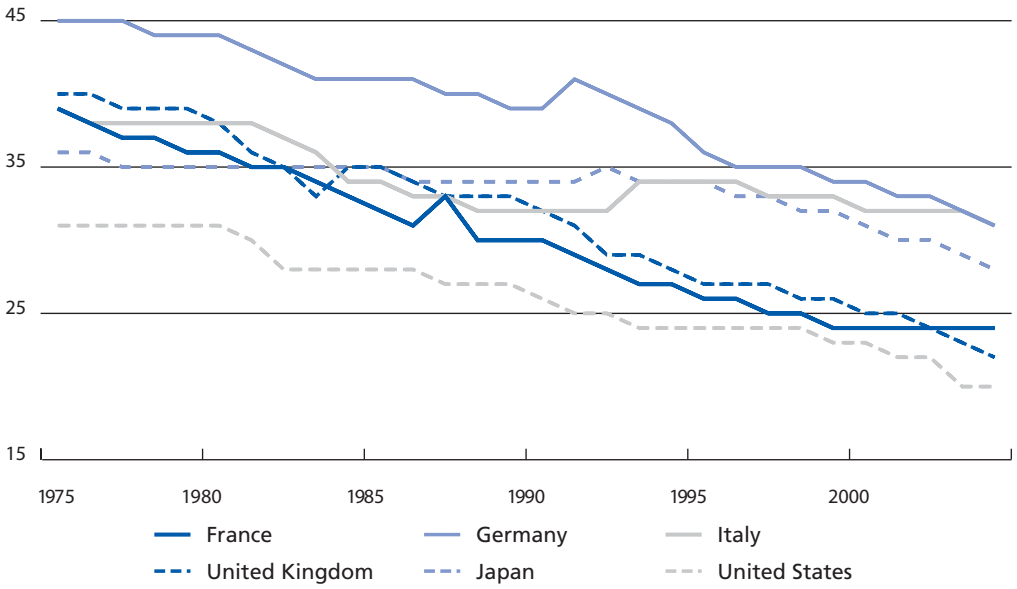


Source: OECD STAN database.

Turning then to the relative employment shares, Figures 3 and 4 demonstrate that the share of industrial employment in total employment in Europe and Japan has declined from around 40 percent in 1975 to just over 25 percent. In the United States, the decline has been from 30 to 20 percent. Meanwhile, the employment share of services has increased in Europe and Japan from 40-60 percent three decades ago to around 70 percent now, and in the United States it has grown from 65 to almost 80 percent.

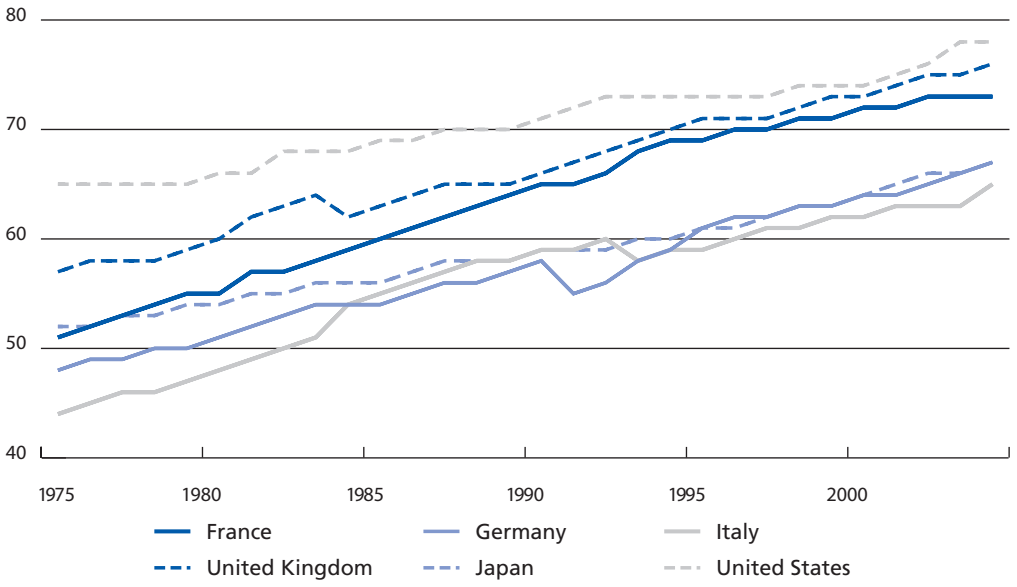
Industry employs 25 percent of workforce, in contrast to 40 percent three decades ago.

Figure 3. Manufacturing relative to total employment (%), 1975-2004



Source: Labour force statistics OECD.

Figure 4. Employment in services relative to total employment (%), 1975-2004



Source: Labour force statistics OECD.

All in all, it is clear that Europe, Japan and the United States have all experienced relative de-industrialisation in terms of both output and employment. In all cases, industrial output and employment have lost between one-third and one-half of their share in total output and employment. This loss has been accompanied by an equivalent increase in the relative share of services.

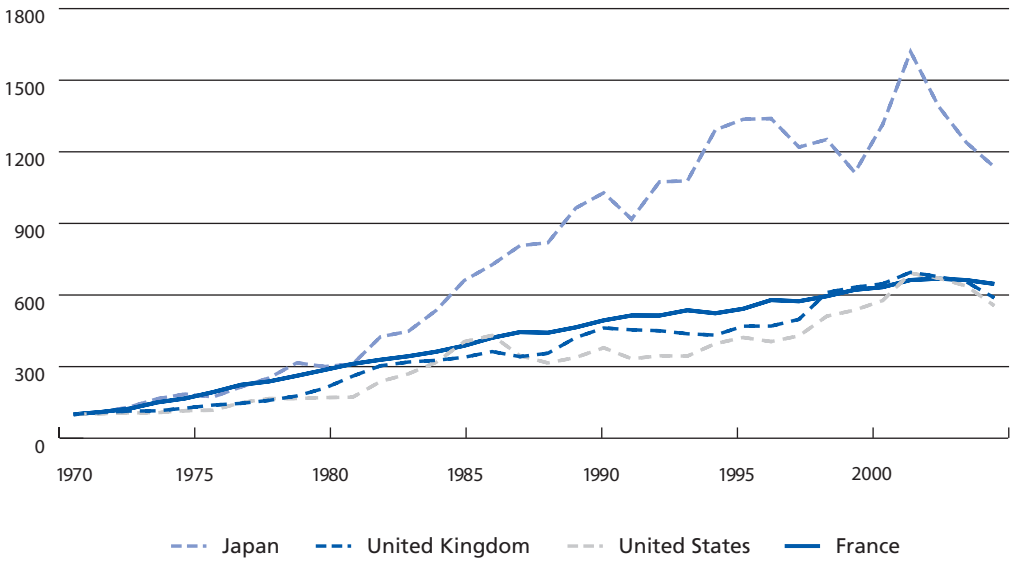
As a brief detour, let us put this relative de-industrialisation in a broader context and take a glimpse of even longer-term changes in the relative shares of agriculture, industry, and services. Historical data by Maddison (1991 and 2005) and the OECD (2003) covering the period from 1870 through 1999 show that the employment share of agriculture in the United States dropped from a half to just a few percent during that period, while the share of industry started off at around one-quarter, peaked at one-third in the early 1950s, only to decline to about 20 percent at the turn of the millennium. Consequently, the employment share of services rose from one-quarter in 1870 to three-quarters in 1998.

The evolution of employment shares was broadly similar in Europe, except in the United Kingdom, where industrialisation had started earlier and where the employment share of industry had reached 40 percent by 1870. In contrast, industrialisation started later in Japan, where agriculture employed as much as 70 percent of the workforce in 1870. Despite these differences, the employment shares of agriculture, industry, and services had converged to similar levels in Europe and Japan by 1999.

In absolute terms, industrial output has been growing rapidly.

Turning then back to developments in the past three to four decades, it remains to examine whether the relative de-industrialisation discovered earlier has been due to an absolute decline in industrial output and employment or just their slower growth relative to the rest of the economy. Figure 5 demonstrates that industrial value added has grown in absolute terms by as much as 5-6 percent per year on average since 1970 in Europe, Japan, and the United States.

Figure 5. Volume of industrial value added (1970=100), 1970-2003



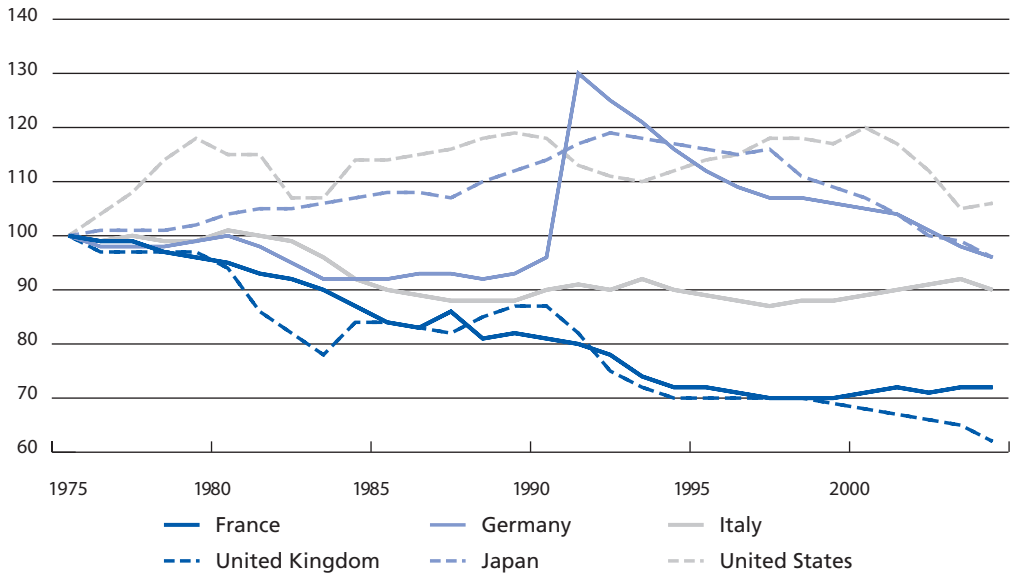
Source: AMECO.

However, it appears that the uptrend in industrial value added was broken simultaneously in Europe, Japan, and the United States around the year 2000.[1] While this downturn in industrial output coincided with a global cyclical downturn at that time, it appears unusually steep and persistent in many countries. It is obviously too early to judge whether the downturn is primarily cyclical or structural, but there is some evidence, to be reviewed in next section, to suggest that there is a structural element to it.

There has been an absolute decline in industrial employment.

Industrial employment has been declining even in absolute terms in Europe, as shown in Figure 6. Over the past quarter-century, the number of industrial employees has declined by roughly one-third in the United Kingdom and France. In contrast, the number of industrial employees now is approximately the same as in the mid-1970s in Japan and the United States, although it has been declining for the past five to ten years in both countries, having peaked in the mid- to late 1990s.

Figure 6. Volume of industrial employment (1975=100), 1975-2004



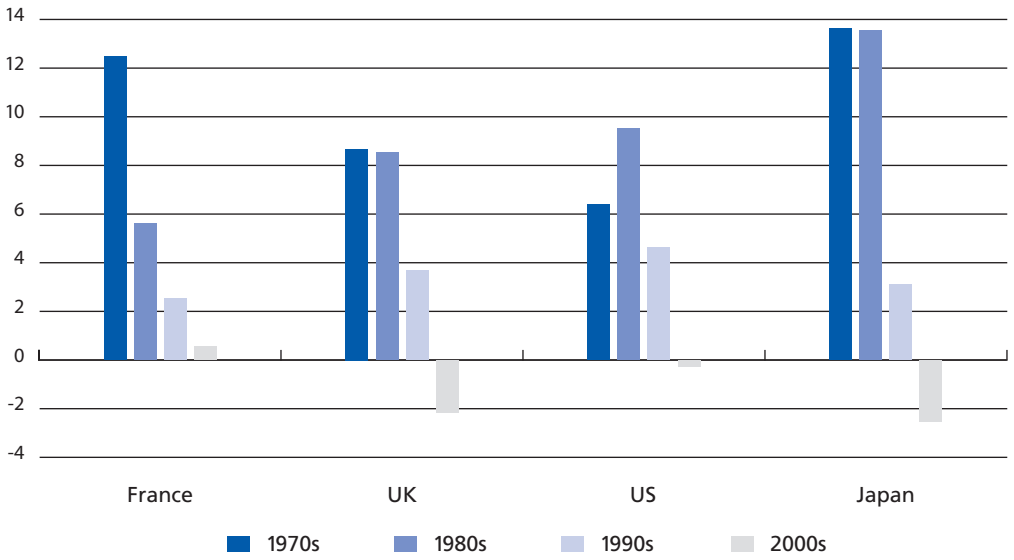
Source: AMECO.
Note: The jump in the line for Germany is due to re-unification in 1990.

To sum up, the evidence concerning absolute de-industrialisation is mixed. While industrial employment has been on a downtrend in Europe and started declining more recently also in Japan and the United States, industrial value added has been rising – except in the last few years.

Having described the broad trends in industrial employment and value added, let us now consider how stable the process of de-industrialisation has been over the past decades. To this end, Figures 7 and 8 depict the average annual percentage changes in industrial value added and employment over the past few decades. They suggest that while there is a downtrend in the growth rate of value added, with the exception of the United States, there is no unambiguous trend across countries as regards the rate of decline in industrial employment. In other words, growth in industrial production has been steadily decelerating, but this has not translated into a parallel accelerating decline in industrial employment since the early 1980s in all countries. However, with the notable exception of France, the decline in industrial employment seems to be accelerating.

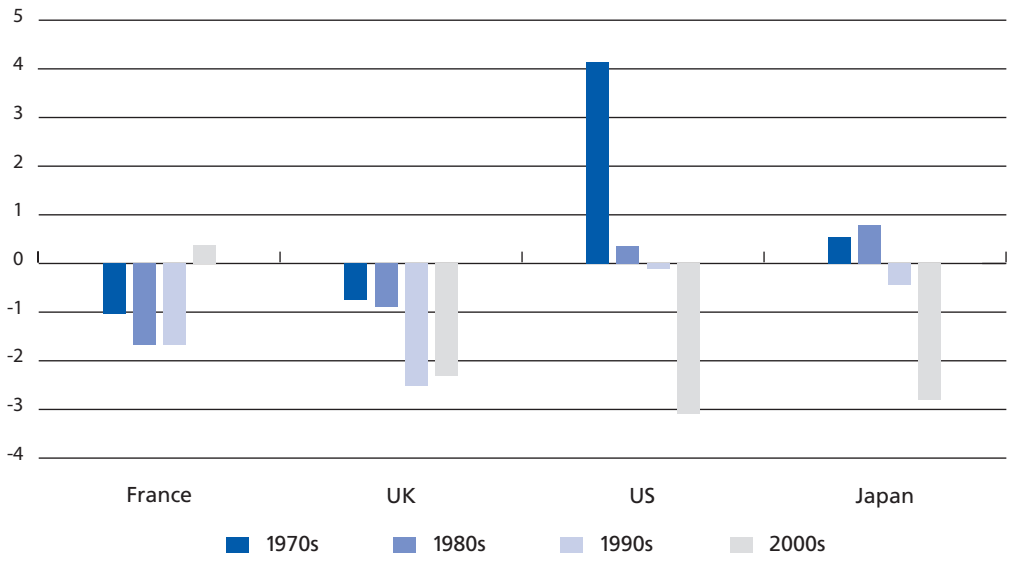
1 At the level of individual sectors in Europe, output has been on a longer-term downtrend in textiles, clothing, leather and shoes, shipbuilding and repair, oil refining, coal and nuclear fuel.

Figure 7. Average annual rates of change in industrial value added (%)



Source: AMECO.

Figure 8. Average annual rates of change in industrial employment (%)



Source: OECD labour force statistics.

Long-term de-industrialisation in Europe, Japan, and the United States has been relative, but it may have turned into absolute in recent years.

Putting then all the pieces from this section together, we can conclude that Europe, Japan, and the United States have all experienced relative de-industrialisation, which may have turned into absolute de-industrialisation in recent years. Industry has been losing its share of total economic activity to services for many decades already. While industrial value added grew steadily and rapidly during all these decades, suggesting that the relative de-industrialisation did not translate into a fullblown absolute de-industrialisation, both industrial value added and

employment have been on a simultaneous downtrend since the late 1990s in Europe, Japan, and the United States.

The information presented above is clearly insufficient to pass judgement about the permanence of the recent episode of absolute de-industrialisation. What is more, it is insufficient to judge whether de-industrialisation is 'good' or 'bad', that is, whether or not it warrants public intervention by means of economic policy measures. To better understand the nature and recent changes in the de-industrialisation process, let us now turn to examining its root causes.

3. Factors explaining de-industrialisation

This section reviews empirical studies that try to disentangle the factors driving the de-industrialisation process. After an overview of the various factors and their relative importance in explaining de-industrialisation, special attention is paid to the impact of outsourcing, which is frequently associated with de-industrialisation.

3.1 Overview of empirical studies

De-industrialisation has been driven by both supply-side and demand-side factors.

A small number of studies, to be reviewed below, have sought to determine the driving factors behind de-industrialisation. They have, in general, focussed on the decline in the share of industrial employment in total employment as the measure of de-industrialisation to be explained. As explanatory variables the studies have used a number of supply-side and demand-side factors. Let us first just list them, before considering their relative importance.

On the supply-side, productivity gains achieved in the manufacturing sector have reduced the demand for labour. The productivity gains are obvious from Figures 5 and 6 above: industrial output has grown steadily, although industrial employment has trended down. Indeed, the growth of labour productivity in industry has been much faster than in services.

Increased exposure to international trade as a result on trade liberalisation has contributed to the increase in productivity by stimulating competition and productive efficiency. In addition, trade with low-wage economies has induced relocation of industrial activities so as to better reflect comparative advantages.

The fragmentation and segmentation of the production process have also had an impact on industrial employment. Outsourced activities previously performed in-house by manufacturing industries (transport, logistics, information technology) are increasingly provided by specialised service firms, as discussed in detail below. The resulting de-industrialisation is a mere statistical artefact to the extent that it only involves a re-classification of industrial employment as service sector employment. However, to the extent that outsourcing is done outside the home country's borders, it has a visible impact on employment.

Turning to the demand-side factors responsible for de-industrialisation, changes in consumer demand are related to population ageing and a shift of demand towards services. The falling share of income devoted to the purchase of manufactured goods is not related to any 'saturation effect', but to a rapid fall in the relative prices of these goods. With higher income the demand for service products is increasing, for instance through higher spending on tourism and health care.

Some studies have attempted to rank the relative importance of the factors discussed above for de-industrialisation. Using a different taxonomy, Rowthorn and Ramaswamy (1998) as well as Rowthorn and Coutts (2004) conclude that supply- and demand-side factors internal to advanced economies, such as productivity gains and changing consumption patterns, have been more important in explaining de-industrialisation than external factors, notably trade. Their results are summarised in Table 1 below.

Table 1. Importance of internal and external factors in explaining falling industrial employment

	1970-1994		1992-2002	
	Internal factors	External factors	Internal factors	External factors
EU	84%	15%	72%	25%
US	81%	12%	90%	10%
Japan	90%	-20%	60%	30%

Source: Rowthorn and Ramaswamy (1998), Rowthorn and Coutts (2004).

In the EU, internal factors, such as productivity gains and changing consumption patterns, explain 70 percent of the decline in the share of industrial employment.

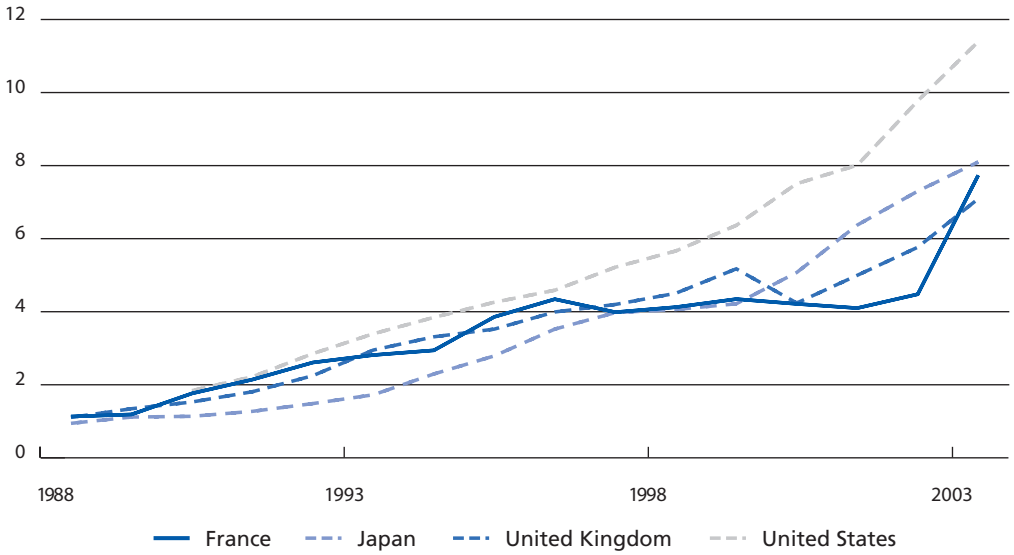
In the EU, internal factors explain over 70 percent of the decline in the share of industry in total employment during 1992-2002, down from over 80 percent during 1970-94. External trade explains a quarter of the decline in industrial employment during 1992-2002, up from 15 percent over the period 1970-94. This increase in the importance of trade in explaining de-industrialisation is associated with trade with low-wage economies. Nevertheless, its impact on industrial employment in the EU (EU-15) remains rather small, especially considering that the estimated impact of external trade includes not only the direct employment impact of competition, but also its indirect impact due to increased productivity.

Internal factors explain the bulk of the decline in industrial employment also in the United States and in Japan. During the 1990s, internal factors accounted for 90 percent of industrial job losses in the United States and 60 percent in Japan. In the United States, trade with low-wage economies has grown in importance, while in Japan the opposite is true.

Applying the same methodology to a sample of OECD countries between 1970 and 2002, Boulhol (2004) estimated that the competitive pressure from emerging countries accounts for 15 percent of the de-industrialisation process – defined again as the reduction of relative manufacturing employment – between 1970 and 2002, with an acceleration of this process between 1987 and 2002 affecting especially countries like Belgium, Finland, Spain and the Netherlands within the EU. Hence, structural changes observed in the manufacturing sector mainly result from the internal restructuring process, although the impact of the competitive pressure from emerging countries is increasing.

To better gauge the impact of import competition, consider manufacturing imports from China and India since the late 1980s, shown in Figure 9 below in relation to industrial value added. While manufacturing imports from these two countries only amounted to some 2 percent of manufacturing value added two decades ago, they now amount to 11 percent in the United States and 8 percent in France, Japan, and the United Kingdom. Manufacturing imports from China and India alone have thus grown 4-6 times faster than manufacturing value added. As concluded earlier, this increasing competition has reduced industrial employment in developed countries both directly and indirectly through higher productivity.

Figure 9. Manufacturing imports from China and India (% of manufacturing value added), 1988-2003.



Source: OECD.

All in all, it is obvious that import competition from low-wage countries such as China and India is an increasingly important factor in de-industrialisation.[2] To what extent import competition is responsible for the steep and persistent decline in industrial output and employment in the past few years is, however, too early to judge – especially as the simultaneous cyclical downturn in developed economies has taken its toll, too. But one should not dismiss the possibility that import competition may be accelerating the pace of de-industrialisation.

Import competition from low-wage countries is increasingly important in explaining de-industrialisation.

3.2 Focus on outsourcing

The empirical results presented above suggest that factors internal to advanced economies remain more important than external ones, such as import competition from low-income countries, in explaining de-industrialisation. One internal factor often mentioned in this context is outsourcing.[3] It was alluded to earlier that outsourcing is related to the fragmentation and segmentation of production processes and, moreover, that the resulting de-industrialisation is a mere statistical artefact to the extent that it only involves a re-classification of industrial employment as service sector employment.

However, if activities previously performed in-house by industrial firms are outsourced to specialised service firms located in other countries, the loss of industrial employment, all other things equal, translates into a loss of total employment in the home country. Such international outsourcing is also referred to as offshoring.

Note that offshoring of service activities supporting industrial production is distinctly different from the relocation of production. Offshoring is a means to rationalise production that remains in the home country. Relocation involves the move of entire production processes and facilities from home to other countries and can give rise to direct import competition, as reviewed earlier.

2 For further, details, see for instance Amiti and Wei (2004) and Bhagwati *et al.* (2004). Specifically for the United Kingdom, see Abramowsky *et al.* (2004).

3 For a general discussion about the link between manufacturing and service industries, see Kalmbach *et al.* (2003), Pilat and Wölfl (2005), and Wölfl (2003, 2005).

Data on individual cases of firm restructuring compiled by the European Monitoring Centre on Change (EMCC)[4], give an indication of the employment impact of outsourcing, offshoring, and relocation in the EU. Since the beginning of 2002, out of the total number of planned job reductions, only about 1½ percent were attributed to outsourcing, while some 6½ percent were due to offshoring or relocation of production.

Marin (2004) examines the impact of offshoring and relocation within the enlarged EU by assessing the impact of outward investment to Eastern Europe by German and Austrian firms. Based on a large sample of direct investment projects undertaken by 2,200 German and Austrian firms during the period 1990-2001, relocation of production led to a direct loss of around 91,000 jobs in Germany and 24,000 jobs in Austria. However, the opening of subsidiaries in Eastern Europe had also an indirect employment impact through intra-firm exports from the parent to the subsidiaries and imports the other way around. All in all, the net destruction of jobs in Germany and Austria is estimated at 90,000 jobs and 22,000 jobs, respectively, representing 0.3 percent and 0.7 percent of total employment.

