

The Matrix Approach to Industrial Policy

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ABSTRACT *The objective of this paper is to analyse the development of industrial policy in the European Union. The changing concepts and rationale for industrial policy are reported with reference to the treaties and communications of the European Commission. Industrial policy has followed the course of these changes, although in reality, the practical changes have occurred at a slower and less radical pace than the changes in philosophy. A new paradigm of industrial policy has recently been developed by the European Commission in a document that first calls for measures improving the competitiveness in all sectors in terms of rather broad measures, and subsequently acknowledges sector differences in the impact of these measures, calling for complementary sector-specific measures. We label this new paradigm the 'matrix approach' to industrial policy, because it combines horizontal and vertical measures. On the empirical level, we see a divide between countries practising a future-oriented approach emphasising innovation and knowledge, and countries that take a more defensive stance, with higher subsidies and a greater amount of regulation. The countries pursuing the more future-oriented approach achieve higher shares of technology-driven and skill-intensive industries and excel with respect to the goals of the Lisbon strategy.*

KEY WORDS: Industrial policy; Lisbon strategy; horizontal vs vertical policies; framework conditions; competitiveness; innovation.

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Introduction, Motivation, Outline

The objective of this paper is to analyse the development of industrial policy in the European Union (EU). This is done by studying the changing philosophy behind industrial policy and the relevant documents of the European Commission (EC), as well as by examining data for indications of the use of instruments and the outcome of industrial policy measures. Although industrial policy played a significant role in European economic policy for many years, its importance waned in most countries and throughout the EU as a whole during the 1990s. At this time, the new emphasis was creating a Single Market, the start of the Monetary Union

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and European enlargement. Most recently, interest in industrial policy has re-emerged, and seems to play a specific role within the Lisbon strategy.

The next section presents statistics on the size and importance of manufacturing and delineates the development of the 'philosophy' behind industrial policy within the EU since the 1950s. We distinguish between three phases from the start of the European integration up to the late 1990s: the first was very interventionist but concentrated on a specific sector, namely iron and steel. It may have been the model for the second phase of sectoral policy focusing on sector-specific measures. The third stage, which implemented what was known as horizontal policy, emphasised measures relevant to all sectors of manufacturing and focused on 'European competitiveness'. Some analysts ventured to speak about the phasing out of industrial policy. However, since the mid 1990s, interest in industrial policy in general, as well as in sectoral differences, cluster programmes and top-down projects in specific countries has re-emerged, probably owing to the insufficient performance of the European economy and the declining share of manufacturing in many countries.

We then report that the renewed interest has at least concurred with a gradual change in the basic philosophy of industrial policy. We analyse the documents of the EC, which indicate the degree of change in the scope and content of industrial policy. The documents stress that horizontal measures have differing impacts in specific sectors; furthermore, some documents acknowledge that horizontal measures might need complementary sectoral measures. In this paper, we call this fourth phase of industrial policy the 'matrix approach' because it can be mapped into a matrix, with policy instruments as one dimension, and sector impact assessments or sector-specific complementary measures in the other. We discuss which definition of industrial policy fits the matrix approach and examine the rationale behind industrial policy and the instruments it emphasises.

An empirical overview of industrial policy measures across countries is then provided, acknowledging that quantitative data will not be able to provide more than a limited insight into the complex patterns of industrial policy. In conclusion, we examine the relationship between the renewed interest in industrial policy and the new approach and how it will ultimately be embedded in a wider economic strategy for Europe. We venture the hypothesis that the incorporation of industrial policy into the Lisbon strategy will make industrial policy broader and less ideological.

The Philosophy of Intervention: Exhaustion and Renewed Interest

The Role of Manufacturing

Traditionally, manufacturing has been and still is a large sector of the economy. In the EU15, this holds true even though the share of manufacturing in GDP is below 20%.¹ Measured in nominal terms, it amounted to 17% in 2003 and has been declining over time. It was 24.7% in 1980 and 21.7% in 1990. The decline accelerated between 1986 and 1993,² but later flattened slightly. There has definitely been no sign of a significant acceleration in the downward trend over the ten years since 1996. Taking the decades as rather artificial boundaries, we find a decline of 3.0 percentage points between 1980 and 1990, and 3.7 points between 1990 and 2000 (Figure 1).

Despite the decline in manufacturing, this sector is unanimously assumed to be of vital importance to the dynamics and competitiveness of an economy. The

greater relative importance of manufacturing—in comparison to its share in value added—can be attributed to the following factors: its intensive use of inputs from other sectors and its role as a provider of new technology and new knowledge to the service sector.

The phenomenon that industry and services are becoming more and more interwoven may even encourage an industry definition embracing not only the production of goods, but also the provision of related services (financial, ICT, logistics and business services, for example). Table 1 shows that the decline in manufacturing (3.7% between 1991 and 2002) is partly compensated by the increase in business services.³

Table 1. Sectoral composition of GDP in the EU

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Agriculture and mining	3.7	3.5	3.4	3.4	3.4	3.4	3.2	3.0	2.9	3.0	2.9	2.8
Total manufacturing	22.3	21.5	20.5	20.6	20.7	20.3	20.3	20.2	19.7	19.5	19.0	18.6
Construction, electricity, gas and water	8.7	8.7	8.4	8.3	8.2	8.1	7.7	7.5	7.5	7.3	7.4	7.4
Total services	65.3	66.3	67.7	67.7	67.7	68.3	68.7	69.2	69.9	70.2	70.7	71.1
Out of which: Business sector services	44.1	44.7	45.7	45.9	46.0	46.4	47.0	47.6	48.2	48.5	48.9	49.0
"Wider Manufacturing"	66.5	66.2	66.2	66.5	66.7	66.7	67.3	67.8	67.8	68.0	67.9	67.6

EU: Belgium, Germany, Denmark, Greece, Spain, Finland, France, Italy, the Netherlands, Austria, Sweden, the United Kingdom; 'Wider Manufacturing' = Manufacturing plus business services.

Source: WIFO calculations using OECD (STAN database).

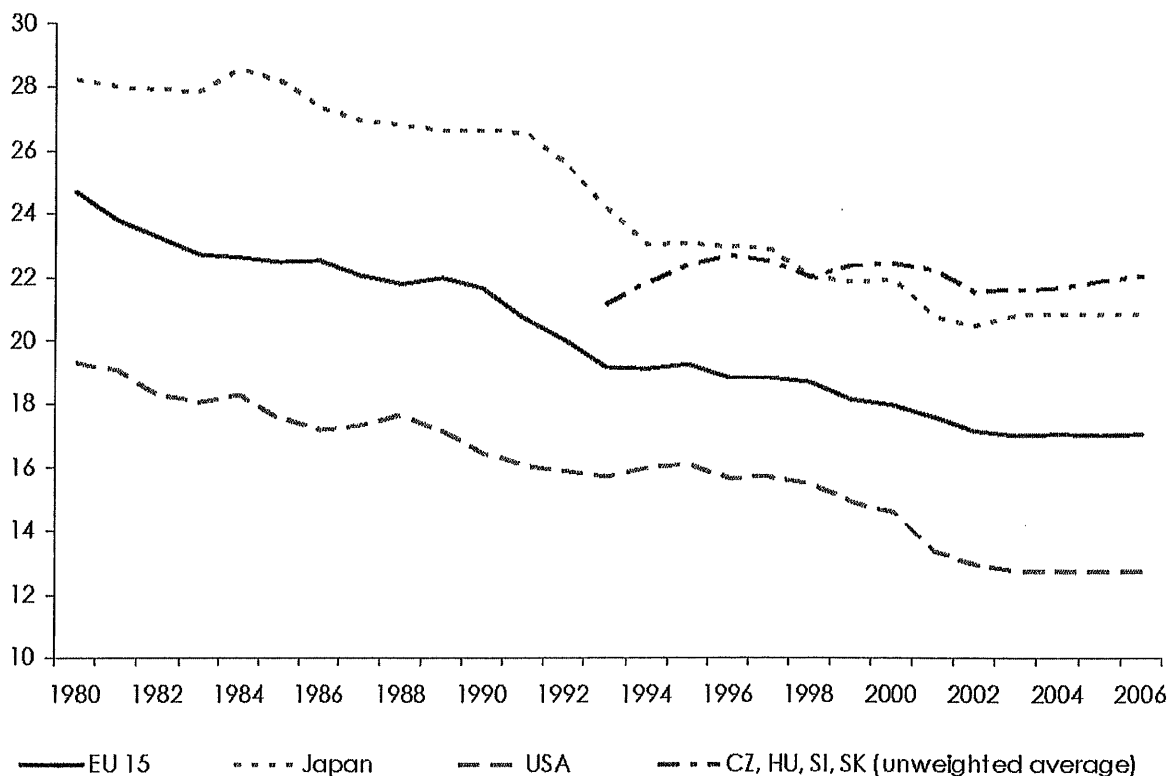


Figure 1. The share of manufacturing in the total economy

Note: Nominal value added relative to nominal GDP; EU 15 2003 estimated. 2004–2006 estimated using real data (2004 with the exception of Czech Republic).

Source: WIFO calculations using AMECO.

The Three Phases of Industrial Policy between the 1950s and the late 1990s

The history of European industrial policy developed over the course of several phases. The treaty establishing the European Coal and Steel Community (ECSC) in 1951 was a first attempt to implement some sort of industrial Policy at the European level; the ECSC can correctly be seen as a predecessor of today's EU.⁴

The treaty establishing the European Economic Community (EEC) in 1957 marks the beginning of the second phase, even though the treaty itself does not mention industrial policy. The main purpose of European integration—aside from political goals—was the creation of an internal market. The attempt to increase competition and the free flow of goods necessitated the reduction of tariffs and trade barriers. Subsidisation and national assistance to specific sectors had to be abandoned or at least made subject to common rules. The treaty nevertheless allowed various versions of industrial policy to be maintained in different member countries, some of which focused on sectoral policies, others on framework conditions.

