Towards a More Refined Economic Approach in State Aid Control

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1. Introduction

Public authorities give subsidies to firms which affect their business decisions including entry, exit, the level of output, research and development, the location of their facilities and the choice of their inputs. While such State aid may be used by Member States for sound public policy reasons, it may distort competition between firms and trade between Member States, providing the rationale for EU control.

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In recent years, a number of steps have been taken to gradually improve the effectiveness of State aid and State aid control, to strike a better balance between the costs and benefits of State aid. Both at the national and the European level, the objective has been to achieve 'less and better targeted State aid'[1].

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In June 2005, the Commission published its State Aid Action Plan, less and better targeted State aid[2], in which it set out a roadmap for State aid reform in

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[1] The political mandate for an approach towards "less and better targeted State aid" has been expressed in various conclusions of the European Council since the launch of the so-called Lisbon agenda for growth and jobs in 2000.

[2] *State Aid Action Plan, less and better targeted State aid: a roadmap for State aid reform 2005 to 2009,* available at ec.europa.eu/comm/competition/State_aid/reform/saap_en.pdf. For an elaborate description of the State Aid Action Plan, see PART 1 - Chapter 3 of this volume.

the period 2005 to 2009. The State Aid Action Plan presents a general balancing test as a conceptual framework for analysing State aid cases. In essence, this test asks (i) whether the State aid addresses a market failure or other objective of common interest; (ii) whether there is an incentive effect (i.e. whether the aid affects the behaviour of the recipient in a way which meets the objective) (iii) whether the aid leads to distortions of competition and trade and (iv) whether given the magnitude of the positive and negative effects, the overall balance is positive.

1.4 The balancing test has subsequently been introduced in a number of enforcement guidelines and has been applied in individual cases. The aim of this chapter is to elaborate on the main steps of the balancing test (assessment of market failure, incentive effect and distortions of competition and trade) and to illustrate the application of the test drawing on the experience accumulated in recent cases.

1.5 This chapter is organized as follows. Section 2 briefly discusses the concept of distortion of competition and trade in light of the enforcement practice of Article 87(1). Section 3 sets out the balancing test that has been developed in the context of Article 87(3). Sections 4, 5 and 6 describe the three main steps of the balancing test and give some illustrations based on recent cases. Concluding remarks are presented in Section 7.

2. Distortion of competition and trade

1.6 Only State measures which constitute State aid within the meaning of Article 87(1) are subject to EU State aid control and such State aid is in principle prohibited. State aid measures can however be allowed under Article 87(3).

1.7 The existence of a distortion of competition (or the threat of it) and the prospect that trade between member States will be affected are in principle necessary conditions to establish the existence of State aid under Article 87(1).

1.8 According to case law[3], these conditions are in most cases considered to be fulfilled if the measure is "selective" in terms of granting an advantage. A

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[3] Commission's *Vademecum: Community rules on State aid* (2007), p. 3. For more details, see PART 2, Chapter 3 of this volume.

measure is deemed selective if it is capable of affecting the competitive balance between the recipient firm and its competitors in the member State concerned[4]. "Selectivity" is what differentiates State aid measures from so-called general measures, which apply equally to all firms in all economic sectors in a member State (e.g. most nation-wide fiscal measures). A scheme is also considered selective, if the authorities administering the scheme enjoy a degree of discretionary power. The selectivity criterion is further satisfied if the scheme applies to only part of the territory or a specific industry of a member State (this is the case for all regional and sectoral aid schemes).

1.9 The notion that a distortion of competition arises when the competitive balance is affected would seem to accord with intuition, even if the notion of competitive balance would need to be made more precise. Fundamentally, it would appear that aid can in some cases be deemed selective (in the sense described above) even when it does not appreciably affect the competitive balance between companies from an economic perspective.

1.10 The competitive balance among firms will be affected when recipient firms are led to behave in ways which reduce the profit of their competitors or impair their ability to compete. State aid is in turn likely to affect the market behaviour of recipient firms when it changes the costs or benefits associated with taking a particular action. Subsidies will typically reduce the marginal costs of the recipient firm and reductions in marginal cost lead firms to produce more than they otherwise would have done.

1.11 Note that subsidies may not have an impact on the product markets in which the beneficiary is active, but rather on markets which are upstream or downstream of those product markets. To illustrate, consider a subsidy scheme encouraging companies to invest in environmentally friendly production techniques. Such aid may have no impact on either of the financial position of the beneficiaries (when the subsidy just compensates for the extra cost the new equipment) or the competitive position of the companies (when the new equipment does not make the company more efficient). The main effect such aid may have is to sponsor suppliers of environmentally friendly equipment in the country concerned[5].