Trade with low-income countries, offshoring, and relocation remain much less important than internal factors in explaining de-industrialisation.

Falk and Wolfmayer (2005) suggest that 'international outsourcing' (offshoring) has had some negative impact on manufacturing employment in Europe. Based on data on intra-industry imports of intermediate goods from low-wage countries, they estimate that outsourcing of business services reduced manufacturing employment by 0.3 percent per year in the seven EU countries in their sample during 1995-2000. There is, however, significant variation across industries, with more rapidly growing industries experiencing no employment reduction due to international outsourcing.

To sum up, while the importance of external factors, notably trade with low-income countries such as China and India is gaining in importance as a determinant of de-industrialisation in advanced economies, internal factors – such as productivity gains and changing demand patterns – remain much more important. Offshoring and relocation of production to other countries has only had a negligible impact on industrial employment in Europe.

4. European industrial structure and specialisation

We have so far considered the character and determinants of de-industrialisation at the aggregate level, without paying any attention to the sectoral composition of industry. Let us now turn to a more detailed examination of European industry, with a view to assessing what kind of production constitutes European comparative advantage in the international division of labour and how de-industrialisation may be changing Europe's comparative advantage.[5]

As a first step to that end, let us consider the characteristics of European manufacturing exports in terms of their labour and technology input. A useful indicator for characterising the export intensity of different types of goods is the Revealed Comparative Advantage (RCA) index. It measures the share of a good in, say, total European exports in relation to the share of that good in exports worldwide. Thus, if a good's share in European exports is 40 percent and in worldwide exports 30 percent, the index assumes the value 1.33 (=0.4/0.3). Values above 1 indicate that Europe exports that good relatively more intensively than the world on average, thus suggesting that Europe has a 'revealed' comparative advantage in producing and exporting the good.

4 The EMCC compiles the European Restructuring Monitor, for which the data are collected from leading European daily newspapers and business press and present planned job reductions by economic sector, country and the type of firm restructuring. For details, see www.emcc.eurofound.eu.int/erm/index.php?template=help3.

5 For an extensive discussion on EU productivity and competitiveness, see European Commission (2003), O'Mahony and van Ark (2003) or Gordon (2004).

Using the RCA index to characterise European manufacturing exports, Table 2 shows that Europe's revealed comparative advantage lies in exports with intermediate labour skill content. In contrast, Europe's revealed comparative advantage is less prominent in products with either high or low labour skills. This is in contrast to high-income countries outside the EU (including Japan and the United States), whose comparative advantage is in goods with high or high-intermediate labour skill content.

Table 2. Revealed Comparative Advantage (RCA) index by labour skills categories (2002)

	Products by labour skills categories			
Regions by income level	High	High-intermediate	Low-intermediate	Low
EU-15	0.92	1.14	1.21	0.91
High non EU-15	1.05	1.33	0.98	0.90
Upper-medium	1.11	0.47	0.98	1.05
Low-medium	0.96	0.47	0.79	1.26
Low	0.68	0.25	0.62	1.61

Source: European Commission (2005), Table VI.9.

Using the RCA index to characterise the technology content of EU exports, Table 3 shows that Europe's revealed comparative advantage is in medium-high technology goods. Again, high-income countries outside the EU are more clearly oriented towards high technology goods. Indeed, high-technology industries accounted for only about 20 percent of total EU manufacturing exports in 2003, compared with some 29 percent in the United States and 27 percent in Japan (European Commission 2005).

Table 3. Revealed Comparative Advantage (RCA) index in products by technology categories (2002)

	Products by technology skills categories			
Regions by income level	High	High-intermediate	Low-intermediate	Low
EU-15	0.86	1.17	0.95	0.88
High non EU-15	1.12	1.13	0.93	0.68
Upper-medium	1.12	0.92	1.06	0.97
Low-medium	0.92	0.57	1.21	1.72
Low	0.47	0.36	1.03	2.67

Source: European Commission (2005), Table VI.11.

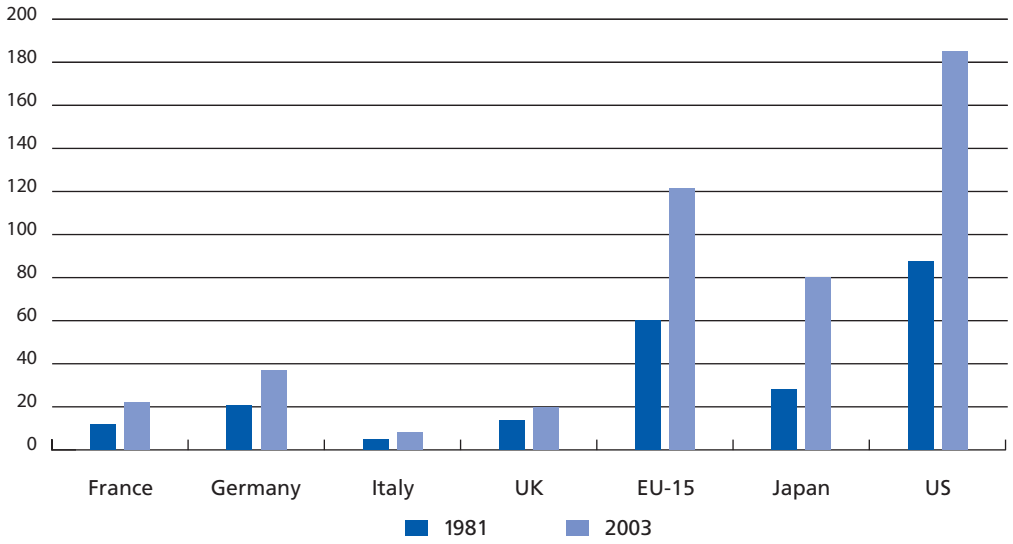
European producers are oriented towards goods with intermediate human capital and technology intensity.

That European producers are more oriented towards goods with intermediate human capital and technology intensity makes them possibly more vulnerable to competition from emerging economies. As discussed in Section 3, manufacturing imports from countries like China and India have exploded during the past decade. It is reasonable to expect emerging economies to move gradually towards producing and exporting goods with ever higher human capital and technology intensity, thus increasing competitive pressure in, first, markets where European producers currently have their comparative advantage and, later on, markets for products based on high-skilled labour and high technology.

It is worth pointing out that the relatively speaking lower human capital and technology content in European exports is not due to inferior innovation and product development effort. To see this, consider the research and development (R&D) effort of European manufacturing firms in international comparison. Figure 10 shows the evolution of business enterprise expenditure on R&D (BERD) between 1981 and 2003, expressed in constant (year 2000) US dollars and corrected for real exchange rate differentials. As is obvious from the figure, the absolute level of BERD in Europe falls between that

in the United States and Japan. However, the average annual growth in BERD during 1981-2003 was only 3.2 percent in Europe, which contrasts with 3.5 percent in the United States and almost 5 percent in Japan.

Figure 10. Business enterprise expenditure on R&D (in billions of year-2000 US dollars at PPP), 1981-2003.

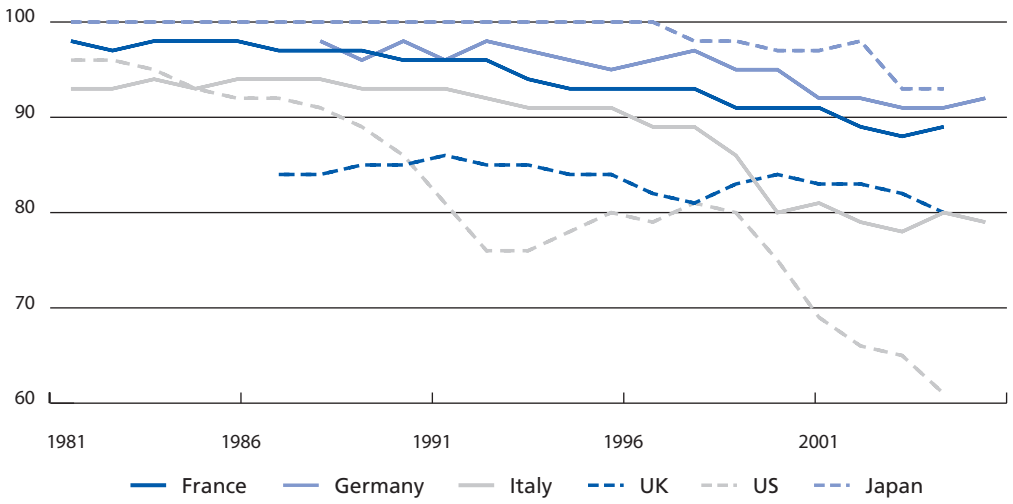


Source: OECD Main Science and Technology Database

The relatively low human capital and technology content of European exports is not due to inferior R&D spending.

Considering the share of the manufacturing sector in total BERD, Figure 11 suggests that the manufacturing sector remains the dominant R&D investor, albeit decreasingly so. In the United States, the share of manufacturing in total BERD has dropped to around 60 percent as a result of a rapidly increasing (and ever better measured) R&D spending in services sectors. In Japan, manufacturing still accounts for over 90 percent of BERD, while European countries lie in the middle of these two extremes.

Figure 11. Share of manufacturing industries in total business enterprise expenditure on R&D (%), 1981-2003.

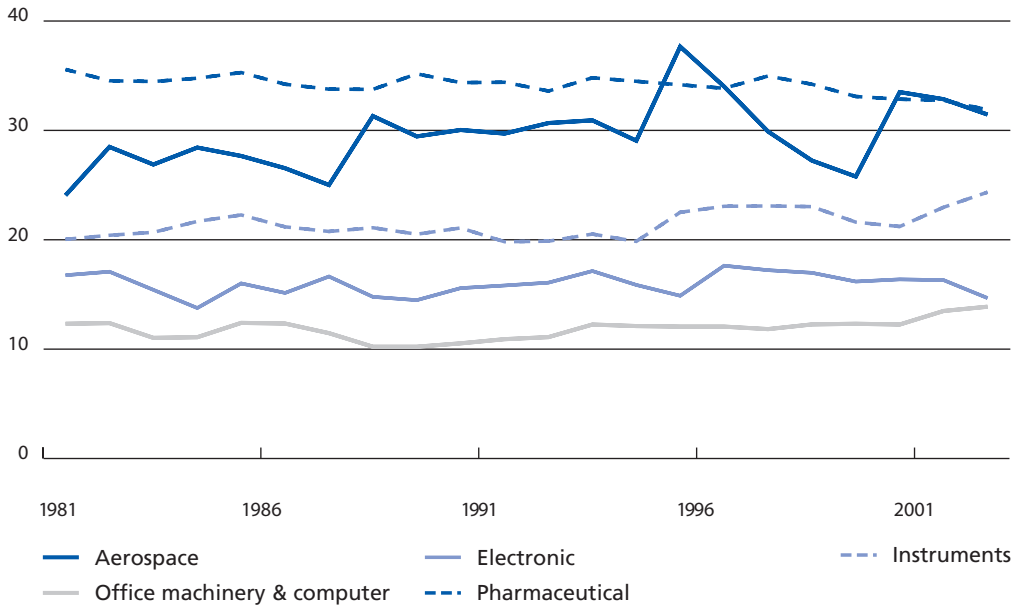


Source: OECD Main Science and Technology Database

Overall, European industry is placed somewhere between its US and Japanese counterparts in terms of R&D spending, so innovation and product development do not seem to explain why Europe's revealed comparative advantage in high-tech, skilled-labour intensive products is not as strong as in other high-income countries. In any case, we will now turn to some evidence suggesting that Europe's competitive position in producing and exporting high-tech, skilled-labour intensive products in selected high-technology industries remains strong.

Based on a classification by the OECD, high-technology industries include aerospace, pharmaceuticals, computers and office machinery, communication equipment and scientific (medical, precision and optical) instruments. Figure 12 shows the global market shares of European producers in these five industries. In all these industries, European producers have maintained relatively stable market shares. Pharmaceuticals and aerospace are clearly ahead of other high-technology sectors in terms of European market dominance, but European competitive advantage is less clear in the high-tech sector related to information and communication technologies.

Figure 12. EU export market share (%) in high-technology industries, 1981-2002.

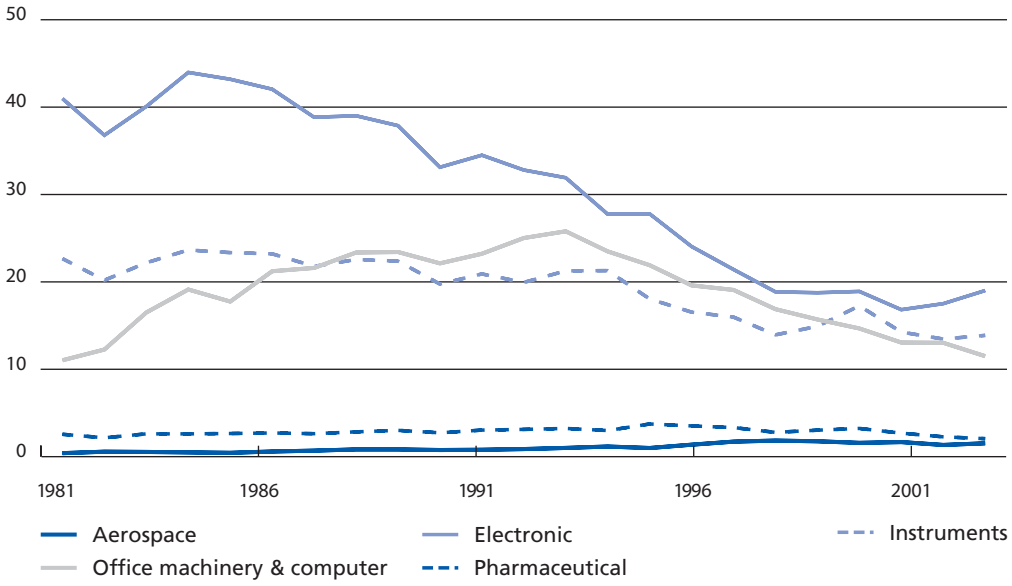


Source: OECD Main Science and Technology Database

The market shares of European high-technology industries have been more stable than those of Japan and the United States.

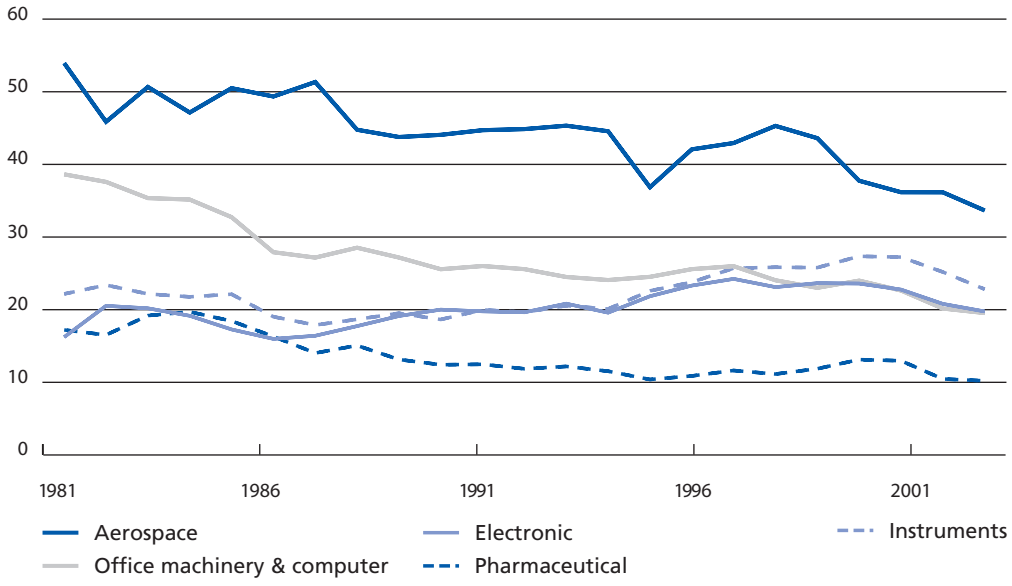
Comparing European performance with that of Japan and the United States, shown in Figures 13 and 14 below, two observations stand out. First, as opposed to Europe, both Japan and the United States have been losing global market shares in at least some high-technology industries. In some cases, such as US aerospace or Japanese electronics, that loss has been quite dramatic. Second, the market shares of European high-technology industries are much closer to one another in the 15-30 percent range, while those in Japan and the United States show greater dispersion. This suggests that the European high-technology industry is more diversified than its Japanese and US counterparts. This higher diversification can be interpreted as a sign of lesser vulnerability to competition from emerging high-technology producers, such as China and India.

Figure 13. Japanese export market shares (%) in high-technology industries, 1981-2002.



Source: OECD Main Science and Technology Database

Figure 14. US export market shares (%) in high-technology industries, 1981-2002.



Source: OECD Main Science and Technology Database

It is reasonable to expect increasing competition from emerging economies in the sectors where Europe has so far had a revealed comparative advantage.

To sum up, the revealed comparative advantage of European industry is in goods with intermediate human capital and technology intensity, where it is reasonable to expect gradually increasing competition from emerging economies. This contrasts with high-income countries outside the EU, including Japan and the United States, whose comparative advantage is more clearly in goods with high human capital and technology content. This difference cannot be traced back to particularly low investment in innovation and product development in Europe, at least in comparison with Japan and the United States. This being said, in high-technology industries, European producers have been able

to maintain relatively stable global market shares across the board, while Japanese and US producers have lost theirs in at least some industries. What is more, Japanese and US high-technology sectors appear less diversified and thus more vulnerable to competition from emerging markets.

The apparently robust position of the European high-technology industry suggests that the inevitable transition away from less human capital and technology intensive production and exports does not need to involve any deep and prolonged economic malaise, provided that European markets and economic institutions are flexible enough to facilitate the transition. That said, the transition will involve major changes in the structure of European economies; in the skills necessary for the labour force; and in the stock of productive capital. Such changes take a long time and can be disruptive, involving transitory economic and social pain.

5. Conclusions and policy implications

We have identified two types of changes in Europe's economic structure related to de-industrialisation. First, as in Japan and the United States, the industrial sector in Europe has been losing ground to services for a while already. This process has long been relative in character, with industrial value added and employment declining relative to the rest of the economy. While industrial employment has been on a downtrend in absolute terms for a while, industrial value added has been growing, and growing rapidly at that. However, industrial value added might also have entered an absolute downtrend in recent years, apparently as a result not only of cyclical but also structural factors, such as import competition from low-income countries.

Another structural change, more prospective than contemporary in character, is related to the composition of the industrial sector. Right now, the revealed comparative advantage of European industry is in goods characterised by intermediate human capital and technology content. This is in contrast to high-income countries outside the EU, including Japan and the United States, whose comparative advantage is more clearly in goods with high human capital and technology content. Given the gradually increasing competition from emerging economies, it is only a question of time before the comparative advantage of European industry will have moved more strongly towards goods with high human capital and technology content.

The fundamental factors underlying de-industrialisation include technological change and education (which boost productivity); higher income levels, population ageing and changing consumer preferences (which change consumption patterns); and changing comparative advantages between countries, coupled with external trade liberalisation (which foster an economically meaningful division of labour between countries). The changing composition of the industrial sector is related to the same factors, with changing comparative advantage and international trade liberalisation playing the pivotal role.

Importantly, all these factors – including trade with low-income countries – are benign in character in that they do not represent market or government failures. This being the case, economic efficiency and thereby the growth potential of the EU economy could not be improved by policy intervention addressing the root causes of de-industrialisation; in fact, public intervention could even hurt long-run growth.

The factors behind de-industrialisation are benign in character, so public intervention should not seek to reverse the process.

The speed and easiness of these structural adjustment processes will depend on the flexibility of domestic factor markets in facilitating factor migration from shrinking to expanding sectors. As a consequence of well-documented rigidities in the European labour markets – and assuming that it

is impossible to remove those rigidities at least in the short term – intervention by the public sector may be warranted to smooth the structural changes and to lessen the associated economic and social costs. The details of such industrial policy intervention is the subject matter of other contributions to this volume of the *EIB Papers*.

References

Abramowsky, L., Griffith, R., and Sako, M. (2004). "Offshoring of business services and its impact on the UK economy". Advanced Institute of Management Research Paper.

Amiti, M. and Wei, S-J. (2004). "Fear of service outsourcing: is it justified?". IMF Working Paper N0.04/186.

Bhagwati, J., Panagarya, A., and Srinivasan, T.N. (2004). "The muddles over outsourcing". *Journal of Economic Perspectives*, (18:4), pp. 93-114.

Boulhol, H. (2004). "Quel impact du commerce international sur la désindustrialisation dans les pays de l'OCDE? ". *Flash CDC-Ixis Capital Markets*, (206).

European Commission (2003). "European Competitiveness Report 2003". Staff Working Document SEC(2003) 1299.

European Commission, DG Enterprise and Industry (2005). *EU sectoral competitiveness indicators*, Office of Official Publications of the European Communities, Luxembourg.

Falk, M. and Wolfmayer, Y. (2005). "The impact of international outsourcing on employment: empirical evidence form EU countries". Austrian Institute of Economic Research Paper, WIFO, March.

Gordon, R.J. (2004). "Why was Europe left at the station when America's productivity locomotive departed". CEPR Discussion Paper No.4416.

Kalmbach P., Franke R., Knottenbauer K., Krämer H., and Schaefer H. (2003). "The significance of competitive manufacturing industries for the development of the service sector – An analysis of the determinants of the expansion of business-related services in modern industrial societies". Universität Bremen, Institut für Konjunktur- und Strukturforschung, final project report 22/02 to Bundersministeirum für Wirtschaft und Arbeit.

Maddison, A. (1991), *Dynamic forces in capitalist development*, Oxford University Press, Oxford, UK.

Maddison, A. (2005), Growth accounts for selected countries (Up-dated statistical data), Unpublished paper.

Marin, D. (2004). "A nation of poets and thinkers – less so with Eastern enlargement? Austria and Germany". CEPR Discussion Paper No. 4358.

O'Mahony, M. and van Ark, B. (2003). *EU productivity and competitiveness: an industry perspective: Can Europe resume the catching-up process?*, European Commission DG Enterprise, Office of Official Publications of the European Communities, Luxembourg.

OECD (2003), *The World Economy: Historical statistics*, OECD, Paris.

Pilat, D. and Wölfl, A. (2005). "Measuring the interaction between manufacturing and services". OECD-STI Working Paper No. 2005/5.

Rowthorn, R. and Ramaswamy, R. (1998). "Growth, trade, and deindustrialization". IMF Working Paper No. 98/60.

Rowthorn, R. and Coutts, K. (2004). "De-industrialization and the balance of payments in advanced economies". UNCTAD Discussion Paper No.170.

Wölfl, A. (2003). "Productivity growth in service industries – an assessment of recent patterns and the role of measurement". OECD-STI Working Paper No. 2003/7.

Wölfl, A. (2005). "The service economy in OECD countries". OECD-STI Working Paper No. 2005/3.

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.*

Elie Cohen (elie.cohen@wanadoo.fr) is Professor of Financial and Industrial Strategy at Sciences Po and Research Director at CNRS (Centre National de la Recherche Scientifique).

This paper is based partly on the report produced by Elie Cohen and Jean Hervé Lorenzi for the *Conseil d'Analyse Economique: Politique industrielle, CAE Report No 26, La Documentation Française.*

Theoretical foundations of industrial policy

1. Introduction

Elie Cohen

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 polices, 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

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 World War II, economic literature has contrasted horizontal against vertical 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

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

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

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

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

Strategic trade policy is also industrial 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?

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

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

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.

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

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

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.

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.

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

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

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.

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

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.

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.

References

Abramovitz, M. (1986). "Catching up, forging ahead, and falling behind". *Journal of Economic History*, (46).

Aghion, P. and Howitt, P. (1992). "A model of growth through creative destruction". *Econometrica*, (60), pp. 321-351.

Aghion, P. and Howitt, P. (1998). *Endogenous growth theory,* MIT Press, Cambridge, UK.

Amable B., Barre, R. and Boyer, R. (1997). *Les systèmes nationaux d'innovation à l'ère de la globalisation*, Economica, Paris, France.

Arrow, K. (1962). "Economic welfare and the allocation of resources for invention", in NBER (ed.), *The rate and direction of inventive activity, economic and social factors*, Princeton University Press, Princeton, USA.

Barnes, T. (1987). "Homo economicus, physical metaphors, and universal models in economic geography". *The Canadian Geographer*, (31).

Belussi, F. (1996). "Local systems, industrial districts, and institutional networks: Towards a new evolutionary paradigm of industrial economics?". *European Planning Studies*, (4).

Brander, J. and Spencer, B. (1986). "Rationals for strategic trade policy and industrial policy" in Krugman (ed.), *Strategic trade policy and the new international economics*, MIT Press, Cambridge, USA.

Camagni, R. (1995). "The concept of innovative milieu and its relevance for public policies in European lagging regions". *Papers in Regional Science*, (74).

Cohen, E. (1992). *Le colbertisme high-tech*, Hachette Collections Pluriel, Paris, France.

Commissariat Général du Plan (1999). *Marché unique, monnaie unique : quel scénario pour une nouvelle géographie économique de l'Europe? Rapport Maurel*, Economica, Paris, France.

Coriat, B. (2000), "Entre politique de la concurrence et politique commerciale, quelle politique industrielle pour l'Union européenne?", Supplement G in La Documentation Française (ed.), *CAE Report No. 26: Politique industrielle*, Paris, France.

Crévoisier, O. (1994). "Dynamique industrielle et dynamique régionale: articulation par les milieux innovateurs". *Revue d'Économie Industrielle*, (70).

