

# Dynamics of Innovation ,Competition and Market Dynamics

## In Network Industries

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### SUMMARY

This study surveys a broad spectrum of economic studies on innovation and technological change developed primarily over the last two decades with a view to identifying theories, models and ideas that could provide guidance to competition authorities on how best to analyze the impact of innovation and market dynamics on a merger or an anti-trust investigation.

The literature review — provided in the Appendix — covers a wide range of studies on technological change and discusses both mainstream models of innovation and studies that fall within other traditions such as evolutionary economics.

Within this framework, this chapter provides a discussion of the key issues, theories and concepts from which the development of the analytical tools and guidance would start. These are largely drawn from the industrial organization literature, endogenous growth theories and parts of the evolutionary economics literature, and are briefly summarized below:

**Product market competition” versus “competition in innovation”.** The analytical tools make use of the idea that the effects of mergers, agreements and conduct on the competitive process can be understood by reference to the effects on these two *dimensions* of competition. “Product market competition” captures the competitive constraints placed on firms in the supply of given products and services. “Competition in innovation” captures the competitive constraints placed on firms in the innovative activity they undertake with a view to introducing new products and services in the future.

**Winner-takes-all markets.** Once the competitive process is considered according to the two dimensions of product market competition and competition in innovation, it is apparent that the relative importance of each dimension will vary across markets. Some markets may be so static that competition in innovation is barely seen. However in some markets, competition in innovation may be the only dimension along which the competitive process proceeds, creating “winners” who achieve temporary product market dominance until a new round of competition in innovation is experienced. One reason for the existence of such markets may be **network effects** which are demand-side factors that may favour the tipping of the market towards one product or standard.

The lack of a general **relationship between intensity of competition and innovation.** At a general level, there is some evidence in favor of an inverse-U shape between intensity of competition and innovation, indicating that innovation may be relatively less rapid at both very low and very high intensities of competition. However, there is insufficient practical guidance from the literature to develop these ideas into a general theory on this issue, which is perhaps best addressed on a case-by-case basis.

As such, much of the analysis to be discussed seeks to draw implications between

the **nature of innovation** and the competitive implications for product market competition and/or competition in innovation. This may be particularly important once attention is paid to **firms' heterogeneity** and differences in their **capabilities** to innovate and supply different product markets.

**Horizontal versus vertical innovation.** An innovation is vertically (horizontally) differentiated compared to an existing product if all (only some) consumers consider it better at the same price. The extent of vertical and horizontal differentiation between new and old products may be an important determinant of how innovation affects competition.

**Stepwise innovation versus incremental innovation.** Step-wise innovation involves a relatively substantial degree of novelty (e.g. a new product or production process that is substantially different and/or better than an older "generation" of products). By contrast, incremental innovation is characterized by minor cumulative changes to products or production processes. Again, this distinction may be an important determinant of the way in which innovation affects competition.

**Tacit knowledge.** Tacit knowledge cannot be codified, transferred or imitated by external parties but is rather embodied in routines and skills of the firm. The capability of a firm to innovate in particular areas will be affected by the extent of tacit knowledge underpinning the innovative activity, and whether the firm has access to this knowledge (e.g. acquired through a process of learning-by-doing).

**Invention versus adoption.** Innovation is more adoptive than inventive the less it relies on internal innovative efforts of the firm and more on benefiting from such activity by other firms (especially suppliers) and organizations (such as universities). Again, the capability of a firm to supply a future market through innovation will depend on the nature and extent of inventive effort required.



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### 1. Introduction and Overview

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## **Policy Assessment Tools**

The tools discussed here offer a structured approach to the analysis of the impact of technological change on competition and to the consideration of innovation in anti-trust and merger investigations. While these draw on the ideas from the academic literature, they seek to provide guidance that is of practical value given the inevitable constraints of a competition policy investigation.

In particular, we reach the view that explicit consideration of market dynamics may be particularly important in the context of a competition policy investigation for two reasons:

**Dynamic markets are "unstable".** Expected market developments may be such that assessment of the effect of a merger, agreement or conduct in the current relevant market would not be robust in the future. In other words, analysis of the effects on product market competition today would not necessarily be validated by a more forward-looking approach which seeks to take account of those changes in the competitive environment (e.g. introduction of innovative products, changes in consumer preferences, new methods of supply) which, though not certain, can at least be anticipated.

**"Competition in innovation" features prominently in the competitive process.** The standard practice of competition policy investigation – which places emphasis on analysis of firms' positions and market shares to assess competition within current relevant markets – may not be sufficient to capture the effect on the competitive process as a whole; specifically analysis may need to consider both the effects on product market competition and the effects on competition in innovation.

## **The definition of current and future markets**

In seeking to take more explicit account of dynamic factors, the importance of market definition is perhaps not self-evident. Some commentators have argued that when analyzing dynamic markets, market definition is neither necessary nor appropriate. It has also been argued that market definition in dynamic markets should not proceed on the conceptual basis of the traditional hypothetical monopolist test.

We argue however that market definition is an important element of the analysis of dynamic markets because it guides and disciplines the analysis of competitive constraints in the supply of products. Since these competitive constraints, or expectations of these competitive constraints, condition competition in the supply of current products, competition in the supply of future products and competition in innovation, we favor the retention of this approach.

The analysis can be structured on the basis of the definition of a “future market” which can be thought of in the same way as a typical relevant market, but where the time period in which the market applies, and in which supply and competition are to be assessed, is expected to begin at some date in the future.

This approach can be adopted for two types of competition assessment that, individually or jointly, may be relevant in a particular case:

forward-looking assessment of competition in the supply of current products — i.e. how the current market is expected to “evolve” over time; and

forward-looking assessment of expected competition in supply of products that are yet to be introduced to market.

It is important to note that we are not suggesting that such future markets can be identified or defined with great precision. We accept that it is an impossible task to develop a precise approach in an uncertain world. But we think that the disciplines of market definition analysis enable greater clarity for forward-looking competition policy assessment in the face of this uncertainty.

## **Capability to supply analysis**

While partly analogous to consideration of barriers to entry in a standard investigation, it is necessary to draw attention to one important difference. Since a future market is yet to be supplied by any firm, it is appropriate to analyze supply to the market by reference to what factors determine which firms (or types of firms) are able to supply the future market, rather than simply what factors favor “incumbents” versus “entrants”. Moreover the complexities of analyzing which firms are capable of innovating such that they can supply future products may be particularly challenging; this suggests the benefits of a structured approach to assessment of firms’ capabilities to innovate and supply future markets.

On this basis we set out a step-wise approach that may facilitate analysis of the capability of firms to supply future markets. Assessment of the capability to supply a future market can be structured by conducting analysis based on the components listed below.

**Step 1: Identification of the nature and source of the innovation.** The identification of the nature and source of innovation will play a crucial role in determining which (types of) firms are capable of supplying the future market, and where their competitive advantage may lie. In particular it is instructive to consider the extent to which the innovation in question is adoptive or inventive, and also to assess the nature of the knowledge base underpinning the innovation (e.g. the requirements for tacit knowledge).

**Step 2: Identification of inter-market links.** Often relevant markets are linked to each other in such an important way that competition analysis of one market in isolation would provide a poor picture of the competitive and innovative implications of the market. In

particular it may not be appropriate to analyze innovative activity on a market-by-market basis — frequently the same source of innovation activity may be associated with multiple future markets. Furthermore, a firm’s ability to innovate and successfully supply a future market may be contingent on its success (or at least interaction with) related markets.

**Step 3; Identification of inter-temporal links.** Assessment of the capability to supply a future market may hinge dramatically on analysis of the “inter-temporal links” that exist between suppliers in a current market and potential suppliers to a future market. In particular, it may be valuable to assess whether conditions are such that it is necessary to be competing strongly in a current market in order to have the capability to supply a related future market, or whether the innovation associated with the supply of the future market is so drastic that “entrants” and “incumbents” have a similar capability to supply the future market.

**Step 4: Identification of access services.** Besides access to the innovation underlying the future market, a firm’s ability to compete in the innovative activity related to a future market may also be dependent on key inputs that it must obtain from other firms and organizations. Such “access services” describe the inputs that are needed to supply the future market, and may be associated, for example, with physical assets, IP rights or information. Analysis of how such factors could relate to the future market can inform on both the potential for different (types of) firms to innovate and supply the future market and also the ability of firms supplying such “access services” to distort future competition and innovation.

### **Understanding the Nature of Innovation**

Both the proposed tools relating to definition of current and future markets and to analysis of the capability to supply future markets draw on distinctions between different types of innovation.

- (i) innovation based on stepwise vs. incremental innovation,
- (ii) drastic innovation such that competition is mainly “for the market”
- (iii) innovation of vertically vs. horizontally differentiated products
- (iv) innovation based on adoption vs. invention
- (v) innovation based on tacit rather than codified knowledge base

For example, as discussed above a distinction between vertical and horizontal innovations is useful in assessing the impact of innovation on the boundaries of the relevant market, while identification of whether the knowledge base underpinning an innovation is tacit or codified is valuable in analyzing firms’ capability to innovate and supply future markets.

A problem with the definition of a “future market” neglects the uncertainty dimension of future markets and therefore could miss structure and size. This kind of definition could border on speculation and be of limited help for anti-trust assessment.

Given the qualitative relations to various activities on innovation vs. competition, market structure/ future and present it remains to be linked to strategic decision making.

### **Competition Policy Cases**

How may the guidance on market definition in dynamic markets and the capability to supply analysis be incorporated into anti-trust policy investigations?

Analysis of abuse of dominance cases in dynamic markets may often be guided by assessing whether the conduct in question impedes competition by restricting other firms’ capabilities to innovate and supply future markets. In particular, a firm that holds a dominant position in the supply of an “access service” on which other firms depend if they are to innovate may be in a position to distort competition in innovation through the terms on which this access service is supplied. Similarly, a dominant firm may take other actions that are revealed by the analysis to have inhibited other firms’ capabilities to supply future markets.

In mergers and agreements cases we emphasize how both the market definition and capability to supply analysis can be used to assess the effects of the merger or agreement on (a) product market competition and (b) competition in innovation. As regards product market competition, a forward-looking perspective may need to consider the competitive effects in the future “evolution” of the current relevant markets (i.e. future markets for the products currently supplied). It may also need to consider the expected competitive effects in separate future markets relevant to prospective products which are yet to be introduced (but whose future introduction is anticipated with some confidence). As regards competition in innovation, a forward-looking assessment may need to consider not just whether competition will be impeded in the supply of current and anticipated products, but also whether competition will be impeded in innovative activity associated with potential products that are yet to be developed.

### **Multiple Sources of Innovation and Competition**

It has been only recently, mainly over the last two decades, that the economic forces behind technological innovation have started to be investigated in more detail within mainstream economics. As a result, a wide variety of theories and models, sometimes very diverse in spirit, describing the economics of innovation are now available. All these theories share the common aim of providing a conceptual foundation for understanding how innovation affects the economy, how economic forces affect the emergence of technological changes, and the decision-making processes through which technological innovation occurs.

#### *Industrial Organization*

Traditional models of innovation focus on the study of firms’ incentives to invest resources in Research and Development (R&D) activities. Game-theoretical models developed in the industrial organization literature have investigated firms’ R&D decisions in strategic environments. . (Endogenous growth models, discussed in the next sub-section, have developed the study of market dynamics in models that explain the relationship between firms’ investments, innovation and economic growth.)

Game-theoretical models (GTMs) suggest that there are two main forces that underlie firms’ investment in R&D: the search for higher profits and the threat posed by falling behind potential innovating rivals. GTMs study these forces in a variety of market situations and address issues such as the interplay between innovation and market structure, the dynamics of competition and the nature of the relationship between intensity of competition and innovation.

These models provide a rich picture of what the plausible strategies and industry equilibria in dynamic markets can be. However, general predictions, that can be considered appropriate across all situations and industries, are scarce. On one hand, this is a result that seems to stress the lack of predictive power of these models, i.e. (almost) everything can be rationalized; on the other hand, however, the variety of results seems well to fit with the variety of observed behaviours and “equilibria”. There is no general model that can uncritically be applied to any case: the understanding of the specific characteristics of the single situation needs to underpin any appropriate choice of a modeling framework.

Despite the absence of general results, these models are certainly useful tools to understand firms’ incentives to invest in R&D activities in strategic environments and to suggest what main factors may be central in shaping the nature of dynamic competition. For instance, these models suggest that:

in order to understand R&D investments in strategic environments it is necessary to understand how innovation may affect profits both of successful and non-successful innovators. The first perspective captures the idea that firms want to innovate to increase their profits; the second captures the idea that firms want to innovate to maintain



competitiveness.