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[4] Measures which are *de jure* not selective may *de facto* have a divergent economic impact on firms, sectors or regions.

[5] Note that Article 87(1) may apply not only when the aid helps the direct beneficiary but also when it favours the production of certain goods.

1.12   State aid which affects sunk costs can change expansion, entry and exit decisions. Whereas without the prospect of aid, a company may not wish to expand its production facilities or the scope of its activities because it would not be profitable to do so, a subsidy may raise revenues to such extent as to make it worthwhile. For instance, a State subsidy may make it profitable for the beneficiary to invest in new production capacity, or to continue producing, or to invest in another region than that originally foreseen.

1.13   Similarly, a company whose investments are sunk may continue to produce despite making losses as long as its revenues cover variable cost. A lump sum subsidy contingent on the interruption of production might make it more profitable to exit.

1.14   It is however more difficult to see how a lump-sum payment by the State without specific conditions attached can affect company behaviour in ways which have a direct impact on competitors. Indeed, the provision of liquidities will not by itself trigger the development of new projects or the interruption of existing ones, given that the opportunity cost of funds is equal to the return that the company can achieve by investing in alternative investments opportunities. If the recipient does not face any financing constraints, in the absence of a lump sum, it will have undertaken all internal projects providing a (risk adjusted) return exceeding the return that can be achieved in external investment opportunities (and equal to the cost of funds). The best return that the recipient can obtain from a lump sum is then the return accruing from external investment opportunities (which remain unchanged) – this return is necessarily higher than the return that could be achieved from internal projects at the margin.

1.15   Of course, in the presence of financing constraints, matters may be different. In those circumstances, there are internal projects with a return in excess of that accruing from external opportunities that cannot be financed, or only at a high cost. A lump sum may trigger the development of these projects and thereby have an effect on competitors. Thus, to the extent that a beneficiary company does not face any particular financing constraints it is unlikely that a simple transfer of State money will have an effect in the market place[6]. Rather, it will result in a mere windfall profit to shareholders.

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[6] Of course, when the State transfers money to companies without any explicit conditions, one may wonder why the State does this in the first place. One cannot exclude that the money comes with implicit conditions, e.g. not to close factories, not to lay off people, or a commitment next time to invest at a later stage in the country concerned.

3. A more refined economic approach under Article 87(3)

As indicated above, measures which involve State aid in the meaning of Article 87(1) are, in principle, illegal. Nonetheless, State aid measures can be exempted from this prohibition if one or more grounds for exemption as set out in Article 87(3) are met. Such measures are called "compatible" (i.e. compatible with the common market).

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The general principle behind the Commission's compatibility assessment is to balance the positive impact of the aid measure (pursuing an objective of common interest) against its potential negative effects (distortions of trade and competition). In most cases such a balancing is not carried out explicitly, but rather by reference to predetermined criteria or proxies[7].

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Over the years, there has been a growing willingness at the level of the EU and the member States to consider the effectiveness of State subsidies in pursuing public policy objectives, and to look more closely at the costs and benefits of State aid. The stated aim in recent years has been to strive for 'less and better targeted State aid'[8].

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In June 2005, the Commission published its State Aid Action Plan, less and better targeted State aid,[9] in which it set out a roadmap for reform of State aid control in the period 2005 to 2009. According to this plan, more attention should be paid - in the design of State aid rules as well as in the assessment of individual State aid cases - to the analysis of when exactly State aid is useful in improving the market outcomes and when, to the contrary, the effect of aid is mainly to distort competition and/or trade between member States[10].

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[7] The approach taken in most block exemption regulations (BERs) and enforcement guidelines in State aid control is to define a set of objectives and eligible costs on the basis of which companies may receive State aid. The amount of subsidy is specified in terms of maximum aid intensities of the eligible costs. The implicit balancing inherent in this approach is to obtain the positive impact of the aid measure by declaring expenses eligible which target objectives of common interest (like investment in an environmentally friendly techniques or specific R&D projects) while restricting the possible distortions of competition by limiting the aid intensity.

[8] The political mandate for an approach towards "less and better targeted State aid" has been expressed in various conclusions of the European Council since the launch of the so-called Lisbon agenda for growth and jobs in 2000.

[9] *State Aid Action Plan, less and better targeted State aid: a roadmap for State aid reform 2005 to 2009*, available at ec.europa.eu/comm/competition/State_aid/reform/saap_en.pdf. For an elaborate description of the State Aid Action Plan, see PART I – Chapter 3 of this volume.