David, P. (1975). *Technical choice, innovation and economic growth, essays on American and British experience in the nineteenth century*, Cambridge University Press, Cambridge, UK.

Doeringer, P.B. and Terkla, D.G. (1995). "Business strategies and cross-industry clusters", *Economic Development Quarterly*, (9).

Dosi, G. (1988). "Sources, procedures and microeconomic effects of innovation", *Journal of Economic Literature*, (26:3).

Duby, J-J. (2000). "La politique française d'innovation et la concurrence internationale", Complément B in La Documentation Française (ed.), *CAE Report No. 26: Politique industrielle*, Paris, France.

Florida, R. (1995). "Technological policy for a global economy". *Science and Technology*, (11:3).

Fontagné, L. (2000). "Géographie économique et intégration européenne". Supplement in La Documentation Française (ed.), *CAE Report No. 26: Politique industrielle*, Paris, France.

Foray, D., Rutsaert, P., and Soete, L. (1999) "The coherence of EU trade, competition and industry policies in the high tech sector – The case of the telecommunications services sector. Paper prepared for the International Conference on EC policies on competition, industry and trade: Complementarities and conflicts, Louvain-la-Neuve, 27-28 October, 1994.

Fredrikkson, C.G. and Lindmark, L.G. (1979). "From firms to systems of firms: International study of interregional interdependence in a dynamic society" in Hamilton (ed.), *Spatial analysis, industry and the industrial environment*, John Wiley & Sons, London, UK.

Freeman, C. (1982). *The economics of industrial innovation*, Frances Pinter, London, UK.

Freeman, C. (1988). "Japan, a new national system of innovation" in Dosi, G. *et al* (ed.), *Technical change and economic theory*, Pinter Publisher, London and New York.

Freeman, C. (1995). "The national systems of innovation in historical perspective". *Cambridge Journal of Economics*, (19).

Freeman, C. and Perez, C. (1988). "Structural crisis of adjustment, business cycles and investment behaviour", in Dosi. G. *et al* (eds.), *Technical change and economic theory*, Pinter Publisher, London and New York.

Fujita, M. and Thisse, J.F. (1996). "Economics of agglomeration". *Journal of Japanese and International Economics*, (10).

Geroski, P. (1992). "Quelle politique industrielle pour stimuler l'innovation?". Problèmes Économiques No 2279.

Hayter, R. (1997). *The dynamics of industrial location: The factory, the firm and the production system*, John Wiley & Sons, Chichester, UK.

Head, K. and Mayer, T. (1998). Non-Europe: The magnitude and causes of market fragmentation in the EU. Miméo.

Held, J.R. (1996): "Clusters as an economic development tool: Beyond the pitfalls", *Economic Development Quarterly*, (10:3).

Hummels, D. (1998). A geography of trade cost. Mimeo.

Johnson, B. (1992). "Institutional learning" in Lundvall, B.A. (ed.), *National systems of innovation: Towards innovation and interactive learning*, Pinter Publisher, London, UK.

Katz, M. (1986). "An analysis of cooperative research and development". *Rand Journal of Economics*, (17,4).

Krugman, P. (1987). "Is free trade passé?". *Journal of Economic Perspectives*, (1:2), pp. 131-144

Krugman, P. and Venables, A. (1993). "Integration, specialization, and adjustment". NBER Working Paper No. 4559.

Laussel, D., Montet, C., and Péquin-Feissolle, A. (1988). "Optimal trade policy under oligopoly: A calibrated model of Europe-Japan rivalry in the EEC market", *European Economic Review*, (32:7), pp. 1547-1565.

Lorenz, E.H. (1992). "Trust, community and cooperation: Toward a theory of industrial districts" in Storper, M. and Scott, A.J. (eds.), *Pathways to industrialization and regional development*, Routledge, London, UK.

Lundvall, B.A. (1992). *National systems of innovation, towards a theory of innovation and interactive learning*, Pinter Publisher, London, UK.

Malecki, E.J. (1998). *Technology and economic development: The dynamics of local, regional and national competitiveness*, Addison Wesley Longman, Essex, UK.

McCallum, J. (1995). "National borders matter: Canada-US regional trade patterns". *American Economic Review*, (85:3), pp. 615-623.

McKelvey, M. (1991). "How do national systems of innovation differ?" in Hodgson, G.M. and Screpanti, E. (eds.), *Rethinking economics: markets, technology and economic evolution,* Edward Elgar, Aldershot, UK.

Nelson, R. (1993). *National systems of innovation: A comparative study*, Oxford University Press, Oxford, UK.

Nelson, R. (1995). "Recent evolutionary theorizing about economic change". *Journal of Economic Literature*, (33:1), pp. 48-90.

Nelson, R. (1999). "The sources of industrial leadership". *The Economist*, (147:1).

Nelson, R., Baumol, W., and Wolf, E. (1994). *"Convergence of productivity: Cross-national studies and historical evidence"*. Oxford University Press, Oxford, UK.

Nelson, R. and Phelps, E.S. (1966): "Investment in human, technological, diffusion and economic growth". *American Economic Review,* (56:1/2).

Nester, W. (1997). *American industrial policy: Free or managed markets?*, Macmillan Press Ltd, London, UK.

OECD (1999). "Politiques structurelles, recherche et innovation - La France". Rapport d'information n° 54, Rapport d'évaluation.

Piore, M.J. and Sabel, C.F. (1984). *The second industrial divide: Possibilities for prosperity*, Basic Books, New York, USA.

Ragni, L. (1997): "Systèmes localisés de production: une analyse évolutionniste", *Revue d'économie industrielle*, (81).

Rodrik, D. (2004). "Industrial policy for the twenty-first century". Paper prepared for UNIDO.

Romer, P.M. (1990). "Endogenous technological change". *Journal of Political Economy*, (98:5), pp. 71-102.

Scott, A.J. (1988). *New industrial spaces*, Pion, London, UK.

Seabright, P. (2005). "National and European champions – Burden or blessing". *CESIfo,* (6:2), pp. 52-57.

Siroën J-M. (1994). "La politique commerciale de la Communauté". Cahiers français No. 264.

Spence, M. (1984). "Cost reduction, competition and industry performance", *Econometrica*, (52:1).

Stiglitz, J. (1991). "Social absorption capability and innovation". CEPR Paper No. 292.

Storper, M. (1995). "Regional technology coalitions: An essential dimension of national technology policy". *Research policy,* (24).

Takeuchi, A. (1992). "Activities of small scale industries in Japan, through inter-enterprise cooperation". Report of Research, Nippon Institute of Technology No. 21**.**

Tucker, C. (1998). "The role of government in supporting technological advance". Doctoral thesis, Columbia University.

Tyson, L.A. (1992). *Who's bashing whom? Trade conflict in high-technology industries*, Institute for International Economics, Washington, DC, USA.

Watkins, T. (1991). "A technological communication costs model of R&D consortia as public policy". *Research Policy*, (20).

Wei, S.J. (1996). "Intra-national versus international trade: How stubborn are nations in global integration". NBER Working Paper No. 5939.

Zysman, J., Tyson, L.A. and Dosi, G. (1990): "Technology, trade policy and Schumpeterian efficiencies" in de la Mothe, J.d.L and Ducharme, L.M. (eds.), *Science, technology and free trade,* Columbia University Press, New York, USA.

ABSTRACT

This paper focuses on the systems-of-innovation (SI) approach and its policy implications. *It introduces the topic by briefly reviewing the emergence, development, and diffusion of this approach and, then, spells out the constituents, activities, and boundaries of the SI approach. On this basis, the paper discusses the reasons for public policy intervention in the innovation process and the division of labour between private and public actors in carrying out SI activities. In this context, the paper argues that the notion of optimality is irrelevant in an innovation system context and it discusses the importance of uncertainty for innovation policy and the inevitable selectivity of such policy. A brief survey of the strengths and weaknesses of the SI approach rounds off the paper and points to avenues for future research.*

Charles Edquist is Professor of Innovation Studies and Director of the Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE) at Lund University. **Cristina Chaminade** is Assistant Professor of Innovation Studies at CIRCLE.

Industrial policy from a systems-of-innovation perspective

1. Introduction[1]

Charles Edquist

Cristina Chaminade

The innovation concept used in this paper is wide and includes product and process innovations. Product innovations are new - or better – material goods and new intangible services. Process innovations are new ways of producing goods and services. They may be technological or organisational (Edquist *et al.* 2001).

Firms do not innovate in isolation but in continuous interaction with their environment, including the users but also other actors such as universities, suppliers, or other firms. The main focus of the systems-of-innovation (SI) approach is, therefore, the operation of the system and the complex interactions that take place among the different organisations and institutions in the system (at regional, sectoral, national, and supranational level).

The term 'national system of innovation' (NSI) was, in published form, first used by Freeman (1987). He defined it as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies" (Freeman 1987. p.1). Two major books on national systems of innovation are Lundvall (1992) and Nelson (1993), which use different approaches to the study of NSIs. Nelson (1993) emphasises empirical case studies more than theory development[2], and some of the studies focus narrowly on nations' research and development (R&D) systems. By contrast, Lundvall (1992) is more theoretically oriented and seeks to develop an alternative to the neoclassical economics tradition by placing interactive learning, user-producer interaction, and innovation at the centre of the analysis.

Lundvall argues that "the structure of production" and "the institutional set-up" are the two most important dimensions that "jointly define a system of innovation" (Lundvall 1992, p.10). In a similar way, Nelson and Rosenberg (1993) single out organisations supporting R&D, i.e., they emphasise those organisations that promote the creation and dissemination of knowledge as the main sources of innovation. Organisations disseminating knowledge include firms, industrial research laboratories, research universities, and government laboratories. Lundvall's broader approach recognises that these narrow organisations are "embedded in a much wider socio-economic system in which political and cultural influences as well as economic policies help to determine the scale, direction and relative success of all innovative activities." (Freeman 2002, p.195).

Both Nelson and Lundvall define national systems of innovation in terms of determinants of, or factors influencing, innovation processes.[3] However, they single out different determinants in their definitions of the concept, presumably reflecting their judgment about the most important

1 The paper builds partly on our own earlier work, particularly Edquist (2005), Chaminade and Edquist (2006a and 2006b), Edquist (2001), and Edquist (1994).

2 This emphasis is crystal clear from Nelson and Rosenberg (1993, p.4): "…the orientation of this project has been to carefully describe and compare, and try to understand, rather than to theorise first and then attempt to prove or calibrate the theory".

3 Their definitions of NSIs do not include, for example, consequences of innovation. This does not mean that innovations emerging in innovation systems do not have tremendously important consequences for socio-economic variables such as productivity growth and employment – on the contrary. And then, distinguishing between determinants and consequences does not, of course, exclude feedback mechanisms between them.

determinants of innovation. Hence, they propose different definitions of the concept, but use the same term. This reflects the lack of a generally accepted definition of a national system of innovation.

A more general definition of (national) systems of innovation includes "all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of innovations" (Edquist 1997, p.14). If a NSI definition does not include all factors that influence innovation processes, one has to argue which potential factors should be excluded – and why. This is quite difficult since, at the present state of the art, we do not know the determinants of innovation systematically and in detail. But obviously one could miss a great deal by excluding some determinants since they might prove to be very important once the state of the art has advanced. For example, 25 years ago, it would have been natural to exclude the interactions between organisations as a determinant of innovation processes. Included in this general definition are the relationships among the factors listed and the actions of both firms and governments.

There are other systems of innovation than national ones – such as sectoral, technological or regional systems. Carlsson (1995) focuses on technological systems, arguing that these are unique to technology fields. The sectoral approach of Breschi and Malerba (1997) similarly focuses on a group of firms that develops and manufactures the products of a specific sector and generates and uses the technologies of this sector. The concept of regional innovation system has been developed and used by Cooke *et al.* (1997) and Braczyk *et al.* (1998), Cooke (2001), Asheim and Isaksen (2002), and Asheim and Coenen (2005) to emphasise the interactions embedded in a certain region. Asheim and Coenen (2005), for instance, define regional innovation systems as a "constellation of industrial clusters surrounded by innovation supporting organizations".

National, sectoral, technological, and regional systems of innovation may all be considered variants of a single generic systems-of-innovation approach.

The three perspectives – national, sectoral and regional - may be considered variants of a single generic systems-of-innovation approach (Edquist 1997). Much of the discussion in this paper is relevant for the generic approach, and is based on the premise that the different SI variants coexist and complement each other. Whether the most appropriate SI concept, in a certain context, should be national, sectoral, or regional depends to a large extent on the questions one wants to ask.[4]

The diffusion of the SI approach has been surprisingly rapid, and it is now widely used in academic circles. The approach also finds broad applications in policy contexts – by regional authorities and national governments, as well as by international organisations such as the OECD, the European Union, UNCTAD and UNIDO[5]. In Sweden, a public agency has even been named after the approach, i.e., the Swedish Agency for Innovation Systems (VINNOVA). The practice of VINNOVA is strongly influenced by the SI approach, an approach that appears to be especially attractive to policy makers who seek to understand differences among economies' innovative performance, and develop ways to support technological and other kinds of innovation. In addition, managers of firms rely increasingly on the SI approach with a view to placing their companies in their context.

4 It should also be mentioned that the publications cited in this section by no means exhaust the stock of literature addressing or using the SI approach. Edquist and McKelvey (2000) is a reference collection containing 42 articles on SIs.

5 For a detailed discussion of the adoption of the SI approach by policy makers see Mylteka and Smith (2002)

Having introduced the gist of the systems-of-innovation approach and its diffusion, the remainder of this paper is structured as follows. The next section describes in greater detail the constituents, function, and boundaries of the SI approach and it previews the activities carried out in systems of innovations. Before turning to an in-depth presentation of such activities in Section 4, we motivate in Section 3 the role of public policy in the innovation process. We consider such innovation policy – i.e., public policy that influences innovation processes – to be the most important part of a future-oriented industrial policy. Section 5 critically assesses the strengths and weaknesses of the SI approach, and Section 6 concludes.

2. Constituents, function, boundaries, and activities of systems of innovation

2.1 What is a system?

To develop the SI approach, it might be useful to relate it explicitly to general systems theory.

In an effort to develop the SI approach, it might be useful to relate it explicitly to 'general systems theory', which has been used much more in natural sciences than in social sciences. In everyday language and in large parts of the scientific literature, the term 'system' is used generously and with limited demands for a precise definition. This being said, to the question 'What is a system?' everyday language and the literature give common answer, focussing on three features (Ingelstam 2002). To begin with, a system consists of two types of constituents: components and relations among them. The components and relations should form a coherent whole, which has properties different from the properties of the constituents. Second, the system has a function, i.e., it is performing or achieving something. Third, it must be possible to discriminate between the system and the rest of the world, that is, it must be possible to identify the boundaries of the system.[6] Obviously, for empirical studies of specific systems, one must know their extension.

Making the SI approach more theory-like does not require specifying all components and all relations among them. This would be too ambitious and unrealistic. At present, it is not a matter of transforming the SI approach into a general theory of innovation, but rather to make it clearer and more consistent so that it can better serve as a basis for generating hypotheses about relations between specific variables within SIs (which might be rejected or supported through empirical work). Even the much more modest objective of specifying the main (rather than all) functions of SIs, their activities and components, and the key relations among the latter would represent a considerable advance in the field of innovation studies. Used in this way, the SI approach can be helpful for developing theories about the relations between specific variables within systems of innovation. To further develop ideas, we now take a closer look at the main components of such systems.

2.2 Main components of SIs

Organisations and institutions are often considered the main components of SIs, although it is not always clear what these terms mean[7]. For the purpose of our analysis, we define organisations as formal structures that are consciously created, have an explicit purpose, and act in the systems

6 Only in exceptional cases is the system closed in the sense that it has nothing to do with the rest of the world (or because it encompasses the whole world). Like the SI approach, general systems theory might be considered an approach rather than a theory.

7 We will get back to this issue when discussing the weaknesses of the SI approach in Section 5.2.

of innovation (Edquist and Johnson 1997). Some of the important organisations in SIs are firms, universities, venture capital funds, and public agencies responsible for innovation policy, competition policy, regulation (of drugs, for instance), and so on.[8] And then, we define institutions as sets of common habits, norms, routines, established practices, rules, and laws that regulate the relations and interactions between individuals, groups, and organisations (Edquist and Johnson 1997). In essence, institutions defined in this way reflect the rules of the game. Examples of key institutions in SIs are patent laws and the rules and norms influencing the relations between universities and firms. Obviously, our definition of institutions and organisations is 'Northian' in character (North 1990), discriminating between the rules of the game and the players in the game.

Organisations and institutions are likely to differ across real-world systems of innovations.

Organisations and institutions are likely to differ across real-world SIs. To illustrate this, first, for organisations: in one country (e.g., Japan), research institutes and company-based research departments might be important players in carrying out R&D, whereas research universities might largely play this role in another country (e.g., the United States). Likewise, in some countries, such as Sweden, most research is carried out in universities, while the independent public research institutes are weak; by contrast, in Germany, for instance, the latter are much more important. That the organisational set-up varies considerably among national systems of innovation is shown in profiles of the national systems in Austria, Belgium, Finland, Germany, Spain, Sweden, Switzerland, and the United Kingdom, presented in OECD (1999a).

Turning to institutions, they also differ considerably among national systems. For example, patent laws are different across countries. In the United States, for instance, an inventor can publish before patenting, whereas this is not possible according to European laws. And then, in Sweden, university teachers own their patents outright, thanks to the so-called 'university teachers privilege'. However, this is not the case in the United States. In Denmark and Germany, new laws have recently transferred patent ownership from teachers to the universities where they work, while in Italy and Australia a transfer in the opposite direction has occurred. Many OECD governments are currently experimenting with changes in the ownership of knowledge created in universities, hoping that such changes will influence the propensity to patent and accelerate the commercialisation of economically useful knowledge.

In summary, there seems to be general agreement that the main components in SIs are institutions and organisations – among which firms are often considered to be the most important organisations. However, the specific set-ups of institutions and organisations vary among systems.

2.3 Activities in SIs that influence the innovation processes

One way of analysing SIs is to focus not only on its constituents, but also on what actually happens in the systems. At a general level, the main function – also known as 'overall function' – in SIs is to pursue innovation processes: that is, to develop and diffuse innovations. What we, from here on, call 'activities' in SIs are those factors that influence the development and diffusion of innovations. In this sense, we use the term activities as equivalent to determinants of the innovation process. Although a system is normally considered to have a function, this function and the activities

8 Although there are actors other than organisations – e.g., individuals – the terms organisations and actors (or players) are used interchangeably in this paper.

influencing it were not addressed in a systematic manner in the early work on SIs. From the late 1990s, some contributions addressed these issues (Galli and Teubal 1997, Johnson and Jacobsson 2003, Liu and White 2001, Rickne 2000). As we have argued elsewhere (Chaminade and Edquist 2006a), one can broadly distinguish four approaches that researchers have taken in analysing activities in SIs.

To start with, Edquist 2005, Furman *et al*. (2002) and – though to a lesser extent – Liu and White (2001) focus on activities linked to the innovation process as such, that is, activities needed to turn an idea into a new product or process. The second line of research, represented by the work of David and Foray (1995) and Johnson and Jacobsson (2003) concentrates on activities linked to the knowledge production process, that is, the way knowledge is created, transferred, and exploited. Here there is a strong emphasis on the channels and mechanisms for knowledge distribution. Third, some researchers (Borrás 2004, for example) try to identify the activities of different organisations that have an impact in the innovation system. Finally, for another line of research, innovation policy is the focal point. The main question pursued is which activities (and organisations) in the innovation system can be stimulated by public intervention. The OECD (2002a) and other international organisations follow this approach.

Clearly, there is no consensus as to which activities should be included in a system of innovation and this provides abundant opportunities for further research. We believe that it is important to study the activities of SIs in a systematic manner. Box 1 presents a list of ten priority activities worth studying. The list of activities – structured along four themes – is based on the literature (reflecting the research approaches mentioned above) and on our own knowledge about innovation processes and their determinants: (i) the provision of knowledge inputs to the innovation process, (ii) demand-side activities, the (iii) provision of constituents of SIs, and (iv) support services for innovating firms.

This list is provisional and will be subject to revision as our knowledge about determinants of innovation processes increases. In addition to a set of activities that is likely to be important in most SIs, there are activities that are very important in some types of SIs and less important in others. For example, the creation of technical standards is critically important in some (sectoral) systems, such as mobile telecommunications.[9]

The systematic approach to SIs suggested here does not imply that they are or can be consciously designed or planned. On the contrary, just as innovation processes are evolutionary, SIs evolve over time in a largely unplanned manner. Even if we knew all the determinants of innovations processes in detail (which we certainly do not now, and perhaps never will), we would not be able to control them and design or 'build' SIs on the basis of this knowledge. Centralised control over SIs is impossible and innovation policy can only influence the spontaneous development of SIs to a limited extent.

Systems of innovation cannot be consciously designed or planned but are evolutionary, evolving over time in a largely unplanned manner.

In Section 4, we will take a much closer look at the activities set out in Box 1, notably the government's role in different activities in the system of innovation. But let us first see how to motivate government intervention in a systems-of-innovation approach.

9 The activities in this sectoral system are discussed in Edquist (2003).

Box 1. Key activities in systems of innovation

I. Provision of knowledge inputs to the innovation process

1. Provision of R&D and, thus, creating new knowledge, primarily in engineering, medicine and natural sciences.

2. Competence building: educating and training the labour force for innovation and R&D activities.

II. Demand-side activities

3. Formation of new product markets.

4. Articulation of quality requirements emanating from the demand side with regard to new products.

III. Provision of constituents for SI's

5. Creating and changing organisations needed for developing new fields of innovation. Examples include enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms; and creating new research organisations, policy agencies, and so on.

6. Networking through markets and other mechanisms, including interactive learning between different organisations (potentially) involved in innovation processes. This implies integrating new knowledge elements, developed in different spheres of the SI and coming from outside, with elements already available in the innovating firms.

7. Creating and changing institutions – e.g., patent laws, tax laws, environment and safety regulations, R&D investment routines, etc. – that influence innovating organisations and innovation processes by providing incentives for and removing obstacles to innovation.

IV. Support services for innovating firms

8. Incubating activities such as providing access to facilities and administrative support for innovating efforts.

9. Financing of innovation processes and other activities that can facilitate commercialisation of knowledge and its adoption.

10. Provision of consultancy services of relevance for innovation processes, e.g., technology transfer, commercial information, and legal advice.

Source: Edquist (2005)

3. Public policy intervention in the innovation process

3.1 A framework for analysis: the importance of systemic failures and the irrelevance of the market-failure benchmark

The main focus of the SI approach is the complex interactions that take place among the different organisations and institutions in the system. Policy makers need to intervene in those areas where the system is not functioning well. Policy rationale is based on 'systemic' failures or problems rather than on 'market' failure (Chaminade and Edquist 2006b).

Market failure in mainstream economic theory implies a comparison between conditions in the real world and an ideal or optimal economic system. However, innovation processes are path dependent over time, and it is not clear which path will be taken as they have evolutionary characteristics. We do not know whether the potentially optimal path is being exploited. What is more, the system never achieves equilibrium, and the notion of optimality is irrelevant in an innovation context. It follows that we cannot specify an ideal or optimal system of innovation and, therefore, comparisons between an existing system and an optimal system are not possible; as a corollary, it is not meaningful to talk about optimal policies. Thereby, the notion of market failure loses its meaning and applicability. Instead we talk about systemic problems.[10] Systemic problems mentioned in the literature include (Smith 2000 and Woolthuis *et al*. 2005):

One cannot specify an ideal or optimal system of innovation and, therefore, comparisons between an existing system and an optimal system are not possible.

- Infrastructure problems, including the physical infrastructure (for example, telecoms and transport) and the scientific infrastructure (such as high-quality universities and research laboratories, technical institutes, and so on);

- Transition problems – the difficulties that might arise when firms and other actors encounter technological problems or face changes in the prevailing technological paradigms that exceed their current capabilities;

- Capability problems (which are linked to transition problems), i.e., limited capabilities of firms (especially small and medium-sized enterprises), which might limit their capacity to adopt or produce new technologies over time;

- Lock-in problems, derived from the socio-technological inertia, that might hamper the emergence and dissemination of more efficient technologies;[11]

- Hard and soft institutional problems, linked to formal rules (regulations and laws, for example) and more tacit ones (such as social and political culture);

- Network problems, which include problems derived from linkages being too weak or too strong (blindness to what happens outside the network) in the SI.

One way of approaching the criteria for innovation policy intervention is the following. In a modern society, capitalist firms and the market mechanism best fulfil many economic tasks. The market mechanism evaluates and coordinates the behaviour of private and public actors – often in a

10 This means that we decrease the degree of rigour and formality. We speak about a 'problem' on an empirical basis and in a pragmatic way – not referring to a formal model.

11 One clear example of lock-in is fossil energy (Smith 2000). The productive system is so dependent on fossil energy that it is preventing the expansion of new forms of energy (such as solar, wind energy, etc).

smooth and flexible manner. This concerns the production of most goods and services. However, sometimes there are reasons for public intervention to complement markets and private firms. This is true in the areas of law, education, environment, infrastructure, social security, income distribution, research, radical innovations, and so on. In some of these areas, there is no market mechanism operating at all, and the activities are fulfilled through other mechanisms, regulation by institutions, for instance. In others, the market mechanism does not lead to the fulfilment of the objectives established by the government.

There are two main conditions for public policy intervention in the innovation process of a market economy: policy opportunity and policy competence.