The third phase began with the discussions surrounding the Maastricht Treaty, which established industrial policy explicitly as an area of the Community's responsibility. Industrial policy was defined as the promotion of competitiveness, with a focus on the horizontal approach. The importance of new technologies in general and of information technologies in specific was acknowledged.⁵

Starting in approximately the year 2000, renewed interest in industrial policy has since been stimulated by globalisation, enlargement, fear of de-industrialisation and slow European growth. It has constituted the basis for a fourth phase, adding a more sophisticated sectoral perspective to the horizontal approach, which we call the matrix approach to industrial policy.

Phase 1: Interventions in the coal and steel industry (ECSC 1951) Beside the main aim of securing peace in Europe, the central economic goal of the ECSC was to ensure the provision of coal and steel, which was then in short supply. Instruments such as investment planning, quotas, minimum prices and trade protection were used to achieve this goal. Price regulations and subsidies were made contingent on the scrapping of capacities. From today's perspective, this was not only a sectoral approach aimed at supporting market forces or combating market failures; with respect to the instruments used for co-ordination, it stopped just short of becoming a form of central planning. The policy was continued—with less direct intervention—for several decades. When market conditions shifted from under- to over-supply, the policy was maintained as a community-assisted version of co-ordination. Today, the ECSC treaty has expired, and iron and steel are subject to the general rules of the EU. The industrial policy implemented and the instruments initially used to regulate the coal and steel industries convincingly document the changes that have taken place between the start of industrial policy in the 1950s and the present day. The success of the coal and steel policy in dampening cycles and in transforming the market from one of short supply to one which provides cheap inputs must be acknowledged equally as well as the delay of necessary adjustments in these industries and the persistence of state aid and of government influence.

Phase 2: Opening the market plus sectoral industrial policy Industrial policy was not included explicitly in the Treaty of Rome (1957)—see Darmer & Kuyper (2000). The main emphasis of this treaty, which established the EEC, was on reducing

tariffs, limiting subsidies, abolishing non-tariff barriers and finally establishing a common market. These are policies that are specifically important for manufacturing and could thus be included under a broader definition of industrial policy (see Darmer & Kuyper, 2000, pp. 17ff). Implicitly however, sectoral measures of restructuring and policies favouring specific sectors or even 'grand projects' dominated in most countries. The tradition of sectoral planning in France—even if it was of the indicative version only—leads many researchers to label this phase sectoral industrial policy or even 'French industrial policy'. The first steps toward an explicit industrial policy on the community level are mentioned in a memorandum on industrial policy dated 1970 (European Commission, 1970).⁶

Phase 3: Fostering European competitiveness by means of horizontal policies The next phase of industrial policy was initiated in the 1990s (Figure 2), by which time a new consensus had been reached, that seemed to mark an end to the sectoral approach (Darmer & Kuyper, 2000). Industrial policy was now defined in terms of fostering the competitiveness of European industry.

The first time that industrial policy is explicitly mentioned in a European Community treaty is in Article 130 of the Maastricht Treaty of 1992, now Article 157:

The Community and the Member States shall ensure that the conditions necessary for the competitiveness of the Community's industry exist. ... the community should contribute to the achievement of the objectives ... through policies and activities it pursues under other provisions of the Treaty. (European Community, 2002)

This statement can be likened with an umbrella spanned above European industrial policy in its entirety. It mentions four main goals of economic policy, which clearly constitute an industrial policy, namely:

- (1) speeding up the adjustment of industry to structural changes,
- (2) encouraging an environment favourable to initiative and to the development of firms and businesses throughout the Community, particularly small and medium-sized firms,
- (3) encouraging an environment favourable to co-operation between firms, and
- (4) exploiting the industrial potential of policies focussing on innovation, research and technological development.

Industrial policy and innovation policy were twin strategies during this phase, both aiming to boost European competitiveness. This connection to innovation policy is specifically visible in the documents on the global information society published in 1994 and in those on Europe's attempt to promote the information society. The eventual result was the Competitiveness Advisory Group and finally the Annual Reports on the Competitiveness of European Manufacturing. Many documents carved out European strengths (for example, trade surpluses, and a good position in quality competition), as well as weaknesses (European Commission, 1990, 2002a; Aiginger, 2000; Aiginger & Sieber, 2005). The findings were that Europe's position was not unfavourable, but nevertheless in need of more emphasis on new technologies, additional expenditures on innovation and information technology and a more ambitious vision. Policies would have to be redirected, leading to the fulfilment of the Lisbon target of becoming the most competitive region by 2010. This would be achieved by fostering growth and innovation, as well as through greater social cohesion and environmental sustainability.

The main principles of European industrial policy, which eventually led to the inclusion of the industry article in the Maastricht treaty, were laid down in the communication 'Industrial Policy in an Open and Competitive Environment: Guidelines for a Community Approach' (European Commission, 1990).*

In order to meet the challenges of European industrial policy on the Community level, the communication emphasises areas that affect the importance of structural adjustment. The areas listed are 'maintaining a favourable business environment', 'implementing a positive approach to (structural) adjustment', 'maintaining an open approach to markets' and 'enabling an ever higher standard of living'. The main aim should be to facilitate the structural adjustment process, by pursuing the following three stages of structural change:

- (i) Ensuring the necessary prerequisites for adjustment (like securing a competitive environment, maintaining a stable economic environment, ensuring a high level of educational attainment, promoting social cohesion and achieving a high level of environmental protection);
- (ii) providing catalysts for adjustments addressing internal market policies, with special emphasis on standards, public procurement, the legal framework for business, the abolition of national quotas and the enactment of a liberal trade policy, and
- (iii) accelerating adjustment (such as policies to promote SMEs, a more effective use of human resources, ensuring the prerequisite conditions for the development of business sectors and promoting research and technology).

The communication points out that sectoral policies of intervention were not effective in fostering structural change. It therefore proposes that industrial problems should be resolved by horizontal measures. On a practical level, sectoral problems in the steel, textile and shipbuilding industries retained an important place in the agenda (Darmer & Kuyper, 2000). Explicit strategies for biotechnology, information technology and mechanical engineering might additionally hint at sectoral elements at the other end of the industry spectrum.

Figure 2. The development of the horizontal approach.

*In 1990, the industry council agreed on goals of industrial policy, which were then documented in the 1990 Communication (European Commission, 1990) and became the basis for an explicit paragraph in the Maastricht Treaty.

Renewed Interest in Industrial Policy

The reasons behind the renewed interest in industrial policy that emerged at the turn of the millennium are manifold.

First and foremost were the new challenges. Globalisation, faster technological progress and the increased speed of structural adjustments called for new policy instruments. Traditional policy instruments could not be used—at least not to the same extent—because of GATT and WTO agreements and rules on European competition. The new geographical landscape of an integrating Europe was leading to the redefinition of regional status. Several medium-income regions were no longer able to subsidise investments. New member countries are currently trying to attract foreign direct investment more aggressively, in order to reduce their gaps in productivity and per capita income.

At the same time, economic growth slowed down to a disappointing level, ranging between 1 and 2%; medium term growth prospects are now lower than in the USA. Unemployment is persistently high, at about 8% in the old member

and 12% in the new member countries, pointing towards severe structural problems. Progress in the liberalisation of network industries and in the Internal Market Programme in general, as well as in privatisation and deregulation, have not contributed to growth as fast as expected. The Lisbon targets of a 3% growth rate and of becoming the most competitive region in the world still seem far from realisation.

Third, fears have re-emerged that Europe could lose some of its core industries and that the share of manufacturing is threatening to decline too rapidly. Outsourcing is a danger to employment and it is not unlikely that new plants will be built in more dynamic regions. The development of China and India, for example, is gathering momentum. As these countries gain competitive ground, they are becoming increasingly attractive industrial locations. The growing concern in Europe related to all these matters can be summarised under the heading 'de-industrialisation'.

A fourth reason for the renewed interest in industrial policy may be the entry of new member countries. The gap between old and new member countries in productivity and income is large, as are regional imbalances. In contrast to their previous practise of restraint from intervention, new member countries are paying increasing attention to the structure and dynamics of the industrial sector. Complementary forms of domestic investment and capabilities that augment each other should nevertheless prevent the development of monolithic industry structures in the future.

Investigating the issue of de-industrialisation, the EC could not find any signs of absolute de-industrialisation.⁷ It confirmed, however, the slowdown in the growth of industrial productivity and the disappointing performance of Europe, especially in high-tech sectors (European Commission, 2004d, 2003a). It stresses that an attractive environment for industrial development is necessary, if industry is to fulfil the competitiveness and growth targets that were laid down at the Lisbon Council.

The new challenges, the disappointing progress with regard to growth, job creation and competitiveness, the fear of de-industrialisation and the enlargement process has finally induced a new discussion on the necessity and focus of industrial policy.⁸

Phase 4: The Matrix Approach to Industrial Policy

Documentation of the Fourth Phase

The renewed interest in industrial policy coincides with a basic philosophical change. On the one hand, the primarily horizontal approach has been maintained, i.e. measures are general and provide for a favourable competitive environment (that is, they are not industry-specific, selective, or conducive to the deceleration of structural change). On the other hand, it is acknowledged that the effects of broad horizontal policies can vary significantly from industry to industry, that competitiveness needs specific policy mixes for specific sectors, and that some sectors may require complementary measures that are not necessary or relevant in other sectors. To bring a few examples: innovation policy and patent policy have a stronger impact in technology-driven industries; knowledge is more important to skill-intensive industries; basic research is of greater necessity to industries using new generic technologies like biotech than to mature industries; deregulation has a

higher impact in strictly regulated industries like pharmaceuticals, and a weaker impact in the apparel industry.