The relationship between concentration of an industry and its rate of technological innovation is certainly complex and in general not a causal one: both should be thought of as the outcomes of the operation of market forces and exogenous factors such as the nature of demand, technological opportunity and the conditions governing appropriability.

Dynamic competition may be characterized by persistent dominance of the incumbent leader or by action-reaction whereby incumbents are overtaken by a rival whose incumbency is itself then short-lived. The nature of market dynamics depends on a number of factors, such as the type of innovation, i.e. drastic or non-drastring, the uncertainties involved in R&D activities, the nature of patent protection and of knowledge spillovers, the intensity of product market competition, etc.

When the relationship between competition and innovation is investigated, it is necessary to be clear what the notion of intensity of competition describes and how this relates (or does not relate) to market structure. Indeed a market where competition is tougher may be more concentrated simply because inefficient firms cannot survive. There may be trade-off between the intensity of static competition and innovation. In general, the relationship between intensity of competition and innovation need not be monotonic at all.

#### *Endogeneous growth models*

Endogeneous growth models have recently developed the earlier game theoretical literature on innovation in the context of studies that seek to explain the relationship between innovation and economic growth. These models suggest that innovation, resulting from intentional R&D investments by profit-maximizing firms or simply by unintentional learning-by-doing, is a fundamental driver of economic growth in the long run.

Early Schumpeterian endogenous growth models stressed the importance of ex-post rents for innovation: competition would have a detrimental effect on innovation by decreasing the rents that an innovator would be able to appropriate. More recent models have emphasized another mechanism by which competition affects innovation: tougher competition may increase the incentives of firms to innovate in order to escape from fierce competition. These recent studies suggest that the relationship between competition and innovation may not well be monotonic and that instead, one should expect an inverse-U shaped relationship: when competition is low, an increase in competition would foster innovation; the reverse would happen when competition is fierce.

The result that competition may be conducive to innovation is also obtained in studies where the traditional behavioral assumption of profit-maximizing firms is relaxed. When principal-agent considerations are introduced to explain managers' behaviors, another mechanism by which competition may favor innovation is suggested: the speed of innovation may be retarded by the slack of managers who tend to avoid private costs associated with innovation. When competition intensifies, the higher threat of bankruptcy may force managers to speed up the process at which new ideas are adopted. Hence, competition may be conducive to faster rates of innovation.

#### *Locations and Clusters*

New economic geography is a branch of economics which is mainly concerned with spatial aspects of economics. In particular, it seeks to explain why and how given economic activities concentrate geographically, either within individual countries (agglomerations) or between different countries (industrial clustering). Furthermore, it considers the inter-relationships between geographical concentration of industry, international trade and economic

development.

### *Evolutionary economics of innovation*

The evolutionary approach to the study of innovation has been developed on very different methodological basis than those underlying traditional economic models of innovation. In particular, we observe the rejection of the modelling assumptions of rationality and equilibrium that are fundamental to the traditional approach.

Evolutionary economics looks from the outset at dynamic processes. In particular, it is associated with the use of analogies from evolutionary biology to explain economic growth and the process of competition. Thus the cornerstones of an evolutionary analysis of competition and innovation are variety, selection and imitation.

At a basic level, using Darwinian analogies, we can begin to appreciate the role of the market in selecting the more fit firms (efficient and profitable), products and techniques at the expense of less fit firms, products or techniques. In addition to this effect, we would expect to see imitation of winning ideas by those whose survival is otherwise threatened (although this is limited by the tacit nature of knowledge).

Inherent in this model of competition is the association between competition and experimentation and variety. A variety of experiments allows, through the process of selection, for greater economic progress than would be available through uniform optimization.

The economic development and innovation can be seen as a combined effect of selection (via competition) from a *variety* of competing routines and practices as well as the more endogenous process of agents seeking improved routines and practices. While the latter is certainly incorporated, if treated somewhat differently, under the mainstream neoclassical approach, the emphasis on selection from variety seems an important addition to this approach.

This suggests that models found in other branches of economics might miss something important when they analyze dynamics with reference to homogenous profit-maximizing firms: namely the benefits of selection from heterogeneity in capabilities and innovative experimentation.

### *Systems of innovation*

At an aggregate level, the evolutionary approach to the study of economic growth draws attention to the importance of institutions in the process of economic growth. The key findings of the literature are as follows:

Innovation and its diffusion take place within systems of interconnected organizations and institutions. Important constituent elements of such systems are organizations such as firms, governments and universities. Institutions, with which these organizations interact reflect laws and statutes (e.g. the institution of patent protection) as well as more abstract elements (e.g. cultural aspects of the economy such as the spirit of entrepreneurial activity).

Innovation within the system will depend not only on single institutions but also on the nature and intensity of interactions between the various elements of the system.

When considering the interaction between competition and innovation, we must remain aware that the effects of such interaction will depend on the evolving institutional background against which agents in the economy operate.

Cliometrics is a methodological framework for the study of economic history. The existing body of cliometrics draws attention to the following factors relevant to “systems of innovation”.

Economic growth is a result of a complex interaction between institutions and markets. Examples of institutions that are frequently important for innovation are the protection of property rights (for example, against piracy) and patent policy.

Innovation plays a critical role in economic progress and development. This involves not only technological innovations but also changes in institutions. Thus, institutions themselves evolve according to changing circumstances. These two last points complement the concepts of systems of innovation found in the macroeconomic field of the evolutionary approach.

### **Preliminary Assessment**

Traditional competition policy analysis is most closely linked to the neo-classical paradigm, at least when discussed from an economic rather than legal perspective. The analysis carried out in competition policy cases normally involves assessment of the nature of competition in concentrated markets where strategic interaction is an important feature of the competitive process. It is probably for this reason that the industrial organization literature appears most readily applicable to, for example, the analysis of an allegation of foreclosure, or the effects of a merger on market power.

Our view is that this is the correct approach to start with. The emphasis that the industrial organization literature places on incentives should be at the forefront of competition policy analysis, regardless of whether we seek to analyse the implications of current pricing constraints or more dynamic considerations (such as the effectiveness of ongoing competition in innovation). Economic models of innovation (or aspects of these models) associated with this strand of literature are likely to fulfill well the concepts of usefulness exactly because they relate to the issues raised under this criterion.

Furthermore, when analyzing the process of competition we must also consider the role that it plays as a selection mechanism.

The effect of incentives on firm-level (and inter-firm) strategy, as analyzed via the industrial organization framework, seems insufficient to explain the process of innovation and dynamics brought about by competition. The incentive effects of competition should be able to explain well the behavior adopted by firms. But an analytical approach that focuses on incentives does not appear to be the most efficient means through which to understand how firm-level dynamics relate to industry-level dynamics.

Regardless of how far we adopt evolutionary economics' rejection of models based on rationality it remains a matter of fact that real markets are characterized by heterogeneity. This heterogeneity exists both in terms of the goods and services currently available, and the capabilities different organizations possess in terms of the production methods currently employed and the searches for new products and techniques currently being undertaken. Evolutionary theories that relate the competitive process to one of selection in the face of such variety bring an extra dimension to an attempt to make more explicit the relationship between competition and innovation. Furthermore, this suggests why taking a systems perspective, as provided by the systems of innovation literature, is valuable in the analysis of the interplay between competition and innovation and why this can facilitate the assessment of the benefits of inter-firm cooperation on innovation.

Nevertheless, some components covered in a literature review are not reflected in the

selection of key theories and concepts. The cliometrics literature, and related parts of the systems of innovation literature, are valuable in indicating the importance of institutions for innovation. Not only should we expect the prevailing institutional background to affect innovation at some aggregate level but, more importantly, it will affect the relationship between innovation and competition as stylized by the twin processes of incentives and selection. The institution and characteristics of patent protection clearly affects the incentives for innovation. And we can imagine that market regulations (including inter alia competition policy itself) affect the ability of the market to bring benefits through the selection mechanisms of competition.

However, while competition policy analysis needs to be aware of the institutional background (and indeed some cases will turn on the effects of particular institutions and regulations), the Institutional environment as a whole is unlikely to be central to the analysis of particular market behavior and interaction.

The microeconomics and the sectorial aspects of each individual case should dominate the analysis, drawing on aspects on the institutional background (e.g. whether university research is important to innovative competition in an industry under consideration, which we consider under “capabilities to supply” but without a detailed exposition of the complete institutional environment. Similarly, the analysis coming from new economic geography may provide useful context material, and be relevant to other aspects of innovation policy, but appears to offer little in the way of critical additions in the current context.

## 2. Key Concepts of Competition for Network Industries

One of the most important results from the literature review is the suggestion, largely from the industrial organization literature of an analytical distinction between product market competition and competition in innovation.

**Product market competition** can be understood as competition between firms in the supply of existing products. This competition can be conceptualized as the rivalry between firms in terms of marketing, and notably pricing, of their products taking as given the characteristics of products (including production processes and costs). In markets that are considered relatively “static”, product market competition is the main channel through which the competitive process takes place.

**Competition in innovation** can be understood as the competition between firms to develop new products and production processes; this competition is often associated with the ideas of a competitive threat from innovation. Two firms are competing in innovation if they are undertaking (uncoordinated) innovative activity that can be identified with the prospect of introduction of products or services that will compete in the future. This innovative activity could be investment in R&D or less formalized activity such as product improvement through a process of learning-by-doing. Where two firms are competing in innovation, we expect their decisions regarding innovative strategy to be influenced significantly by the innovative strategies employed by rival firms — failure to innovate successfully will lead not just to loss of potential profit but also risk falling behind innovative rivals.

Mainstream economics also makes use of the terminology of “static” and “dynamic” competition. Along the same lines as above, the static dimension of competition is usually related to price competition, which takes place given the set of products or services that are marketed by firms. Dynamic competition, on the other hand, refers to the process whereby new and improved products, services and production processes are introduced. However, in the context of ‘innovation and competition’ we consider it more appropriate to use the terminology of “product market competition” and “competition in innovation” as this is more specific and seems more conducive to the development of guidance for competition

policy practice.

Indeed, the distinction between product market competition and competition in innovation is particularly well suited to taking innovation and market dynamics into account for the purposes of competition policy. This is because competition policy practice is well accustomed to the analysis of product market competitive constraints through analysis of competition within a relevant market. Thus explicit consideration of competition in innovation can be seen as an additional dimension to this analysis, rather than a fundamental change in the concepts of competition used for assessment.

An important aspect of the tools and guidance developed in subsequent sections is to relate these dimensions of competition to practical concepts used in competition policy assessment, in particular to market definition analysis.

### **Winner-takes-all markets**

Industrial organization models, and the review of studies of network industries, suggest that competitive interaction in innovative activities may take different forms according to the structure of payoffs of innovative activities to “winners” and “losers”.

In some organization models, and the review of studies of network industries, suggest that competitive interaction in innovative activities may take different forms according to the structure of payoffs of innovative activities to “winners” and “losers”.

In the first case, competition in innovation may be the essential, or at the limit the only, dimension of the competitive process, i.e. winner-take-all markets. Persistence of monopoly may be observed in a winner-take-all market, but provided that competition in innovation is effective, this does not necessarily imply that competitive forces are muted. On the other hand, in these markets, competition in innovation is the area where the current dominant firm may be more likely to abuse its dominance (since, by definition, such markets are not conducive to sustained product market competition).

These considerations suggest that it is useful to distinguish between different economic environments, according the relative importance of competition in innovation and competition at the product market level that can be expected in the market. The literature on network industries is particularly useful in explaining why a market may exhibit winner-takes-all properties.

### **Network effects**

The review of the industrial organization / network industries literature relating to innovative markets has suggested that network effects may be an important factor in determining the competitive environment .

A (positive)direct network externality exists where the demand for a service increases as an extra unit is consumed. In order for this effect to be “direct” the reason for the increase in demand must come directly from the additional consumption of the service in question, without need for a strategic response by suppliers in the same or related market. For example, the demand for PSTN telephony services (i.e. the demand for subscriptions to networks) may increase as more users consume this product (e.g. enter into subscription agreements with PSTN network operators) simply because more users allows a greater number of potential connections to be made of the network.

By contrast, a (positive) indirect network externality exists where the demand for a service supplied in one relevant market has a significant effect on supply or another product (typically in a different relevant market) such that this in turn increases demand in the first relevant market.

An example of indirect network effects is that of computer software for a particular operating system platform. An increase in consumption in the market for supply of operating systems is likely to bring benefits to the markets for supply of compatible software, by expanding the market such that a greater variety of software is offered or the unit price decreases (since fixed costs of software development can be spread over a greater number of potential buyers). In turn, the benefits to the software markets render the same operating system more valuable, and thus increase demand for it. But the effect is indirect because it relies on a strategic response of software suppliers to the increase in the consumption of operating systems.