The key question is thus: which tasks should be performed by the state or the public sector? This question can – and should – be discussed in an analytical way, although ideological judgement will obviously play a role too. Taking an analytical approach, there are two main conditions for public policy intervention in the innovation process of a market economy. One is that capitalist firms and the market mechanism must fail in achieving the objectives formulated. In other words, a problem not spontaneously solved by private actors and market forces must exist (we call this policy opportunity). The second condition is that the state (national, regional, local) and its public agencies must have, or be able to build up, an ability to solve or mitigate the problem (we call this policy competences).

Provided that there is a policy opportunity and the state has the policy competence, there are two main categories of policies to solve or mitigate problems.

First, the state may use non-market mechanisms, which is mainly a matter of using regulation instead of the market mechanisms of supply and demand. One example is a subsidy to a poor region. The state might also provide educational services free of charge or at a subsidised cost. Other kinds of regulation – particularly related to innovation activities – are the creation of technical standards, subsidies in support of private firms' R&D, or tax incentives to R&D and other innovation activities.

Second, through various public actions, the operation of markets can be improved or the state might create markets. Improving the operation of markets is the objective of competition law and competition (anti-trust) policies. It is often a matter of increasing the degree of competition in a market. This might sometimes be achieved through deregulation, i.e., getting rid of old or obsolete regulations. Policy makers can also enhance the creation of markets by supporting legal security or the formation of trust. Another example is innovation support through public procurement. This is when a public agency places an order for a product or a system that does not yet exist and, thus, an element of innovation is required to deliver it.

One difficulty in this context is, of course, that it is not possible to know for sure *ex ante* if public intervention can solve the problem.[12] The decision to intervene or not must then depend on how likely intervention is to mitigate the problem. Hence, the decision must be taken in a situation of uncertainty. Then one can afterwards – *ex post* – evaluate whether the problem was solved or mitigated. If this was not the case, we are talking about a policy failure or a failed policy. In other words, policy failures can never be completely avoided because of the uncertainty mentioned. We must accept mistakes in public activity – as we do in private activities. Moreover, to determine the success or failure of a given policy intervention, it is crucial that the policy objectives were clearly formulated *ex ante*.

12 This is especially the case with innovation. Here, by definition, it is highly unlikely that there will be any clear-cut precedents for the problem to be solved.

There may be two reasons why public intervention cannot solve or mitigate a problem. One is that the problem cannot be solved at all – neither by the market mechanism and private actors nor by public intervention and, thus, all types of intervention would be in vain. The other reason is that the state might first need to develop its ability to solve the problem. A detailed analysis of the underlying problem and its causes, involving a detailed empirical comparison for instance, might be a necessary means of acquiring this ability. Moreover, the creation of new organisations and institutions to carry out the intervention might be necessary, for instance a new research organisation or a patent office, the latter possibly operating on the basis of reformed patent laws. In addition, in analysing the problem at hand, it might turn out that new policy instruments are needed, such as tax breaks for R&D spending.

It is important to note that problems motivating public intervention might concern the future. In fact, the 'problem' might not yet have emerged, and a policy addressing this type of situation might be called an opportunity-creating or anticipatory policy. To illustrate, uncertainty might stifle firms' incentives and thus prevent new technologies from emerging. In these circumstances, public funding of basic R&D, for example, might be helping the search for such technologies. Another example is that training people and stimulating research in public organisations in a certain field could create new opportunities that would not be realised without policy.

Problems motivating public intervention might concern the future, and a policy addressing this type of situation might be called an anticipatory policy.

All in all, the discussion of policy intervention raises two issues that are worth pursing in greater detail. For one thing, policy intervention is especially needed when uncertainty and risk are very high and private actors have insufficient incentives to invest in high-risk products and processes. For another, policy intervention needs to be selective, focusing on specific products, processes, or technologies that better fulfil the objectives (economic, social, environmental, etc.) of the government. These issues of uncertainty and selectivity will be discussed next.

3.2 Uncertainty

When uncertainty and risk are high, the danger that markets underperform relative to government objectives is particularly big. For example, private actors might underinvest in basic R&D (Arrow 1962) or they might not invest at all in activities of great social return but low individual return (e.g., some drugs). High uncertainty might also prevent the emergence of innovations. In the very early stages of developing new fields of innovation there is uncertainty about whether there will be a market for the new product. In these circumstances, public organisations have sometimes been instrumental in market creation, directly – through public technology procurement for instance – or indirectly. In recent decades, government support has also come in the form of 'incubating activities' carried out by public or semi-public science parks to facilitate commercialisation of knowledge.

In fact, uncertainty plagues innovation as such, and it is of particular concern for innovation in new fields of production. Historically we have also seen that a minor public intervention in an early stage of an innovation process may have a very large impact. The public support to the development of the Nordic Mobile Telephony Standard (NMT 450) is an example, with the support amounting to a few hundred man-years. But there are also examples of major public efforts in a mature stage of product development having only a small impact. A case in point is the massive support to the Swedish shipyard industry in the 1970-80s, which did not show any long-term impact although it amounted to around ½ percent of GDP over a period of ten years.

Empirical evidence also suggests that large-scale and radical technological shifts rarely take place without public intervention (as opposed to incremental innovations in established sectors).

Carlsson and Jacobsson (1997) have shown this for technological breakthroughs in electronics, semiconductors, and genetic engineering in the United States and Sweden. Mowery (2005) has shown that publicly funded R&D in combination with public technology procurement has played a crucial role in developing new high-tech sectoral systems of innovation in the United States (and thereby in the world). Examples include the early phases of developing numerically-controlled machine tools, commercial aircraft, semiconductors, computer hardware and software, and the internet. Overall, Mowery concludes that government innovation support to new products and sectors has been very strong in the United States.

Before moving on, it is useful to point out that the general conclusion is that innovation involves a high degree of uncertainty and risk. And the higher the uncertainty, the lower are private actors' incentives to invest in certain new activities and the stronger is the motivation for public intervention. This raises a crucial question, hotly debated among scholars and policy makers: are governments better than firms at determining which new activities should be funded? This takes us to the issue of selectivity in innovation policy.

3.3 Selectivity

As innovation policies address certain systemic problems, they cannot be neutral but are necessarily selective.

We have argued that innovation policies should focus on solving or mitigating certain systemic problems. Obviously, to solve a problem, policies have to target exactly this problem, implying that policies cannot be neutral but are necessarily selective. An example indicating the selectivity of innovation policy is public R&D spending. Impartial analysis might suggests that spending should be reallocated from, say, R&D in information technologies to R&D in biotechnology. As innocuous as it may appear at first sight, re-prioritising public R&D spending is selective since it favours one sector (or firm) at the expense of others. And then, the analysis might show that, say, pharmaceutical firms spend too little on developing drugs with a potentially large positive social impact (e.g., a drug to cure malaria) but invest heavily in privately more profitable drugs – Viagra for instance. The government might decide to allocate funds to research in socially more valuable drugs, but in doing this its innovation policy is clearly selective.

Nevertheless, the design of innovation policy, notably its objective (where to intervene and with which purpose) and instruments (how to intervene), should rest on impartial, professional analyses. In practice, however, policies are not shaped by such analyses alone but also by ideology, the influence of lobbying groups, or simply the imitation of existing policy models. Imitation refers to the tendency to copy policies that have been successful elsewhere without proper adaptation to the circumstances in the new environment. Lobbyism refers to the pressure exerted by special interests groups in the design of innovation policy, trying to favour specific firms or sectors, the car, shipbuilding, and information and communication industries – to name just a few potential recipients of support.

We argue that the selection of objectives and instruments has to be the result of an analysis of the system, its activities and the division of labour between private and public actors. Irrespective of whether innovation policy largely reflects lobbyism (which is common) or analysis of the kind proposed by us (which is rare), the resulting policy is selective rather than neutral. There are reasons to limit the degree of selectivity – and maybe accept it only for sectors and products in very early stages of their development. However, this must be analysed in more depth. Then a distinction needs to be made between selectivity with regard to sectors, products, activities, and firms. In the next section, we will discuss the government's role in different activities of the system of innovation.

In general, we will argue that government support is most needed when uncertainty and risk are high and the likelihood is thus great that the private sector will not act, thereby neglecting socially valuable innovation opportunities. Whether this support to new activities and products should be limited to new sectors or the radical transformation of more traditional sectors (such as helping the car industry to develop engines running on renewable fuels) is still subject to a hot debate among scholars – including the authors of this paper.

4. Activities in SI's from a policy perspective

In this contribution we are placing greater emphasis on activities than much of the early work on SIs. Nonetheless, this emphasis does not mean that we can disregard or neglect the components of SIs and the relations among them. Organisations or individuals perform the activities; institutions provide incentives and obstacles influencing these activities. To understand and explain innovation processes, we need to address the relations between activities and components, as well as among different kinds of components. However, we believe that understanding the dynamics of each of these activities and the division of labour between public and private actors in performing them can be a useful departure point for discussing the role of the government in stimulating innovation processes. We will therefore now discuss the ten activities introduced in Box 1 from a policy point of view, pointing out the role of public agencies influencing or directly carrying out these activities.

4.1 Provision of knowledge inputs to the innovation process

4.1.1 Provision of R&D

Path-breaking innovations result from R&D activity often partly financed and carried out by public agencies.

R&D is an important basis for some innovations, particularly radical ones in engineering, medicine, and natural sciences. Such R&D has traditionally been an activity partly financed and carried out by public agencies. This applies to basic R&D, but – in some countries – also to more applied kinds of R&D. This publicly performed R&D is carried out in universities and other public research organisations. NSIs can differ significantly with regard to the balance between these two kinds of organisations in the provision of R&D. In Sweden, less than 5 percent of all R&D is carried out in public research organisations. In Norway, this figure is more than 20 percent. In 1999, the proportion of all firm-financed R&D in the OECD countries ranged from 21 percent in Portugal to 72 percent in Japan (OECD 2002b).

Such data may be a way of distinguishing different types of NSIs. In most NSIs in the world today, little R&D is carried out and most of this is performed in public organisations. Most of these countries are poor or medium-income countries. The few countries that spend a lot on R&D are rich, and much of their R&D is carried out by private organisations. This includes some large countries such as the United States and Japan, but also some small and medium-sized countries such as Sweden, Switzerland, and South Korea.

Because innovation processes are evolutionary and path-dependent, there is the danger of negative lock-ins, that is, trajectories of innovation that lead to inferior technologies resulting in low growth and decreasing employment. Potentially superior innovation trajectories may not materialise and the generation of diversity may be reduced or blocked. In such situations, governments may favour experimentation and use R&D subsidies and public innovation procurement, for instance, to support possible alternatives to the winning technologies (Edquist *et al.* 2004).

In sum, public organisations can influence R&D activity in different ways, ranging from allocating funds for specific research activities in public universities and research centres to stimulating alternative technologies via R&D subsidies. However, much research is needed to understand the relationship between R&D, innovation, productivity growth, the role of R&D in innovation in different sectors, and the impact of different instruments in the propensity of the firms to invest in R&D.

4.1.2 Competence building

The concept of competence building is usually linked to the qualification of human resources. However, it involves other processes and activities related to the capacity to create, absorb, and exploit knowledge for individuals and organisations. Here we follow the definition of Lundvall *et al.* (2002, p. 224) of competence building that includes: "…formal education and training, the labor market dynamics and the organization of knowledge creation and learning within firms and in networks".

In most countries, the education and training that is important for innovation processes is primarily provided by public organisations.

In most countries, the education and training that is important for innovation processes (and R&D) is primarily provided by public organisations – schools, universities, training institutes, and so on. However, some competence building is done by firms through learning-by-doing, learning-by-using, and learning-by-interacting. Competence building increases the human capital of individuals: that is, it is a matter of individual learning, the result of which is controlled by individuals.[13]

The organisational and institutional contexts of competence building vary considerably among NSIs. There are particularly significant differences between the systems in the English-speaking countries and continental Europe. However, scholars and policy makers lack good comparative measures on the scope and structure of such differences. There is little systematic knowledge about the ways in which the organisation of education and training influences the development and diffusion of innovations. Since labour, including skilled labour, is the least mobile production factor, domestic systems for competence building remain among the most enduringly national elements of NSIs.

Competence building should not be limited to human capital. Organisations have competences that exceed those of the employees. Human capital is hired by the company but is always owned by individuals. However, there are ways by which the firm can capture individual knowledge and transform it into organisational knowledge. Organising the processes of knowledge creation and learning within the firm and in networks is part of the competence-building activity. Scholars have started only very recently to analyse such processes, and many questions remain unanswered (Chaminade 2003, Edvinsson and Malone 1997, Guthrie and Petty 2000, Nooteboom 2004, Sanchez *et al.* 2000).

The role of the government in the timely provision of qualified human resources is clear, although the proper division of labour between private and public actors continues to be debated. However, the situation is very different with regard to components of competence building such as knowledge and learning dynamics. We know very little about knowledge dynamics in firms and networks. Evidence is based on cases, but they can seldom be compared and, thus, the evidence cannot

13 There is also organisational learning, the result of which is controlled or owned by firms and other organisations. Organisational learning leads to the accumulation of 'structural capital,' a knowledge-related asset controlled by firms (as distinct from 'human capital'). An example is a patent. Organisations can also accumulate knowledge thanks to their ability to combine knowledge of individuals. Organisations have an interest in transforming individual knowledge into organisational knowledge.

be generalised. Little can be said about the role of government in supporting these processes, although some attempts have been made (European Commission 2003, OECD 1999). It remains an issue to be further developed.

4.2 Demand-side activities

4.2.1 Formation of new product markets

The government might need to intervene in the market for two main reasons: a market for certain goods and services might not exist yet or the users of goods and services might not be sophisticated enough to provide the required feedback to the producers with regard to new needs.

In the very early stages of the development of new fields of innovation there is uncertainty whether a market exists. A telling example was the belief in the 1950s that the total computer market amounted to four or six computers. Eventually markets develop spontaneously.

One example of market creation is in the area of inventions. The creation of intellectual property rights through patents gives a temporary monopoly to the patent owner. This makes selling and buying of technical knowledge easier.[14] Policy makers can also enhance the creation of markets by supporting legal security or the formation of trust.

Examples of public support to market creation include the establishment of technical standards and public innovation procurement.

Another example of public support to market creation is the creation of standards. For example, the NMT 450 mobile telecom standard created by the Nordic telecommunication offices in the 1970s and 1980s – when they were state-owned monopolies – was crucial for the development of mobile telephony in the Nordic countries. This made it possible for the private firms to develop mobile systems (Edquist 2003).

In some cases, the instrument of public innovation procurement has been important for market formation.[15] In other words, a market emerged because the public sector demanded products and systems that did not exist before the public innovation procurement. This has been – and still is – an important instrument in the defence sector in all countries. It has also been important in infrastructure development (telecoms, trains, etc.) in many countries. Public policy may also influence demand – and thereby diffusion of innovations – when public agencies require a certain product mix, such as a minimum share of electricity based on renewable resources or of cars powered by fuel cells.

4.2.2 Articulation of quality requirements

The provision of new markets is often linked to the articulation of quality requirements, which may be regarded as another activity of the SI. Articulation of quality requirements emanating from the demand side with regard to new products is important for product development in most SIs, enhancing innovation and steering processes of innovation in certain directions. Most of this activity is performed spontaneously by demanding customers in SIs. It is a result of interactive learning between innovating firms and their customers. However, quality requirements can also be a consequence of public action, for example, regulation in the fields of health, safety, and the environment, or the development of technical standards. Public innovation procurement normally

14 Paradoxically, then, a monopoly is created by law in order to create a market for knowledge: that is, to make trade in knowledge possible.

15 Edquist and Hommen (2000) analyse public innovation procurement in more detail.

includes a functional specification of the product or system wanted, and this certainly means demand articulation that influences product development significantly.

But we know very little about the formation of new markets and the articulation of quality requirements. Instruments such as public procurement, regulation, or subsidies can influence these activities, but further discussion is needed on the adequate division of labour between public and private actors.

4.3.1 Creation and change of organisations

As pointed out above, organisations are considered key components in systems of innovation. Entry and exit of organisations, as well as change of incumbent organisations, are therefore important activities contributing to the change of systems of innovation as such. Organisations include not only firms, but also universities, business services, research institutes, financing bodies, and so on. But since firms are ultimately responsible for commercialising new products, and as there is only so much one can say in one paper, we will focus here on the creation and change of firms.

Creation and change of organisations for the development and diffusion of innovations is partly a matter of spontaneous firm creation (through entrepreneurship) and diversification of existing firms (through intrapreneurship). However, public action can facilitate such private activities by simplifying the rules of the game and by creating appropriate tax laws. New R&D organisations and innovation policy agencies can also be created through political decisions.

An important role of policy is to enhance the entry and survival of new firms by facilitating and supporting entrepreneurship.

One important role of policy is to enhance the entry and survival of new firms by facilitating and supporting entrepreneurship. Compared to incumbents, new entrants are characterised by different capabilities, and they may be the socio-economic carriers of innovations. They bring new ideas, products, and processes. Hence, governments should create an environment favourable to the entry of new firms and the growth of successful small and medium-sized firms. Survival and growth of firms often require continuous (or at least multiple) innovation, particularly in high-tech sectors of production.

Enhancing entrepreneurship and intrapreneurship is a way of supporting changes in the production structure in the direction of new products. There are three mechanisms by which the production structure can change through the addition of new products: existing firms might diversify into new products (as has happened often in Japan and South Korea, for example); new firms in innovative product areas might grow rapidly (as many have in the United States, for example); foreign firms might invest in new product areas in a country (Ireland, for example).

Adding new products to an existing bundle of products is important since the demand for new products often grows more rapidly than for old ones – with accompanying job creation and economic growth. New products are also often characterised by high productivity growth. Governments should therefore create opportunities and incentives for changes in the production structure. Policy issues in this context are how policy makers can help develop alternative patterns of learning and innovation and nurture emerging sectoral systems of innovation.

In any system of innovation it is important to study whether the existing organisations are appropriate for promoting innovation. How should organisations be changed or engineered to induce innovation? This dynamic perspective on organisations is crucial in the SI approach, both in theory and in practice. Creation, destruction, and change of organisations were very important in the development strategies of the successful Asian economies and they are crucial in the

ongoing transformation of Central and Eastern Europe. Hence, organisational changes seem to be particularly important in situations of rapid structural change which in turn is linked to building the capacity to deal with changes.

4.3.2 Interactive learning, networking, and knowledge integration

As we have pointed out, relations among SI components (i.e., organisations like firms, universities, public agencies and institutions such as established practices, rules, and laws) are a basic component (constituent) of systems of innovation. Relations facilitate interactive learning which in turn is the basis for innovation. The SI approach emphasises interdependence and non-linearity. This is based on the understanding that firms normally do not innovate in isolation, but interact with other organisations through complex relations that are often characterised by reciprocity and feedback mechanisms in several loops. Innovation processes are not only influenced by the components of the systems, but also by the relations between them. This captures the non-linear features of innovation processes and is one of the most important characteristics of the SI approach.

The interactive nature of learning and innovation implies that this interaction should be targeted much more directly than is normally the case in innovation policy today.[16] Innovation policy should not only focus on the organisations of the systems, but also – and perhaps primarily – on the relations among them. Relations between organisations might occur through markets but also through other mechanisms. This implies integrating new knowledge developed in different spheres of the SI and coming from outside with knowledge already available in the innovating firms.

The interactive nature of learning and innovation implies that this interaction should be targeted much more directly than is normally the case in innovation policy today.

Most interaction between organisations involved in innovation processes occurs spontaneously when there is a need. The activity of (re)combining knowledge – from any source – into product and process innovations is largely carried out by private firms. They often collaborate with other firms, but sometimes universities and public research organisations are also involved. The long-term innovative performance of firms in science-based industries strongly depends on interactions between firms, universities, and research facilities. If they are not spontaneously operating smoothly enough, these interactions should be facilitated through policy. Here formal institutions are important, as we will see in the next sub-section.

The relations between universities and public research institutes, on the one hand, and firms on the other are coordinated only to a limited degree by markets. Policies help coordinate relations in different ways and to different degrees, reflecting differences across NSIs – but sometimes they are not coordinated at all. Incubators, technology parks, and public venture capital funds (discussed in sub-section 4.4) might also help in similar ways. This means that the public sector might create organisations to facilitate innovation. At the same time, however, it might create the rules and laws that govern these organisations and their relations to private ones – that is, create institutions (Edquist *et al.* 2004).

4.3.3 Creation and change of institutions

Institutions are normally considered the second main component (in addition to organisations) in SIs. Creating, demolishing, and changing institutions are activities crucial to the maintenance of SIs' dynamism. Important institutions in systems of innovation are intellectual-property-rights (IPR) laws, technical standards, tax laws, environment and safety regulations, R&D investment

16 Interactive learning has been studied empirically by Lundvall (1992) and Meeus and Oerlemans (2001).

routines, firm-specific rules and norms, and many more. They influence innovating organisations and innovation processes by providing incentives or obstacles for organisations and individuals to innovate. Many institutions are publicly created (such as laws and regulations) and therefore easy to modify by governments. However, others are created by private organisations, such as firm routines, and they are much more difficult to influence by government intervention.

IPR laws are considered important as a means of creating incentives to invest in knowledge creation and innovation (and, as argued above, they create markets). Tax laws are also often considered to influence innovation processes. An important question here is which kinds (and levels) of taxes hinder or facilitate innovation and entrepreneurship.

We have already mentioned the important role of institutions in facilitating the interaction between organisations in the previous sub-section. Governments may, for example, support collaborative centres and programmes, remove barriers to cooperation, and facilitate the mobility of skilled personnel between different organisations. This might include the creation or change of institutional rules that govern the relations between universities and firms, such as the one in Sweden stating that university professors shall perform a 'third task' in addition to teaching and doing research: that is, interact with the society surrounding the university, including firms (Edquist *et al.* 2004). There are also institutions that influence firms and others that operate inside firms (for taxonomies of institutions see Edquist and Johnson 1997).

Key policy questions are whether existing institutions are appropriate for promoting innovation and how institutions should be changed or engineered to induce innovation.

Some institutions are created by public agencies. They are often codified and constitute policy instruments (such as the aforementioned IPR laws). Public innovation policy is largely a matter of formulating the rules of the game that will facilitate innovation processes. These rules might have nothing to do with markets, or they might be intended to create markets or make the operation of markets more efficient. But not all institutions are created by public agencies. Other institutions develop spontaneously over history without public involvement, such as culture, norms, routines, and so on.

As in the case of organisations, it is important to study whether the existing institutions are appropriate for promoting innovation and to ask the same question of how institutions should be changed or engineered to induce innovation. Here, too, the evolution and design of new institutions were very important in the development strategies of the successful Asian economies and in the ongoing transformation of Central and Eastern Europe. Hence, institutional (as well as organisational) changes are particularly important in situations of rapid structural change.

4.4 Support services for innovating firms

4.4.1 Incubation

Incubating activities include the provision of access to facilities and administrative support for new innovating efforts. In recent decades, incubating activities have been carried out in science parks to facilitate commercialisation of knowledge. That this activity has become partly public has to do with the uncertainty characterising early stages of product development, which means that markets do not operate well in this respect. Also very recently, universities have started their own incubating activities to commercialise the results of their research activities.

However, innovations are also emerging in existing firms through incremental innovation and when they diversify into new product areas. In those cases, the innovating firms normally provide

incubation themselves. There is a need to understand better the conditions under which incubation needs to be a public activity and when it should be left to the private initiative.

4.4.2 Financing

Financing of innovation processes is crucial for turning knowledge into commercially successful innovations and to facilitate their diffusion. Finance comes primarily from private actors within innovating firms, stock exchanges, venture capital funds, or individuals ('business angels'). However, in many countries – including the United States – public agencies provide finance, for instance in the form of seed capital in support of innovation activities.

Financing of innovation processes is crucial for turning knowledge into commercially successful innovations and to facilitate their diffusion.

As with public intervention in general, public funds should only come forward when firms and markets do not spontaneously perform this activity (for example when uncertainty is too large). But the question is not just when the public sector should finance innovation activities but also how: that is, what should be the instruments and what should be the appropriate balance between public and private funding in a particular SI.

4.4.3 Consultancy services

We finally arrive at the tenth SI activity included in the list of Box 1, that is, the provision of consultancy services for innovation processes. Worth mentioning here are consultancy services related to the transfer of technology, commercial information, and legal questions. They are primarily offered by private organisations (such as specialised consultancy firms or entrepreneurial associations), and they can be instrumental when innovations result from diversification processes and when new firms are established around innovations.

But there are cases (certain SMEs and mature sectors, for example) where public authorities also provide consultancy services, either directly or by acting as brokers between firms and service providers. As an example one may mention regional public agencies, which provide, among other things, information to local SMEs on market opportunities, new technology developments, and partnership opportunities.

5. Strengths and weaknesses of the SI approach to innovation policy

5.1 Strengths of the SI approach

The SI approach focuses on innovation and learning processes. The emphasis on learning acknowledges that innovation is a matter of producing new knowledge or combining existing (and sometimes new) elements of knowledge in new ways. This focus distinguishes the SI approach from other approaches that regard technological change and other innovations as exogenous.

The SI approach adopts a holistic and interdisciplinary perspective. It is holistic in the sense that it tries to encompass a wide array – or all – of the important determinants of innovation, and allows for the inclusion of organisational, social, and political factors, as well as economic ones. It is interdisciplinary in the sense that it absorbs perspectives from different (social science) disciplines, including economic history, economics, sociology, regional studies, and other fields.

The SI approach employs historical and evolutionary perspectives, which makes the notion of optimality irrelevant. Processes of innovation develop over time and involve the influence of

many factors and feedback processes, and they can be characterised as evolutionary. Therefore, an optimal or ideal system of innovation cannot be specified.[17] Comparisons can be made between different real systems (over time and space), and between real systems and target systems, but not between real systems and optimal ones. Although this is a complex view of the innovation process, it is far richer and more realistic than its alternatives.