The documents upon which the development of this new approach has been based are summarised in Figure 3. The first is a document regarding industrial policy in the enlarged EU (European Commission, 2002b). A communication from the year 2004 follows, specifying the specific approach. Finally, a communication dated 2005⁹ proposes into which sectors industries should be clustered for assessing and fine tuning of industrial policies. Each of these four broad categories are characterised by their own distinctive set of challenges. Seven major cross-sector policy initiatives address the challenges across groups of various industries. In addition, a number of sector-specific initiatives have also been identified. The new policy approach should be:

- more relevant, through the identification of the most appropriate policies for each sector;
- more widely applicable, through greater coherence and the integration of policies;
- more consensual, through the involvement of key stakeholders.

The preliminary economic analysis of this approach was made in the Background Report on the Competitiveness of Manufacturing 2005 (Aiginger & Sieber, 2005), provided by WIFO and partners for the EC. The term 'matrix approach' appears for the first time in this document. A communication calls for the combination of horizontal measures and sectoral differentiation; in addition, it even publishes a matrix with sectors as rows and policy instruments as columns, but refrains from using the term 'matrix approach' (see European Commission, 2005a, Annex 1 and Figure 4).

The four broad sectors proposed in the communication are:

- (1) *Food and life science industries:* This sector combines the rather traditional food and drink industry with pharmaceuticals and biotech. It comprises one fifth of the value added of European manufacturing. It is said to be 'characterised by medium to high growth rates'. General challenges, specifically important to this sector, are knowledge and better regulation. Sector-specific challenges are a 'fully competitive single market for pharmaceuticals and environmental and market access issues related to the food and drink industries ...'.
- (2) *Machine and systems industries:* This sector includes ICT and mechanical engineering. It makes up one third of value added and is also characterised by medium and high growth rates. Important general challenges are innovation, property rights and skills. Sector specific challenges have to do with standards and the updating thereof. Better access to international markets is specifically important to some sub sectors, as is environmental performance to vehicles in specific.
- (3) *Fashion and design industries:* This sector comprises textiles and footwear, accounts for 'just 8%' of value added and has 'experienced low or negative output growth and relatively low R&D spending over recent years'. Successful structural adjustment is the key challenge. Improving innovation, property rights, and skills are the preconditions for a quality upgrade. Better access to the heavily protected world market is 'also a key policy requirement'.
- (4) *Basic and intermediary industries:* These include chemicals, steel, pulp and paper, and account for some 40% of the value added of European manufacturing. Growth rates range from medium to low (but are high in chemicals and

European Commission (2002b):

'Industrial policy is horizontal in nature and aims at securing framework conditions favourable to industrial competitiveness. Its instruments, which are those of enterprise policy, aim to provide the framework conditions, in which entrepreneurs and business can take initiatives, exploit their ideas and build on their opportunities.

However, it needs to take into account the specific needs and characteristics of individual sectors. It therefore needs to be applied differently, according to the sector. For example, many products, such as pharmaceuticals, chemicals, automobiles, are subject to detailed sector-specific regulations dependent on their inherent characteristics or use.

Industrial policy therefore inevitably brings together a horizontal basis and sectoral applications.'

European Commission (2004d):

'The Union must continue to develop the sectoral dimension of industrial policy. This implies analysing the effectiveness at a sectoral level of policy instruments which are of a horizontal nature, with a view to evaluating their relevance and to propose, if necessary, the appropriate adjustments. The Communication presents the sectoral initiatives that have already begun over the last few months and announces several new initiatives in sectors such as the car industry or mechanical engineering.'

European Commission (2005a):

'The Commission is committed to the horizontal nature of industrial policy and to avoid a return to selective interventionist policies. ... For industrial policy to be effective, account needs to be taken of the specific context of individual sectors. Policy needs to be combined in a tailor-made manner on the basis of the concrete characteristics of sectors ... achieving policies that are more relevant, integrated and consensual.

Figure 3. The matrix approach to industrial policy as found in recent EU documents.

the rubber industry). The main cluster of challenges relates to energy and the environment. Important challenges to this sector are regulation (REACH) and the legislative simplification of the construction sector.

The following policy areas were chosen for the screening of 27 individual sectors of manufacturing:

- Ensuring an open and competitive Single Market, including competition
- Knowledge, such as research, innovation and skills
- Better regulation
- Enduring synergies between competitiveness, energy and environmental policies
- Ensuring full and fair participation in global markets
- Facilitating social and economic cohesion

This communication unites the traditional goals of industrial policy on the one hand, with the objectives of competition policy, as well as with broader goals like social and economic cohesion and environmental standards on the other, narrow definitions of industrial policy and border fights between sub disciplines are less likely. It characterizes the embedment of industrial policy into the Lisbon strategy to enhance economic growth and employment, while maintaining social cohesion

and sustainability. Within the Lisbon strategy and specifically the 'National Action Plans' provided by governments in 2005 many sector specific measures are implemented, which would have induced controversial discussions on the appropriate type of industrial policy in the decades before.

Impact on the Definition of Industrial Policy

No generally accepted definition of industrial policy exists in the literature. Some definitions are very broad, like 'everything that affects a company', while others are quite narrow, such as 'specific measures oriented towards specific sectors'.¹⁰ Some definitions indirectly reveal the approach these authors implicitly advocate: stressing that industrial policy consists of measures targeted at different sectors indicates a sectoral approach, stressing that industrial policy fosters productivity competitiveness or creates favourable general conditions for firms lays the foundation for a horizontal approach.

The new documents provide no new definition of industrial policy, which however might be necessary for the matrix approach. We therefore tentatively propose defining industrial policy as 'activity that creates a favourable environment for European business in general, as well as for the manufacturing sector and its industries in specific'. This definition stresses the central role of manufacturing, but also acknowledges that service activities and the regulatory environment are important and that the borderline between manufacturing and services is no longer rigid. The definition does not advocate a strong sectoral focus; it highlights all policies improving competitiveness and productivity. It is open to the different impact of horizontal measures across sectors, as well as to the fine-tuning of strategies to the needs of different sectors and regions.

Annex 1

Industry	KNOWLEDGE			BETTER REGULATION		ENVIRONMENT & ENERGY					TRADE		STRUCTURAL CHANGE	SECTOR SPECIFICITIES	SECTORAL ACTIONS ^a	
	Research & Innovation	Quality & Energy	Skills	Access to finance for SMEs	Administrative burden of regulation	Internal Market	Harmonisation	Trade Barriers	'Climate change'	Water	Waste	Air				Internal Energy Tax
Food, Drink & Tobacco																
Chemicals, Pharmaceuticals																
Textiles, Leather Goods, Jewellery																
Metals, Machinery, Transport																
Agriculture, Forestry, Fishing																
Energy, Electricity, Gas, Heat																
Information & Communication																

¹⁾ With regard to installations belonging to energy activities all sectors fall under the ETS provided the installation in question is above the capacity threshold indicated in Annex I of the Directive. Trading Directive 2003/87/EC. The actions marked in this table are included in the ETS for the first period (2005-2009).

²⁾ Any sector will also be affected by the new legislation framework for chemicals (REACH).

³⁾ ICT challenges are sector specific, ICT uptake is a general challenge for the industry.

⁴⁾ Includes legislative actions and/or actions involving members of the Commission.

⁵⁾ GATS

⁶⁾ Energy Using Products (EUP)

⁷⁾ Financial Institutions

⁸⁾ Access to Land

⁹⁾ Energy and Financial Inst. Topics

¹⁰⁾ Market surveillance

The table indicates with crosses, the cases in which a policy challenge is considered of the highest priority for each sector amongst the many relevant policy challenges. Hence the absence of a cross does not therefore necessarily denote that the challenge is unimportant to a sector, only that it is not considered as an issue of greatest priority.

Figure 4. Matrix type industrial policy according to EU COM (2005) 474, Annex 1.

The new industrial policy outlined in the matrix approach is a definite sign of a more pro-active policy approach. Slogans like the one coined for the USA 'that the best industrial policy is no industrial policy' are clearly rejected. In its emphasis of sector differences, the new definition is also certainly more pro-active than the approach stressing only horizontal measures and framework conditions.¹¹

The new industrial policy does not mention the need to pick winners, to select and promote large industrial programmes or to develop industrial cores or competitive centres. It thus is far from a top-down approach and 'Grand Projects'—a recurrent topic in French Industrial Policy.¹² It does not speak directly of sunset and sunrise industries. The emphasis on innovation in life sciences on the one hand, and on structural adjustment in the fashion and design industries on the other, nevertheless illustrates the differences between growth industries and those in decline.

Impact on the Rationale Behind Industrial Policy

In principle, this new approach does not change in principle the rationale behind the industrial policy of the European Community, which was used to combat market failures. Public authorities were to act 'only if needed i.e. when some types of market failure justify government intervention'. A further sentence added that authorities should act '... in order to foster structural change' which to some extent indicates a more pro-active role of industrial policy. However, the communication broadens the perspective. It expresses the necessity to 'reduce the social costs of change' and favours 'employment and social policies that generally apply across the economy and the facilitation of social and economic cohesion'.