### **Horizontal and vertical innovation**

The study of industrial organization and endogenous growth models suggests that the distinction between "horizontal" and "vertical" innovation may be useful. Horizontal innovation entails the discovery of a new product which, setting aside price considerations, is considered better than existing products only by some users (or for some uses). By contrast, vertical innovation entails the discovery of a new product which, setting aside price considerations, is considered better than existing products by all users (for all uses); hence the idea that products can be ranked according to a "quality ladder".

The importance of this distinction derives from the differences in market dynamics that are associated with the two types of innovation. In particular, horizontal innovation generally results in the creation of new product groups that can coexist with older product groups.

Vertical innovation, on the other hand, is generally associated with a process whereby new and better products displace older obsolete products from the market. In markets subject to vertical differentiation, a firm (or more accurately a product) that does not follow the pace of technological advance may be driven out of the market. In other words, in order to survive, a firm needs some basic capabilities, and the need to improve these capabilities over time as its competitors improve theirs (hence the idea that a rising "quality window" exists, outside which firms cannot survive in the market). This economic process can guide on the nature of market dynamics that may affect a particular industry.

### **Step-wise innovation versus incremental innovation**

Step-wise innovation involves a relatively substantial degree of novelty, e.g. a new product or production process that is substantially different and/or better than older products. By contrast, incremental innovation is characterized by minor cumulative changes to products or production processes.

The extent to which an innovation is novel may be an important factor in assessing whether incumbent firms have an advantage over potential entrants or vice versa. In fact, industrial organization models suggest that incumbent firms may have different incentives to innovate than entrants. Similarly, given the difficulties that incumbent leading firms may have to deal with drastic changes – a form of of intra-firm systemic inertia – the opportunities for step-wise innovation may relatively favor incumbent firms.

### **Intensity of competition and innovation**

There is little consensus about the relationship between intensity of competition (however defined) and innovation . At a general level, there is some evidence in favor of an inverse-U shape, indicating that innovation may be relatively less rapid at both very low and very high intensities of competition.

However, there is insufficient guidance from the literature to develop these ideas into a general theory. For example, the question of "at what point is more competition worse?" does not seem appropriate to be analyzed at the generic level, given the current level of understanding of these effects. Much of these problems derive from the difficulties involved in understanding the link between product market competition and innovation. Therefore, we do

not consider there to be guidance from the literature on this issue, which is perhaps best addressed on a case-by-case basis.

### **Firms' heterogeneity and capabilities**

Mainstream models of dynamic competition deal essentially with firms' *incentives* to innovate. Not much attention is paid by theories rooted in the neo-classical tradition to the resources that firms need to innovate, nor to the importance that firms' heterogeneity may have in affecting market dynamics. For instance, whether a market is prone to dynamic persistence of monopoly depends not only to the incentives to innovate that an incumbent firm has compared to a potential entrant, but also on their relative capabilities, which may not be immediately ostensible.

The notion of firms' capabilities seems crucial to the understanding of market dynamics driven by innovative activities. In fact, we believe that it is by emphasizing the importance and nature of different firm's capabilities that evolutionary theories of innovation are most useful to the development of analytical tools .

Capabilities to innovate may depend on a number of factors:

having (the ability to) access external sources of knowledge (e.g. scientific knowledge);

having access to some tacit knowledge which is not transferable (perhaps because embodied in organization routines); and

having access to some specific complementary resources, e.g. specific input factors.

### **Tacit knowledge**

The capability of a firm to innovate in particular areas will be affected by the extent of tacit knowledge underpinning the innovative activity, and whether the firm has access to this knowledge (e.g. acquired through a process of learning-by-doing).

Tacit knowledge cannot be codified, transferred or imitated by external parties but is rather embodied in routines and skills of the firm. The term "tacit knowledge" is used to encapsulate the idea of knowledge that is found to be useful (e.g. in an organizational routine or a skill) without being directly accessible to consciousness or articulable, and therefore without being directly transferable (e.g. sold as information) or imitable.

### **Invention versus adoption**

Both the endogenous growth theories and the evolutionary economics literature, discussing cumulative versus science-based industries, suggest a distinction between cases where innovation is exogenous to the unit of inquiry (be this a firm, a system of innovation, or the whole economy) and cases where it is endogenous..

In the context of our analysis a distinction can be drawn between innovation resulting from inventive efforts by the firm supplying an innovative product and innovation resulting from adoption of inventive innovation by other parties. This distinction indicates the need to separate where innovative activity is taking place (i.e. the source of invention) from where it is observed on the economic landscape (i.e. its application). Innovation is more adoptive than inventive the less it relies on internal innovative efforts of the firm and more on benefiting from such activity by other firms (especially suppliers) and organizations (such as university research). Thus, we draw a distinction between

**1. markets based on invention**, where the sources of learning are essentially internal and dynamic change is largely due to firms' own creative and inventive actions, possibly in the form of R&D, or other sunk costs, investments or activities that lead to learning-by-doing

**2. markets based on adoption**, where innovation derives largely from external sources, such as suppliers or other sectors in the economy (e.g. research organizations)

### 3. DYNAMIC COMPETITION

#### 3.1 Dynamic Markets and Assessment of Competition

Every market is dynamic to the extent that we expect changes over time, for example in the quality and characteristics of the goods and services produced, their prices, the processes used in their production and the firms engaged in their supply. Innovative actions of firms affect all markets in the economy.

In line with the fundamental distinction we have drawn between product market competition and competition in innovation, we discuss how a more explicit consideration of market dynamics can inform on each of these dimensions of analysis.

First on the product market dimension, in dynamic markets **time matters**. A snapshot of the market observed at the time of the investigation is likely to be very different from a hypothetical snapshot of the same market taken in the near future. Such changes may be due to innovation undertaken by the firms in the market, or due to factors outside the market such as external technological developments, or shifts in consumer tastes. The result may be either more competitive or less competitive market conditions over time.

Second, in dynamic markets, the production, assimilation, and commercial use of new knowledge is central to the competitive process, i.e. it is a fundamental determinant of firms' success and failure. Thus, in some cases **innovation** (i.e. activity related to the supply of new services in the future) may be a crucial dimension along which the process of competition takes place.

Of course, anticipation is subject to great uncertainties. The view that the markets of telecoms, computers etc. converge was largely anticipated but it turns out to be different than expected and therefore may run contrary to anticipated market definitions. Example: G3 was the name of the game more than a decade ago where billions of dollars/euros through UMTS were skimmed off from anticipating market participants, only to know later that rival standards based on new technologies (Wi-Fi) bypassing UMTS, would create completely new markets not being anticipated.

#### Market Dynamics and Product Market Competition

If analysis of competition in a current relevant market is to provide guidance on dynamic effects in that market, we require some understanding of how this current relevant market is likely to evolve in the future. In areas of economic activity where the relevant markets are expected to remain stable, analysis of competition in the current relevant markets, with due attention to likely entry to that market, could be broadly informative on future competition in



those markets.

However, market dynamics will often mean that analysis of competition in the current market may not be a reliable indicator of competition in the future. Technical change may affect market definition, for example by widening the range of possible substitutes. In addition, technical change may affect the structure of the market as defined, for example, by making economies of scale more or less important. Such changes may be due to innovation undertaken by the firms in the market, or due to factors outside the market such as external technological developments, or shifts in consumer tastes.

Taking account of these factors is not simply a question of examining entry possibilities. Indeed it requires consideration of how the market to which entry applies, and the barriers to entry that may exist in this market, changes over time.

This concern has various practical implications. For example, in analyzing a merger, the two merging firms may currently be operating in completely separate relevant markets, thus raising no current competition concern. But product development may mean that the relevant markets converge in the future, such that these firms are expected to be competitors in the future. This does not mean the merger should be blocked; simply that competition analysis may need to be forward-looking as to how current markets are likely to evolve in future. Furthermore, in an extreme case of the “stability” problem highlighted above, a firm may not be active on any current markets but may be developing products that would compete in the future.

This may be the case for a merger between biotechnology companies that have no current products to sell – as shown for the history of this industry (Gottinger, Umal and Floether, 2010) In this case the competition investigation may need to explicitly define the future markets on which the outcome of the parties’ product development would be traded, in order to analyze the effects of the merger on product market competition. The aim would be to establish whether the expected outcomes of the biotechnology companies’ product development programs — i.e. the products the parties are anticipated to supply *in the future* — would face product market competition from other suppliers *when* they are introduced. (This analysis would abstract from the effects of the merger on the parties’ development of these new products; thus as an additional stage the analysis of this merger would need to consider the effect on competition in innovation, which is discussed below).

### **Market dynamics and competition in innovation**

By focusing on competition in defined product markets, be these current or future, analysis may miss the effect of competition in innovation. In some instances this will not hinder successful examination of a competition case, either because competition in innovation is subordinate to competition in the product market, or because analysis of the effects on competition in the product market may act as a “proxy” for analysis of the effects on competition in innovation.

However, where innovation is clearly an important part of the competitive process, the effect of a merger or anti-competitive conduct on competition in innovation may be significantly different to its effect on competition on the product market. For example, if a market seems to exhibit “winner-takes-all” properties,<sup>1</sup> such that it can only sustain one firm at a point in time, an abuse of dominance case may need to explicitly consider whether conduct by the dominant firm affects competition in innovation rather than product market competition. As such, competition in innovation may need to be considered in its own right. One caveat is that even if no competition in innovation is observed, this could in fact be due to from explicit consideration of dynamic effects and the potential for competition in innovation. Therefore the underlying issue should be competition, *or* potential for competition, in innovative activity.

## Identification of Dynamic Markets

The identification of a market as broadly dynamic or static is an output of the competition analysis itself, rather than a feature that can be established a priori before the investigation on the basis of some pre-defined indicia. Nonetheless, it is possible to identify some initial indicators of dynamic markets that would suggest the benefits of the further analysis proposed in this study.

We are interested in observable market features that relate to either the importance of competition in innovation or the potential instability of competition assessment in the current relevant market. The main indicators identified can be classified respectively into inputs to innovation (e.g. R&D), outcomes of innovation (e.g. changes in product performance) and changes in relative prices ; these features are discussed briefly below.

### Inputs to innovation

R&D and patent data are the most commonly used quantitative measures of innovative inputs and outputs and both could be considered proxies of the extent to which innovation is important in the sector considered.

A large R&D expenditure (say relative to other costs) or substantial labour input to R&D would indicate that a firm is investing a significant amount of effort in developing new products, or improving old products, both of which would suggest (but not prove) that competition in innovation is important.

Patent data would indicate the measures a firm is taking to protect innovations, be they product or process innovations. Since the granting of patents is dependent on some form of novelty, innovation is necessary (although the relative importance of innovation in the competitive process is not fully established).

Thus both R&D and patent data are potential indicators of whether competition in innovation is an important part of the competitive process. In addition, by implication, if competition in innovation is found important, it is likely that the competitive assessment in the current relevant market is not sufficient for assessment of product market competition since the new products and new technologies could render this assessment unstable into the future.

Despite their common use, however, these indicators are imperfect for several reasons, notably the excessive focus on formalized activities as a source of innovation and patented inventions as a measure of commercial innovations. In a competition policy investigation it is normally possible to access more specific measures of innovation in the market, notably related to observed changes in products' technologies, characteristics and prices. These are discussed briefly below.

### Outcomes of innovation

While R&D and patent data essentially relate to the inputs of innovations, observations on changes in product characteristics reflect the outcome of innovation. In this sense these are a more direct measure of the importance of innovation and the instability of competition assessment in the current market.

Where products embodying new technologies or significantly improved characteristics have been introduced recently, or are expected to be introduced, it is unlikely that the competitive conditions today reflect closely those in the near future. Indeed, observation of the specific nature of technologies used in the market may suggest that this is going through a drastic change of the technological paradigm that may entail profound changes in its structure, and hence require particular care in its analysis.

Indicators of significant changes in product characteristics include evidence (or expectation) of the following:

- introduction of products that embody a new technology;
- short product life-cycles;

- high proportion of market turnover accounted for by new products (i.e. products introduced, in say the previous 6 months); and
- rapid improvements in products' performance.

Nonetheless, one area where looking for changes in product characteristics may fail to pick out dynamic markets is where a period of market stability (in terms of products supplied) is accompanied by firms undertaking product development that has yet to bring products to the market. In this case no discernable changes in products would be observed today, but we may predict competitive conditions to change in the future. R&D data, or discussion with industry experts, could inform on the importance of such innovation for future market dynamics.