The strength of the SI approach is its emphasis on innovation and learning processes, interdisciplinary and evolutionary perspectives, interdependence and non-linearity, product and process innovations, and on the role of institutions.

The SI approach emphasises interdependence and non-linearity. This is based on the understanding that firms normally do not innovate in isolation but interact with other organisations through complex relations that are often characterised by reciprocity and feedback mechanisms in several loops. Innovation processes are not only influenced by the components of the systems, but also by the relations between them. This captures the non-linear features of innovation processes and is one of the most important characteristics of the SI approach.

The SI approach can encompass product and process innovations as well as sub-categories of these types of innovation. Traditionally, innovation studies have, to a large extent, focused on technological process innovations and to some extent on product innovations, but less on non-technological and intangible ones, i.e., service product innovations and organisational process innovations. There are good reasons to use a comprehensive innovation concept, and the systems-of-innovation approach is well suited to this comprehensive perspective since all categories of innovations specified in this paper can be analysed within this concept. That non-technological forms of innovation deserve more attention is also argued in OECD (2002a).

The SI approach emphasises the role of institutions. Practically all specifications of the SI concept highlight the role of institutions rather than ignoring them as determinants of innovation. This is important since institutions strongly influence innovation processes. There is, however, no agreement about what the term 'institutions' means (see section 2.3).

These six characteristics are often considered to be strengths of the SI approach by academic analysts, policy makers, and – increasingly – by firm strategists, and partly explain its rapid diffusion. However, the SI approach also has weaknesses, which represent challenges for future research on systems of innovation.

5.2 Weaknesses of the SI approach

The SI approach is still associated with conceptual diffuseness. One example is the term 'institution', which is used in different senses by different authors. It is sometimes used to refer to organisational actors and institutional rules. Sometimes the term means different kinds of organisations or 'players' (according to the definitions in section 2.2). At other times, the term means laws, rules, routines, and other 'rules of the game'. For Nelson and Rosenberg (1993), institutions mean basically different kinds of organisations, and for Lundvall (1992) it means primarily the rules of the game.

Another example of conceptual diffuseness is that the originators of the SI approach did not indicate what exactly should be included in a (national) system of innovation; they did not specify the boundaries of the systems (Edquist 1997). Nelson and Rosenberg (1993) provided no sharp guide to just what should be included in the innovation system, and what can be left out. Lundvall insisted that "a definition of the system of innovation must be kept open and flexible" (Lundvall 1992, p.13).

17 Since we cannot describe an optimal system, it is also more relevant to talk about 'good practice' or 'relatively good practice' than about 'best practice'.

The SI approach has also been criticised for not being able to establish clear linkages with the microeconomic level. Although the SI approach acknowledges the role of the different organisations in the system, the focus of the approach is the system itself and the interactions between the different actors in the production, use, and diffusion of innovations.

With regard to the status of the SI approach, it is certainly not a formal theory in the sense of providing specific propositions regarding causal relations among variables. It can be used to formulate conjectures for empirical testing, but this has been done only to a limited degree. Because of the relative absence of well-established empirical regularities, 'systems of innovations' should be labelled an approach or a conceptual framework rather than a theory (Edquist 1997).

Weaknesses of the SI approach include conceptual diffuseness and relative absence of well-established empirical regularities.

Scholars disagree on the seriousness of these weaknesses of the SI approach and on how they should be addressed. According to some, the approach should not be made too rigorous; the concept should not be 'over-theorised' and it should remain an inductive one.[18] Another position argues that the SI approach is 'under-theorised', that conceptual clarity should be increased and that the approach should be made more 'theory-like'. Such a view has, for example, been expressed by the OECD: "There are still concerns in the policy making community that the NIS approach has too little operational value and is difficult to implement" (OECD 2002a). Fischer (2001) expresses similar concerns.

All told, scholars of systems of innovation continue to debate the importance of the weaknesses of the SI approach. One of the goals of this paper has been to increase the rigor and specificity of the SI approach by unfolding the role of public and private organisations in different activities of the system of innovation.

6. Conclusions

This paper has placed great emphasis on the rationales for public policy intervention in the innovation process and the activities in systems of innovation, and we have elaborated on ten such activities. However, this emphasis does not mean that we can neglect the components of SIs and the relations among them. Organisations or individuals perform the activities, and institutions provide incentives and obstacles. We believe that the analysis of innovation systems proposed here can fruitfully be used for innovation policy purposes, and that the activities that influence innovation processes in the systems are a useful point of entry in the policy analysis. Thereafter, one can identify the organisations performing the activities and see that there is not a one-to-one relation between them, but that a certain kind of organisation can perform more than one activity and that many activities can be carried out by more than one category of organisation.

A similar exercise can be carried out for innovation policy: we can analyse the division of labour between private and public organisations with regard to the performance of each of the activities in innovation systems and whether this division of labour is justified or not. The criteria for policy intervention proposed here are, first, that a systemic problem not spontaneously solved by private actors and market forces exists (i.e., firms and markets fail to achieve the public policy objectives) and, second, that the public agencies must have the ability to solve or mitigate the problem.

18 See Lundvall *et al.* (2002) and Lundvall (2003), where it is argued that the pragmatic and flexible character of the concept might be a great advantage. However, Lundvall *et al.* (2002) also argue that efforts should be made to give the concept a stronger theoretical foundation.

The policy discussion at each point should focus on changes in the division of labour between the private and the public spheres and on changes in those activities already carried out by the public agencies. This includes adding new public policy activities as well as terminating others. Terminating activities carried out by public organisations are not the least important!

In addition to these general conclusions, some specific conclusions follow from our discussion. To start with, an optimal or ideal system of innovation cannot be specified and, therefore, the notion of optimality is irrelevant in the context of the systems of innovation approach. This implies that the notion of 'market failure' loses its meaning and applicability and that an awareness and identification of 'systemic problems' provide a much more meaningful orientation for policy making. Along similar lines, we argued that comparisons cannot be made between real and optimal systems, but only among different real systems (over time and space). Another key insight is that innovation policy normally is and should be selective. The selection should be made on the basis of a rigorous analysis of the system of innovation and not as a result of pure lobbyism. We have argued in favour of prioritising those areas where there is a greater degree of uncertainty and risk (which includes the emergence of new sectors and new products but also new innovations in established sectors) or where the collective returns might be very large.

References

Arrow, K. (1962). "Economic welfare and the allocation of resources for invention", in R. Nelson (ed.), *The rate and direction of inventive activity.* Princeton University Press, Princeton, New Jersey, USA.

Asheim, B. and L. Coenen (2005). "Knowledge bases and regional innovation systems: Comparing Nordic clusters". *Research Policy*, 34(8), 1173-1190.

Asheim, B. and Isaksen, A. (2002). "Regional innovation systems: The integration of local 'sticky' and global 'ubiquitous' knowledge". *Journal of Technology Transfer,* (27), pp. 77-86.

Braczyk, H-J., Cooke, P., and Heidenreich, M. (1998). *Regional innovation systems: the role of governance in a globalised world*. UCL, London and Pennsylvania.

Borrás, S. (2004). "System of innovation: Theory and the European Union". *Science and Public Policy,* (31:6), pp. 425-43.

Breschi, S. and Malerba, F. (1997). "Sectoral innovation systems: technological regimes, Schumpeterian dynamics, and spatial boundaries", in Edquist, C. (ed.), *Systems of innovation: Technologies, institutions and organizations,* Pinter/Cassell Academic, London and Washington.

Carlsson, B. (1995). *Technological systems and economic performance: The case of factory automation*, Kluwer, Dordrecht, Netherlands.

Carlsson, B. and Jacobsson, S. (1997). "Diversity creation and technological systems: A technology policy perspective", in Edquist, C. (ed.), *Systems of innovation: Technologies, institutions and organizations,* Pinter/Cassell Academic, London and Washington.

Chaminade, C. (2003). "How IC management can make your company more innovative", in *How to develop and monitor you company's intellectual capital*, Nordic Industrial Fund, Oslo, Norway.

Chaminade, C. and Edquist, C. (2006a, forthcoming). "From theory to practice. The use of the systems of innovation approach in innovation policy". CIRCLE Discussion Paper Series. (Forthcoming in *Innovation, learning and institutions*, Oxford University Press, Oxford, UK).

Chaminade, C. and Edquist, C. (2006b). "Rationales for public policy intervention in the innovation process: a system of innovation approach". Paper presented in the International Conference 'Innovation pressure. Rethinking competitiveness, policy and the society in a globalized world'. Tampere, Finland. March 2006.

Cooke, P., Gomez Uranga, M., and Etxebarria, G. (1997). "Regional systems of innovation: Institutional and organisational dimensions". *Research Policy*, (26), pp. 475-491.

Cooke, P. (2001). "Regional innovation systems, clusters, and the knowledge economy". *Industrial and Corporate Change*, (10:4), pp. 945-974.

David, P. and Foray, D. (1995). Interactions in knowledge systems: Foundations, policy implications and empirical methods. *STI Review*, (16), pp. 14-68.

Edquist, C. (1994). Technology policy: The interaction between governments and markets, in Aichholcer, G. and Schienstock, G. (eds.), *Technology Policy: Towards an integration of social and ecological concerns*, Walter de Gruiter, New York, USA.

Edquist, C. (1997). "Systems of innovation approaches - Their emergence and characteristics", in Edquist, C. (ed.), *Systems of innovation - Technologies, institutions and organizations*, Pinter Publishers/Cassell Academic, London, UK. (The book is out of print, but this chapter has been republished in Edquist, C. and McKelvey, M. 2000.)

Edquist, C. (2001). "Innovation policy – A systemic approach", in Lundvall, B-Å. and Archibugi, D. (eds.), *Major socio-economic trends and European innovation policy*, Oxford University Press, Oxford, UK.

Edquist, C. (2003). "The fixed internet and mobile telecommunications sectoral system of innovation: Equipment, access and content", in Edquist, C. (ed.), *The internet and mobile telecommunications system of innovation: Developments in equipment, access and content,* Edward Elgar Publishing, Cheltenham, UK.

Edquist, C. (2005). "Systems of innovation: Perspectives and challenges". *The Oxford Handbook of Innovation*, (Chapter 7), pp. 181-208.

Edquist, C. and Hommen, L. (2000). "Public technology procurement and innovation theory", in Edquist, C., Hommen, L. and Tsipouri, L. (eds.), *Public technology procurement and innovation.* Boston/Dordrecht/London: Kluwer Academic Publishers.

Edquist, C., Hommen, L., and McKelvey, M. (2001). *Innovation and employment: Process versus product innovation*, Edward Elgar Publishing, Cheltenham, UK.

Edquist, C. and Johnson, B. (1997). "Institutions and organisations in systems of innovation", in Edquist, C. (ed.), *Systems of innovation: Technologies, institutions and organizations,* Pinter/Cassell Academic, London and Washington. (The book is out of print, but this chapter has been republished in Edquist, C. and McKelvey, M. 2000.)

Edquist, C., Malerba, F, Metcalfe, J.S., Montobbio, F., and Steinmueller, E. (2004). "Sectoral systems: Implications for European innovation policy", in Malerba, F. (ed.), *Sectoral systems of innovation - Concepts, issues and analysis of six major sectors in Europe*, Cambridge University Press, Cambridge, UK.

Edquist, C. and McKelvey, M. (2000). *Systems of innovation: Growth competitiveness and employment*, Edward Elgar, Cheltenham, UK.

Edvinsson, L. and Malone, M. (1997). *Intellectual capital; realizing your company's true value by finding its hidden brainpower*, Harper Collins Publisher, New York, USA.

European Commission (2003). "Study on the measurement of intangible assets and associated accounting practices". DG Entreprise.

Fischer, M.F. (2001). "Innovation, knowledge creation and systems of innovation". *Regional Science*, (35), pp. 199-216.

Freeman, C. (1987). *Technology policy and economic performance: Lessons from Japan*, Pinter, London, UK.

Freeman, C. (2002). "Continental, national and sub-national innovation systems – complementarity and economic growth". *Research Policy*, (31:2), pp. 191-211.

Furman, J., Porter, M., and Stern, S.. (2002). "The determinants of national innovative capacity". *Research Policy,* (31), pp. 899-933.

Galli, R. and Teubal, M. (1997). "Paradigmatic shifts in national innovation systems", in Edquist, C. (ed.), *Systems of innovation - Technologies, institutions and organizations*, Pinter Publishers/Cassell Academic, London, UK.

Guthrie, J. and Petty, R. (2000). "Intellectual capital literature review". *Journal of Intellectual Capital,* (1:2), pp. 155-176.

Ingelstam, L. (2002). *System – att tänka över samhälle och teknik* (Systems – Reflecting on society and technology), Energimyndighetens förlag, Eskilstuna, Sweden.

Johnson, A. and Jacobsson, S. (2003). "The emergence of a growth industry: A comparative analysis of the German, Dutch, and Swedish wind turbine industries", in Metcalfe, S. and Cantner, U. (eds.), *Transformation and development: Schumpeterian perspectives*. Physica/Springer, Heidelberg, Germany. Forthcoming.

Liu, X. and White, S. (2001). "Comparing innovation systems: A framework and application to China's transitional context". *Research Policy*, (30), pp. 1091-1114.

Lundvall, B-Å. (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*, Pinter, London, UK.

Lundvall, B-Å. (2003). "National innovation systems: history and theory" (to be published), in *Elgar companion to neo-Schumpeterian economics*, Edward Elgar Publishing Ltd, Cheltenham, UK.

Lundvall, B-Å., Johnson, B., Andersen, E.S., and Dalum, B. (2002). "National systems of production, innovation and competence building". *Research Policy*, (31:2), pp. 213-231.

Meeus, M., Oerlemans, L., and Hage J. (2001). "Patterns of interactive learning in a high tech region. An empirical exploration of complementary and competing perspectives". *Organization Studies,* (22:1), pp. 145-172.

Mowery, D. (2005). "National security and national innovation systems". Paper presented at the PRIME/PREST workshop on 'Re-evaluating the role of defence and security R&D in the innovation system', University of Manchester, September 19 – 21, 2005.

Mytelka, L.K. and Smith, K. (2002). "Policy learning and innovation theory: An interactive and co-evolving process". *Research Policy,* (31).

Nelson, R.R. (1993). *National systems of innovation: A comparative study*, Oxford University Press, Oxford, UK.

Nelson, R.R. and Rosenberg, N. (1993). "Technical innovation and national systems", in Nelson, R.R. (ed.), *National systems of innovation: A comparative study,* Oxford University Press, Oxford, UK.

North, D.C. (1990). *Institutions, institutional change and economic performance*, Cambridge University Press, Cambridge, UK.

Nooteboom, B. (2004). *Inter-firm collaboration, learning and networks. An integrated approach*, Routledge, London and New York.

OECD (1999). *Managing national innovation systems*, OECD, Paris, France.

OECD (2002a). *Dynamising national innovation systems*, OECD, Paris, France.

OECD (2002b). *Main science and technology indicators*, *Volume 2002/2*, OECD. Paris, France.

Rickne, A. (2000). *New technology-based firms and industrial dynamics: Evidence from the technological systems of biomaterials in Sweden, Ohio and Massachusetts*, Chalmers University of Technology, Department of Industrial dynamics, Chalmers, Sweden.

Sánchez, P., Chaminade, C., and Olea, M. (2000). "Management of intangibles – an attempt to build a theory". *Journal of Intellectual Capital*, (1:4), pp. 312-327.

Smith, K. (2000). "Innovation as a systemic phenomenon: Rethinking the role of policy". *Enterprise and Innovation Management Studies,* (1:1), pp. 73-102.

Woolthuis, R. K., Lankhuizen, M., and Gilsing, V. (2005). "A system failure framework for innovation policy design". *Technovation,* (25), pp. 609-619.

ABSTRACT

Spillovers from national industrial policies can cause helpful or harmful competition among policy makers and helpful or harmful interactions among the targeted industries. *As a result, it is not in general possible to say whether industrial policy coordination is good or bad. However, reaching agreement at the EU level on any type of policy – trade policy, monetary policy or industrial policy – is costly in terms of time, information, and political goodwill. The contrast between the vagueness of the benefits of coordination and the surety of the decision-making costs suggests that the EU has no need to set up a new institutional structure for coordinating industrial policy. In the few cases where the merits of coordination are obvious, such as public spending on R&D, they will be obvious to all and* ad hoc *cooperation will work.*

Richard Baldwin (baldwin@hei.unige.ch) is Professor of International Economics at the Graduate Institute of International Studies, Geneva, and **Philippe Martin** (philippe.martin@univ-paris1.fr) is Professor of International Economics at the University of Paris-I, Panthéon-Sorbonne.

Coordination of industrial policy in the European Union

1. Introduction

Richard Baldwin

Philippe Martin

Europe has long worried about its industrial competitiveness. The first page of the 1956 Spaak Report – a report that became the blueprint for the economics in the Treaty of Rome – worries about how Europe's industries could stand up to US competition:

L'Europe bénéficie pour le développement de sa productivité d'une assimilation rapide des techniques à l'écart desquelles les circonstances l'avaient tenue. Dans l'état présent de son organisation économique, elle ne saurait prolonger ces progrès et soutenir par ses propres forces ce rythme d'expansion. Trois exemples feront concrètement apparaître ce que signifie, face aux possibilités du monde moderne, le cloisonnement européen des marchés. Il n'y a pas une entreprise automobile en Europe qui soit assez grande pour utiliser de manière économique les plus puissantes machines américaines. Aucun des pays du continent n'est capable sans apports extérieurs de construire de grands avions de transport. Dans le domaine de la science atomique les connaissances acquises à grands frais dans plusieurs des pays d'Europe ne représentent qu'une faible fraction de celles que les États-Unis mettent maintenant librement à la disposition de leur industrie et des autres pays; et il faudrait des années pour produire quelques milliers de kilos de cet uranium enrichi dont l'Amérique vient d'annoncer qu'elle pouvait mettre à la disposition de son industrie et du reste du monde un surplus de 40 tonnes.

Tighter European integration has been one means through which Europe has promoted its industry, but this has sporadically been accompanied by a concern for more direct industrial policy.

Industrial policy was all the rage in the 1980s, fostered by academic writings on the so-called strategic trade policy[1], and the apparent success of Japan's industrial policy. The 1990s, however, saw industrial policy fall from favour as free-market thinking was explicitly or implicitly embraced by all of Europe's mainstream political parties. The emergence of East Asia, China in particular, and the accession of ten new, low-wage, low-productivity nations, however, has revived concerns that Europe is de-industrialising. The response has been to embrace bold goals in the Lisbon process. As part of this, industrial policy is back on the front burner of policy makers' stoves[2].

The target of industrial policy is to influence the volume and composition of Europe's industrial output, primarily its manufacturing output. In general, the aim is to boost the volume of production and/or jobs, although more subtle analysts focus on promoting 'good jobs', not just any jobs. So what then is industrial policy?

Moving from principles to practice, it is worth noting that everything affects everything in a general equilibrium system. Any policy in any factor or goods market in any nation in the world could, in principle, affect the volume and composition of Europe's industrial output. But taking industrial policy to mean every policy in the world is to rob the concept of its analytic content. Moreover, most policies have negligible effects on Europe's manufacturing sector, and so can be safely excluded from the list. But because everything could affect everything, there can never be a thin red line dividing policies that are industrial policies from those that are not. This, of course, is why it is absolutely impossible to develop a definitive definition of industrial policy.

1 See Brander and Spencer (1985) and Leahy and Neary (2001) for a more a recent analysis.
2 See also Rodrick (2004) for recent academic arguments in favour of industrial policy.

Failing a perfectly general definition, we shall fall back on the Humpty-Dumpty principle.[3] The words mean what we say they mean. In particular, we shall consider all policies that have a significant effect on Europe's industrial sector to be an industrial policy. The definition of 'significant' will be flexible, so we are not forced to disregard policies that we believe are relevant. This casts the net rather widely, but we believe that is the only way to view coordination.

The aim of this paper is to consider the advantages and disadvantages of coordinating industrial policy at the EU-wide level, either by outright delegation – as in the case of trade policy (the Common External Tariff is set at the EU, not national level) – or other looser forms of coordination. We start in Section 2 with the economic pros and cons of coordinating industrial policies. As the reference to pros and cons might suggest, we will see that coordination could be helpful in some circumstances, but harmful in others. We will also argue that the justification for coordination is stronger in the case of so-called specific (or vertical) industrial policies, but that coordination in these cases might well mean an agreement among nations to refrain from such policies. Section 3 zooms in on cases where policy coordination makes sense and asks whether it would not be even better to delegate such policies to a supranational authority, as it is done, for instance, with trade policy or monetary policy in the eurozone. Section 4, which returns to looser forms of coordination, examines how the degree of spatial and sectoral spill-over effects and of international factor mobility influences the pros and cons of coordinating industrial policies. Section 5 concludes.

2. Coordination: pros and cons

2.1 A simple analytical framework

The classic strategic-complement, strategic-substitute framework offers insights into the pros and cons of industrial policy coordination that are relevant, correct, but not obvious beforehand.

Good theory helps organise one's thinking about the insanely complex world we live in. To do this, the theory must be relevant and correct, but not obvious. Many economists skip the first point and build up the third point by using confusing notation and overly elaborate frameworks. The best theory is where the relevance is self-evident and the theory is correct and not obvious beforehand, but becomes obvious after the intuition is provided. Producing such theory is a tall order, but fortunately there is almost nothing new under the sun when it comes to coordination issues in general. The classic paradigm is the strategic-complement-strategic-substitute framework.

We start, as all good theory does, by radically simplifying the world in order to focus on essentials. This prevents muddled thinking when we start adding complexities back into the mix.

Imagine that the world consists of two symmetric countries with governments that are perfect – they know everything about the world that matters and they care only about their country's wellbeing. Moreover, suppose they can sign enforceable contracts with other governments. As it turns out, this case is too simple to help us understand real-world complexities since in this case, cooperation can never be bad. If international spillovers of any sort lead cooperating nations to choose policies that they would not without cooperation, then the world is a better place. The argument rests on a simple revealed preference argument. Governments know best and care only about wellbeing, so if they choose something with coordination that they would not have chosen without coordination, then the coordinated outcome must be better. To paraphrase Dr. Pangloss, "Coordination is always for the best, in the best of all possible words."

3 As the great egg said to Alice: "When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean -- neither more nor less." (Lewis Carroll, *Through the Looking Glass,* Chapter 6).

Unfortunately, while there are such perfect public servants in this world, not all government officials and politicians are totally selfless. Indeed, assuming that all politicians are interested in things other than the welfare of their electors is probably closer to reality than assuming they are all perfect public servants. For example, it is quite common for politicians to systematically favour politically powerful special interest groups – e.g., granting them tax breaks, subsidies, and favourable laws – even when this is bad for the average citizen. This is at least as true in the area of industrial policy as it is in other areas of economics.

Allowing for this type of political economy distortions – i.e., a situation where there is a wedge between the government's objectives and social welfare – we can easily get second-best results where coordination actually makes things worse. This point is illustrated with the help of Figure 1, which illustrates the link between the industrial policies (IP) of two nations, Home and Foreign.

The top pair of lines shows the best-reaction functions of a government when industrial policies are strategic complements. The basic idea of strategic complements in the context of industrial policy is that the more one government does, the more the other wants to do; production subsidies or tax competition would be good examples. Loosely speaking, strategic complements reflect cases of negative policy spillovers. That is, when the Home government chooses its policy uncooperatively, the higher the Foreign government's policy choice, the higher the optimal response for the Home government, and so on. In these circumstances, cooperation will lead to a lower level of policy in both nations. In Figure 1, this can be seen by the fact that the uncoordinated equilibrium, *E1*, is further out on the 45-degree ray and so involves a higher level of policy for both nations (since we have assumed that nations are symmetric, we do not have to show best-reaction functions for both).

The basic idea of strategic complements in the context of industrial policy is that the more one government does, the more the other wants to do.

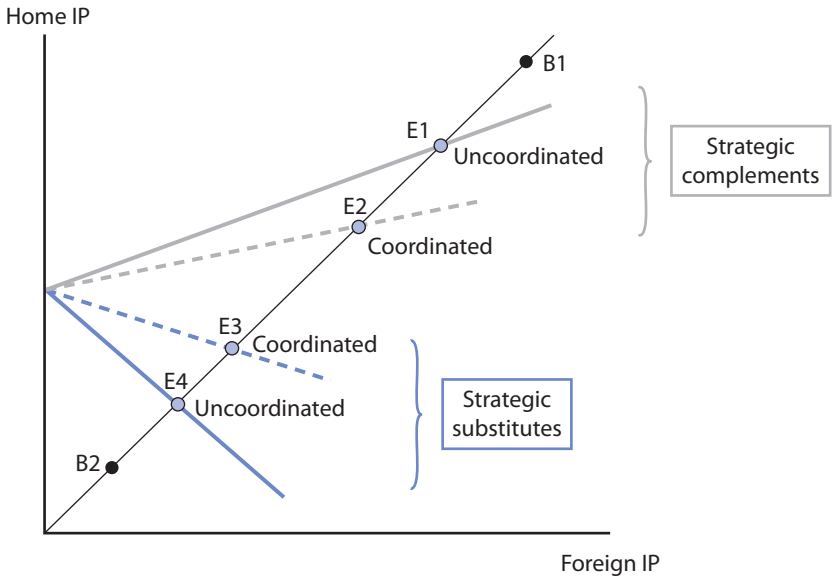
Is the coordinated equilibrium, *E2*, better than the uncoordinated equilibrium, *E1*? In general, there is no unambiguous answer to this question. If the 'bliss point', i.e., the optimal policy choice from a social welfare perspective is *B1*, coordination moves the outcome in the wrong direction, and the answer is 'no.' If the bliss point is *B2*, coordination moves things in the right direction, and the answer is 'yes.' Since the bliss point could, in principle, be anywhere, we can make no generally valid comments on the advisability of coordination.