All these formulations hint at a less ideological approach to industrial policy than the many previous documents and discussions. There is no hint that social and industrial policies are distinct objectives of public policy, which may not be combined or that 'competition policy and industrial policy' conflict *per se*.

With respect to industrial policy, Aiginger & Sieber (2005) distinguish between static market failures, dynamic market failures, technology- and knowledge-based arguments, and policy-focused arguments. Static market failure is not explicitly addressed in the communication, but is implicit to the goal of market access. Dynamic market failures are addressed in terms of fostering structural change. Knowledge-based arguments are incorporated via policies promoting innovation and knowledge. The policy arguments proper are—somewhat surprisingly—acknowledged explicitly through the reference to the social costs of change and the importance of social and economic cohesion. The latter also provides a bridge to regional policy aimed at reducing income differences across regions.

One of the reasons that the new documents are less ideological may be that industrial policy today is to a certain extent already integrated into the Lisbon strategy. The Lisbon Strategy is designed to make Europe the most competitive, knowledge-based region in the world. To achieve this end, the EC has developed and declared several goals and sub-goals, *inter alia* a growth rate of 3%, R&D expenditures of 3% of GDP up to 2010 and individual employment targets for total and female employment and elderly persons. This paper is not the proper forum for discussing the success and failures of the strategy. However, it appears as if the Lisbon strategy seeks to act as an umbrella above a more active industrial policy. The Lisbon strategy was fine-tuned in 2005—among other reasons because a mid-term review revealed that it had not been extremely successful. One of the

means of increasing its effectiveness was to strengthen the role of national governments. Each government is now responsible for devising its own National Lisbon Plan, which incorporates macro- and microeconomic issues and also addresses the goal of increasing social cohesion. These national plans include several areas that can be considered core elements of industrial policy, such as innovation policy, education policy and competition policy. The same General Directorate of the European Commission, namely the Enterprise Directorate, is now responsible for the Lisbon strategy, for European competitiveness and for industrial policy.

This new situation is reflected in the title of the document specifying the new industrial policy (European Commission, 2005a), namely 'Implementing the Community Lisbon Program ... towards a more integrated approach to industrial policy'. The more general 'Communication on Industrial Policy' was announced under the Community Lisbon Programme of July 2005 (Common Actions for Growth and Employment, COM 2005, 330).

Impact on the Instruments Used

In general, industrial policy applies the following instruments: subsidies, tax incentives, regulation/deregulation and fostering innovations. The new industrial policy clearly shuns most forms of subsidies, particularly those given to mature industries that are under competitive pressure. Various facets of the regulation issue are addressed, from the general goal of better regulation, to the reference to REACH (which is a sector-specific regulation designed to help monitor chemical materials), to the regulation of pharmaceuticals (meaning quicker procedures, without compromising on health), and the environment (meaning less emissions but no compromises regarding mobility). Fostering innovation and knowledge diffusion is definitely at the core of a modern industrial policy and is consequently addressed under various policy issues (R&D, property rights, skills, venture capital for SMEs) and for all broad sectors (even those with a different emphasis). Surprisingly little is said about financial incentives like taxes to promote education and lifelong learning. These three policies are at the core of the Lisbon process and many countries use financial incentives or have announced new ones in their National Action Programmes under the renewed Lisbon Strategy. The documents on industrial policy circumvent much mention of this instrument. Very little is said about restructuring programmes, competition for foreign direct investment and cluster policies. The reason might be that these instruments of industrial policy are associated with old-fashioned national strategies or the top-down or 'big projects' approach, which are not favoured by the matrix approach.

Quantitative Indicators of the Use of Policy Instruments

Empirical Data on Traditional vs Future-Oriented Industrial Policy

Industrial policy is a field of economics in which the analysis of institutions and instruments is dominant. Very seldom policy assessment is based on data. This is the reason why some discussions will never end, why ideologies have a high impact on industrial policy, while differences in actual implementation are much smaller. We try to present at least some data on the policy instruments used in

different countries, and compare the use of instruments with the outcome in terms of industry structure.

We implement four data sets: the first set shows the amount of state aid reported; the second measures (de)regulation, market access and competition; the third comprises data on innovation, education, technology diffusion and access to (innovation) finance. While these three sets of indicators look at instruments, the fourth set looks directly at 'outcomes', by measuring the share of technology driven and skill intensive industries.

A high share of subsidies plus strict regulation might be an indication that the traditional approach to industrial policy has been applied: interventionist, maybe sector-specific, and more favoured by phases one and two of the industrial policy philosophy. In contrast, low subsidies plus a less regulated market are emphasised in the Single Market Programme, with open access, fewer national regulatory schemes, and lower entry and exit barriers. If, at the same time, investment into innovation and education were high, this would be consistent with the third phase of industrial policy, which promotes competitiveness and a favourable business environment. The fourth data set analyses the success of a country (and its manufacturing sector), as measured by high shares of technology-driven and skill-intensive industries. It is interesting to observe whether success is more closely related to instruments used in traditional industrial policy or in future-oriented industrial policy promoting innovation and education. Because all data relate to rather recent years and a very short time span, we can not analyse changes in industrial policy in individual countries over time. Rather, we can draw our conclusions only from the differences across countries in instruments and performance.

The Data Available

Traditional industrial policy supports firms by means of direct aid, often in combination with price regulation and entry and exit barriers. Subsidies can be given to specific sectors or granted for specific purposes. In this paper, we supply figures on total state aid in relation to GDP, state aid to manufacturing in relation to value added, and the share of horizontal measures. The indicators of regulation refer partly to product markets and partly to labour markets. In addition, regulation indicators describe the speed of liberalisation in network industries and progress in the Single Market Programme.

Future-oriented, pro-competitive industrial policy fosters future investments with positive externalities. We report on investment in research, education and information technology, as well as on broadband penetration, indicating the industrial policy approach consistent with the Lisbon target. This group of indicators could be also summarised under the title 'investments in the future' (see Aiginger, 2004b).

The outcome of the competitive process—be it the result of firm performance or of a successful industrial policy—can be measured by the share of sophisticated industries. We provide indicators of the *ex post* industry structure, by measuring the share of value added in technology-driven and skill-intensive sectors in the total value added of manufacturing. High shares of sophisticated industries may reflect the policy pursued, or they may be a persistent, inherent characteristic of a country, resulting from comparative advantages. The indicators are listed in Table 2.

Table 2. List of indicators

State aid	Total state aid (share in GDP) 2002
	Manufacturing state aid (share in manufacturing value added) 2002
	State aid to horizontal objectives (share in total aid) 2002
Regulation, liberalisation, internal market	Product market regulation 2003
	Administrative regulation 2003
	Economic regulation 2003
	Network liberalisation 1998
	Labour market regulation (EPR, Employment protection regulation) 2003
	Open tender (Published public procurement as % of total public procurement 2002)
Investment in the future	Public R&D expenditures (share in GDP) 2001
	Business expenditures on R&D (share in GDP) 2001
	Science & engineering graduates (% of 20–29 years age class) 2002
	Population with tertiary education (% of 25–64 years age class) 2002
	Participation in life-long learning (% of 25–64 years age class) 2002
	Penetration of broadband 2004
	ICT expenditures (as % of GDP) 2003
	Venture capital investments: early stage (as % of GDP) 2003
Industry structure	Venture capital investments: expansion and replacement (as % of GDP) 2003
	Technology driven industries (value added in % of manufacturing industries value added) 2001
	High skill industries (value added in % of manufacturing industries value added) 2001

Sources: European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

Country Results

Indicators of state aid Historically, state aid has been the most intensively used instrument of industrial policy. In support of its goal to create open and well-functioning markets, the EU tried to limit the use of this instrument or at least make its implementation more transparent and the subject of certain rules. At the 2001 European Council in Stockholm, member states agreed—consistent with earlier attempts—on two goals: first, the overall amount of state aid should be reduced and second, remaining aid should be redirected towards horizontal objectives (European Commission, 2004a).

The figures for 2002 confirm significant disparities between member states. The share of state aid in GDP ranged from less than 0.20% in Sweden, the UK, Finland and the Netherlands, to around 0.55% in Germany, Spain and Portugal, and 0.72% in Denmark. The share of state aid in GDP decreased in 14 of the 15 members of the EU15 between 1999 and 2002, with the sharpest fall in Portugal (as a result of a sizeable reduction in a regional tax scheme in Madeira) and in Ireland. In contrast, the share of state aid in GDP increased in Denmark, owing to substantial increases in horizontal state aid for employment and even more for the environment (European Commission, 2004c).

State aid to manufacturing includes assistance for shipbuilding, steel, textiles and other manufacturing sectors, as well as for horizontal objectives. The latter include SMEs, the environment, reductions in energy consumption, employment, training and regional development and probably some expenditures for R&D. It is not always known which specific sector(s) will profit most from these horizontal objectives. This uncertainty can lead to an overestimation of the state aid

spent on manufacturing, as may especially be the case in Greece, where almost all aid is awarded through regional development schemes, and in Denmark, where training and the environment receive high levels of state aid (European Commission, 2004c).¹³

State aid for horizontal objectives usually creates less distortion than sectoral and *ad hoc* aid. In most countries, there is presently a shift towards horizontal objectives. For instance, in Denmark, Greece and Finland nearly 100% of all state aid is horizontal; in the Netherlands, Belgium, Italy and Austria the corresponding figure is more than 95%. In Portugal, Ireland, France, Germany, Spain and the UK, a substantial amount of state aid is still sectoral, ranging from 40% in Portugal to 70% in the UK (albeit measured in relation to the much lower importance of state aid in general). Germany, France and Spain still support their coal sectors with considerable amounts of aid.