[10] See also H. Friederiszick, L.-H. Röller and V. Verouden, *European State aid control: An Economic Framework*, in: Paolo Buccirossi: Handbook of Antitrust Economics, MIT Press (2007).

1.20 The State Aid Action Plan highlights that State aid may contribute to the common interest in two main ways: First, it can alleviate market failures, that is, State intervention may improve the functioning of markets when competition, if left to its own devices, is unlikely to produce efficient outcomes in terms of prices, output and use of resources. Second, it can bring about more acceptable outcomes in terms of social or regional cohesion. Whereas the first goal of State intervention is often referred to as the "efficiency objective", the second goal is often referred to as the "equity objective".

1.21 The State Aid Action Plan presents a general balancing test as a conceptual framework for analysing State aid cases. In essence, this test asks (i) whether the State aid addresses a market failure or other objective of common interest; (ii) whether there is an incentive effect (i.e. whether the aid affects the behaviour of the recipient in a way which meets the objective) (iii) whether the aid leads to distortions of competition and trade and (iv) whether given the magnitude of the positive and negative effects, the overall balance is positive.

1.22 The balancing test set out in the State Aid Action Plan could be read either as a sequential or an integrated test. According to the former, weak evidence either on the presence of a market failure or the presence of an incentive effect would suffice to disqualify the aid. Following this approach, aid measures may be declared incompatible without a thorough assessment of the distortionary effects of the aid on competition and trade. In view of the main justification for EU State aid control – limiting distortions of competition and trade – it would seem appropriate to also bear in mind the magnitude of the possible distortions, however. In particular, less demanding evidence as to the positive aspects of the aid should suffice if the distortions of competitions appear relatively limited.

1.23 So far, the main area of State aid control in which the above principles have been implemented is the area of R&D and innovation aid, and the provision of risk capital. The opportunity for review was given by the fact that the earlier Commission Framework for the assessment of R&D and that for risk capital measures aid were up for renewal in 2006. The new R&D&I Framework[11] has, on the one hand, enlarged the range of projects

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[11] Community Framework for State aid for research and development and innovation, OJ C 323 of 30.12.2006, p.1. For a description, see T. Kleiner, *The new Framework for Research, Development and Innovation, 2007–2013*, European State Aid Law Quarterly, Issue 6/2007, p. 231-248.

that may be supported by State aid. In particular, many more types of innovation projects can now be supported. At the same time, the Framework sets out that when the aid amount exceeds a certain level (e.g. more than EUR 7.5 million for experimental development activities), the Commission has to assess in detail whether the aid measure is, on balance, likely to be in the common (EU) interest. To make this assessment, the Framework uses the balancing test.

1.24 Another area in which some of the principles have been implemented is that of regional aid[12]. The balancing test has further been applied in a number of cases for which currently there exists no explicit assessment framework, such as State support for the construction of broadband infrastructure.

1.25 In the next sections, the various dimensions of the balancing test will be discussed in more detail. Reference will be made to a few cases in which the test has already been applied.

4. Market failures

1.26 State intervention may improve the functioning of markets when they are unlikely to produce efficient outcomes in terms of prices, output and use of resources. These instances are referred to as "market failures".

1.27 The main market failures which may be relevant in the context of State aid are externalities and imperfect information, in particular asymmetric information and coordination failures[13].

4.1. Externalities

1.28 Externalities arise when actions by one agent have consequences for other agents. These effects may be negative ("negative externalities") or positive ("positive externalities") and when these effects are not taken account by

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[12] Guidelines on national regional aid for 2007-2013, OJ C 54 of 04.03.2006, p. 13-44. In a limited number of cases, the Commission will perform an in-depth analysis of the incentive effect and distortions to competition and trade. See also PART 4 - Chapter 6 of this volume.

[13] For summaries of the arguments regarding market failures see J.E. Stiglitz, *Economics of the Public Sector*, 2000 (3rd edition) or R. Meiklejohn, *The Economics of State Aid*, European Economy, 1999: 3, 25-31.

the decision maker, they drive a wedge between the private benefits of a given action (to the actor) and the overall economic benefits of the action, resulting in an inefficient market outcome[14].

1.29   To illustrate, when producers do not take into account the deterioration of the environment induced by their activities, negative externalities may arise; this may for instance increase the cost of other companies in the economy that rely on a clean environment to produce goods (farmers, camping sites, water companies). In those circumstances, the market produces too many environmentally harmful goods and provides too few incentives for the polluting companies to invest in environmental improvements, even though it would be beneficial for the economy if they did ("market failure"). In such cases, State intervention can change the incentives of the market players so that they do take the costly side effects into account[15].