#### Changes to relative prices

Even if product characteristics are reasonably stable, assessment of competition in a current market may not provide a reliable guide to future competition where relative prices change. Although the relative prices of products should never be used on their own to define markets, significant changes in relative prices between two products may mean that they move from separate markets to a single relevant market (or vice versa).

In particular, while a new technology may initially be supplied at a high price compared to previous generations of products, and in a different market, subsequent market developments may mean that the price differential falls and both old and new technologies compete in a single market. Analysis of a merger in such instances would need to be aware that market definition is sensitive to the time period considered.

The price of the new technology may fall for various reasons, including increased competition among suppliers of the new technology, greater efficiency of production as the new technology becomes more popular and a fall in the price of inputs to produce the new technology. The latter may be reflective of competition in innovation in a related input market, or at least in the production processes relevant to the products in question.

Finally, as discussed further in Sec. 4, it is not only significant changes in relative prices that can change market boundaries, but also expectations of these changes. For example, consumers may delay purchase of a high-price new technology anticipating that its price will fall sufficiently to become a good substitute for an old technology; in this way the new and old technologies may exert competitive constraints on each other today: such competitive constraints may be missed by a static snapshot of current competition.

## 4. DEFINITION OF CURRENT AND FUTURE MARKETS

### 4.1 Introduction

Market definition is an important element of merger and anti-trust investigation and seeks to identify the competitive constraints that derive from consumers' substitution patterns. Innovation that affects products' characteristics and prices is a major source of instability of consumers' substitution patterns, and hence of the boundaries of relevant markets over time.<sup>2</sup>

Furthermore, market definition, by making use of the concept of a "future market", can allow for conceptually robust analysis of the effects of a merger, agreement or conduct on both prospective product market competition and on competition in innovation.

Article 82 is underpinned by the view that the unilateral behaviour of a firm can only significantly distort the process of competition to the detriment of consumers where that firm holds market power. It is necessary to consider *where* a firm holds market power in order to establish *where* it can distort competition (in the same or a related market). In the context of an agreement or merger, market definition allows for identification of the competitive constraints that might be lost if the merger were allowed to proceed.

#### **4.2 Issues that arise in dynamic markets**

The purpose of market definition is to identify a relevant market as those products and services, the suppliers (or potential suppliers) of which are capable of exerting effective competitive pressures on each other and of constraining each other's behaviour.

The major challenge that market dynamics pose to market definition derives from the instability of the market environment: technological change alters the set of products or services sold, how they are produced, their characteristics and prices and hence affects substitution patterns and the related competitive constraints. This instability may be most profound when the markets considered are reflecting a substantial change in the underlying technological paradigm but can also derive from less drastic change along a given technological trajectory.

This process will have implications for the appropriate assessment of the effects of a merger, agreement, or conduct by a dominant firm on competition between products currently on the market.

Changing consumers' substitution patterns imply that the temporal aspect of market definition is likely to be particularly important. Most clearly the boundaries of the current relevant market will evolve, perhaps due to changes in product characteristics and relative prices. Consequently, analyzing whether two products are substitutes today may provide a poor guide of whether they will be substitutable, and hence likely to compete, in the future. Furthermore, expectation that new products will be introduced in the future may provide a constraint on the terms under which current products are supplied. This suggests the potential importance of using the concepts of a future market to consider how the current relevant market (i.e. the traditional starting point for competition analysis) can be expected to *evolve* over time.

In addition, competition assessment of a merger, agreement or conduct by a dominant firm may need to pay attention to the competitive effects on products not yet supplied to the market, but whose introduction on the market can be anticipated to some reasonable extent; this has implications for market definition analysis. For example, in analyzing a merger in a dynamic setting, it may be necessary to consider not only the future evolution of markets for the merging firms' current products, but also the relevant future markets on to which the firms are expected to introduce new products (which could be entirely separate).

#### **4.3 Current and future markets**

Demand substitutability is also affected by changes in products' attributes and by changes in the available set of products. Dynamic competition that results in such changes may hence affect the boundaries of competition between firms and the boundaries of relevant markets. For instance, a new technology may, due to its insufficient quality, initially be considered not to be a substitute for the old technology but technological improvements may in the near future cause the two technologies to be considered close substitutes by consumers. Conversely, substitutability between a new high-quality/high-price product and an old low-quality/low-price product may increase over time as relative prices converge sufficiently to reflect consumers' perceptions of quality differences.

In some cases, technological change is expected to result in new relevant product markets altogether. For example, this may be appropriate in analysis of a merger between two pharmaceutical firms that are investing in R&D targeted at the discovery of new drugs for the same currently untreatable disease. In this case the new drugs would not be expected to face competition from existing drugs and would probably constitute an entirely new relevant market.

If estimates can be made of future product attributes then some notional 'future market' can be considered by applying the principles of the hypothetical monopolist test not to the current supply of products but to the expected future supply of products. As far as assessment of the effects of a merger, agreement or conduct by a dominant firm is concerned, there are two general reasons why it may be appropriate to consider future markets:

- to allow forward-looking assessment of the competitive effects on the supply of current products *in the future*, in light of anticipated or potential market developments (this can be considered as the "future evolution" of the current relevant markets);
- allow assessment of the competitive effects on the supply of products that are yet to be introduced, but whose introduction can be anticipated and is relevant to the investigation.

Therefore, future markets can be defined both from the perspective of the supply of current products (looking forward) and also from the perspective of the supply of products whose introduction is anticipated. The latter may be relevant, for example, in analyzing a merger between two firms that have potential products in the "R&D pipeline" that are yet to be introduced but which can be identified with some confidence; the potential products expected to result from the pipeline could be associated with the loss of expected competitive constraints in future product market competition (the merger case study in Section presents an example from the agrochemicals sector for which this is a relevant concern).

The time horizon to be chosen for this future market would depend on the specific characteristics of the case, e.g. the pace of technological progress. While we cannot capture all the possible future markets within the practical constraints of investigation — in terms of timing and information— there is benefit in attempting to consider those future markets where we expect the effect of a merger (agreement, or conduct) to be significantly different than in the current relevant market.

### **Meaning and Scope of future market**

It is clear that identification and definition of a future market will be subject to more uncertainty than the definition of a current relevant market. The definition of current markets can be based on observation and analysis of the characteristics, performance and price of current products, perhaps drawing on data relating to recent substitution patterns or evidence from consumer surveys. The correct definition of the current market may be fraught with difficulties, but it can at least begin on solid ground with consideration of what products are currently supplied.

By contrast, any definition of a future market will need to be based on predictions of future supply, in particular as to the nature and timing of new products and of what improvements will be made to existing products, and of consumer preferences in the future. These predictions can be expected to be subject to significant uncertainty, and to become less reliable the further into the future we are required to consider.

In proposing that the definition of a "future market" may be a useful component of competition analysis in dynamic cases we fully recognize this uncertainty. But we do not consider that uncertainty rules out completely the formation of reasonable views on what the definition of a relevant market will be in the future.

While market definition is sometimes seen as simply a step necessary to allow the calculation of market shares, its true value is as a discipline and framework for the identification of

competitive constraints — it is thus equally valid for future products (what competitive constraints will apply to products supplied in the future?) as it is for current products (what competitive constraints apply to products supplied today?). The only difference is a practical one: uncertainty in the analysis.

Analysis of future markets will require caution and the resulting definitions should be seen only as a best attempt in light of the practical constraints of the investigation. As with any market definition, the market does not have to be defined exactly; it needs only to be defined to the extent that further accuracy/refinement does not have a bearing on the outcome of the investigation.

Uncertainty is inherent to any investigation that seeks to consider the effects on competition at some point in the future. But uncertainty per se should not be used as an objection to the exercise of defining future markets. For instance, if a competition authority is to intervene in a proposed merger because of concerns over the effects on competition relating specifically to new products that are expected to be introduced in the future (e.g. products in a research pipeline) then uncertainty is not avoided by declining the attempt to define a future market. It is just hidden.

If competition concern is with future products, then assessment cannot be undertaken without reference to whether these products are likely to exert a competitive constraint on each other in the future and the extent to which other products will exert a competitive constraint on these. This is the question at the heart of market definition. If any assessment is to be made of the effect of a merger, agreement or conduct on future competition, market definition seeks to make the analysis more explicit and more transparent.

In addition, by specifying what are the right questions to consider, market definition may decrease the uncertainty associated with prospective competition assessment. Arguably where there is most uncertainty, there is greatest need for analysis to be explicit about what assumptions the analysis relies on and what inferences it draws from these assumptions

Any decision taken on the basis of assessment of future markets would need to acknowledge the uncertainty and draw the best conclusions it can from the available evidence. One approach would be to prepare a number of alternative hypotheses of the scope of the future market according to various foreseeable outcomes as to the outcomes of innovation. Competition assessment based on such an approach would draw on the likely effects on competition in each of the identified hypotheses, attributing weights (at least implicitly) driven by the likelihood of each.

In some circumstances, however, the nature of the uncertainties surrounding innovation and the reaction of consumers to it, may be so substantial that no reasonable expectations as to the future evolution of demand substitutability can be reached. Thus it may not be possible to define a future market, or even alternative hypotheses for the future market, to any degree of credibility. We would argue that this implies there is too much uncertainty as to future market developments to assess the effects of a merger, agreement or conduct on competition conditions in the future

### **The time dimension of market definition**

Expectations of *future* supply can form a competitive constraint on the supply of a product in the same way as the *current* supply of another product can. This is the essence of the temporal dimension of the relevant market.

Consider a hypothetical monopolist of all computer software for today only. We would not expect such a firm to have market power simply because consumers can substitute to consumption tomorrow. The competitive constraint that would exist is a competitive constraint based on the expectations of future supply tomorrow. The definition of the time dimension of a market would capture such constraints.

As with all aspects of market definition, the heart of the analysis of temporal aspects lies in assessment of substitutability. The time dimension of a relevant market captures the extent to

which consumers are willing to substitute consumption of a product today by consumption of the same product, at the same place, in the future, i.e. to delay consumption.

For analytical purposes the time dimension can be considered in the conventional manner under the hypothetical monopolist framework: would a monopolist over a group of services be constrained from increasing its price today by the threat that its customers would delay purchase and switch to consumption of those services in the future. If such a constraint exists, we consider a possible monopolist over a longer “time window” and ask whether that firm would be constrained from increasing its prices in that time window by the threat that customers will switch consumption to later time windows.

Clearly the length of the time window of a relevant market (i.e. the temporal scope of the market) will depend on the nature of the products in the market, because this will be an important determinant of the extent to which consumption can be deferred. A hypothetical monopolist of a certain type of food may be constrained in its supply of that food today by the threat that customers would delay their consumption of that food until tomorrow. But it is likely that a hypothetical monopolist over a type of food across a time window of several days will have market power. Conversely, where purchases are for large capital assets such as airplanes or railway rolling stock, the customers are likely to be able to switch consumption over quite lengthy periods of time according to what is on offer in the market today and what they expect to be on offer in the future. A hypothetical monopolist of railway rolling stock over a time window of one year may be expected not to have market power, as it is constrained by the threat that the users of this stock (e.g. train service operators) can delay renewal of their existing stock for quite a period of time; thus the temporal dimension of this market could be a time window of a few years.

Furthermore, where consumers are able to anticipate the future introduction of new products this can act as a constraint on the demand side where the new products are perceived to be (likely) substitutes for existing products. The hypothetical monopolist test would ask whether the suppliers of current products would be constrained from a small price increase today by the threat that consumers will switch to a strategy of delaying consumption and buying the new product when it is available. If so, the expected introduction of the new product would fit within the time window of the current relevant market.

Note that this is a completely different effect from any competitive constraint associated with the threat of entry. This is because the competitive constraint discussed here arises from the threat of potential action by consumers (delaying purchase) rather than the threat of potential action by other firms (entering the market).

Finally, it is interesting to recognize that more explicit consideration of the time dimension of the relevant market may bring unexpected results. In many cases a “new generation” of a product is introduced to the market at a premium compared to the old generation of the product. However, since consumers expect the price to fall, there is a sense in which the supply of the old generation of product is constrained, not by current supply of the new product (which may be very expensive and only appeal to niche users) but instead by the future supply of the new product (once price has fallen). Table 1 summarizes how the relevant markets may be defined under such circumstances (note that this for indicative purposes only — clearly there is no way of telling ex ante which cases this situation would apply to; market definition analysis needs to be applied carefully on a case-by-case basis).