The high share of sectoral state aid in Portugal is due to the tax aid scheme in Madeira. In the UK, the government set up an ample rescue package for British Energy in 2002. The majority of member states, in particular Ireland and Italy, continued to redirect state aid to horizontal objectives between 1998 and 2002. In three member states, the share of horizontal aid declined slightly, although from a relatively high point of departure (a level of 85% or more; European Commission, 2004c).

Indicators of (de)regulation and liberalisation The OECD regulatory database provides indicators describing product market and labour market regulation (Aiginger, 2004a). The information is ranked on a scale from 0 (unregulated) to 6 (highly regulated). The overall product market regulation indicator provides a single synthetic measure of regulation for each member state (OECD, 2004).

Regulation is lowest in the UK, followed by Ireland, Sweden and Denmark. The strictest product market regulation can be found in Italy, Portugal and Greece, followed by France and Spain.

The subcategory 'administrative regulation' reports on such indicators as licence and permit systems, administrative burdens for corporations, sole proprietor firms or sector specific administrative burdens (OECD, 2004). The countries with the least regulation are the same as in the aggregate; high levels are reported for the Netherlands, Portugal and Spain. 'Economic regulation' reports *inter alia* the scope and size of the public enterprise sector, the degree of direct control over business enterprises, and the existence of legal barriers or antitrust exemptions (OECD, 2004). Italy, France and Finland have a greater degree of economic regulation than administrative regulation. Administrative regulation is stronger relative to economic regulation in the Netherlands and in Austria.

The indicator of network liberalisation¹⁴ measures the degree of regulation and the liberalisation of network industries. It is calculated as the average of seven indicators of network industries (airlines, telecom, electricity, gas, post, railways and roads). In the network industries, it is again the UK that has the highest degree of liberalisation, followed by Sweden, Germany and Finland. The lowest degree of liberalisation is in Greece, followed by Italy, Ireland and Portugal.

Labour market regulation is measured according the indicator of employment protection legislation (EPL), which is actually an indicator of one specific aspect of labour market regulation.¹⁵ Employment protection legislation is strict in Portugal, Spain, Greece and France, while in the UK, Ireland and Denmark the indicator has

a very low value. Sweden and Finland have rather strict regulation for permanent contracts, but very few rules for temporary workers (Aiginger, 2004a, b).

Public procurement, that is, purchases of goods, services and public works by governments and public utilities, can have an important influence on the activities of firms and the development of core technologies, especially in sectors where public procurement is an important demand factor, like defence, transport or health care (European Commission, 2003a). The value of openly tendered public procurement¹⁶ as a percentage of total public procurement 2002 can be seen as an indicator of market access and openness to competition. The high share in Greece (more than 40% of total public procurement) is due to the fact that structural funds are subject to open tenders (European Commission, 2004a). The second, third and fourth best results (all above 20% of total public procurement) are achieved by Spain, the UK and Italy. Germany lags behind the EU15 member states, followed by the Netherlands; for both countries the resulting figure is below 10% of total public procurement.

Indicators of 'investment in the future' Investing in innovation, education and the diffusion of new technologies is important for growth and competitiveness and is therefore the core of the Lisbon Strategy. R&D plays an important role in today's innovation system, first of all because radical innovations are almost always based on R&D, and second, because minor innovation and third, the dissemination of new technologies are also based on R&D. Future-oriented strategies are always in need of innovation and skills.

Sweden (above 4%) and Finland (above 3%) report the highest research expenditures relative to GDP, outperforming even Japan and the USA. Denmark and Germany rank closely behind them with approximately 2.5% (European Commission, 2004a).

Public R&D is highest in Finland and Sweden at 1% of GDP, followed by France at approximately 0.8% (European Commission, 2004b). Luxembourg has the lowest share with only a bit more than one tenth of the Swedish and Finnish values preceded by Ireland and Greece with values of around 0.4%.

The impact of business research is considered to be stronger than that of public research. Accordingly, the Lisbon strategy calls for increasing the private share of R&D relative to the public share. Business enterprise expenditures include all R&D expenditures attributable to the business sector 'manufacturing and services'. Specifically, impressive shares of business enterprise expenditures in GDP are again reached by Sweden (above 3%) and Finland (above 2%), followed by Germany and Denmark. In contrast, business expenditures in Greece, Portugal and Spain are, at the most, only 0.5%.

For education, our research investigates the share of science and engineering graduates, the share of the population with tertiary education and engagement in life-long learning.

The share of all science and engineering graduates is defined as the share of persons in the age class 20–29 with a post-secondary education in life sciences, physical sciences, mathematics and statistics, computing, engineering and engineering trades, manufacturing and processing or architecture and building (European Commission, 2004b). Performance leaders are Ireland, France and the UK, with values around 20%. Luxembourg has by far the lowest share, with less than one tenth of the Irish and French values, preceded by Austria, Italy and the Netherlands with around 6% (European Commission, 2004a). Over the period 1998–2001 the EU¹⁷ percentage increased clearly; some convergence is starting to

take place. In Ireland, Germany and Austria, the share remained unchanged or even declined. However, in most countries it increased.

Tertiary education is measured as the share of population aged 25–64 that has attained some form of post-secondary education. It is largest in Finland, with tertiary education above 30%, followed by Denmark and the UK. In Portugal and Italy only 10% of the population in this age class has a tertiary education, preceded by Austria (around 17%).

Life-long learning is defined as participation in any type of education or training course during the four weeks prior to the survey.¹⁸ Life-long learning is well developed in the UK, with values above 22%, followed by Finland, Sweden and Denmark (around 18%). Very low levels are evident in Greece, France and Portugal (below 3%).

Broadband promotes the development of new services and allows the reorganisation of production and working processes. Therefore, the use of advanced services on a secure broadband infrastructure, a main objective of eEurope2005, opens the opportunity for substantial benefits (European Commission, 2004a). The highest rates of broadband penetration¹⁹ are in the Scandinavian²⁰ countries, together with Belgium and the Netherlands, followed by Austria. The lowest penetration rate is in Greece. Ireland also has a remarkably low broadband penetration rate; Luxembourg lies at the lower end of the distribution.

Total ICT expenditures include outlays on office machines, data processing, data communication and telecommunication equipment, as well as related software and telecom services. ICT are related to the reorganisation of business structures and processes; they therefore have a major impact on productivity growth. Hence, fostering their diffusion is one main policy area for a dynamic, knowledge-based economy. Sweden, the UK and the Netherlands record high levels of ICT expenditures; the lowest levels are recorded in Ireland and Spain.

Venture capital is an indicator of financing for innovative and risky projects. It is available for two investment stages: first, the early stage and second, the expansion and replacement stage, and is presented as venture capital investments as a percentage of GDP.²¹

Early stage venture capital, which includes seed finance plus the financing of the start-up phase (investments in product development and initial marketing before selling starts), is especially important for new innovative enterprises with high growth potential. As these types of investment are highly risky, they are often supported by the government through funding, tax breaks or incubation support. The most venture capital investments (in absolute values) are made in the UK, France, Germany and Italy.²²

The best values for early stage venture capital are attained by Sweden and Finland, followed by Denmark. Italy, which holds the last position, reached only a tenth of Denmark's value, and was preceded closely by Greece.

Although Finland also achieves very high levels of venture capital investments in the expansion and replacement phases (Rank 2), the best performance is by the UK, with a value of more than 0.2% of GDP. Similar to the case in early stage investments, Greece performs very weakly in expansion and replacement stage investment, and Germany places second to last.

The share of sophisticated industries High income countries need to increase their shares of technology- and skill-intensive industries. This reorientation of European industry is already taking place, is necessary, and must be continued (European

Commission, 2004d). High shares of sophisticated industries may evolve as a result of firm strategies, but are also influenced by policy priorities.

The shares of technology driven industries²³ are high in Ireland, Sweden and Finland; they are low in the southern European countries. Italy's share is larger than that of Spain, Portugal or Greece. France and Germany have fallen behind the top countries and are now ranked fourth and fifth.

The highest share of skill intensive industries is reported for Denmark and Sweden, followed by Germany and the UK. The lowest shares are held by Greece, Portugal and Spain.

Grouping Countries with Respect to Policy and Performance

The results from the country profiles suggest building groups or clusters of countries according to the set of policy instruments used (see Figures 5 and 6).

A group of small northern countries, comprising Sweden, Finland and Denmark operate a future-oriented industrial policy, very much in line with the Lisbon strategy. These countries spend little money on state aid, they have less-regulated product and labour markets, they invest heavily in research, education and life long learning, make use of information technology and consequently have a high share of technology-driven and skill-intensive industries. Within this group, Denmark is somewhat unique, relying more on state aid (primarily for environmental purposes, partly for training). Technology diffusion, ICT use and clusters are promoted, R&D expenditures increased with a bit of delay. In all countries, labour market de-regulation (specifically for part time work) is made acceptable by support for training and offers of new jobs.²⁴

The group of big continental countries includes Germany and France and Italy. This group spends more on total state aid than the European average (each country, not only Germany in the wake of unification). The share of horizontal aid is, in part, relatively low, and regulation is high (with the exceptions of the network industry in general, economic regulation in Germany, and administrative regulation in France). As far as investment in the future is concerned, France and Germany have moderate positions, while Italy performs rather poorly. Life-long learning, broadband penetration and ICT expenditures are below the EU average in both France and Germany and are even lower in Italy.