1.30   R&D provides an example of a positive externality. When a company undertakes R&D, this activity may have spill-over effects to the benefit of other companies (through the diffusion of knowledge). Even when the company concerned has intellectual property rights over the results of its R&D, it may be difficult to appropriate all the benefits of R&D that accrue to other companies. As a result, the individual company may undertake too little R&D from the point of view of society as a whole. State intervention, in the form of subsidies to R&D, can establish a more efficient outcome.

Illustration: NeoVal

1.31   NeoVal is a case in which it was argued that State aid was necessary to correct for market failures. It was notified to the Commission in 2006[16] and led to the first decision taken by the Commission on the basis of the in-depth assessment procedure under the new R&D&I Framework.

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[14] Fundamentally, the presence of externalities can be traced back to the absence of adequate property rights which make that the externalities cannot become the subject of efficient trade. This problem is also referred to as the problem of missing markets. See R. Coase, *The Problem of Social Cost*, Journal of Law and Economics, 3, 1-44 (1960).

[15] An alternative response could be to design an adequate system of tradable emission rights, allowing the holders of such rights to emit a given amount of pollution.

[16] Commission Decision of 21.02.2007 in case N 674/2006, *NeoVal*. For a more detailed description of the case, see Isabelle Neale-Besson and Jean-Charles Djelalian, *Premier cas d'application du nouvel encadrement communautaire des aides d'Etat à la recherche, au développement et à l'innovation: l'aide de l'Agence française de l'innovation industrielle au programme NeoVal*, Competition Policy Newsletter, 2007-2, p. 60-64.

The case is about a subsidy to an R&D programme directed by Siemens Transportation Systems (STS), a subsidiary of Siemens AG with activities in France[17]. The aim of the NeoVal programme was to develop a new generation of driverless metro trains featuring a number of innovative functions, in particular power optimisation and dynamic on-board power supply, allowing the metro to move autonomously between certain stations. The total cost of the R&D programme amounted to EUR 60 million over six years, the aid element being EUR 11 million in subsidies and EUR 15 million in repayable advances. The French authorities indicated that with the aid, STS would perform NeoVal project in full, whereas without the aid a less ambitious project would be conducted (hereinafter the "base project").

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The potential externalities that the Commission analysed in this case related to the benefits that the introduction of the new metro system would bring about in the field of urban transport. These benefits included a lower energy consumption (and associated reduction in the emission of greenhouse gasses), an improvement of service quality for the users of public transport, and an improvement of traffic flows in congested municipalities.

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The existence of these benefits of NeoVal was not disputed by the Commission. In particular, the Commission ascertained that no other players in the sector were already actually planning to do such a project. If so, the NeoVal would probably bring about few additional benefits (and only result in distortions). But the question also arose whether any firm supplying a metro with the characteristics of NeoVal[18] would not be able to appropriate a large enough part of the benefits by charging a higher price for its product or by winning more contracts. If so, few of the benefits would be external (i.e. not already being taken into account in the decision making of the supplier).

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In principle, customers are willing to pay for the direct benefit generated by a product. This is not different for a municipalities contemplating to invest into new metro system. If the system is worth more because of the benefits, they will normally be willing to pay more. In the specific case, NeoVal would allow its owners a limitation of energy consumption and, consequently, a reduction of operating costs. Arguably, also the improved

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[17] The programme would be conducted in partnership with LOHR Industrie, a smaller French company specialised in designing and developing freight and passenger transport systems.

[18] At the market failure stage, the first question is not whether STS would be willing to undertake the project, but rather whether any supplier in the market would be willing to do so.

traffic flow and the reduced pollution levels are features for which municipalities would be willing to pay. STS submitted evidence, however, that municipalities' investment decisions appear to be constrained in this regard; municipalities in practice appear hesitant to increase the total available budget in order to allow the purchase of a superior product[19]. Accordingly, the scope for appropriating the benefits of a superior product by charging higher prices would be rather limited.

1.36 Further externalities included the potential spill-over effects of the NeoVal program in terms of scientific and technological knowledge. If successful, the new product would constitute a demonstration of the concept of embedded energy storage in transport, a concept which could be transferred to, and developed in, other products and other fields of transportation.

1.37 The analysis of market failures thus revealed that, in principle, there are a number of externalities at play in the sector: some benefits of the development of the new metro system are unlikely to be captured by the suppliers.

Public goods

1.38 Closely related to the problem of externalities is the provision (or absence thereof) of public goods. Public goods are goods which are non-rivalrous in consumption (the use of the good by one person does not reduce the possibilities of others persons to use or consume it) and for which it is difficult or impossible to exclude anyone from consuming it (and hence making users pay for the goods)[20].