**Table 1: Plausible Market Definitions for Major Vertical Innovation**

Launch of new technology (Current markets)	Niche new relevant market for current supply of new technology
New technology diffused (Future markets)	Single relevant market for new and old technology in which relative price difference is related to relative quality difference (if the two technologies coexist)

The potential for such a scenario may be of particular interest in considering abuse of dominance cases. A firm supplying the old generation product may appear dominant today because consumers are not willing or able to substitute between the old and new products today. However, this supplier may not be dominant at all as it could be strongly constrained by the threat that its customers will switch to future consumption of the new technology, once it has diffused and its price has fallen. Such a case would demonstrate both the value of considering the time dimension of the market and the complexities of assessing dominance in dynamic markets.

### **Inter-temporal substitutability and new and old technologies**

Analysis of the effect of innovation on the scope of the relevant market may need to define both the current market(s) and also future markets.

In defining the current relevant market, analysis would start by consideration of whether the price of the old technology is constrained by the price of the new technology at the current point in time, taking their relative qualities and prices as given. This assessment may find that the new technology is introduced at a very high price such that consumers of the old products would not readily substitute even though there is a quality advantage. This would suggest new and old technologies would be in separate markets.

However, we also need to consider the time dimension of the market. While current supply of the new technology may not constrain supply of the old technology, consumers will take into account their expectations of future prices. In this example, they expect a substantial fall in the price of the new technology. This expectation may mean that they are prepared to substitute between buying the old technology today and waiting to buy the new technology in the future. Thus a hypothetical monopolist of the old technology (today) would be constrained in its pricing by the threat of consumers delaying consumption with the specific intention of buying the new technology in the future, even if it not constrained by today's supply of the new technology. This is a genuine constraint on the market power of the hypothetical monopolist. Therefore the relevant market should be defined to include the current supply of the old technology and the future supply of the new technology.

This relevant market may then be accompanied by a "niche" relevant market for those buyers of the new technology who value this far higher than the current technology and are not prepared to wait for the future technology to drop in price, and therefore do not substitute over time. These consumers would comprise the bulk of purchasers at the initial release of the product, in what would be a separate relevant market to that defined above.

Nonetheless, in defining today the future market (i.e. one outside the time window of the current relevant market), based on the expected prices in the table above, we could well expect there to be a single relevant market for the supply, at that future point in time, of the new and old technology. This would be the case where the relative price difference between the technologies has fallen to a level that reflects the perception of the quality difference between the two products, in which case they would be generally regarded as substitutes.

## **4.4 Innovation and Product Substitutability**

How to provide analytical guidance on market definition in the context of technological change, building on the conceptual market definition issues raised in the previous section? The proposition developed is that by first identifying the "technology" underlying a set of products, rather than considering all the features of particular products in one go, it may be easier to form forward-looking views on substitutability, and hence inform on (future) market definition.

This discussion is perhaps most applicable in considering how the relevant market for current products may be expected to evolve over time (allowing identification of future markets that represent future evolutions of the current relevant markets) rather than in forming views on the relevant market from the perspective of products that are yet to be introduced (e.g. pharmaceuticals products in the R&D pipeline), although the discussion will also be of benefit to the latter.

Technological progress is a major source of change that may affect the evolution of consumers' substitution patterns and thus the boundaries of relevant markets over time.



While product characteristics are considered constant in the assessment of substitutability between different products as driven by the responsiveness of consumers to price changes, their modification is the essence of dynamic competition. Thus we should expect dynamic competition to manifest itself in changing market boundaries over time, as changes in product characteristics (including production costs) result in modified consumers' propensity to substitute between products as their relative prices change.

Analysis of innovation and product substitutability aims at assessing, in sufficiently foreseeable environments, how technological progress affects the boundaries of the relevant market over time on the basis of the consideration of the impact that expected changes in products' characteristics have on consumers' substitution patterns

The analysis could proceed at two levels: the identification of the different technologies associated with the products competing in the market; and the analysis of the directions of innovation within each technology ("technological trajectory").

At each level, we suggest that a useful tool for guiding the understanding of the impact of technological change on the evolution of market boundaries is the distinction between elements of horizontal and vertical differentiation associated with different technologies and technological trajectories.

For instance, if photographic cameras were considered, the first step of the analysis would identify the existence of two (main) competing technologies, a conventional technology and the new digital one, and the second step would consider the trajectory of technological change along which digital cameras are subject to innovation, e.g. increase in the resolution of pictures. The likely evolution of market boundaries may then be analyzed on the basis of the expectation of a process of diffusion of the digital technology connected to the process whereby a better (and improving) technology replaces an inferior one, although elements of horizontal differentiation between the two technologies would suggest that cameras embodying different technologies are likely to coexist in the market despite this diffusion process.

The analysis of technological change and product substitutability should result in the understanding of the likely evolution of market boundaries needed to define current and future markets as summarized in the following chart:

Identification of current products  $\Rightarrow$  Analysis of technologies/technological trajectories  $\Rightarrow$   
Choice of time horizon  $\Rightarrow$  Definition of future relevant market.

The view that in many circumstances it is possible to identify relatively predictable patterns of technological change does not imply that the analysis of the evolution of market boundaries is an easy task. The ability of assessing, with any degree of confidence, the evolution of market boundaries relies crucially on the capacity of identifying past techno-economic trends that are expected to continue in the future. This would be less likely if a radically new technology has just been introduced in the market but would be more feasible when there is evidence of ongoing directions of changes such as when innovation is of a more incremental nature.

The specific characteristics of each case would clearly determine the time-horizon of the analysis, which also crucially depends on the extent to which confident predictions on the evolution of technological change can be reached.

In any case, it is important that the analysis is undertaken with focus on the consumers' perspective, and that a broad approach is followed since even changes that appear external to the relevant market may be important in affecting the scope of the market in the future.

In order for products' changes to be considered indicative of the nature of future demand substitutability, the consumers' perspective is adopted: no change of market boundaries may be expected to take place if there is no likelihood of changes in consumers' patterns of substitution between different technologies/products.

Moreover, it should be noted that technological changes taking place outside the current relevant market might also have an important impact on its evolution, i.e. on the identification of future relevant product markets. For instance, technological change that affects the

products in a different market than the relevant one may impact on the latter due to convergence of products' characteristics and functionalities (e.g. mobile phones and PDAs). Hence, it is necessary that a broad approach is followed, which considers intra-market but also broader technological trends.

Nevertheless, the analysis should remain always a focused investigation on the consideration of predictable techno-economic trends over a reasonable time-horizon that are likely to have a direct impact on the products considered, rather than economy-wide general technological trends.

### **Analysis of technologies**

The first step in the analysis of the impact of technological change on demand substitutability consists in the identification of the different technologies that are embodied in the products sold in the market and the analysis of the nature of differentiation between different technologies.

A distinction between vertical and horizontal differentiation is likely to be useful :

- the vertical dimension of differentiation is related to the extent to which all consumers would consider the new technology better than the previous one for all uses/users, leaving aside price comparisons.
- the horizontal dimension, instead, captures the extent to which each technology would be considered relatively better than other technologies in some uses, or for some users, leaving aside price comparisons.

The distinction is important because the future evolution of market boundaries may be different in the two cases.

#### *Vertically differentiated technologies*

The vertical dimension is usually associated with a process of diffusion of the new technology that replaces the obsolete one. In this case, different technologies coexist possibly only for a limited time after which the new generation displaces the previous now obsolete one. The relevant question to ask is how consumers would substitute over time between products that embody different technologies as a response to changes in relative prices.

The diffusion of a new technology usually follows a classic S-shaped pattern, and could be driven by the diffusion of information on the characteristics of the new technology, by its staggered adoption by heterogeneous groups of consumers or firms and by an incremental process of technological change along a particular technological trajectory that improves the quality and characteristics of the products sold and their quality-adjusted prices

With respect to the relationship between the new and the old technologies, the process of diffusion may evolve in different ways

- **Immediate replacement.** In some cases the process of diffusion of the new technology may be very rapid and result in a new generation of products that quickly displace the older generation. This would probably be the case when technological progress is step-wise and drastic (e.g. the introduction of a new generation of game consoles).
- **Gradual diffusion, only the higher quality technology survives.** A new technology may initially not be considered as a close substitute for the old one. However, gradual quality improvements and a reduction of relative prices often result in increased substitutability and diffusion of the new technology over time. This process of diffusion may result in complete displacement of the old technology if the production costs of the products associated with different technologies are similar or if the new technology is

associated with a new superior standard that is not compatible with the old technology.

• **Gradual diffusion, the vertically differentiated technologies coexist.** If the products associated with the different technologies have very different costs of production, the diffusion of the new technology may not result in complete displacement of the older one if the cost structure means that the products can coexist at prices that compensate for differences in performance.

Market definition in presence of vertically differentiated technologies would normally entail the choice of whether products associated with different technologies should, or should not, be considered in the same relevant market and the assessment of the timing of the process of diffusion of the new technology, over which demand substitutability is likely to vary over time.

For instance, it may be possible that the products associated with the two technologies are in separate relevant markets at early stages of the life cycle of the new technology, are considered close substitutes in intermediate stages and, perhaps, result again in two niches markets when the new technology reaches its maturity.

To the extent that products that embody the two technologies have substantially different production costs, one may expect that the old technology would not eventually exit from the market but coexist with the new one, with differences in prices reflecting relative differences in perceived quality. In this case, it may be the case that the two technologies are eventually to be in separate relevant markets, depending on the extent of vertical differentiation

When vertical technological progress is step-wise, relevant markets may be associated with the different generations of the products. Hence, a future product market may be considered as comprising of the products of the future generation that are in the pipeline.

#### *Horizontally differentiated technologies*

The horizontal dimension of differentiation between technologies is associated with the co-existence and possible proliferation of product groups, associated with different technologies. Horizontal differentiation implies that each product group associated with one technology has relative advantages and disadvantages over other products associated with a different technology. Each of these products groups is likely to be relatively homogenous in terms of characteristics but this, *per se*, is no indication of the fact that cross-group substitution is limited.

Unlike the vertical dimension of differentiation, the horizontal one is generally not associated with a process of diffusion whereby a new technology replaces an obsolete one but by the coexistence and proliferation of product groups associated with different technologies. In other words, the horizontal dimension is not likely to be associated with drastic changes of consumers' substitutability patterns *over time*, although a new horizontally differentiated technology would possibly diffuse as information on its characteristics spreads out and its quality improves along a vertical technological trajectory. In fact, it is likely that the evolution of markets with horizontally differentiated technologies is relatively stable over time and subject only to relatively short periods of disequilibrium when a new technology that leads to a new product-group is discovered

One question that would typically arise in the context of horizontally differentiated technologies is whether markets should be defined at the level of the single product-group associated with each technology or more broadly at the higher level of a set of different product groups. As is generally the case, this issue should be addressed through consideration of consumers' willingness to substitute between products associated with different technologies rather than differences in products' attributes *per se*.

Horizontal innovations may also result in the creation of new relevant markets, in particular

where the new product is expected to serve a niche of customers who, once the product is introduced, would not readily substitute between this new product and the products that were previously available.

### **Analysis of technological trajectories**

Market dynamics may result not only from the introduction and diffusion of products that embody a new technology in the market but also from technological change that takes place within a given technology, along what we call a “technological trajectory”.

If such technological change were to proceed randomly, along directions that cannot be predicted with any degree of accuracy, it would not be possible to make any reasoned statement on the evolution of the boundaries of product markets over time. Definition of future markets would be subject to such uncertainty as to render it no use to competition assessment

However, it is often possible to observe a relatively ordered techno-economic pattern of innovation at the level of single technologies. For instance, Dosi (1988) observes that technological progress in aircraft technology “has followed two quite precise trajectories (one civilian and one military) characterized by log-linear improvements in the trade-offs between horsepower, gross takeoff weight, cruise speed, wing loading, and cruise range”.

The notion technological trajectory is a useful one since it suggests that it is possible to identify the major trends that characterize the evolution of a technology in a certain market and to predict their impact on market boundaries

Within each technology, it is likely that a technological trajectory is identifiable in terms of the pattern of changes that characterizes innovation within that technology. The analysis of technological trajectories may allow the identification of whether or not innovation is resulting in convergence between currently separate markets or, vice versa, in fragmentation of a current relevant market into a number of different future markets.

It is very hard to provide guidance at this very general level, since the evolution of dynamic industries rarely follows predictable patterns. Even the life-cycle model that has often been considered a valuable description of a representative pattern seems not to fit all industries. Nonetheless, by considering the nature of the innovation we can form some view on the likely effect on the scope of the market, and hence competition. An example of some typical patterns is provided in Table 4.3 overleaf.