One example where coordination moves both nations in the right direction might be production subsidies. In the absence of coordination, both countries choose a high level of production subsidies that in equilibrium distort competition. Coordination in this case would move both countries towards a lower level of subsidies (closer to *B2*). One example where coordination might be counterproductive is tax competition. The distortion created by the externality at the international level (the attempt to attract mobile capital at the expense of the other country) generates too much tax competition. However, suppose that at the national level another distortion (political economy for example) exists such that taxes on capital are too high so that the bliss point is one where there are low taxes or high tax competition (point *B1*). The important point is that without coordination the two distortions more or less compensate each other. With coordination between the two countries, the international distortion is removed leaving the national one alone and the outcome is further away from the bliss point. In the next section, we spell out more precisely another example where coordination may be counterproductive[4].

4 The possibility of counterproductive international coordination has been extensively studied in the field of international macroeconomics (see Rogoff 1985, Canzoneri and Henderson 1991, and Canzoneri *et al.* 2006). In Canzoneri and Henderson (1991), it is also shown that if only a subset of countries (such as the EU) cooperates, then this limited cooperation may be counterproductive. The reason is again that coordination among EU members eliminates one distortion. This distortion may have actually compensated for another one with another group of countries. One could also apply this example to the issue of industrial policies.

Note that we have focused on political economy distortions, but the governments' choices could deviate from social optimality for many reasons – information problems being a leading contender.

Figure 1. Coordination *vs.* uncoordinated outcomes



The basic idea of strategic substitutes in the context of industrial policy is that the more one government does, the less the other wants to do.

Strategic complements, however, is not the only possibility. Many industrial policies are marked by a free-rider problem, where the more one nation does, the less the other nation wants to do: nations' policies are thus strategic substitutes. Loosely speaking, strategic substitutes imply positive policy spillovers; R&D policies in the presence of knowledge spillovers are a good example. In this case, the reaction functions slope downward, and the coordinated policy outcome is beyond the uncoordinated one since each nation takes account of the positive benefit of its policy on the other nation. Note that the ordering of coordinated and uncoordinated outcomes is reversed: coordination leads the two symmetric nations to raise their level of policy, they settle in *E3* rather than *E4*.

Is coordination a good idea here? Again the issue depends on the bliss point. If bliss would involve a high level of policy, coordination improves the situation (point *E3* is closer to *B1* than *E4* is). R&D policies would be an example of this (see section 2.3.2 on global public goods). If bliss would involve little policy, for example *B2*, then coordination is a bad thing. Subsidies for innovation policy for some politically sensitive sectors (say defence industry) might be a case. Innovation produces positive knowledge spillovers at the international level so that coordination would lead to more subsidies for innovation. However, one could make the argument that some domestic political distortion leads to too much subsidy for innovation in certain sectors (again, say, defence or other 'strategic' industries). Which distortion is most important in practice is difficult to evaluate in general, but the important point here is that international coordination is not always going to lead to a better situation in a world where many international and domestic distortions exist. Another way to say this is that coordination is not necessarily a good idea if the international distortion eliminated by coordination actually compensates for a national distortion.

Still, it is easier to think of situations where well-informed and well-intentioned governments could improve the outcome with coordination. We start, therefore, in the next sub-section with

two examples of harmful coordination. One is called 'jurisdictional competition' and the other 'task allocation among government levels' – both issues are well known from the public finance literature. Situations where coordination is helpful are left for sub-section 2.3.

2.2 Harmful coordination

2.2.1 Jurisdictional competition and Europe's anti-industrial policy

European voters demand a high level of social protection from their governments and they are willing to pay for it through taxes, or at least it seems so from watching the electoral competitions on the Continent. One extremely important source of the money needed to pay for this comes from a very high tax on employment, often called 'social charges.'

Taxes discourage the taxed activity, so it is not surprising that labour economists consistently find that employment taxes reduce employment. For this reason, many economists view employment taxes as an inferior way of raising the money governments need to pay for the social policies that voters want, especially since high employment levels are on every government's wish list. The reasons why this inferior tax is used so widely are complex, but one of the most important ones is that people do not understand the true burden of the tax. Without thinking hard about the matter, it appears that corporations pay a large fraction of the tax. Many voters therefore believe that social charges are a good way of forcing corporations to pay their fair share. But corporations are no one, so corporations cannot pay anything. The burden of the tax either falls on the firm's shareholders, workers, or customers. Since both customers and shareholders have a broader range of alternatives, prices adjust so that much of the burden of the tax – the 'incidence' in public finance jargon – falls on the workers. In particular, such taxes lower the take-home pay of workers.

Taxes on employment, that is, social charges act as an anti-industrial policy because industrial goods are traded and service sector goods are not.

But what has this got to do with industrial policy coordination? As it turns out, social charges act as an 'anti-industrial policy' because industrial goods are traded and service sector goods are not (the share of output of agriculture in the EU is so small that we can ignore it). To see why this is so, let us look at the basic economic impact of wage and non-wage costs on employment. To get to the core of the argument, we start by making strong assumptions that radically simplify the range of issues at hand. We add back some important aspects of reality after having established the basic points.

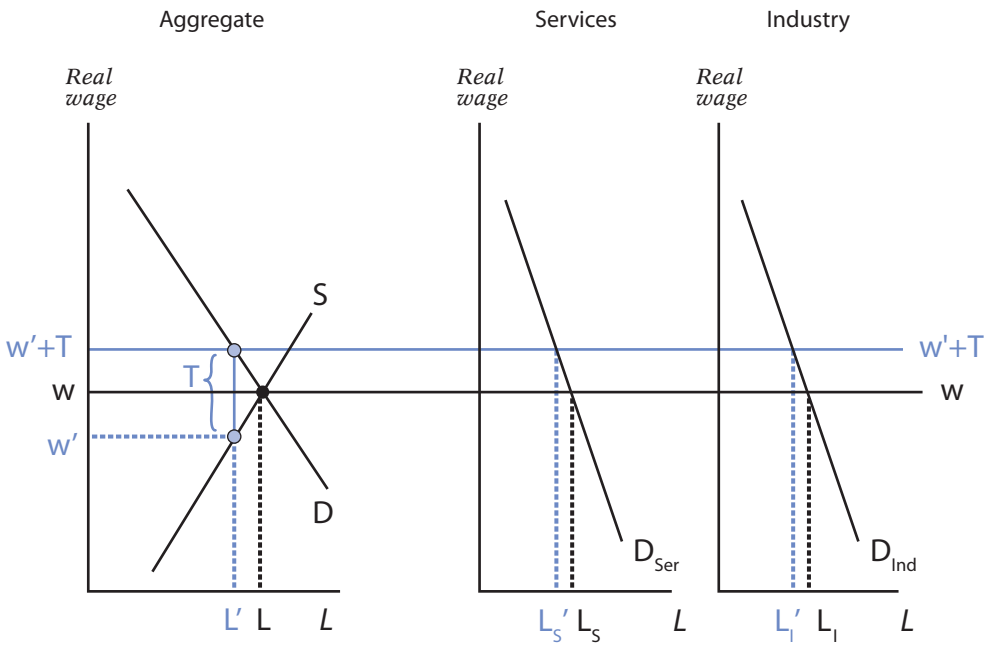
Consider a single nation and start with the unrealistic, but convenient simplifying assumption that labour markets operate like other markets (i.e., wages adjust so that there is no involuntary unemployment). Moreover, to keep things simple, suppose the nation starts without any social policies and initially is closed to trade. The equilibrium, shown in the left panel of Figure 2, is where the real wage is w and employment is L.

Now suppose the government adopts a whole series of social policies, for example limits on working hours, obligatory retirement benefits, maternity leave, sick leave, six weeks of annual holidays, and so on. These policies would undoubtedly be good for most workers. Indeed, most Europeans view these as necessities, not luxuries. Yet, however good these policies are for workers and the society at large, such policies are expensive for firms. To be specific, suppose that they raise the cost of employing workers by T euros per week. What happens to wages and employment?

The new equilibrium wage paid to workers – the take-home pay – falls to w', while the cost to the firm of employing a worker rises to $w'+T$. Hence, the social policy 'tax' drives a wedge between the wage cost to the firm, $w'+T$, and workers' take-home pay, w'. It is useful to think of the tax being

paid partly by consumers (in the form of higher prices) and partly by workers (in the form of lower take-home pay). The firms we consider here are competitive and so cannot bear any part of *T*; they earn zero profits before and after *T* is imposed. Or to put it differently, if *T* did lower the rate of return on firms' capital, capital would move elsewhere. The new equilibrium employment in the economy is *L'*. The social policy thus leads to a drop in aggregate employment (left-hand panel of Figure 2). As we are assuming for now that labour demand in both sectors responds in the same way to changes in the wage cost to firms (see the middle and right-hand panel of Figure 2), the aggregate drop in employment splits evenly between industry and services.

Figure 2. Social charges and jobs in a closed economy.



In setting the level of social charges, the government needs to trade off political expediency (suggesting high charges) against employment effects (suggesting low charges).

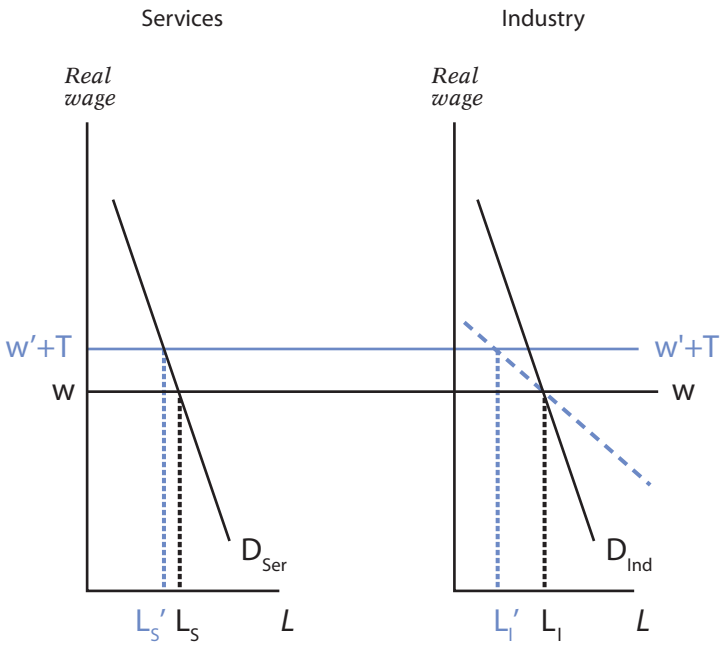
How high will the tax be? On one hand, the government would like a high tax since it is a politically convenient way of paying for social policy (the true effects of the tax are not very transparent to voters). On the other hand, the government will not be happy about the job destruction. The tax chosen presumably is the politically optimal trade-off between these conflicting objectives.

Note that this is one of those situations where political expediency leads governments to choose a level of employment taxes that is too high from the social perspective. Taxes like a value-added tax could raise the same revenue without destroying jobs, but voters find it much easier to understand the impact of the VAT, so politicians 'hide' the taxes in the form of social charges.

Europe's economies are far from closed. So let us examine how openness to international trade changes the anti-industrial policy impact of social charges. A simple way to introduce openness in this sort of diagram is to flatten the labour demand curve. The labour demand curve in a particular sector, industry for example, is downward sloped for two reasons. First, a higher real wage leads to capital-labour substitution and thus lowers labour demand, but this channel is not affected by openness. Second, higher wages mean higher prices, resulting in lower sales and less of a need for workers. The extent to which higher prices translate into lower sales and thus employment depends intimately on openness. If the sector's customers have ready access to imported alternatives, each price rise yields a greater drop in labour demand. Or, to put it simply, the labour demand curve gets flatter. This is shown by the dashed labour demand curve in the right-hand panel of Figure 3.

As trade becomes freer, the labour demand curve in industry gets flatter, but little happens to the labour demand curve in the services sector since most services are non-traded and, thus, firms have greater scope to pass on higher wages in the form of higher consumer prices. What all this means is that unless social charges are reduced, progressively more open markets foster a shift in employment from the traded goods sector (industry) to the non-traded goods sector (services).

Figure 3. Social charges and jobs in an open economy



In short, high social charges are an anti-industrial policy since they tend to shift jobs out of industry and into non-traded goods sectors like services, and the impact gets worse as markets progressively open to international trade. The intuition should be clear. High non-wage labour costs force firms to raise prices. In non-traded goods sectors, all firms in the market face roughly the same need to raise prices, so the overall impact on any particular firm is dampened. In traded goods sectors, customers have an alternative to paying the higher price charged by local firms – they can buy abroad. Thus, a given increase in non-wage cost has a systematically more negative impact on the competitiveness of firms in industry than it does on services firms. The natural result is a shift in the nation's employment pattern from industry to services.

The anti-industry impact of social charges gets worse as markets progressively open to international trade.

It is interesting to note that the force with which this logic imposes itself on a particular nation depends upon how open it is. Small nations like Ireland, Finland, and the new member states of the European Union have little in the way of sheltered markets, so the cost of not reforming is much higher for them than it is for large nations like Germany and France. Little wonder, therefore, that the small nations of Europe have tended to be the ones who have reformed the fastest (and reaped the most benefits from globalisation).

How have governments reacted to this? In answering this question, we finally get to the issue of jurisdictional competition – more precisely: the merits of it. Apart from bemoaning this aspect of globalisation while embracing globalisation in general, European governments have tended to moderate the rate at which they have increased social charges, and in some cases they have decreased them. Since social charges are an economically inefficient way of raising taxes, this tendency has probably improved Europe's economic welfare, even if it has posed problems for

politicians who were used to hiding much of the tax burden from voters by way of social charges. In short, social charges are a good example of where governments choose a policy level that is too high.

Coordination on social charges is bad. Other factors speaking against coordination include 'diversity across EU nations' and 'informational advantage of national governments'.

If European governments coordinated on social charges – that is, required a minimum level – the average level of social charges would surely increase. The point is that the industrial job losses generated by higher social charges, especially in traded goods sectors, is a mechanism that prevents European governments from hiding an even greater slice of the tax burden in this economically inefficient but politically expedient tax. Coordinating on a minimum level of social charges would allow governments to raise the social charges with less loss of employment. How high would it rise? Of course, no one can know, but assuming governments choose the level to balance job losses against political expediency, one might guess that governments would raise the tax to a level where the job loss was more or less at its pre-coordination level. This would probably improve the welfare of European politicians but harm Europe's economy.

In Figure 1, this is a situation where coordination would move the outcome from *E4* to *E3* (higher taxes), but this would be harmful since the bliss point involves lower social charges, not higher ones. It follows that coordination on social charges is bad since it inhibits competition among governments that would prevent them from overtaxing their citizens due to political economy distortions.

2.2.2 Subsidiarity and task allocation among different government levels

We will now look at two other factors that might argue against coordinating (industrial) policies: one is the diversity across EU nations and the other is the informational advantage of national governments over a central EU authority.

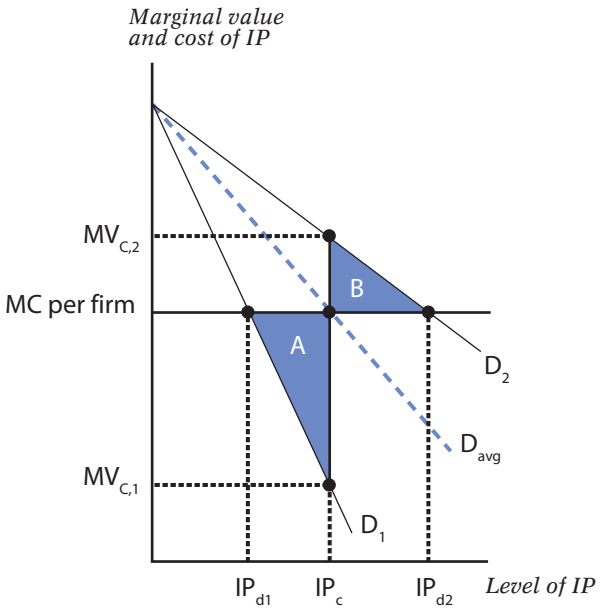
To start with diversity, productive conditions differ widely across the EU, and Member States' attitudes towards government intervention also vary a great deal. In these circumstances, centralisation or even strict coordination of industrial policy can result in a one-size-fits-all compromise that might be inferior for most or even all EU nations. Indeed, this is probably the main reason why most of Europe's industrial policies are set at the national or even regional level.

To illustrate this general idea more concretely, consider the two-nation model shown in Figure 4. The downward-sloped curves in the diagram show the marginal value per firm (*MV*) of implementing industrial policy; so they are something like demand curves for industrial policy. D_1 and D_2 show the marginal value curves for the two nations under study. The marginal value of industrial policy differs in the two nations, for example, perhaps country 1 has a well-functioning venture capital market that exploits many opportunities while country 2 has none, so the marginal value of industrial policy is systematically higher in country 2.

What levels of industrial policy would the two nations choose independently? If the marginal cost per firm (*MC*) of undertaking industrial policy is the same in the two nations (we assume this for simplicity), the government of country 1 would best serve its citizens by choosing IP_{d1} where the per-firm marginal value equals the per-firm marginal cost (*d* is a mnemonic for decentralised). The government of country 2 would choose a higher level of industrial policy, IP_{d2}. Contrast this with the situation of strict coordination in the sense of imposing the same level of industrial policy in both nations. The best one-size-fits-all policy is IP_c (*c* for coordinated), where the per-firm cost matches the average marginal value per firm (D_{avg}).

Plainly, the strictly coordinated outcome is inferior. Taking the decentralised choice as the initial situation, both regions are made worse off. Country 1 has too much industrial policy whereas country 2 has too little. The welfare loss of country 1 from coordination is reflected in the size of the triangle *A* (this measures the gap between the marginal value and the marginal cost integrated over the change in the level of policy). The loss of country 2 is shown by area *B*.

Figure 4. Diversity of preferences and decentralisation



Of course, it is possible for the central authority to choose separate industrial policies for the two nations, but then the best it can do is to reproduce the uncoordinated outcome. More important, however, the above discussion assumed that national governments and the central authority were perfectly well informed. In reality, neither is. But it is reasonable to assume that the cost of gathering information on national preferences for and costs of industrial policy is lower at the national than the EU level. It follows that even if coordination were successful in tailoring industrial policies to national conditions, formulating and implementing it would be more costly than uncoordinated national polices.

The general presumption is that coordinating industrial policy at the EU level is likely to be harmful or useless. Of course, strong spillovers can counter this presumption.

All in all, given the diversity across nations, the informational advantage that national governments have, and the difficulty of negotiating common policies in a group of nations as diverse as the EU, it is unlikely that the centralised policy choice would be as good as the decentralised one. We thus arrive at the general presumption that coordinating industrial policy at the EU level is likely to be harmful or useless. Of course, strong spillovers can counter this presumption. This takes us to cases where coordination could help.

2.3 Helpful coordination

2.3.1 Negative spillovers: beggar-thy-neighbour policies

Most international coordination of industrial policy in the EU and in the world more generally consists of what might be called mutual self-denial, that is, nations agree to prohibit beggar-thy-neighbour industrial policies. The EU's prohibition on most forms of direct state aid to industry is a classic example, along with the WTO's prohibition on export subsidies.

Consider an industrial policy that lowers the marginal costs of firms in a specific sector within a single nation. This policy will create negative pecuniary externalities for firms in other nations. In particular, the enhanced competitiveness of the favoured firms will depress the price of the good they produce in all markets – presuming the good is traded – and this will force un-favoured firms to accept both lower prices and lower sales. Of course, the welfare effects of this might be just the reverse – the nation pursuing this policy might end up losing as a whole and other nations might end up winning overall – but such policies are generally viewed as bad, and this for two distinct reasons. First, many governments act as if the interest of their industrial firms represented the interest of their nations. Second, even without this sort of political economy distortion, it is easy to argue that allowing such beggar-thy-neighbour policies would result in a non-cooperative outcome of the prisoner's dilemma type where all nations adopt expensive industrial policies merely to neutralise the effects of foreign industrial policy.

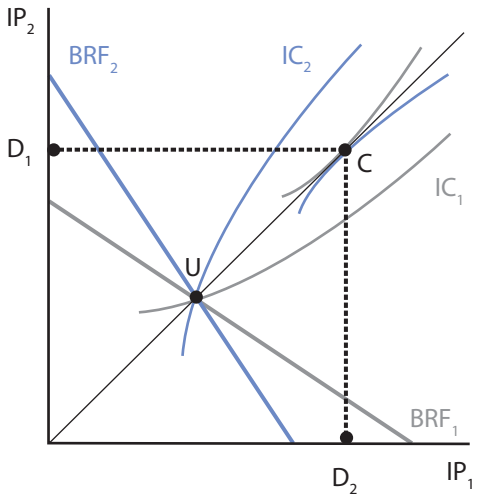
The Treaty of Rome prohibits an extremely wide range of such policies. These include not just proactive industrial policies that have direct effects on other Member States' markets, but also trade barriers that are meant to favour local firms in the local market. In terms of Figure 1, we have been considering industrial policies that are strategic complements, and agreement to refrain from such policies could be viewed as a move from *E1* to *E2*, with the bliss point being *B2*.

2.3.2 Positive spillovers: global public goods

A classic example of where coordination improves outcomes is the case of global public goods, such as the knowledge arising from research and development.

A classic example of where coordination improves outcomes is the case of global public goods. In the case of industrial policy, spending on research and development (R&D), especially on science and technology, has global public good aspects in the sense that one EU nation's spending bolsters the competitiveness of industrial firms in all EU nations. As R&D spending of one nation reduces other nations' incentive to spend on R&D too, we are thus considering industrial policies that are strategic substitutes in the parlance of Figure 1.

Figure 5. Coordinated *vs.* uncoordinated R&D spending



Consider the example of spending on basic research in the pharmaceutical industry. The knowledge created with the help of public money facilitates the development of new products in all of Europe's pharmaceutical companies, not just those in the nation paying for it. However, the cost of the funding falls solely on the paying nation. Figure 5 illustrates the situation.

The curve marked IC_1, shows the preferences of country 1 towards R&D spending by itself and country 2. The important part is that country 1 prefers every point above its *IC* since such points involve more spending by country 2 – which provides free spillovers for the firms of country 1 – for any given level of spending by country 1. The line marked BRF_1 (the best-reaction function) shows the best responses of country 1 for any given level of spending by country 2. The corresponding curves with the subscript '*2*' show the analogous constructs for country 2.

If the two nations set their R&D spending levels in an uncoordinated fashion, the outcome will be the point marked *U*; this is where country 1 is doing its best taken as given the spending of country 2 – and *vice versa*. In other words, the combination of R&D spending implied by point *U* is stable in the sense that neither nation would want to change its spending unilaterally.

Figure 5 illustrates the possible gains from coordinating nations' R&D spending: all points between the two *IC*-curves (northeast of *U*) are combinations of spending where both nations would be better off. Such points are called the region of mutual gain. How is it that nations would choose point *U* when both could be better off by choosing combinations of spending in the region of mutual gain? The logic explaining this is exactly akin to the logic behind the well-known prisoners' dilemma, and can be best described as a coordination failure.

Note that an outcome like *C* is unlikely to arise without some form of institutional commitment on the part of the two nations. If country 1 believed that country 2 would spend at the level implied by point *C*, the best unilateral move of country 1 would be to cut its spending to zero and free ride on the R&D spending of country 2. This is the deviation-from-coordination point D_1. Of course, as country 2 is symmetric, its best unilateral reaction to country 1 spending at point *C* would be to cut its spending down to zero (point D_2). This is where a supranational organisation like the EU comes into the picture. If EU nations can credibly commit to spending at point *C*, they will all be better off. For example, if nations simultaneously commit funds to the EU, the EU will spend it and all nations are better off. Note that without the EU, nations could probably succeed in some coordination involving a level of spending that is between *U* and *C*. The basic reason being that any 'cheating' by one nation could induces the other countries to revert to the uncooperative outcome. Thus, the losses each nation fears from the breakdown of coordination and the gains they enjoy when they coordinate provide the 'carrot and stick' necessary to maintain cooperation.

If all EU countries can credibly commit to spend a certain amount on global public goods, such as research and development, they will all be better off.

2.4 Other aspects shaping the pros and cons of coordinating industrial policy

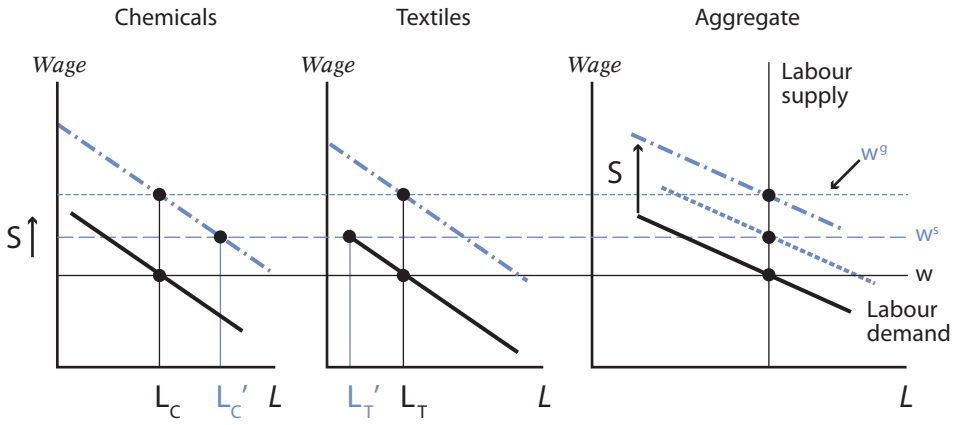
2.4.1 General *vs.* specific industrial policy

When it comes to prohibiting and thus coordinating industrial policies – especially subsidies – it is important to distinguish between general (or horizontal) and specific (or vertical) policies. Policies applied to all sectors are called general policies and those applied to only some sectors are called specific policies. General policies will lead to wage adjustments that fully, or at least largely, offset the initial competitiveness effects of such policies. As a result, there is a general presumption that general policies are less likely to be beggar-thy-neighbour policies.