The group of small continental countries includes Belgium, the Netherlands and Austria. This group has low expenditures on state aid, and somewhat more administrative and less economic regulation, as is reflected by generally moderate rankings (with the exception of higher levels of state aid in Belgium). These countries have a smaller share of sophisticated industries, are extremely short of venture capital and have a low share of science and engineering graduates. They have a moderate position in research and a slightly better position in information technology, leaning towards incremental innovation and technology diffusion. In general, industrial policy seems more flexible and future-oriented than in larger countries, although there have been some attempts to soften the burden of change through the use of regulations. The moderate position in innovation—particularly in contrast to the high per capita GDP in these countries—may be due to the fact that when the European market was still segmented, large firms did not locate headquarters and research units of sophisticated industries in small countries.²⁵

The group of southern peripheral countries comprises Spain, Portugal and Greece. These countries are characterised by strict regulations and low investments

in the future. The share of sophisticated industries is low. According to some indicators, state aid is not exceptionally high, open tendering seems to be enforced by EU programmes.

The UK and Ireland can not be easily assigned to any one of these groups. The UK resembles the northern countries to a certain extent, but regulation is lower, as are investments in research and development. Both characteristics are also typical of Ireland, with the exception of network liberalisation and less research, reflective of the fact that a large part of the growth strategy was based on foreign direct investment. Ireland has a remarkable catching-up story, while the UK first followed the bumpy road of industrial decline and then Thatcherite reforms, and most recently, gradual restructuring with a high emphasis on the stimulus of a booming service sector.

Rankings, Correlations, Caveats

As a final exercise, we present the ranks for the four sets of indicators, add two more general performance indicators and provide rough correlations between policies, instruments and outcomes (Table 3 and Table 4).

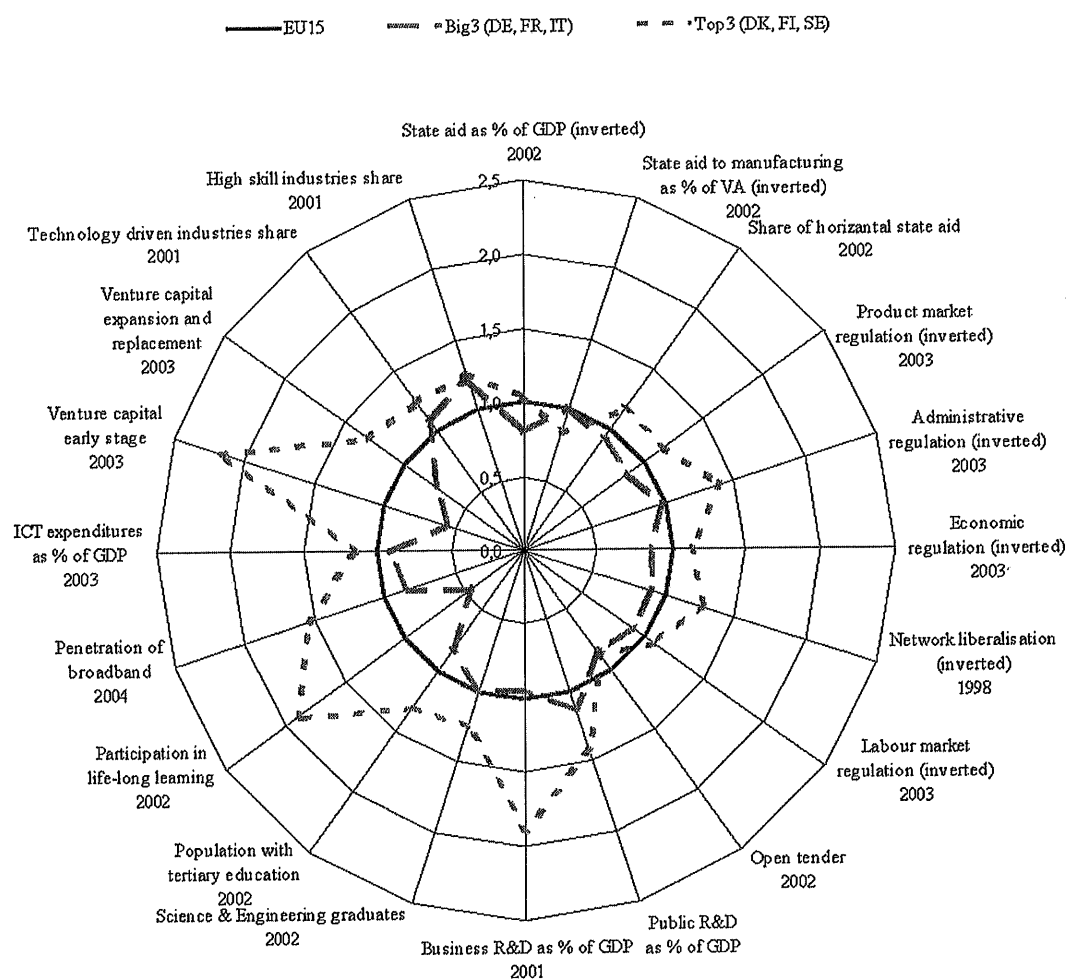


Figure 5. Country profile Big3 and Top3 (relative to the EU15 average).

Note: Total aid less agriculture, fisheries and transport; S&E graduates (percentage of 20–29 years age class): France, Italy, 2001; Greece: no figures for S&E graduates are available.

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

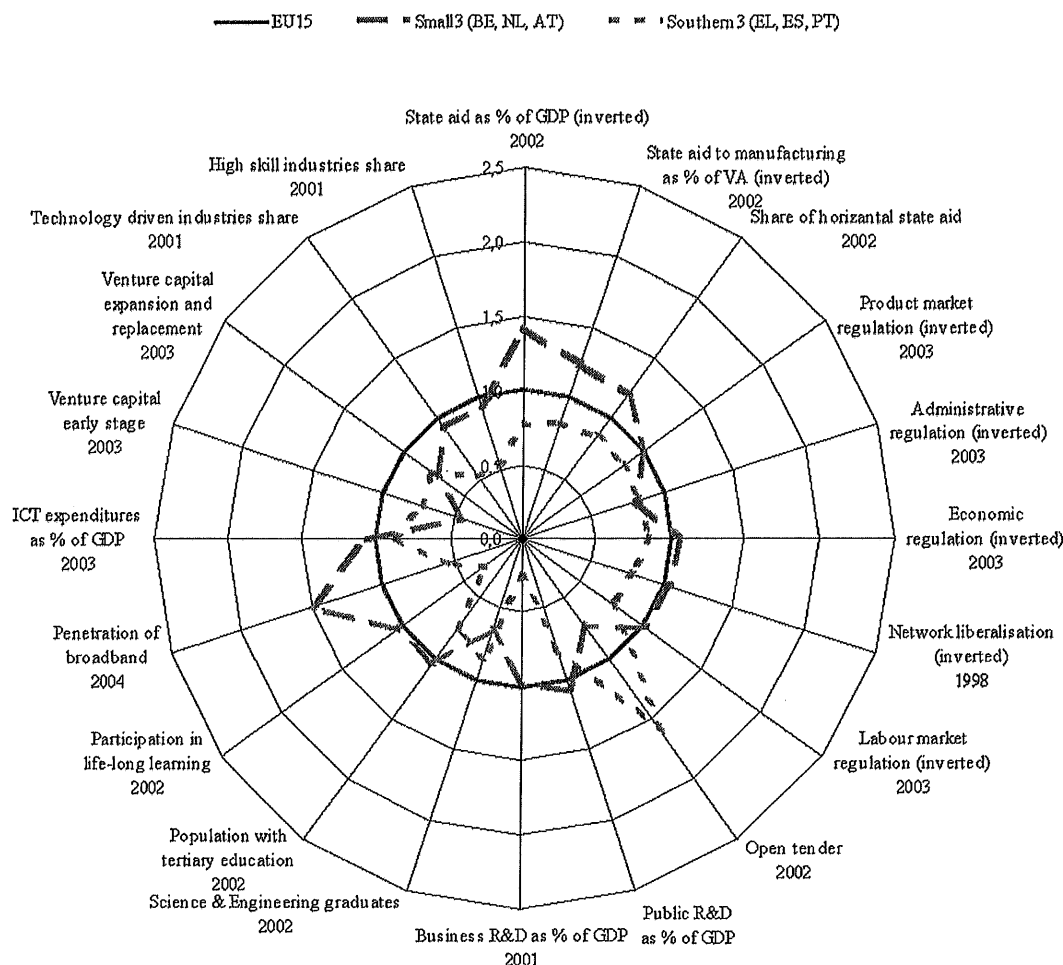


Figure 6. Country profile Small3 and Southern3 (relative to the EU15 average).

Note: Total aid less agriculture, fisheries and transport; Public and business expenditures on R&D share in GDP: Austria 1998; S&E graduates (percentage of 20–29 years age class): Denmark, Finland 2001.

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

Countries are ranked according to their policies and their performances. The value 1 stands for low state aid, low regulation and high investment in the future. Shares of sophisticated industries are used as an indicator of performance, as done previously. We add a policy evaluation according to the Lisbon strategy, provided by Wanlin (2005) and an evaluation of macroeconomic performance (according to 13 indicators of growth, employment, and productivity) presented in Aiginger (2004a). The rank 14 indicates the lowest performance. A simple unweighted average of the country groups is reported for each set, bringing the picture into a somewhat sharper view, together with a column (superrank) in which the countries are listed according to their average ranks within a set of instruments or a set of performance indicators.