Practically, the analysis may proceed by identifying a set of key characteristics, that are likely to be key drivers of the evolution of substitution patterns (e.g. the improvement of the resolution of digital cameras) and are central to the technological trajectory in the market. Quantitative evidence on the past trends of the evolution of these key performance or design variables may be useful to infer the likely evolution, included the time dimension, of changes of products’ characteristics.

A final point on process innovation and market definition is warranted. Since market definition concerns the products and services supplied, without reference to the way that these are supplied, improvements in a firm’s production processes, through the introduction of new technology or organizational routines, should not be analyzed at the market definition stage (though such changes may be critical in determining firm’s capability to supply a market). Such changes matter to market definition only to the extent that they affect the characteristics and prices of the products supplied, which falls under product innovation. Furthermore, where a production process itself is the service supplied on the market (e.g. the supply of manufacturing machinery or cleaning services) then any change in this process can be considered a product innovation as above

## 4.5 Challenges to market definition

Market definition seems, from an economic perspective, to be a necessary component for establishing dominance in Article 82 cases of EU Competition Law, be they static or dynamic.<sup>5</sup> Article 82 is underpinned by the view that the unilateral behaviour of a firm can only significantly distort the process of competition to the detriment of consumers where that firm holds market power. The moment we recognize that each firm undertakes different activities, supplies different products, competes in multiple dimensions, and evolves over time, the importance of market definition becomes clear. Since firms may be dominant in some markets and not dominant in others, market definition sets out the areas of economic activity where a firm may be able to commit abuse. It is necessary to consider *where* a firm holds market power in order to establish *where* it can distort competition. The distortion to competition could be either in the market in which dominance is held, or in supply or innovation associated with a related market. On balance, misuse may only characterize negative aspects of market power and need to be determined on a case-by-case basis. For example, gaining market power through innovation is a positive incentive and thus by itself not problematic and need to be targeted at repeated misuse to suppress competition but only in cases which are not based on merit or technological preeminence..

In the context of a merger, market definition allows for identification of the competitive constraints that might be lost if the merger were allowed to proceed. This is important in determining the extent to which the merger is likely to impede competition, taking account of any pro-competitive gains. Indeed market definition is especially valuable in dynamic markets where the competitive conditions under which firms operate vary across the range of services they supply (or could supply), vary across the supply chain in which they are active within and vary over time. Only through robust market definition, and understanding of the relationships between different markets, can the implications of this variation be clearly set out.

Moreover, as highlighted in the introduction, for two firms to be placing a competitive constraint on each others' innovative activity (i.e. competing in innovation) implies that we expect, with some non-negligible probability, that they will introduce products to the same future market. Thus market definition in the context of innovation provides an analytical framework through which we can determine, for example, whether the innovation undertaken by two firms can be seen as competitive. If we do not anticipate that the outcomes of the innovative activity — be these final products or some intermediate goods — will be substitutable in the eyes of customers, then it is difficult to argue that the firms are competing in innovation. The thought experiment behind the hypothetical monopolist test provides a consistent approach for this assessment, regardless of whether data exists for a quantitative "test".

Finally, some argue that a weakness of the hypothetical monopolist test in dynamic markets is that it leads to the definition of markets that are "too narrow".

Concerns with findings of narrow markets may be valid where definition of a narrow market is combined with a view that dominance per se is bad (when, in fact, anticipations of gaining market power often provide a necessary spur to innovation) or when narrow markets are used to inappropriately infer dominance (e.g. if too much emphasis is placed on market shares and profit analysis and too little on the scope for entry or expansion by other firms). Ultimately such concerns, if well founded, call for a better assessment of competition in the market. But this is not a reason to change the concept of a relevant market for dynamic cases.

### The "innovation markets" approach

The IP Guidelines in the US (1995) introduced the concept of an "innovation market" as an analytical tool to consider the competitive effects on innovation and R&D, rather than identified future product markets:

"An innovation market consists of the research and development directed to particular new or improved goods or processes, and the close substitutes for that research and

development. The close substitutes are research and development efforts, technologies, and goods that significantly constrain the exercise of market power with respect to the relevant research and development, for example by limiting the ability and incentive of a hypothetical monopolist to retard the pace of research and development. The Agencies will delineate an innovation market only when the capabilities to engage in the relevant research and development can be associated with specialized assets or characteristics of specific firms.

In assessing the competitive significance of current and likely potential participants in an innovation market, the Agencies will take into account all relevant evidence. When market share data are available and accurately reflect the competitive significance of market participants, the Agencies will include market share data in this assessment. The Agencies also will seek evidence of buyers' and market participants' assessments of the competitive significance of innovation market participants. Such evidence is particularly important when market share data are unavailable or do not accurately represent the competitive significance of market participants. The Agencies may base the market shares of participants in an innovation market on their shares of identifiable assets or characteristics upon which innovation depends, on shares of research and development expenditures, or on shares of a related product. When entities have comparable capabilities and incentives to pursue research and development that is a close substitute for the research and development activities of the parties to a licensing arrangement, the Agencies may assign equal market shares to such entities".

The innovation market concept relates to the research and development effort that is associated with the future introduction of innovations.

Insofar as any firm that is currently engaging in R&D and other innovative activity may have some tangible output that it could sell today, there are grounds for the concept of a relevant market for the supply of this "innovation". Where innovative activity has led to the creation of information, i.e. knowledge that can be codified (as distinguished from tacit knowledge), or even prototype products and designs, we could consider whether the firm holding this information would face competition if it offered it to market, supported by IP protection.

Indeed the case exists in practice. For example, in the pharmaceuticals sector, small biotechnology companies exist that supply intermediate products in the supply chain, such as molecules that are yet to be tested in clinical trials but have chemical potential to treat certain indications. Where two such firms seek to merge, competition policy analysis would benefit from consideration of the relevant market for this output. But this would probably be standard practice, since the conventional output of these firms is essentially an R&D outcome that is then used as an input by large pharmaceuticals firms (see Gottinger et. Al., 2010). There is no conceptual difference to this market for the supply of an intermediate input than a market for the supply of traditional manufacturing component inputs.

But even if a firm is currently undertaking R&D with no intention of disclosing or selling the information that is associated with each subsequent stage of product development — until it patents and introduces the final product that this R&D has led to — we can consider what competitive constraints it would face were it to offer this information to the market. For example, consider a vertically integrated firm that controls its supply chain from initial product development to final supply on the market. Even if this firm does not currently license any of the intellectual capital associated with the products under development, we could still ask what the relevant market might be were it to supply such a service, and consider whether there would be market power in this market for the potential supply of a license. This in turn would inform on the competitive constraints that the firm would face in the supply of this information. Such an approach might be necessary in abuse of dominance cases, where failure to supply some kind of access service denies competitors access to a related product market (the importance of identifying such "access services" in considering the relationship between competition and innovation is discussed in the next section ).

However, such markets for the potential supply of information relating to the intermediate output of innovation are not the same as the "innovation market" approach defined above. Both the examples above concern cases where the purpose of analysis is to analyze competition, or potential competition in the supply of a service. Such analysis has only a superficial difference to standard market definition and competition analysis, namely that the

service under investigation is information related to a potential product, rather than a more tangible intermediate good.

In contrast, the US innovation market seems more associated with R&D input for its own sake, rather than in relation to some information output that an innovating firm could potentially trade. Moreover, the US definition goes beyond the R&D output that firms may sell on the market, to the identification of a concept of market power in innovation: any concept of market power must relate to a relevant market over which this power is held, even if this is defined implicitly.

Consider again the case of the biotechnology company selling IP-protected information. If this firm has market power it is because its price in supplying this information to potential customers would not be constrained by the supply of similar information, or the potential supply of similar services, by competitors. This market power can be understood in the normal way (expected lack of competitive constraints on pricing) without reference to whether the firm can “retard the pace of research and development”. As argued in the appendix, for practical purposes it seems hazardous to define market power with reference to whether a firm can retard the pace of innovation, simply because it may be that competition itself is the retarding force on innovation.

By creating a concept of market power (and therefore a market) that exists in relation to innovative activity (i.e. input), rather than in relation to the supply of intermediate or final products derived from that innovation (i.e. output), we risk confusion between competition in innovation and the effect of competition on innovation, and between competition in innovation and competition in the supply of the output of that innovation. Since competition in innovative activity is not itself associated with market power (other than from the future market to which it relates) it does not seem appropriate to define a market for it.

Instead, we consider that the fundamental separation we draw between analysis of the effects of a merger, agreement or conduct on product market competition and the effects on competition in innovation is the most useful approach to follow. One of the key drawbacks of the innovation market approach is that it attempts to analyze the “competition in innovation” dimension of the competitive process in much the same way as product market competition is assessed, by considering activity within an (innovation) market.

## Summary

Market definition is an important element of any competition analysis, and this is no less true in dynamic markets. The approach we propose is based on the value of the hypothetical monopolist test as a conceptual tool to define relevant markets, even in dynamic environments. This approach does not reduce the importance of market dynamics but suggests that these can be taken into account in two important ways:

- by explicitly analyzing future markets, based on estimates on the likely patterns of substitutability at a certain future point in time, to consider the future evolution of the current relevant market *and/or* to consider the appropriate market definition for anticipated products that are yet to be introduced; and
- by considering the time dimension of market definition, so that each relevant market is defined over a certain time window (at least informally) and therefore inter-temporal substitution is taken into account..

An understanding of the impact of technological change on consumers’ substitution patterns is a fundamental element of the analysis that results in the definition of relevant markets, current and future, and assists analysis not only of product market competition (current and prospective) but also to analysis of competition in innovation, by providing a firm meaning to the concept.

## 5. Sources of innovation

The literature on innovation surveyed in the review strongly suggests that innovation is associated with the learning process that results from the combination of both internal and external sources. It is useful to assess the extent to which sources of learning associated with innovation observed in the relevant market are external or internal to the firms in the market. As for practical purposes, we shall draw the distinction between:

□ **markets based on invention**, where the sources of learning are essentially internal and dynamic change is largely due to firms' own creative and inventive actions, possibly in the form of R&D, or other sunk costs, investments or activities that lead to learning-by-doing.

• **market based on adoption**, where innovation derives largely from external sources such as suppliers or other sectors in the economy (research organizations)

We should accept that this distinction is not absolute. Each innovation, in every market, would generally involve both elements of invention and adoption. Few innovative improvements will be genuinely unique to the innovating firm since they will always involve a degree of imitation and adoption from observation of the world outside of the firm. Any invention will draw to some extent on past innovations and knowledge. Conversely, even where a firm seems to be directly adopting innovations associated with inventive effort by other organizations, it will need to adapt these to its own characteristics and circumstances, which requires an element of invention. Even where innovation is largely driven by inventive improvements in the services provided by suppliers, firms using such services may need some creative effort to incorporate these into their production processes and products. This view is underlined by comments from Nelson (1996, p244) following an extensive cross-country empirical study on innovation: "the bulk of the effort innovation needs to be done by the firms themselves. While they may draw on outside developments, significant internal effort and skill is needed to complement and implement these."

Nonetheless, we can conceive of distinguishing the extent to which the innovation associated with supply of a future market is adoptive rather than innovative, even if both elements must be present to some degree.

In markets based on invention, a further distinction can be drawn on the basis of the sources of internal learning (and which has implications for the nature of the knowledge bases, discussed next):

• **R&D based markets.** R&D is in many markets an important source of learning at the firm level both because it is associated with the production of new knowledge and because it allows the firm to access external available knowledge.

• In some other markets innovation is mainly driven by **learning-by-doing**. Learning results in a form of knowledge that is likely to be tacit, specific and relatively immobile, which implies that a firm would have to go down the learning curve without possibly relying on major knowledge spill-overs from other firms (other than perhaps by hiring expert staff).

An example of an adoptive market is a supplier-driven market where innovations are largely exogenous to the market and mainly embodied in equipment and components bought from other sectors. In these markets the process of innovation is essentially the process of diffusion of state- of-the-art capital goods and innovative intermediate inputs. The capability to supply in these markets requires essentially access to suppliers at terms that do not put it at a disadvantage relative to incumbent firms. The term "suppliers" needs to be interpreted broadly to include both supplier firms and also organizations such as universities.



All else equal, innovation associated with adoption will yield a larger set of firms with capability to supply the future market which derives from that innovation.

## 5.1 The nature of the knowledge base

Another important determinant of the ability to supply through innovation is the nature of the knowledge base on which innovation in the market is mainly built.

Dosi (1988) defines the notion of “knowledge base” as:

“the set of information inputs, knowledge, and capabilities that inventors draw on when looking for innovative solutions”.