To illustrate the point, consider a nation with two industries, chemicals and textiles, whose prices are fixed by international trade. In Figure 6, the solid lines show the labour demand curves for each industry in the two left-hand panels and the nation's aggregate labour demand in the right-hand panel. The right-hand panel also shows the nation's labour supply curve with a solid line. It is vertical since we suppose, for simplicity, that the supply of labour does not rise with an increase in wages. The equilibrium wage is *w* and employment in the two sectors is L_C and L_T.

Consider now the impact of a general wage subsidy, i.e., one that applies to both sectors. This lowers the marginal production costs and thus raises the value of the marginal productivity of workers by the amount of the subsidy *S*. In Figure 6, this leads to an upward shift in the labour demand curves (the dashed lines). In essence, this is because the general wage subsidy enables firms in both sectors to offer higher wages. What are the effects on equilibrium wages and employment? Since the aggregate supply of labour is fixed, the equilibrium wage in both sectors rises by the full amount of the subsidy, reaching w^g (*g* stands for 'general'), and aggregate and sectoral employment remains unchanged. In other words, a general equilibrium change in production costs (the wage hike) will exactly offset the general wage subsidy. In sum, in this simplified world, a general subsidy would have no impact on the nation's production pattern and thus would have no negative effects on industry in other nations. It follows that the issue of coordination does not arise.

Figure 6. General *vs.* specific industrial policy



If the wage subsidy, by contrast, is specific to one sector, the outcome is quite different. Suppose the chemicals sector gets the wage subsidy but the textile sector does not. In this case, the chemical industry's demand for labour corresponds to the dashed line. Like a general subsidy, the specific subsidy enables chemicals firms to offer higher wages for a given level of employment. By contrast, textile's labour demand curve remains unchanged and thus corresponds to the solid line. The aggregate labour demand curve is the dotted line shown in the right-hand panel; for obvious reasons, it lies between the solid line and the dashed line.

Sector-specific industrial policy is coordinated in the EU in the sense that it is generally forbidden.

What are the effects on equilibrium wages, aggregate employment, and employment in each sector? The nation's wage would rise somewhat, to w^s (*s* stands for 'specific'). With labour mobility across sectors, the nation's textile sector becomes less competitive as there is no subsidy to offset the increase in nation-wide wages. But with an increase in equilibrium wages, textiles' labour demand shrinks along the solid demand curve and employment in the textile sector drops to L'_T. By contrast, the competitiveness of the chemicals sector rises because the wage hike does not fully offset the subsidy paid to firms in the chemicals sector. Employment and output of chemicals rises, with employment reaching L'_C. The nation's trade partners would complain that this specific policy gave the nation's chemicals producers an unfair advantage. For this reason, this sort of sector-specific industrial policy is coordinated in the EU in the sense that it is generally forbidden.

Some caveats and complications are worth mentioning. The diagram used above yields the unambiguous result that general policies do not distort competition. The real world, as always, is much more complex and most of these complexities suggest that even general policies can have distortionary effects (for instance, if the labour supply curve slopes upward). All in all, in a more

realistic model, even general policies can distort competition, but the size of the distortion is likely to be small as long as policies are indeed 'general'.

We have mentioned above that the Treaty of Rome prohibits an extremely wide range of policies that have direct effects on other EU members' markets or aim at favouring local firms in the local market. But such coordination stretches beyond the EU, an issue we sketch next.

2.4.2 WTO obligations

EU nations are members of the World Trade Organization (WTO) and, thus, any EU industrial policy must be informed of WTO strictures.

EU nations are members of the World Trade Organization (WTO) and signatories to the General Agreements on Tariffs and Trade (GATT). Under the WTO/GATT (WTO from here on), nations are not allowed to provide subsidies and engage in policies that distort international trade. But since trade is just the difference between national production and national consumption, and the whole point of industrial policy is to foster industrial production, any discussion of industrial policy must be informed of WTO strictures.

WTO rules discipline the use of subsidies, and regulate the actions nations can take to counter the effects of subsidies. According to the WTO, a policy is a subsidy when it involves a financial contribution, when this financial contribution comes from a government, and when the policy provides a benefit to the receiving firms. A key concept here – a concept that is also very much a part of the EU's rules on subsidies – is the concept of a 'specific' subsidy. This is a subsidy obtainable only by an enterprise, industry, group of enterprises, or group of industries in a particular nation. General subsidies – investment tax credits, for instance – are not subject to WTO discipline since there is a presumption that general equilibrium price adjustments will offset the policy's impact on trade. A further distinction must be made between production and export subsidies.

According to the WTO, subsidies fall into two bins, 'prohibited' and 'actionable'. Prohibited subsidies are designed to distort international trade, either by promoting exporters, or by promoting local goods at the expense of imported goods. It is important to note that a strict interpretation of WTO rules suggests that almost all forms of industrial policy of the EU and its member would be prohibited or actionable.

2.4.3 Competition policy as industrial policy

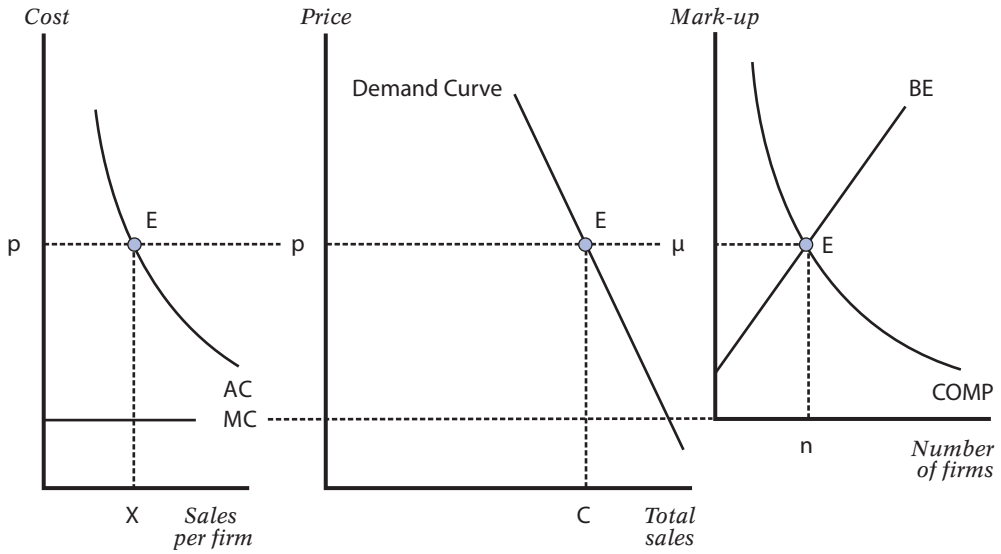
Policy makers tend to view preserving industrial firms by shielding them against competition as an obvious way of promoting industrial production. Although this might be well-intended, it can be a self-defeating policy. What is more, promoting competition can be considered a welfare-enhancing industrial policy. This sub-section sets out why.

The gist of the argument is as follows. Protecting firms against competition results in too many, too small firms that must charge high prices to compensate for their inability to reap scale economies. High prices result in lower demand and production and, thus, protecting existing firms can result in lower industrial production. One clear real-world example was seen in telecom services. Before liberalisation, each European nation had its own monopoly provider, services were expensive since firms were small and, as a result, consumers did not spend much on telecoms. With the liberalisation of telecoms, competition has forced a massive industrial restructuring, increase in the size of firms, and reduction in the price of services. The result has been a boom in the amount of telecom services produced and consumed in Europe.

Working through the logic of this argument, however, is tricky. The task is eased by using a diagram in which the number of firms (assumed to be identical for simplicity), firms' mark-up of prices over

marginal cost, the scale of firms, and aggregate production are determined. The diagram, shown in Figure 7, draws on Baldwin and Wyplosz (2004).

Figure 7. Prices, output, firm size, and number of firms in a closed economy



Source: Baldwin and Wyplosz (2004)

The diagram has three panels. The middle panel is the simplest so that is where we start. It shows the demand curve facing the sector. To keep things simple, we assume that Europe is closed so that total consumption equals total production. In this way, the middle panel tells us what total production will be, once the price is determined.

The left panel shows the average and marginal cost curves for a typical firm in an industry characterised by economies of scale. We assume that the number of firms adjusts to eliminate pure profits, so in equilibrium a firm's scale of production must be such that its average cost equals the price it receives.

The right panel is the most intricate of the three. On its vertical axis, this panel has the mark-up, i.e., the difference between price and marginal cost. On its horizontal axis, it measures the number of identical firms. The COMP curve shows the equilibrium combination of mark-up and number of firms assuming Cournot competition. Plainly, COMP slopes downward since more competitors push down the mark-up that each firm can charge. The BE curve shows for alternative mark-ups the number of identical firms that break even at this mark-up, with break even meaning that price equals average cost. The BE curve slopes upward because as the number of firms rises, sales per firm fall, average costs of the typical firm goes up and, thus, firms would need a higher mark-up in order to cover their fixed costs.

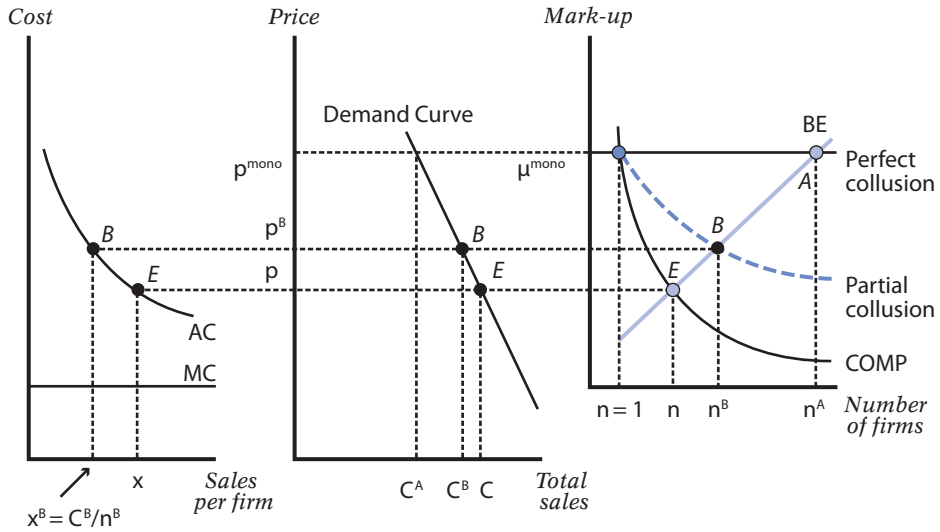
The equilibrium *E* in the three panels identifies the equilibrium number of firms (n), mark-up (μ), price (p), firm size (x), and total output/consumption (C).

We can use the BE-COMP diagram to explain how competition policy can promote industrial production and why competition policy can be considered an industrial policy. To make the point, let us recall that the COMP curve in Figure 7 assumed Cournot competition, that is, firms do not

collude. We turn now to considering the possibility that firms collude. To fix ideas, we first consider extreme collusion, i.e., perfect collusion in which a cartel of all firms manages to maintain the monopoly price and share out production among all firms.

If all firms could perfectly coordinate their sales, they would charge the monopoly price and divide up the market. This type of behaviour is illustrated in the BE-COMP diagram with the 'perfect collusion' line shown in Figure 8. This line extends horizontally since it assumes that the market always equals μ^{mono} regardless of the number of firms. Note that the monopoly mark-up is given by the point on the COMP curve where *n=1*. The equilibrium number of firms under perfect collusion – i.e., the maximum number of firms that could break even under perfect collusion – is given by point *A*. The level of industrial production under perfect collusion is shown by point C^A.

Figure 8. Industrial restructuring induced by competition policy



Source: Baldwin and Wyplosz (2004)

Starting from this situation, consider the impact of an EU-wide competition policy that breaks up the cartel. If the competition policy were completely effective, the situation would move to *E*. The result would be a severe drop in the number of firms, but since the mark-up and price fall, the sector's total output rises to *C*. Firms are able to break even in this more competitive, lower price environment since the industrial restructuring has resulted in fewer, bigger firms with lower average costs.

Competition policy in an industry characterised by scale economies results in lower prices and costs, higher output, and a smaller number of more efficient firms.

If competition policy is imperfect and some collusion prevails, we would get an intermediate outcome: industrial output would be larger (smaller) and the number of break-even firms smaller (larger) than in a situation of perfect collusion (competition policy). In Figure 8, this outcome is labelled as 'partial collusion' and the associated equilibrium is denoted with *B*.

Where does policy coordination come into the picture? Consider the implementation of a perfect competition policy starting from point *A* in Figure 8. We know that the number of firms will fall from n^A to *n*, but which nation's firms will survive?

To be concrete, suppose the EU consists of only two nations, each with an equal number of firms to start with. If there are some natural trade barriers between the two markets (this means stepping slightly out of the assumption behind the diagram), and one nation pursues a less aggressive,

or delayed competition policy than the other nation, there will be a tendency for fewer firms to exit in the nation that pursues a laxer policy. In the end, the overall number of firms will fall to something like *n*, but the share of industrial production in the nation with the lax policy will be greater, potentially much greater. It is possible that something like this is going on in the electricity and water markets in Europe.

EU-wide competition rules are important in preventing beggar-thy-neighbour competition policy.

The problem with this uncoordinated response is that fear of such an outcome might make both nations hesitate to committing to a competition policy that would be in both their interests. In this sense, EU-wide competition policy is important in so far as it lets members believe that market forces rather than devious national policies will lead industrial restructuring. Without such assurances, it is unlikely that EU members would allow deeper market integration to go ahead. Or, to put it differently, EU-wide competition rules are not so important in what they can achieve compared to what national competition policies could, they are important in what they prevent – beggar-thy-neighbour competition policy.

It is worthwhile to finish with a brief analysis of the welfare implications of an EU-wide policy that succeeds in fostering competition. To this end, we look at the welfare changes resulting from industrial restructuring that proceeds from perfect collusion via partial collusion to Cournot competition. In Figure 8, this is the move along the BE curve from *A* to *B* and finally *E*. Note first that in our simplified model firms' profits do not change: while the number of firms falls as the industry approaches *E*, those firms operating in the market just break even – there are no excess profits. In a sense, firms share the fate of the hero in the movie 'Life of Brian' – they start with nothing and they end up with nothing. This implies that it is the change in consumer surplus that determines the impact on society's welfare. In this respect, the message transpiring from the middle panel of Figure 8 is clearly positive: with a decline in prices and an increase in consumption, the consumer surplus – measured by the usual area under the demand curve – continuously increases. While measured in the middle panel of Figure 8, the source of this welfare gain is shown in the left-hand panel, namely the realisation of scale economies and the associated decline in average production costs. To conclude, while our simple framework inevitably abstracts from real-life complications – for instance that industrial restructuring is not without frictions but comes with adjustment cost – it seems fair to conclude that, ultimately, competition policy as an industrial policy has lot to offer to EU nations.

3. Delegation *vs.* coordination

So far, we have viewed coordination in an institutional vacuum – the issue was whether EU nations should coordinate their policies or whether each nation should set its own policy. One of the key insights emerging from this discussion is that coordination makes sense in some cases but not in others. What is more, the merits of coordination might vary over time for a particular issue. In practice, most coordination – notably of industrial policies – is done by getting nations to agree on policies. There are cases, however, where the cost of policy coordination is so high that nations delegate the policy to a supranational body.

To set the scene, let us look at a clear-cut case for delegation of a non-industrial policy, that is, monetary policy in the eurozone. Before the euro was introduced, national central banks in Europe coordinated their policies. They did so since coordination was viewed as providing economic benefits that outweighed the costs of adopting a one-size-fits-all monetary policy. However, as the exchange rate crises of the 1990s showed, the cost of coordination without delegation can sometimes be quite high. The ultimate response was to delegate monetary policy to the EU level.

This, in essence, was more a change in the decision-making procedure than a change in the policies adopted. In the run up to adopting the euro, EU central banks were following almost identical monetary policies (as gauged by interest rates). When the euro was introduced, the main change was in how the common policy was decided. Before EMU, each central bank governor decided on the nation's monetary policy in coordination with other central bank governors. In EMU, governors are deciding – together with the executive board of the European Central Bank – while sitting in the same room.

Another example for delegation rather than coordination is EU trade policy, with the Common External Tariff not set at the national but the EU level. Here again, one could in theory at least think of coordination of different national trade policies. However, coordination in this case would be rather difficult and cumbersome, especially if it allowed for differences in external trade policies to exist among EU members. A common trade policy with, in particular, a single external tariff, is also a way to help trade integration among EU countries (by avoiding the problems of the rules of origins for example). Hence, delegation makes sense as it has been decided *ex ante* that trade policies of member countries should be identical.

There are EU policies where delegation coexists with coordination.

And then there are EU policies where there is delegation alongside coordination. For example, EU members have decided to coordinate some aspects of their regional policies in the form of the 'structural funds'. The level of spending for the EU and its allocation among members is decided at the EU level. But the choice of individual projects is decided in national capitals, although these choices are guided by general guidelines and objectives set at the EU level. This example also nicely illustrates the key difference between coordination and delegation. When the EU decides in the context of its Financial Perspective (the EU's seven-year budget) on the size and allocation of structural funds, the decision-making rule is unanimity and agreement is difficult. But since it is absolutely essential that all members agree on the amount of funds and its allocation, the decision must be delegated to the EU level. The choice of individual projects in each nation could also benefit from coordination at the EU level, but getting unanimous decision on these projects would be so difficult and time consuming that the cost of deeper coordination would outweigh its gains.

When it comes to industrial policy, the relevant example is surely that of structural funds. There are merits from coordinating industrial policy at the EU in a general manner, for instance with a view to avoiding beggar-thy-neighbour industrial policies. But the choice of individual projects involves local knowledge and local spillovers, so fusing the national decision-making into a single EU body is likely to yield greater decision-making costs without substantially improving policy choices.

4. Coordination and the localness of industrial policy spillovers

4.1 Defining localness

The main conclusion emerging from of the previous sections is that coordination should be the exception rather than the rule. Given the endemic problem of information asymmetries and the disciplining effect of jurisdictional competition on special interest groups, it is probably a good idea to presume that policies should not be coordinated unless a strong case can be made in favour of coordination. If nothing else, the time and energy needed to coordinate detailed industrial policies among nations as diverse as the 25 EU members should be enough to suggest that decentralised policies should be the general presumption.

Having said this, it is important to analyse in greater detail the scope of spillovers associated with national industrial policies. This will provide a better understanding of when coordination does not make sense and when it does. What is more, it will provide a framework for thinking about which types of policies would be good candidates for coordination.

Industrial policy spillovers can be local in the sense of only affecting firms in a well-confined geographical area or narrow sectors.

A key principle guiding this analysis is that spillovers and industrial policies can be local in two senses of the word. For one thing, they can be local in the standard spatial sense, i.e., they only affect firms in a well-confined geographical area, a city, a region, or a nation – for instance. For another, they can be local in the sense of only affecting narrow sectors. Using this distinction, we examine, first, spillovers and industrial policies that affect output markets and, second, those that are relevant for factor inputs.

4.2 Industrial policy spillovers and the localness of outputs

Because most manufactured goods are easily traded, few pro-manufacturing policies have purely local effects. There is, nonetheless, a range of localness. When it comes to negative spillovers – the most common one being 'unfair competition' effects propagating through goods markets – there is a close link between the cost of trading the good and the extent of spatial localness of the policy's effect. But quite independent from the spatial reach of spillovers and industrial policies, spillovers and policies might affect only a narrow range of firms, or a narrow sector. Combining spatial and sectoral dimension, we can think of five distinct cases, as illustrated in Figure 9.

Case A: no spatial and sectoral spillovers. Consider a policy that has only very local effects in both the spatial and the sectoral dimension. A direct subsidy to a gravel quarry in France's *Haute Savoie*, for example, would promote industrial output. The spillovers of this policy, however, would be limited. Gravel is relatively expensive to transport over long distances, so the subsidy is unlikely to have negative effects on other regions and nations. As to the sectoral impact of such a subsidy, gravel is highly local since it is not used as an input in many other sectors. Moreover, gravel tends to be an input only in non-traded goods, such as roads.

Under WTO rules, a subsidy to a particular gravel pit is actionable, and under EU rules it is probably prohibited. But since no one is likely to complain about it, it is not a good candidate for coordination. Indeed, given the general lack of positive or negative spillovers it is probably best to leave such policies to the discretion of EU member states.

Case B: positive spatial spillovers but no sectoral spillovers. One example is a subsidy to foster drug-development technologies in the pharmaceutical sector. The effect is local in the sectoral sense since it only helps pharmaceutical firms develop drugs, but it helps such firms in all nations (even if it is under patent). This is a classic example of the sort of vertical industrial policy that would benefit from coordination to mitigate free-rider behaviour. Moreover, even if this policy would be actionable since it is specific, it is unlikely to be challenged since it benefits firms around the world.

Case C: negative spatial and narrow sectoral spillovers. In this category, we find most of the commonly prohibited industrial polices. A classic example is a nation-specific production subsidy or tax-break in a traded goods sector. For example, if one EU nation were to subsidise the production of cars, carmakers in the rest of the EU – and indeed in the world – would be harmed as they would sell fewer cars at a lower price than they would without the subsidy. EU and WTO rules forbid such

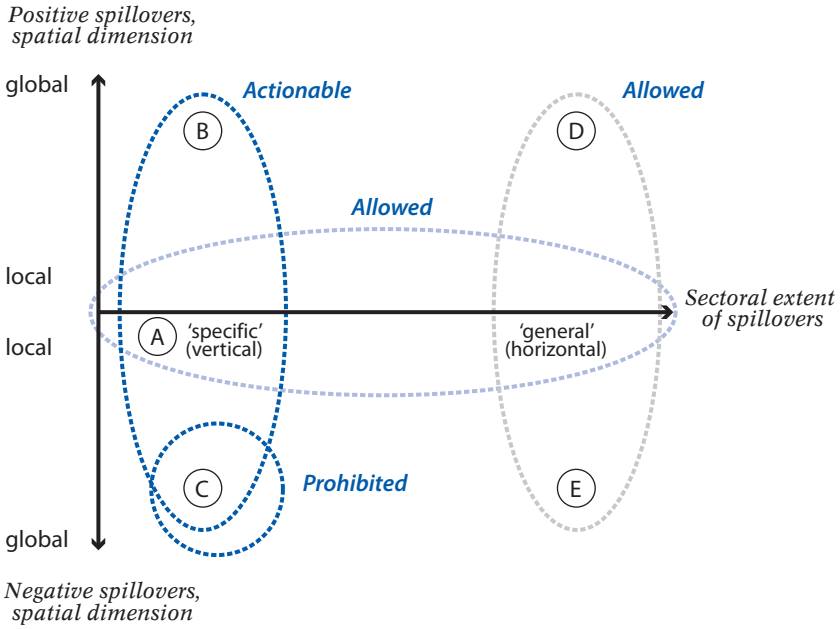
subsidies, and the injured firms are sure to complain. In this case, industrial policy is coordinated but in the sense of a coordinated prohibition of the industrial policy.

Case D: positive spatial and sectoral spillovers. An example of a policy with positive effects across spatial locations and sectors is an educational system that produces a few world-class scientists and engineers, France's *École Polytechnique* for instance. The graduates of such schools tend to work in industry and laboratories producing new knowledge that is useful in a variety of industrial activities. However, not all of them work in France and even those who do often produce knowledge that promotes industry worldwide. Again, the free-rider problem suggests that too little of such training is done, so coordination could well be welfare enhancing.

Case E: negative spatial and sectoral spillovers. This is the mirror image of the previous case. In the enlarged EU, it is often asserted that low social charges and corporate taxes in new EU members harm the industrial competitiveness of 'old' members. As the analysis in Figure 3 showed, there is some truth to this, in which case this sort of 'system competition' might well constitute an industrial-policy example in region *E* of Figure 9. For such policies, coordination has, in principle, the potential to make all nations better off. In practice, however, there is a genuine risk that political expediency leads governments to coordinate on too high a level of social charges and taxes, thereby equalising industrial competitiveness across EU nations at the price of undermining Europe's competitiveness as a whole.

Coordinating social charges and corporate taxes of EU members is liable to lead to a level of social charges and taxes that would undermine Europe's competitiveness as a whole.

Figure 9. Two dimensions of localness of industrial policy spillovers



To conclude the discussion of the localness of industrial policy spillovers on output markets, we have seen that specific industrial policies often create negative pecuniary externalities that lead nations to coordinate on their prohibition. This has shifted the focus to general, i.e., horizontal policies. Some of these policies affect output directly. For example most nations provide some sort of tax credit or accelerated depreciation allowance for capital investments. Much of industrial policy, however, concerns inputs, so it is worth thinking through the basic logic of how the promotion of certain types of inputs can affect a nation's industrial base. This takes us to industrial policy spillovers and the localness of inputs.