The Nordic countries—with top positions in industry structure, successful implementation of the Lisbon strategy, and macroeconomic performance—have low levels of state aid (with the exception of Denmark, as described earlier), low average levels of regulation and the highest amount of investment into the future. The southern peripheral countries have high levels of state aid and regulation and low amounts of investment into the future; consequently, performance is low. The big continental economies rely on a rather traditional industrial policy and

underinvest in the future; in France and Germany the share of sophisticated industries is above average, but is not excellent. The results are in line with the positive impact of a future-oriented industrial policy and the warning that subsidies and regulation will not help in the long run.

Because the grouping of the countries may contain some elements of ambiguity, and differences within groups are indeed revealed, we also report on the correlations between individual country indicators. State aid is not correlated with industry structure, but low state aid is correlated with the rank according to Lisbon strategy performance and macroeconomic performance. Countries with low degrees of regulation, as well as countries with high levels of investment into the future perform better according to all three performance criteria (structure of industry, Lisbon criteria, and macroeconomic performance). While these results are consistent with the expectation regarding prudent industrial policy, we have to acknowledge that the empirical basis is in a very preliminary stage. Furthermore, correlations (explicitly rank correlations with cross section observations for 14 countries only) do not provide adequate information as to the direction of causation.

Summary

(1) Industrial policy in the EU has a long history, which can best be understood in terms of three plus one phases. The first phase was characterised by a high degree of intervention, which was, however, restricted to the coal and steel sectors. In the second phase the European Community tried to dismantle national barriers and eliminate subsidies. At the national level, sectoral intervention and *ad hoc* policies on the firm level prevailed, often in response to crises. However, some

Table 3. Country rankings for three policy sets and three performance rankings

	Superrank State aid	Superrank Regulation	Superrank Future investment	Superrank Industry structure	Rank according to Lisbon Strategy	Rank according to macro-economic performance
Belgium	7	10	7	7	10	11
Denmark	10	3	3	3	1	3
Germany	13	7	8	2	9	13
Greece	6	11	14	14	11	9
Spain	13	9	11	12	13	10
France	10	11	6	5	8	12
Ireland	9	4	9	3	7	1
Italy	8	13	13	9	14	14
Netherlands	4	8	5	10	5	7
Austria	5	6	10	10	3	6
Portugal	12	14	12	13	12	8
Finland	1	5	1	8	6	2
Sweden	2	2	2	1	2	4
UK	3	1	4	6	4	5

Note: Superranks are unweighted averages (which are then ranked again) over the sub-indicators enumerated in Table 2. Low ranks (= favourable position) indicate low regulation and low state aid but high investment into the future and high shares of sophisticated industries.

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Centre for European Reform (Wanlin): The Lisbon Scoreboard VI, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database; Aiginger (2004a).

Table 4. Correlations between policy instruments and performance

Instruments	Superrank Industry structure	Rank according to Lisbon Strategy	Rank according to macroeconomic performance
Superrank State aid (low)	0.0466	0.5294	0.4927
Superrank Regulation (low)	0.6415	0.8325	0.7340
Superrank Future investment (high)	0.6284	0.7582	0.5385

Note: Positive rank correlation coefficients indicate that prudent use of instruments (low state aid, low regulation, high future investments) leads to good performance.

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Centre for European Reform (Wanlin); The Lisbon Scoreboard VI, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database; Aiginger (2004a).

countries (predominantly France) pro-actively favoured 'progressive' industries or large industrial projects. We therefore characterise this phase with the term 'sectoral approach'. In the 1990s, the term 'industrial policy' was explicitly mentioned in the Maastricht Treaty, and its content shifted in the direction of providing a favourable environment for business and fostering European competitiveness. Industrial policy increasingly favoured broad activities like research, education and firm co-operation. To a certain extent, industrial policy converged with innovation policy. Because these measures did not target specific sectors, but rather had an effect on all industries, we associate this third phase with the term 'horizontal approach'. Researchers and countries favouring sectoral concepts tend to mention critically that this phase marked the exhaustion or even end of proper industrial policy.

The most recent years have been characterised by a renewed interest in industrial policy. This may follow from the low growth experience in Europe, from the widening of productivity differences relative to the US (after a long period of catching up), from insufficient competitiveness in many interesting industries or simply from the threat of de-industrialisation. The emphasis of the new industrial policy remains on horizontal measures. It is however increasingly acknowledged that the impact of horizontal policies varies from industry to industry, and that factors defining the competitive edge will differ across industries. Industrial policy therefore has to fine-tune the horizontal instruments according to sector need or even devise complementary measures that can be implemented on the industry level. This combination of the horizontal and the vertical (industry specific) dimension led us to suggest the term 'matrix type of industrial policy' for this new paradigm.

(2) We must acknowledge that the differences in the philosophy that is used to distinguish the four phases of industrial policy are not completely replicated in the actual policy implemented. Even in the first and second phases, there were many horizontal measures—for example, investment subsidies such as accelerated depreciation or tax credits. As France promoted sectoral policies and even a soft version of sectoral indicative planning, German industrial policy traditionally emphasised 'framework conditions', leading to the 'French vs. German industrial policy' debate. To the same degree, the 1990s not only promoted competitiveness

and horizontal policies: subsidies remained in steel, shipbuilding and mining. European policy documents ('communications') even dealt specifically with problems in textiles, mechanical engineering, biotechnology, ICT and aerospace. Thus, differences in the philosophies behind general documents were stronger than differences in specific policies and in lower level documents. Country differences persisted, with France a steady advocate of sector-specific and top-down approaches, and of large projects.

(3) It is difficult but not impossible to find indicators of the extent, direction and performance of industrial policy implementation. We constructed four sets of data for EU member countries (focusing primarily on older members): the first set contains indicators of the scope and nature of state aid, as reported in each country; the second measures regulation, market access and competition; the third compiles figures on innovation, education, technology diffusion and access to (innovation) finance. While these three sets of indicators look at instruments applied in industrial policy, the fourth set looks directly at 'outcomes', by measuring the share of technology driven and skill intensive industries.

The results suggest that countries be grouped as follows. One group consists of small northern countries, namely Sweden, Finland and Denmark. The countries in this group implement a future-oriented industrial policy, very much in line with the Lisbon strategy. These countries spend little money on state aid; their regulation of product and labour markets can be characterised as low to medium; they invest heavily in research, education, information technology and life long learning. As expected, the outcome of this policy is a high share of technology-driven and skill-intensive industries.

The big continental countries (Germany, France and Italy) spend more on total state aid than the European average. The share of horizontal aid is relatively low and regulation is medium to high. As far as investment in the future is concerned, France and Germany have moderate to good positions, while Italy is performing rather poorly, but even France and Germany are trailing in terms of the dynamics of expenditures. This is particularly disappointing in light of the fact that these countries could potentially lead Europe as it strives to reduce the gap in technological competitiveness in relation to the USA. Life-long learning, broadband penetration and ICT expenditures are below the EU average in both France and Germany and are even lower in Italy.

A group of small continental countries includes Belgium, the Netherlands and Austria. This group has low expenditures on state aid, somewhat more administrative and less economic regulation (with the exception of higher levels of state aid in Belgium). These countries are extremely short of venture capital and have a low share of science and engineering graduates. They have a moderate position in research and a slightly better position in information technology, leaning towards incremental innovation and technology diffusion. The share of technology-driven and skill-intensive industries is smaller than would be expected from the high levels of GDP per capita in these countries.

The group of southern peripheral countries includes Spain, Portugal and Greece. This group of countries has strict regulations and low levels of investment into the future. The share of sophisticated industries is low.

It can be shown on the basis of this grouping, as well as at the country level, that low state aid, less regulation and higher levels of investment into the future correlate with positive 'outcomes'. Outcome (of structural change or of industrial policy) is measured by (i) high shares of technology and skill intensive industries,

(ii) good performance in terms of the Lisbon rankings and (iii) macro-economic performance. This is a positive and reassuring result, favourable for a future-oriented industrial policy approach, even though we must stress that simple correlations do not prove causality. Furthermore, many studies demonstrate that an integrative, systemic, strategic policy is important and performance does not depend on specific, isolated instruments.

(4) The role of industrial policy in the general economic strategy of the EU appears to be growing. Many elements of the New Integrated Guidelines for Growth and Jobs, which since 2005 have been seeking to integrate macroeconomic policy, labour market policy and the Lisbon strategy (European Commission, 2005b), refer to industrial policy issues: open and competitive markets, an attractive business environment, entrepreneurial spirit, investment into R&D, ICT and strengthening the industrial base. This may lead to a less ideological and more practical approach to industrial policy than has been practised in the past. The matrix approach—which must still be made more operational—may be a good basis for industrial policy as part of a broader, pro-active economic policy.