For instance, Dosi suggests that in the case of microelectronics there are three major and complementary forms of knowledge: advances in solid-state physics; knowledge related to the construction of semiconductor manufacturing and testing equipment; and programming logics.

Technologies may differ in terms of the degrees of “publicness” and “universality” versus tacitness and specificity of their knowledge bases (Winter 1984). The tacit/codified nature of the knowledge base can be considered very important to determine the firms’ capability to supply in a future product market:

All else equal, innovation associated with a codified, rather than tacit, knowledge base will yield a larger set of firms with capability to supply the future market which derives from that innovation.

Similarly for the general/specific nature of the knowledge base:

All else equal, innovation associated with a general, rather than specific, knowledge base will yield a far larger set of firms with capability to supply the future market which derives from that innovation

This latter consideration suggests that an important element to consider is whether the knowledge base underlying innovation in the relevant markets is shared with other sectors in the economy. It may be the case that different sectors are similar in terms of the underlying knowledge base, so that a firm that operates in one would find it relatively easy to supply in the other market, with a similar knowledge base.

## 5.2 Inter-Market Links

Often relevant markets are linked to each other in such an important way that competition analysis of one market in isolation would provide a poor picture of the competitive and innovative implications of the market.<sup>8</sup>

This does not mean that the markets should be grouped and treated as a single relevant market since market power relates to competitive constraints, not the absence of interactions with other areas of economic activity. For example, analysis of competition needs to appreciate the interrelation between advertising and content markets while maintaining the distinction between the two (e.g. while advertising and content market are strongly interrelated, market power in content does not necessarily imply market power in advertising).

On the supply side, this may arise where products supplied in separate markets share common production or innovation processes. On the demand side, this may arise where the demand in one future market is strongly related to consumption in the same or a related market such that innovation directed at the first market must involve a strategy for interacting with this effect. This is likely to be the case for “secondary markets” and “network effects”. Both types of links can be described as horizontal because they refer to markets that are supplied concurrently while not forming part of a unidirectional vertical supply chain.

Horizontal relations between relevant markets may give rise to two main effects of relevance to this study. First, in analysing the barriers to innovative activity associated with a future market, it may be necessary to consider entry to the linked market together. This may be either because a firm must enter simultaneously on the linked markets in order to be successful on any one of them, or must interact in some way with the linked markets in order to enter the future market. Moreover, from the perspective of innovative activity related to supplying a future market, the individual markets may not be analytically separable as innovation pertaining to one market may also pertain to another (e.g. pharmaceuticals research that, depending on the nature and success of the outcome of the innovative activity, could lead to the introduction of products on any one of a group of separate product markets; the merger case study in Section 7 discusses a similar example). Second, where there is a strong link between a market supplied by a dominant firm and a market in which the same firm faces competition, there may be “competitive effects” transferred from the competitive market to the monopoly market. These could have the effect of assisting productive efficiency in the monopoly market (if this share the same production processes with a competitive market diffusing monopoly profits (as these are competed away in the related competitive market) and providing a spur to innovation.

For example, in mobile telephony, the same network infrastructure is used for both the services in the retail markets (subscription call origination) and the wholesale termination markets. It therefore does not make sense to discuss competition in the innovative activity relating to either of these markets in isolation. Rather, any analysis of competition in the innovative activity relating to these services must recognize how this innovation relates to multiple relevant markets, in which the competitive conditions could be different. Since the network infrastructure makes up a large proportion of the production process for the services supplied in these two markets, if we think that competition in the retail market creates incentives for efficiency, then this can be expected to bring incentives for efficiency in the production process that is common to both services.

Therefore even though there is a monopoly termination market, we would not associate this market with the weak incentives for efficiency of more straightforward monopoly cases. Indeed competition in the innovative activity relating to the competitive market (e.g. network development) would be inextricably linked to the innovative activity relating to the monopoly market.

We describe below three key horizontal links that may exist between markets: supply-side links, secondary market links and network effects.

### **Supply-side links**

If the same technological and organizational production processes are used to develop and produce a good to be supplied in one market and a good to be supplied in another then there is a link between the markets such that any relative efficiency or inefficiency exhibited by the firm in supplying one market is likely to be transferred to the other, to the extent that the shared processes determine the overall efficiency of the supply. <sup>9</sup>Of most relevance to this study, the competition in innovative activity associated with one market cannot be analyzed in isolation from the other market so long as the firm uses the same capabilities and processes to develop products that may (with some non-negligible probability) be supplied in each of the markets.

Such production process links are necessarily the case where there are very high economies of scope in the supply of services in different markets. In this case, production and innovation costs are “joint” because the cost structure of the firm is such that we cannot meaningfully attribute the costs to one service or another. In other cases, the production process links may not be as strong as where joint costs are extensive, but similar technological and organizational routines may apply.

Where supply side links are strong, we would be cautious about the capabilities of a firm to enter one of the markets related to the shared processes without entering the other. In many cases this will be trivial and we would not expect this constraint to be binding, with firms readily entering both markets and benefiting from the production process links. However, where there is a particular barrier to supply one of the markets (e.g. some intangible asset it required to supply one of the markets) then the links in production processes between the two

markets may mean that it is not efficient for firms to supply the one if they cannot supply the other — thus transferring the entry barrier to the other market. This effect could be mitigated by various methods, but it is valuable to be aware of how the capabilities to innovate to a future market may be hindered by restrictions to supply a related market.

### **Secondary markets**

A secondary market can be defined, for current purposes, as one where the existence of demand in the market is dependent entirely on consumption in a related, but separate, relevant market (the primary market).

A commonly cited example is that of printers and compatible ink-refill cartridges, where demand for the latter is derived entirely from consumption of the former. In this case, the scope for competition in innovation directed to refill cartridges will be affected by whether cartridge manufacturers can interact successfully with the printers markets..

A less obvious example is markets concerned with advertising (the supply of advertising space). In most cases, the existence of the advertising market is dependent on consumption in a related content market (be that the supply of television services, the supply of newspapers, magazines, or the supply of content on the Internet). Analysis of competition in the innovative activity related to entry in the advertising markets must pay attention to the need for the firm to simultaneously operate successfully in the content markets. So the relationship between advertising relevant markets and content relevant markets falls under the category of secondary markets.

Of particular importance is where a competitive primary market is associated with a secondary market in which there is monopoly. Thus firms compete in a broad primary market and each achieves monopoly supply in a narrow secondary market. (Printers and refill cartridges.) In such cases we may expect firms to use any marginal increase in profits realized in the secondary market to fund a decrease in price in the competitive primary market and thereby improve their relative position against competitors. Moreover, we would expect there to be checks against certain types of anti-competitive behaviour in the monopoly secondary markets due to the transfer of competitive effects from the primary market. (But the market power should probably not be ignored by seeking to amalgamate the two markets.)

Thus in secondary market cases, the effect may be such that innovative activity related to the secondary markets will depend on the ability of the firm to enter the primary market successfully; or the ability of the firm to “gain access” to the necessary links between the primary and secondary markets.

### **Network effects**

There seem to be clear similarities between secondary markets and network effects, but the former is defined above as where consumption of a product in one market creates demand in another, while network effects are more related to how consumption of a product in one market increases demand for either (i) that product or (ii) a product in a different market that in turn may lead to increases in demand for the original product. (See Gottinger (2003) for discussion of network effects.)

Again network effects have important implications for the capability of firms to supply future markets associated with innovation. Supply to the future market will require a strategy for interacting with the network effects in such a way as to make the entry successful and sustain a position in the market. In particular, network effects can generate important benefits for incumbent technologies and thus create inter-temporal links between current and future markets, as discussed in the following section.

## **5.3 Inter-Temporal Links**

Assessment of the capability to supply a future market may hinge dramatically on analysis of

the “inter-temporal links” that exist between suppliers in a current market and potential suppliers to a future market. At a basic level there exist links over time between relevant markets wherever a firm’s supply on a current market affects its capability to supply a future market, either positively or negatively. In many cases this is trivial, but cases may exist where the cumulative effects are so strong as to be the driving force of which firm will succeed in a distinct future market.

In particular, we would be interested in whether conditions are such that it is necessary to be competing strongly in a current market in order to have the capability to supply the future market, or whether the innovation associated with the supply of the future market is so drastic that entrants and incumbents have a similar capability to supply the future market. These factors will be key drivers of whether there is persistence of market power.

The links between different markets over time may be a critical factor in determining the ability of the process of competition to select the “right” innovations from a new variety of products in a future market. If there are strong factors favouring persistence of leaders in current markets into future markets, this may undermine the benefits of competition in the innovation itself.

In many cases incumbency advantage should not be seen as detrimental. Consumers are likely to value similarities between current and future products, while producers will be able to make efficiency savings from use of similar production processes and reputation effects between current and future markets. But, to the extent that competition is possible in innovation and the supply of the future generation of products and technologies, this may bring sufficient benefits to warrant protection. For example, even if there are benefits in only one operating system dominating current markets (e.g. due to economies of scale and customer familiarity) this does not preclude the benefits of competition to be the dominant supplier of “next generation” operating systems.

Finally and very importantly, it should be possible to distinguish cases where any positive relationship between current and future markets is due to less-strategic” characteristics of the market, such as its cost structure and nature of demand and the type of innovation associated with it; or the opportunity it provides incumbent firms to behave anti-competitively, in particular as regards competition in innovation.

### **Supply Side Links**

The standard link on the supply side from one market to another comes simply from the fact that the production processes used to supply a current relevant market may be capable of use to supply a future market, even if the nature of the product supplied changes over time. This arises in particular where the same sunk costs are incurred to supply both current and future markets and therefore incumbents in the current market have an advantage to the extent that they have already incurred the costs.

In addition to standard production processes links, where the knowledge associated with the innovation into the future market is largely tacit, or non-imitable in another way, incumbents are in possession of a further advantage derived from the nature of the innovation itself. Conversely, where the innovation is more drastic and does not particularly build on tacit knowledge embodied in the supply of previous products we would not expect a strong advantage for current incumbents. Therefore analysis of the nature and source of innovation (Stage 1) will feed into this analysis of inter-temporal effects.

### **Demand Side Links**

When considering inter-temporal relationships, it is beneficial to understand that network effects can work through mechanisms based on both actual events and expectations. Most commonly, network effects are due to consumers at one period in time taking into account past consumption either by themselves or other consumers, when making their current purchase decision.

But network effects can also be generated by expectations. Consumers may form today expectations of what technologies and services other consumers will consume, and in turn lean towards products associated with this in order to benefit from network effects. Where this

occurs firms are likely to be active in advertising and marketing their products to create an impression of high future consumption on current consumers, and to signal staying power in the market.

A further but perhaps less obvious type of (direct) network effect is economies of learning. Where consumers must invest in obtaining some specific knowledge and skills that facilitates consumption of the product, network effects may set in between products.

In the case of direct network effects, the relevant link between markets is actually directly between the current relevant market and the future market. In essence, network effects mean that on the demand-side the future market is linked to the current relevant market by the fact that consumption of a product in the current relevant market enhances demand for that product (or its descendant) in the future market.

In the case of indirect network effects, the relevant link between markets is indirect between the current relevant market and the future market, because it exists through a horizontally related market.

In essence, network effects mean that on the demand-side the future market is linked to the current relevant market by the fact that consumption of a product in the current relevant market enhances demand for that product in the future market. Such relationships are therefore important in Stage 3, and discussed further below. The following table suggests possibilities for inter-temporal links between markets that may put firms which currently supply a related current market at a significant competitive advantage in the capability to supply the future market than firms that do not.

#### **5.4 Access Services**

Besides access to the innovation underlying the future market (identified in Stage 1), a firm's ability to compete in the innovative activity related to a future market may also be dependent on key inputs that it must obtain from other firms and organizations. Such "access services" describe the inputs that are needed to supply the future market, and therefore to compete in the innovation associated with that market.

Identification of access services and specification of the markets to which they pertain could be a valuable component of part of an analytical approach that can render analysis of capability to supply more explicit.

Several examples are explicit. A firm that wishes to supply television content to subscribers to a digital pay-TV platform will need to obtain access services of some nature from the platform operator in order to distribute its content to viewers (unless it decides to sell the content wholesale to the platform operator). Or consider the supplier of a computer operating system. For independent software producers to supply products that are compatible with this operating system, these firms may require timely access to technical information that allows compatibility of software with the operating system. Regardless of how capable a firm is in the innovative activity relating to future computer software, its ability to compete in this regard depends on whether it can generate sufficient compatibility with operating systems, which may require licensing of some intellectual property rights from the operating systems supplier(s).