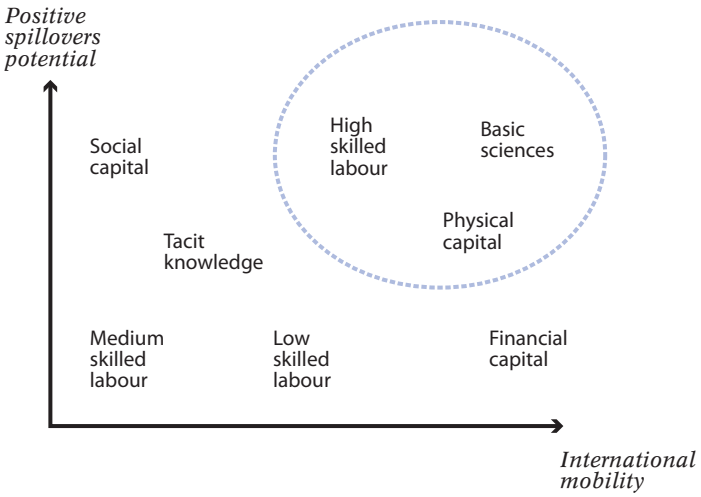
4.3 Industrial policy spillovers and the localness of inputs

In analysing input-oriented industrial policies, it is useful to consider input factors along two dimensions: their mobility and their spill-over potential.

Two questions will be of concern here: first, what are the chances of an input-oriented industrial policy to succeed in promoting industrial production and employment in the jurisdiction of the government implementing it and, second, to what extent should such policies be coordinated among nations? In answering these questions, an important consideration concerns the mobility of the inputs promoted by the policy and policy spillovers. We thus consider factors of production in two dimensions – their mobility and their spill-over potential.

Figure 10 presents a schematic depiction of the features of seven productive factors: three types of labour, two types of knowledge, and three types of capital. The main purpose of this diagram is to help organise thinking about the effects of various input-promoting industrial policies.

Figure 10. Mobility and spill-over potential of inputs



The idea of this diagram is to suggest that one way to think about desirable types of industrial policy and the need to coordinate them is to consider their combination of mobility and spillovers. At one extreme, an industrial policy that promoted a nation's financial capital would have little local effect on industrial production. The point is that the newly created capital would flow to the nation where its reward would be highest. As a result, much – maybe even most – of the effect of this industrial policy would be to boost industrial production in other nations. Since the promoting nation has to pay for the policy but gets little of the benefit, this sort of scheme will be unpopular with individual nations. But of course this is also a reason to coordinate if it turns out that financial capital is crucial to industrial output, a proposition that we doubt.

Contrast this with the impact of promoting basic scientific and technological knowledge. Such knowledge is easily transported around the world and so it is highly mobile. However, the benefits of employing it are not localised; this sort of knowledge often creates important positive spillovers for industry in other nations. We could think, for instance, of new intermediate products that facilitate the introduction of new products and, more generally, new products and processes across the world. Advances in material sciences are an example of this. Hence, public spending on R&D is a natural candidate for coordination as illustrated by Figure 5. The possible mutual gain from coordination, measured by the distance between the two indifference curves, would be large.

Moving down the mobility scale, physical capital is internationally less mobile than both financial capital and basic scientific knowledge, especially after it is sunk, and it has intermediate spillovers. High-skilled labour is next, but it combines comparatively low international mobility with a reasonably high degree of spillovers. This combination is one of the reasons why almost all governments believe that subsidising technical and business education is one of the best ways to promote their nation's industrial competitiveness. Although highly educated workers do switch nations, they are far more attached to the nation who paid for their education than, for instance, financial capital. Hence, in terms of gains from coordination (in terms of Figure 5, the distance between the two indifference curves), education for high-skilled labour would certainly range between basic science and promotion of financial or physical capital.

Tacit knowledge is the next in the schematic diagram. Tacit knowledge is a slippery concept, but this is on purpose. It is meant to represent the knowledge that seems to encourage spatial clustering of production – in Silicon Valley and Northern Italy, for instance. This knowledge is difficult to promote directly, but it has the great advantage of being unlikely to leave the nation once it has been created. This unique combination explains why so many nations are trying to create industrial clusters, or hubs. The gains from coordination are therefore certainly quite low except for possible transnational clusters.

The position of medium-skilled and low-skilled labour requires little comment. Low-skilled workers are relatively mobile in today's Europe, at least relative to medium-skilled workers (craftsmen, mechanics, and so on). Neither medium-skilled nor low-skilled labour generates much spillovers in the sense of there being large differences between the social and private returns to these types of labour.

Finally, each nation, and indeed each location in each nation, has 'social capital' and this affects the appeal of the location for workers and firms alike. What is social capital? A great deal of human interaction, not only in the sphere of economics, depends upon factors like trust and reliability. Clearly, the extent to which societies are marked by these intangible factors varies enormously. If a citizen forgets his wallet at a bar in a small village in the north of Sweden, she is almost certain to get it back within hours. If the same happened in the centre of Rome, the outcome could be, but need not be, as happy. Since economic interactions require trust, too, a sense of social justice and trust can be an important magnet for economic activity. In essence, good social capital lowers transaction costs and thus fosters economic activity. On the spillovers scale, social capital is very localised, but it provides benefits across most sectors. The gains from coordination would certainly be very low.

All told, high international factor mobility makes it difficult for individual nations to fully appropriate the positive effects of policies that promote mobile inputs. This undermines nations' efforts to raise the quantity and quality of such inputs. What makes the situation worse is that each nation thinks it could free ride on the efforts of other nations. It follows that coordinating policies in support of factor inputs is most important when international factor mobility and spillovers are large, such as in the case of basic science, high-skilled labour, and physical capital.

Coordinating policies in support of factor inputs is most important when international factor mobility and spillovers are large.

5. Conclusions and policy implications

Industrial policy is something all nations do. Since the effects of one nation's industrial policies are not entirely limited by its borders, the effects of industrial policies overlap. In principle, this

suggests that coordinating industrial policies at the EU level might be a good idea. But would it be a good idea in practice?

While it is in general not possible to say whether industrial policy coordination is good or bad, the EU has no need to set up a new structure for coordinating industrial policy.

The spillovers from national industrial policies can cause helpful or harmful competition among policy makers and helpful or harmful interactions among the targeted industries. It is not in general possible to say whether industrial policy coordination is good or bad. Note that this ambiguity is not a universal feature of all policy. For example, the case for coordinating external trade policy in a customs union like the EU is ironclad. Nothing but harm could come from allowing each EU nation to decide its own external trade policy.

While the benefits of industrial policy coordination are not easy to pin down in general (although they can be quite obvious for certain cases such as Galileo), we can be quite sure that reaching agreement at the EU level on any type of policy – trade policy, monetary policy, or industrial policy – would be a very costly exercise in terms of time and political goodwill.

The contrast between the vagueness of the benefits of coordination and the surety of the decision-making costs leads to some clear policy conclusions. First, there will be instances of industrial policy in which European-wide coordination will yield large benefits. In these cases, the benefits of teaming up will outweigh the costs of agreeing to and adopting a unified policy. Second, in most cases of industrial policy, the cost of coordination – both economic and political – will outweigh the benefits. Third, the combination of the first two points suggests that the EU has no need to set up a new structure for coordinating industrial policy. In the few cases where the merits of coordination are obvious, they will be obvious to all and *ad hoc* cooperation will work.

References

Baldwin, R. and Wyplosz, C. (2004). *The economics of European integration,* McGraw Hill, London, UK.

Brander, J.A. and Spencer, B.J. (1985). "Export subsidies and international market share rivalry". *Journal of International Economics,* (18), pp. 83-100.

Canzoneri, M. and Henderson, D. (1991). *Noncooperative monetary policies in interdependent economies,* MIT Press, Cambridge, USA.

Canzoneri, M., Cumby, R., and Diba, B. (2006). "The need for international policy coordination: What's old, what's new, what's yet to come". *Journal of International Economics,* (forthcoming).

Leahy, D. and Neary, J.P. (2001). "Robust rules for industrial policy in open economies". *Journal of International Trade and Economic Development,* (10:4), pp. 393-409.

Rodrick, D. (2004). "Industrial policy for the twenty-first century". CEPR Discussion Paper No. 4767.

Rogoff, K. (1985). "Can international monetary cooperation be counterproductive?". *Journal of International Economics,* (18), pp. 199-217.

Spaak, P-H. (1956). "Rapport des chefs de délégation aux ministres des affaires étrangères" (the Spaak Report, 21 April 1956), pp. 9-135.

Economic and Financial Reports*

Report 2005/03	**Gerti Dudkin and Timo Välilä,** *"Transaction Costs in Public-Private Partnerships".*
Report 2005/02	**Eric Perée and Timo Välilä,** *"Fiscal Rules and Public Investment".*
Report 2005/01	**Timo Välilä and Aaron Mehrotra,** *"Evolution and determinants of public investment in Europe".*
Report 2004/02	**Alfred Steinherr, Ali Tukel and Murat Ucer,** *"The Turkish Banking Sector: Challenges and Outlook in Transition to EU Membership".*
Report 2004/01	**Federico Galizia,** *"Systemic credit risk in the presence of concentration".*
Report 2003/02	**Federico Galizia,** *"Measuring the "financial gap" of European corporations: an update".*
Report 2003/01	**Rien Wagenvoort,** *"Bank Survey evidence on bank lending to SMEs in the European Union".*
Report 2002/02	**A. Rossi, G. Bichisao & F. Campolongo,** *"Hedge accounting within IAS39".*
Report 2002/01	**Luisa Ferreira de Almeida & Patrick Vanhoudt,** *"Catching the Celtic tiger by its tail".*
Report 2001/03	**Eric Perée & Alfred Steinherr,** *"The euro and capital markets: A new era".*
Report 2001/02	**Federico Galizia & Dermot O'Brien,** *"Do capital expenditures determine debt issues?"*
Report 2001/01	**Federico Galizia with Thomas Steinberger,** *"The "savings gap" of European Corporations: A first look at the available data".*
Report 2000/02	**Christopher Hurst & Kristian Uppenberg,** *"Investment issues in south-eastern Europe".*
Report 2000/01	**Dermot O'Brien & Rien Wagenvoort,** *"Some empirical findings on the characteristics of cost-efficient credit institutions".*
Report 99/P3	**Carsten Sprenger,** *"Direct investment and the eastern enlargement of the EU".*
Report 99/P2	**Daniel Piazolo,** *"The credibility and growth effects of EU institutions for Eastern Europe".*
Report 99/P1	**Hendrik Hassheider,** *"Private sector investment as a means of financing Trans-European Networks".*
Report 99/02	**Rien Wagenvoort & Paul Schure,** *"The recursive thick frontier approach to estimating efficiency".*
Report 99/01	**Paul Schure & Rien Wagenvoort,** *"Economies of scale and efficiency in European banking: New evidence".*
Report 98/05	**Daniel Ottolenghi,** *"Walking a tightrope: Financial liberalisation in Mediterranean countries".*
Report 98/04	**Christian Keuschnigg,** *"Venture capital: A case for investment promotion".*
Report 98/03	**Roman Arjona, Pascale Viala & Rien Wagenvoort,** *"Small business finance and the European financial environment: Some empirical evidence".*
Report 98/02	**Alfred Steinherr & Roman Arjona,** *"The impact of European Monetary Union on the development of the Mediterranean zone".*
Report 98/01	**Marco Buti, Lucio R. Pench & Paolo Sestito,** *"European unemployment: Contending theories and institutional complexities".*
Report 97/05	**Mireille Fischbach & Maria Scattaglia,** *"Financial flows to Eastern Europe: Determinants, volatility and sustainability issues".*
Report 97/04	**Mirela Keuschnigg,** *"Banking in Central and Eastern Europe".*
Report 97/03	**Gregorio Impavido,** *"Pension funds and stock market development in Eastern Europe: Is there a link?".*
Report 97/02	**Agnès Belaisch & Kristian Kjeldsen,** *"Value-at-risk models for determining capital adequacy: Does allowance for correlation within broad risk categories matter?".*
Report 97/01	**Agnès Belaisch,** *"Why are long-term interest rates so high in Europe?".*

Economic and Financial Reports are preliminary material circulated to stimulate discussion and critical comment.

*As from 2004, EFRs are available in electronic format only.

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895

www.eib.org/efs

EIB Papers 2006

Volume 11, Number 2, 2006: An industrial policy for Europe? From concepts to action

Timo Välilä, *"No policy is an island – on the interaction between industrial and other policies"*
Andreas Strohm, *"Competition policy at war with industrial policy?"*
Otto Toivanen, *"Innovation and research policies:two case studies of R&D subsidies"*
Jordi Gual & Sandra Jódar, *"Vertical industrial policy in the EU: an empirical analysis of the effectiveness of state aid"*
Ha-Joon Chang, *"Industrial policy in East Asia – lessons for Europe"*
Christopher Allen, Didier Herbert & Gert-Jan Koopman, *"The European Commission's new industrial policy"*

Volume 11, Number 1, 2006: An industrial policy for Europe? Context and concepts

Armin Riess & Timo Välilä, *"Industrial policy: a tale of innovators, champions, and B52s"*
James Foreman-Peck, *"Industrial policy in Europe in the 20th century"*
Olivier Debande, *"De-industrialisation"*
Elie Cohen, *"Theoretical foundations of industrial policy"*
Charles Edquist & Cristina Chaminade, *"Industrial policy from a systems-of-innovation perspective"*
Richard Baldwin & Philippe Martin, *"Coordination of industrial policy in the European Union"*

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895

www.eib.org/efs

EIB Papers 2004 – 2005

Volume 10, Number 2, 2005: Innovative financing of infrastructure - the role of public-private partnerships: lessons from the early movers

Armin Riess, *"Is the PPP model applicable across sectors?"*
Paul A. Grout, *"Value-for-money measurement in public-private partnerships"*
Patricia Leahy, *"Lessons from the Private Finance Initiative in the United Kingdom"*
Rui Sousa Monteiro, *"Public-private partnerships: some lessons from Portugal"*
Andreas Brenck, Thorsten Beckers, Maria Heinrich, Christian von Hirschhausen, *"Public-private partnerships in new EU member countries of Central and Eastern Europe"*
Campbell Thomson, *"Public-private partnerships: prerequisites for prime performance"*

Volume 10, Number 1, 2005: Innovative financing of infrastructure - the role of public-private partnerships: infrastructure, economic growth, and the economics of PPPs

Timo Välilä, Tomasz Kozluk, & Aaron Mehrotra, *"Roads on a downhill? Trends in EU infrastructure investment"*
Ward Romp & Jakob de Haan, "*Public capital and economic growth: a critical survey"*
Christophe Kamps, "*Is there a lack of public capital in the European Union?"*
Timo Välilä, *"How expensive are cost savings? On the economics of public-private partnerships"*
Mathias Dewatripont & Patrick Legros, *"Public-private partnerships: contract design and risk transfer"*

Volume 9, Number 2, 2004: The internationalisation of production in Europe: Case studies of foreign direct investment in old and new EU members

Frank Barry, *"Export-platform FDI: the Irish experience"*
Thierry Mayer, *"Where do foreign firms locate in France and why?"*
Magdolna Sass, *"FDI in Hungary: the first mover's advantage and disadvantage"*
Gábor Hunya, *"FDI in small accession countries: the Baltic states"*

Volume 9, Number 1, 2004: The internationalisation of production in Europe: Causes and effects of foreign direct investment and non-equity forms of international production

Armin Riess & Kristian Uppenberg, *"The internationalisation of production: moving plants, products, and people"*
Zbigniew Zimny, *"Long-term trends in international production"*
Kristian Uppenberg & Armin Riess, *"Determinants and growth effects of foreign direct investment"*
Jozef Konings, *"The employment effects of foreign direct investment"*
Ari Kokko & Patrik Gustavsson, *"Regional integration, FDI, and regional development"*

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895

www.eib.org/efs

EIB Papers 2002 – 2003

Volume 8, Number 2, 2003: Europe's changing financial landscape: The financing of small and medium-sized enterprises

Rien Wagenvoort, *"SME finance in Europe: introduction and overview".*
Rien Wagenvoort, *"Are finance contraints hindering the growth of SMEs in Europe?".*
Ulrich Hommel & Hilmar Schneider, *"Financing the German Mittlelstand".*
Michel Dietsch, *"Financing small business in France".*
Luigi Guiso, *"Small business finance in Italy".*

Volume 8, Number 1, 2003: Europe's changing financial landscape: Recent developments and prospects

Eric Perée & Armin Riess, *"The transformation of finance in Europe: introduction and overview".*
Thorsten Beck, *"Stock markets, banks, and economic development: theory and evidence".*
Graham Bishop, *"The role and development of EU capital markets".*
E. Philip Davis, *"Institutional investors, financial market efficiency, and financial stability".*
Arnoud Boot, *"Restructuring in the banking industry with implications for Europe".*

Volume 7, Number 2, 2002: The financial integration of an enlarged EU: Macroeconomic interlinkages

Robert A. Feldman & Nancy Wagner, *"The financial sector, macroeconomic policy and performance".*
Paul De Grauwe & Marianna Grimaldi, *"Exchange rate regimes and financial vulnerability".*
Willem Buiter & Clemes Grafe, *"Anchor, float or abandon ship: exchange rate regimes for the Accession countries".*

Volume 7, Number 1, 2002: The financial integration of an enlarged EU: Banking and capital markets

Armin Riess, Rien Wagenvoort & Peter Zajc, *"Practice makes perfect: A review of banking in Central and Eastern Europe".*
Dana Hájková, Jan Hanousek & Libor Němeček, *"The Czech Republic's banking sector: Emerging from turbulent times".*
Éva Várhegyi, *"Hungary's banking sector: Achievements and challenges".*
Peter Zajc, *"Slovenian banks a decade later".*
Erich Hampel, *"Successful banking in an enlarged EU".*
Jens Köke & Michael Schröder, *"The future of Eastern European capital markets".*

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895

www.eib.org/efs

EIB Papers 2000 – 2001

Volume 6, Number 2, 2001: The 2001 EIB Prize

First Prize; Erich Gundlach & Luder Wößmann, *"Better school for Europe".*
Second Prize; Jan Fidrmuc, *"Democracy in transition economies: Grease or sand in the wheels of growth".*
Third Prize; Gilles Duranton & Vassilis Monastiriotis, *"The evolution of the UK North-South divide: Should we mind the gap?".*

Volume 6, Number 1, 2001: European economic growth: The impact of new technologies

Christopher Hurst & Kristian Uppenberg, *"Wonders will never cease: Prospects for a new economy in Europe".*
Paul David, *"Productivity growth prospects and the new economy in historical perspective".*
Patrick Vanhoudt & Luca Onorante, *"Measuring economic growth and the new economy".*
Danny Quah, *"ICT clusters in development: Theory and evidence".*
Hermann Hauser, *"Nothing ventured, nothing gained".*
Andrew Gillespie, Ranald Richardson & James Cornford, *"Regional development and the new economy".*
Luc Soete & Bas ter Weel, *"Computers and employment: The truth about e-skills".*
Harald Gruber, *"The diffusion of information technology in Europe".*

Volume 5, Number 2, 2000: Regional convergence in Europe: Theory and empirical evidence

Daniel Mouque, *"A survey of socio-economic disparities between the regions of the EU".*
Angel de la Fuente, *"Convergence across countries and regions: Theory and empirics".*
Jacques-François Thisse, *"Agglomeration and regional imbalance: Why? And is it bad?".*
Philippe Martin, *"The role of public policy in the process of regional convergence".*
Patrick Vanhoudt, Thomas Mathä & Bert Smid, *"How productive are capital investments in Europe?".*

Volume 5, Number 1, 2000: Regional development in Europe: An assessment of policy strategies

Christopher Hurst, Jacques-François Thisse & Patrick Vanhoudt, *"What diagnosis for Europe's ailing regions?"*
Yannis Ioannides & George Petrakos, *"Regional disparities in Greece: The performance of Crete, Peloponnese & Thessaly".*
Rodolfo Helg, Giovanni Peri & Gianfranco Viesti, *"Abruzzo & Sicily: Catching up and lagging behind".*
Andrés Rodríguez-Pose, *"Economic convergence and regional development strategies in Spain: The case of Galicia & Navarre".*
Margarethe Quehenberger, *"Lessons from Eastern Germany".*
Bertrand Rossert, *"Contributing to regional development through project selection".*

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895
www.eib.org/efs

EIB Papers 1998 – 1999

Volume 4, Number 2, 1999: The 1999 EIB Prize

First Prize; Philippe Martin, "*Are European regional policies delivering?*".
Second Prize; Rudi Dornbusch & Francesco Giavazzi, "*Hard currency and sound credit: A financial agenda for Central Europe*".
Third Prize; Jordi Gual, "*Deregulation, integration and market structure in European banking*".
Special Topic Prize; Jens Verner Andersen & Jørn Henrik Rasmussen, "*Solving the unemployment puzzle in Europe*".

Volume 4, Number 1, 1999: European banking after EMU

Christopher Hurst & Rien Wagenvoort, "*European banking after EMU*".
Martin Brookes, "*The impact of EMU on portfolio management*".
Graham Bishop, "*New capital market opportunities in Euroland*".
Colin Mayer, "*European capital markets: Competition between systems*".
Luigi Spaventa, "*Comments on the future of the EMU capital markets*."
Daniel Gros & Karel Lannoo, "*The structure of financial systems and macroeconomic instability*".
Clas Wihlborg, "*Supervision of banks after EMU*".
Christopher Hurst, Eric Perée & Mireille Fischbach, "*On the road to wonderland? Bank restructuring after EMU*".
Rien Wagenvoort & Paul Schure, "*Who are Europe's efficient bankers?*".
Philip Molyneux, "*Increasing concentration and competition in European banking: The end of anti-trust?*"
Jean Dermine, "*The case for a European-wide strategy*".
Ingo Walter, "*Financial services strategies in the euro-zone*".

Volume 3, Number 2, 1998: International financial institutions in the 21st century

Christopher Hurst & Eric Perée, "*Only a mid-life crisis? The future for IFIs in an integrated world*".
Michael Klein, "*One hundred years after Bretton Woods: A future history of the World Bank Group*".
Jannick Lindbaek, Guy Pfeffermann & Neil Gregory, "*The evolving role of multilateral development banks: History and prospects?*".
Jean-François Rischard, "*Multilateral development banks and global public networks: Speculations for the next century*".
Pasquale Scandizzo, "*The purpose, management and governance of IFIs: A case study of ambiguity*".
Nicholas Stern & Hans Peter Lankes, "*Making the most of markets: The role of IFIs*".
Joseph Stiglitz, "*IFIs and the provision of international public goods*".
A discussion between Alfred Steinherr & Jacques Attali.

Volume 3, Number 1, 1998: Employment in Europe

Christopher Hurst, "*A discussion of the papers and an overview of the role of investment*".
Jørgen Elmeskov, "*The unemployment problem in Europe: Lessons for implementing the OECD Jobs Strategy*".
Gilles Saint-Paul, "*Does technical progress create unemployment?*".
Michael Burda, "*The consequences of EU enlargement for Central and Eastern European labour markets*".
José Viñals & Juan Jimeno, "*The impact of EMU on European unemployment*".
Jacques Drèze, Alain Durré & Henri Sneessens, "*Investment stimulation, with the example of housing*".
Ole Rummel & Thomas Schröder, "*The employment effects of investment projects*".
Pascale Viala, "*Financing young and innovative enterprises in Europe: Supporting the venture capital industry*".

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies

100, boulevard Konrad Adenauer
L-2950 Luxembourg

infoefs@eib.org (+352) 4379-8895

www.eib.org/efs

EIB Papers 1996 – 1997

Volume 2, Number 2, 1997: The 1997 EIB Prize

First Prize; Bernadette Frédérick & Peter Vanden Houte, "*What is the optimum strategy for freezing exchange rate parities at the start of EMU*".
Second Prize; Jean Dermine, "*Eurobanking, a new world*".
Joint Third Prize; Daniel Gros, "*The dynamics of European integration*".
Joint Third Prize; Martin Kolmar, "*On the efficiency of national social security systems in the European Union*".
Awards for Authors under 30 for essays by Pablo de Andrés Alonso & Félix J. Lopez Iturriaga; Volker Köllmann & Andri Kopperschmidt; and Jérôme Vacher.

Volume 2, Number 1, 1997: Banking in an uncertain world

Edward Gardener & Philip Molyneux, "*The too-big-to-fail doctrine revisited*".
Agnès Belaisch, "*High real interest rates: A long-term risk?*".
Pier-Luigi Gilibert, "*Expected loss as a credit risk measure*".
Jacques Girard & Christopher Hurst, "*The capital structure of private infrastructure projects and the risk of default*".
Kristian Kjeldsen, "*Value-at-risk and capital adequacy: The challenge for financial regulation*".

Volume 1, Number 1, 1996: Special Issue on EMU

Daniel Gros, "*The steeple chase towards EMU*".
Ole Rummel, "*On the feasibility of EMU with diverse European economic transmission mechanisms*".
Bernhard Winkler, "*Is Maastricht a good contract?*".
Paul de Grauwe, "*How to fix conversion rates at the start of EMU*".
Luis Gonzalez-Pacheco & Alfred Steinherr, "*A proposal to stabilise the value of the ECU*".

The above publications are available free of charge from:

European Investment Bank
Economic and Financial Studies
100, boulevard Konrad Adenauer
L-2950 Luxembourg
infoefs@eib.org (+352) 4379-8895
www.eib.org/efs

ISSN 1830-3676

EIB PAPERS

European Investment Bank

Economic and Financial Studies

100, boulevard Konrad Adenauer
L-2950 Luxembourg
www.eib.org/efs

ISBN 92-861-0472-3