Notes

1. These shares are based on WIFO calculations from AMECO. Manufacturing is defined as NACE 15 to 36. Wide definitions of manufacturing include construction, energy and mining; this raises the share by about 7 percentage points. According to OECD figures (STAN database), the share of manufacturing in GDP amounts to 19%.
2. 1993 was a year of recession.
3. However, the combined share of manufacturing and business services overestimates the importance of 'wider manufacturing', because parts of business services are demanded by other sectors, e.g. the service sector itself.
4. Jacquemin (1975), for similar view see also Stöllinger (2000), Hepperle (2004).
5. The Maastricht Treaty is widely seen as the start of a community-wide industrial policy. Interestingly, it does not use this term explicitly; the headline of the chapter reads 'Industry'.
6. A Committee on Industrial Policy was proposed by the Council in the same year, but never set up. In 1973, the Council of the European Community set up guidelines for a European Industrial Policy, which concentrated on removing barriers to production and trade and also published the 'European scale promotion of competitive advanced technology undertakings'. Article 130 EEA of the Single European Act (1986) formed the basis for a common research and technology policy. Its goals of strengthening the scientific and technological basis of industry and its competitiveness are clearly related to industrial policy.
7. 'Some key issues in Europe's competitiveness—towards an integrated approach', European Commission (2003a). Absolute de-industrialisation may be defined as the long-term decline of the manufacturing sector, implying an absolute decline in employment, production, profitability, exports and capital stock in the manufacturing sector and the emergence of persistent manufacturing trade deficits. However, absolute de-industrialisation should be distinguished from relative de-industrialisation characterised by a decline in the share of manufacturing in GDP, which reflects a process of structural change towards a service-dominated economy, as a result of productivity growth in manufacturing, increased real income and therefore a rising demand for services.
8. It may be an interesting task to investigate the relation between the four phases of industrial policy and more general economic and technological trends. The importance of mechanics and electronic technology may have been the cause of the sectoral approach in the 1950s and 1960s. We thank Gunther Tichy for this suggestion.
9. Commission of the European Communities, Communication from the Commission, Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing—towards a more integrated approach for industrial policy, COM(2005) 474 final, Brussels, 5 October 2005.
10. Darmer & Kuyper (2000, p. 4): As an example of a broad definition, see Johnson (1984): 'Industrial policy means the initiation and co-ordination of governmental initiatives to leverage upward the productivity and competitiveness of the whole economy and of particular industries in it.' For a

narrow definition, see for example Tyson & Zysman (1983) 'Industrial policy ... means government policy aimed at or motivated by problems within specific sectors' or Krugman & Obstfeld (1991): 'Industrial policy is an attempt by a government to encourage resources to move into particular sectors that the government views as important to future economic growth.' There is not even agreement on whether the term 'industry' in industrial policy indicates manufacturing—as is more usual in Europe—or whether industrial policy should include measures of producer related services, finance, consulting, and transport (or even construction and energy, which would conform to the US interpretation of 'industries' as sectors)

11. Aiginger *et al.* (1998, 2001). The respondents were economists in the field of industrial organisation, competition policy and innovation, with the majority working in academic institutions and a minority in government institutions and competition authorities. In a survey among economists and policy advisors, 68% of the respondents disagreed with the claim that 'the best industrial policy is no industrial policy' while only 24% agreed. Rejection is somewhat weaker among the US experts, but even here a slight majority rejects *laissez faire*. As to the success of industrial policy, the opinion is mixed: the experts are evenly split on the question whether 'industrial policy is subsidisation in disguise', and whether 'recommendations by experts have an influence on industrial policy'. The results of these surveys, which were carried out in the late 1990s, tell us that the importance of industrial policy is widely acknowledged, while its success is seen as mixed.
12. For an overview of the French approach, see Alcouffe (2005). Outstanding examples of the 'French approach' are Airbus, Concorde, Minitel, HDTV, and TGV. Often, supporting the space industry and energy is also project-oriented, or follows a specific strategy with a strong top-down component.
13. Denmark recorded the highest share of state aid to manufacturing, amounting to more than 4% of value added; shares above 2% are reported for Greece, Luxembourg and Spain. The smallest share—less than 1%—was measured for the UK, Sweden and Finland.
14. It is labelled 'dynamic product market regulation' in Aiginger (2004b), because it is available over time and for more than just one year.
15. The overall EPL indicator is basically a sum of the two indicators for regular and temporary contracts. These are constructed by using factor analysis to aggregate the basic indicators that were calculated according to an in-depth review of existing regulations. For regular contracts, indicators of procedural requirements (duration, notice and severance pay and standards and penalties for unfair dismissals) were reviewed. For temporary contracts, the objectives according to which temporary contracts can be offered, the maximum number of successive renewals and cumulated duration are reviewed. For further details see Nicoletti *et al.* (2000).
16. Eurostat Website Structural Indicators, Explanatory Texts: data on public procurement are based on information contained in the calls for competition and contract award notices submitted for publication in the *Official Journal of the European Communities* (the S series). The nominator is the value of public procurement, which is openly advertised. For each of the sectors—works, supplies and services—the number of calls for competition published is multiplied by an average based, in general, on all the prices provided in the contract award notices published in the *Official Journal* during the relevant year.
17. The share is higher in the EU than in the USA, although the number is still higher in the USA (because of the higher overall number of graduates).
18. Participation rates are only a crude indicator, as no statement regarding the quality or the amount can be made (European Commission, 2004b).
19. Broadband penetration measures the number of broadband connections in relation to the population ($100 \times$ number of broadband access lines/number of inhabitants). Broadband lines are defined as those with a capacity equal or higher than 144 kbits/s (Eurostat Website Structural Indicators, Explanatory texts: http://europa.eu.int/newcronos/reference/sdds/en/strind/innore_bp_sm.htm).
20. In this paper, the term 'Scandinavian countries' refers to Sweden, Denmark and Finland, the terms 'Scandinavian' and 'Nordic' are therefore used interchangeably.
21. Eurostat Website Structural Indicators, Explanatory texts: (http://europa.eu.int/newcronos/reference/sdds/en/strind/innore_vc_base.htm).
22. European Commission (2004a). This work includes no figures on raising venture capital in the largest markets; the largest markets for raising venture capital funds are the UK, Sweden and the Netherlands.
23. For a definition of technology-driven industries, see Peneder (2001).
24. Flexicurity is the technical term for a regime combining flexibility for firms (easy dismissals) with security for employees (new job offers or training).

25. With the exception of the Netherlands, which succeeded in attracting many headquarters because of its geographical position and favourable tax regimes.

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Appendix

Table A1. Country rank for state aid

	State aid as % of GDP (inverted) 2002	State aid to manufacturing as % of VA (inverted) 2002	Share of horizontal state aid 2002	Average Rank	Superrank
BE	7	11	5	7,7	7
DK	14	14	1	9,7	10
DE	13	9	11	11,0	13
EL	6	13	2	7,0	6
ES	11	12	10	11,0	13
FR	9	8	12	9,7	10
IE	10	5	13	9,3	9
IT	8	10	6	8,0	8
NL	4	6	4	4,7	4
AT	5	4	7	5,3	5
PT	11	7	14	10,7	12
FI	2	2	3	2,3	1
SE	1	2	8	3,7	2
UK	2	1	9	4,0	3

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

Table A2. Country rank for regulation

	Product market regulation (inverted) 2003	Administrative Regulation (inverted) 2003	Economic regulation (inverted) 2003	Network liberalisation (inverted) 1998	Labour market regulation (inverted) 2003	Open tender 2002	Average Rank	Superrank
BE	8	10	10	9	8	9	9,0	10
DK	3	2	3	6	3	11	4,7	3
DE	5	10	7	3	8	14	7,8	7
EL	12	8	11	14	11	1	9,5	11
ES	10	12	8	8	13	2	8,8	9
FR	11	6	12	10	11	7	9,5	11
IE	2	4	1	12	2	8	4,8	4
IT	14	7	14	13	7	4	9,8	13
NL	8	14	5	5	6	13	8,5	8
AT	5	9	5	7	5	10	6,8	6
PT	12	13	12	11	14	5	11,2	14
FI	5	5	8	4	4	12	6,3	5
SE	3	2	3	2	10	6	4,3	2
UK	1	1	1	1	1	3	1,3	1

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

Table A3. Country rank for R&D/education/broadband + ICT expenditures/venture capital

	Public R&D as % of GDP 2001	Business R&D as % of GDP 2001	Science & Engineering graduates 2002	Population with tertiary education 2002	Participation in life-long learning 2002	Penetration of Broadband 2004	ICT expenditures as % of GDP 2003	Venture capital early stage 2003	Venture capital expansion and replacement 2003	Average Rank	Superrank
BE	10	5	8	4	8	3	5	8	11	6,9	7
DK	6	4	6	2	3	1	5	3	7	4,1	3
DE	5	3	9	10	9	9	8	8	13	8,2	8
EL	13	14		11	14	14	11	13	14	13,0	14
ES	12	12	6	8	10	9	13	11	3	9,3	11
FR	3	6	2	9	13	7	10	6	5	6,8	6
IE	14	10	1	6	6	13	14	6	10	8,9	9
IT	11	11	12	13	11	12	11	14	8	11,4	13
NL	4	9	11	7	5	2	3	11	4	6,2	5
AT	7	8	13	12	7	6	8	10	11	9,1	10
PT	9	13	10	14	12	11	7	4	9	9,9	12
FI	1	2	4	1	2	5	4	2	2	2,6	1
SE	2	1	5	5	3	4	1	1	6	3,1	2
UK	8	7	3	3	1	8	2	5	1	4,2	4

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.

Table A4. Country rank for 'industry structure'

	Technology driven industry share 2001	High skill industry share 2001	Average Rank	Superrank
BE	6	7	6,5	7
DK	8	1	4,5	3
DE	5	3	4,0	2
EL	14	14	14,0	14
ES	12	12	12,0	12
FR	4	6	5,0	5
IE	1	8	4,5	3
IT	11	5	8,0	9
NL	9	10	9,5	10
AT	10	9	9,5	10
PT	13	13	13,0	13
FI	3	11	7,0	8
SE	2	2	2,0	1
UK	7	4	5,5	6

Sources: WIFO calculations using European Commission State Aid Scoreboard, European Commission Innovation Scoreboard, Eurostat Structural Indicators and New Cronos, OECD Regulatory Database.