In dynamic markets, the existence of access services may be particularly important in determining market dynamics. Where a firm is dominant in the market for supply of an access services, it may be able to affect the evolution and development of the market(s) that the access services concern by preventing or otherwise impeding competition in the innovative activity that leads to the introduction of new products. In other words, access services represent a fundamental route through which a firm controlling the service would be able, unilaterally, to hinder the ability of rivals to supply a future market. In fact, in many cases analysis of potential exclusionary behaviour can be made more robust and transparent by identifying formally the access services that pertains to this potential exclusion and then defining the market for this service and analyzing the competitive effects explicitly. This may be appropriate even if the access service is not seen as a traditional product in which there is trade.

An access service may be defined as a service that a firm must be able to procure (or generate itself in a more trivial case) in order to be able to effectively supply a related market. We do not relate the term to “essential facilities doctrine” which in the context of EU competition law may have a more specific meaning based on certain criteria,<sup>10</sup> although essential facilities would clearly be a sub-set of access services. Any necessary input can be seen as an access service, insofar as access to the input is necessary to supply downstream markets. But in some dynamic markets, the access service is perhaps less tangible than traditional intermediate input goods (e.g. it is a set of information protected by IP rights), and it will be particularly important to consider the existence of these services.

In some instances, there will be no current supply of the access service, particularly where the potential supplier of this service supplies the related market and is keen to maintain its current position within this related market. For instance, in the operating system and software example above, there is analytical value in defining the access services relating to the information (programming codes) that allow compatibility between platform and software, even if such information is not currently provided in the market. The practice of market definition is quite capable of defining markets for the supply of plausible services for which there is no current supply, based on the conceptual framework that should underpin all market definition.

The relationship between secondary markets and access markets may also be instructive. Suppose there is a new entrant that wishes to introduce a new type of printer cartridge. If current printer manufacturers are able to use IP rights to ensure that only the cartridges they choose are compatible with their printers, then this new entrant has two options. First it can seek access to the printer compatibility from printer manufacturers (defining a relevant access market here specifies whether each individual manufacturer is a monopolist in providing independent cartridge manufacturers with the capability to supply compatible cartridges). Second, perhaps if the first option is not available, it can seek to simultaneously enter the market for the supply of printers.

Access services may take the following forms, but this grouping is by no means exhaustive:

- Physical assets which could present bottlenecks to related markets;
- IP rights that are held, whether or not these rights are used in an innovation or held by a firm to protect itself from imitation and rivalry; and
- Information that facilitates compatibility between related products and therefore third party supply.

Note finally that anti-competitive abuse arising through a firm’s dominance over an access service, which acts to the detriment of other firms’ capability to supply a future market, could come from either (single) dominance or collective dominance over the access service market. (Section 6.2 considers in more detail the application of this capability to supply analysis to conduct by dominant firms that may harm other firms’ ability to compete in innovative activity.)

## 5.5 Summary

This section sets out how the complex interrelationships identified above can be brought together conceptually to inform on the implications for future markets. The discussion above suggests that once a future market has been defined, the following components should be represented in the capability to supply analysis:

- the innovation supply chain associated with the future market;
- the markets that are related horizontally to the current and future market;
- the relationships that exist between current and future markets; and
- the access services associated with supply to the future market.

Most obviously, the definition of the likely scope of the future market provides a focal point from which other interrelationships can be analyzed. This future market should be defined with respect to both product and geographic and also time dimensions. A firm can only exert a competitive constraint on another in the supply of a future market if it is able to supply that market within the relevant timeframe.<sup>11</sup> Thus the whole analysis of capability to supply is governed by the constraint that firms can develop the capabilities in time.

Furthermore, it is also likely that understanding of the relationships between current and future markets will depend on prior identification of horizontal relationships and the nature of innovation. Identification of access services as potential bottlenecks will need to be a final piece of analysis once other features are set out.

## **6. COMPETITION POLICY ANALYSIS IN DYNAMIC MARKETS**

### **6.1 Introduction**

The tools and guidance on market definition and capability to supply provide building blocks for the analysis of dynamic considerations in both anti-trust and merger investigations.

In an abuse of dominance case in a dynamic market, the approach put forward confirms that market definition should remain a key element of the assessment of dominance and that capability to supply analysis can provide a structured approach to the analysis of possible exclusionary behaviour and other anti-competitive practices relating to competition in innovation, and, in turn, competition on future product markets. The application of these tools to abuse of dominance cases is discussed in Section 6.2.

In a merger case, the analyses of market definition and capabilities to supply should provide the necessary building-blocks to assess whether the merger raises anti-competitive concerns both pertaining to competition in product markets and to competition in innovation. The application of these tools to the analysis of merger cases in dynamic markets, and similarly to agreements cases under Article 81, is discussed in Section 6.3.

Before considering the application of the tools to these competition policy cases, we discuss the identification of some broad classes of economic environments on the basis of the distinction between the two dimensions of competition emphasized in the introduction to the study: competition on a product market and competition in innovative activity.

### **6.2 A matrix of competitive effects**

The aim of this section is to describe a matrix that identifies a number of stylised economic environments on the basis of the distinction between competition in the market and competition in innovation. The economic environments identified differ in the way the

competitive process develops so that the matrix may be of help in the identification of abuses of a dominant position and in the analysis of the effect of a merger on competition.

The vertical dimension of the matrix describes the competition in the (future) product markets, while the horizontal dimension describes the competition in the innovative activity relating to future product markets. The consideration of the existence, or not, of competition on these two dimensions identifies four distinct economic environments, which can act as a general guide to understanding the process of competition in the markets of concern. (To maintain the focus on dynamics, the matrix assumes that there is at least one new product to be introduced to the future market — i.e. that it is not simply a future market comprising only currently existing products.)

### ***Baseline competitive environment***

The baseline competitive environment is represented by an expectation of competition in the future market as well as competition in the innovative activity relating to supply of the future market. (We do not consider whether this situation is optimal for innovation, but rather focus on its competitive properties.) This scenario fits well with cases where there is rivalry in innovation but the market outcome is not expected to be a “race” with only one “winner”. While the process of competition has the effect of selecting better products from worse products (in consumers’ sense), and thus we would expect some of the innovating firms to fail to achieve success in the market, we expect several of the firms currently innovating to exist in the future market side-by-side.

### ***Competitive constraint due to existing products***

In this type of environment there is no competition in innovation, but an expectation of product market competition once the outcome of the innovation is introduced (i.e. the outcome of the innovation will face competition from existing products). Although innovation is certainly a fundamental source of change of competition in the product market, nevertheless the absence of competition in innovation does not necessarily imply that the single innovating firm will be dominant once the innovation is introduced.

As discussed in Section 4, market definition for future markets associated with innovative activity needs to be made with reference to whether the new product expected from successful innovation will face competition from the continued supply of current products in the future. This can exist for both horizontal and vertical technological change, and is most relevant where innovation is not expected to be drastic.

The temporal aspect of market definition may be important in determining this factor because in early stages of the life-cycle, the price of the new product may be so high as to entail a separate “niche” relevant market for the new technology, which converges to a common relevant market with the old technology as relative prices become more reflective of relative quality differences implying scope for substitutability. Conversely, the new technology may start in the same market as the old, but the old may become increasingly obsolete and eventually drop out of the market.

### ***Competition for the market***

Winner-takes-all markets are associated with cases where there is (often intense) competition in innovative activity but the future market is such that competition in it is, over a reasonable timeframe, not sustainable. Thus firms compete to attain a position of dominance.

Perhaps the most famous example of a winner-takes-all market is that for operating systems for desktop PCs. It is instructive to recognize that this market benefits from massive economies of scale in production protected by IP rights (very low marginal cost of supply compared with very large fixed costs of initial product development) and substantial economies of scale in consumption (due in large part to the network effects associated with



the relationships between the operating system market and the related applications software markets).

Identification of such markets is important because it affects the focus of competitive concerns.

In a winner-takes-all market, competition analysis should focus on whether a merger, agreement or conduct by a dominant firm can harm competition in the innovative activity related to a future product market, rather than whether competition in the market will be restricted.

Most obviously, if there are strong grounds to believe that a future market is a winner-takes-all market, it is perhaps not appropriate for a competition authority to block a merger or agreement between firms on the basis that this will create a dominant position or lessen competition in this future market. By definition, the nature of the market is such that its existence guarantees that a firm will be dominant on it, at least in the medium term. (This illustrates an important point relevant to wider issues in competition policy: it is typically better to have a situation where a firm is dominant in a relevant market than for that market not to exist at all.) Instead, any intervention must be based on the premise that the merger (agreement) lessens or distorts competition on some other, perhaps related market, or in competition in the innovative activity associated with the winner-takes-all market.

Similarly, in dominance cases, if we anticipate that a market is subject to winner-takes-all properties, then it is difficult to establish a case that a firm has abused its dominant position in monopolizing this market — the market is naturally prone to monopolization. Rather, analysis of an alleged abuse of dominance associated with this market should focus on how a dominant position in a related market (perhaps an access market) could be used to distort competition in the innovative activity associated with the winner-takes-all market, or how a dominant position in the winner-takes-all market could be abused to maintain that position — in effect used to distort competition in the innovative activity associated with the future generation of that market.

Of course, it is necessary to have a good idea of whether the future market in question is in fact a winner-takes-all market in which competition between products from the same generation of innovation is not sustainable. The box on the subsequent page discusses the difficulty of this assessment *ex ante*.

### **Winner-takes-all markets**

The key factors that would suggest winner-takes-all markets should have been identified in the analysis of capability to supply a future market because this should have identified reasons why “winning” the race to the market would be associated with dominance, especially in terms of inter-temporal links.

Winner-takes-all markets will arise for both demand and supply-side effects, and in practice both are likely to be required. Large economies of scale and network effects are likely to be the key drivers of this phenomenon: the question to ask is essentially whether the market can sustain competition between different products, or whether demand and supply side factors mean that competition can only take place through the next generation of innovations.

However, there does not seem to be a “difference of kind” between such markets and those in which product market competition is sustainable, since in many cases consumers’ heterogeneity in preferences, supported by attempts at product differentiation (physically or through marketing and branding) by suppliers, will allow a market to exist with a limited number of competing players even in the presence of network effects and large fixed costs.

Therefore, in most cases, it would seem inappropriate to conclude firmly that a future market will be a winner-takes-all market unless there is a comparable (and related) current market of similar characteristics displaying these features. Under this approach, analysis of whether future markets are likely to be winner-takes-all markets would focus on cases where current markets exhibit little product market competition, and seek to identify (i) whether there is scope for competition in innovation related to the supply of future generations of this market and (ii) whether the features of the current market that explain the lack of product market competition are likely to persist into the future generations of the market, even if competition in innovation took place.

### ***Dynamic persistence of monopoly***

Some markets may display no competitive pressures such that only one firm is engaged in the innovative activity associated with a future market, on which it is expected to face no competition.

Thus the products that are expected to result from the innovation are in separate relevant markets from current products supplied by other firms and there are no potential competitors to introduce the new products (i.e. the market is not winner-takes-all because there is only one firm in the race).

These markets are likely to exist in particular where there are such inter-temporal benefits in favour of an incumbent monopoly and where the innovation is not sufficiently drastic to allow new firms to undermine this advantage.

Note that where no current market exists to which the future market relates — i.e. the future market is entirely new — there is no persistence of dominance but simply an overall lack of competition in both innovation and (expected) supply dimensions.

### **6.3 Abuse of Dominance Cases**

In this section we focus on the application of the tools to abuse of dominance cases. In an Article 82 case the concern is whether the behaviour of a firm (or a group of firms) in a dominant position (including collective dominance) impedes the competitive process.

While a firm operating in a dynamic environment may commit various types of abuse, the area most relevant to the analytical tools proposed in this study concern a dominant firm impeding other firms' ability to innovate and distorting competition in the supply of new or improved products in the future. This impediment will typically take the form of restricted access to a critical resource.

“A dominant firm's actions can threaten dynamic competition if it monopolises and restricts access to a critical resource that other firms need in order to innovate. The source of the dynamic problem is not the fact that the firm can earn monopoly rents but that it can restrict access, and so the appropriate remedy should focus on ensuring access.” (Ellig, 2001, p.266)

This is not to say that the tools and guidance discussed in previous sections would be irrelevant to other types of abusive behaviour. But the likelihood is that greatest value would come in cases where the allegation centers on whether a dominant firm has acted in a manner likely to distort competition in innovation and future markets.

#### **Assessment of dominance**

For a firm (or set of firms) to be liable to current infringement of Article 82 it must be dominant within a current relevant market.<sup>14</sup> Thus there is no need to define future markets to establish the applicability of Article 82.