1.39 In a sense, public goods represent an extreme case of externalities, as suppliers of such goods cannot appropriate the benefits that people derive from it. As a result, public goods are not normally provided by the market.

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[19] One might of course wonder whether one should not speak in this context of a "government failure" on the part of these municipalities given that they behave in a way which appears suboptimal over the longer run, and whether a subsidy to STS was the optimal response to the problem. In addition, if indeed the budget available for the purchase is limited in the short term, a strategy for STS could be to ask a low upfront price combined with certain yearly usage fee. The latter solution might however have been difficult to implement given STS' own financing constraints (see the discussion on the incentive effect below).

[20] Examples of pure public goods are rare. National defence and public free-to-air broadcasting services are probably among the few examples. Sometimes, also services of general economic interest are deemed "public goods", mainly because they are by definition available to everyone (i.e. impossibility to exclude any individual user) and the cost of providing the service to additional individual users is rather minimal.

The public provision of such goods or services may then be an efficient response.

4.2. Information asymmetries

Information is not necessarily of a kind that is accessible to everyone and verifiable. Some parties may have private information that cannot be verified by others.

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This arises for instance with respect to investment projects or the characteristics of borrowers. Entrepreneurs will have information about the value of their business development that cannot be verified. They may also know more about their own productivity. In turn, banks may have private information about the characteristics of their clients that cannot be verified by the financial markets.

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In the presence of such asymmetries, that may be common for SMEs in innovative industries, it is difficult for banks or investors to distinguish "good" from "bad" loans or investments, giving rise to adverse selection problems. To the extent that the performance of the companies being financed cannot be verified, banks will suffer from a problem of moral hazard. Investors can invest in research in order to reduce the scope of the asymmetry. Contracts can also be designed in order to address these issues but will involve some inefficiency, relative to the outcome that would prevail in the absence of private information. Some projects that would otherwise be profitable cannot be financed.

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Young firms may in particular suffer from this, to the extent that they may not have gained a reputation yet for developing new products and bringing them to the market, a reputation that would be instrumental in obtaining finance. They may also not have the necessary collateral to obtain loan financing.

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Under such circumstances, providing incentives to the financial sector to increase financing to small and medium-sized companies can be an appropriate response in terms of efficiency. The problem of asymmetric information in the provision of finance is indeed the main motivation behind the Commission's policy towards State support to risk capital in the context of SMEs[21].

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[21] Community Guidelines on State aid to promote risk capital investments in small and medium-sized

4.3. Coordination problems

1.45 Information about future events may be rather poor, so that investors can hardly specify what outcome can arise, let alone what to do if particular outcomes arise. As a result, contracts between parties involved in investments projects will be incomplete and some parties may not undertake the efficient levels of investment (in particular those that exercise little control in case of unforeseen events) or fail to invest at all. Parties will also incur significant costs designing and enforcing appropriate contracts. The cost of coordinating those will also presumably increase with the number of contractual partners.

1.46 Imperfect information may also prevent firms from taking mutually beneficial decisions. This may arise with respect to the setting of standards, in cooperation agreements and in the context of cluster formation.

1.47 When the presence of coordination problems seriously impacts upon the profitability of the project, it is conceivable that State aid may be needed to restore profitability. The practical importance of State aid as a remedy for such market failure should probably not be overestimated, however.

Case example: TVMSL

1.48 The case TVMSL concerned a large R&D programme to develop a solution combining satellite and terrestrial networks with a view to broadcasting television on mobile telephones[22]. The project was headed by French-US company Alcatel-Lucent and involved ten other partners, including Thales Alenia Space for the satellite part, STM and DiBcom for microchip technology, and others.

1.49 The Commission recognized that, in principle, coordination failures of the type affecting collaborative R&D projects are more likely to occur when the need for firms to interact for the project to succeed is large (e.g. because the project requires a wider variety of competencies); when the number of cooperating firms and the intensity of cooperation is high; when there are diverging interests between cooperating partners; when it is problematic to

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enterprises, OJ C 194 of 18.08.2006, pages 2-22. In the context of risk capital (equity financing of companies in their early growth stages), the capital market imperfections preventing the supply of risk capital from meeting demand at a price acceptable to both sides is known as the "equity gap".

[22] Commission Decision of 10.05.2007 in case N 854/2006, *TVMSL*. TVMSL stands for "Télévision mobile sans limite".

design adequate contracts governing the cooperation (e.g. due to imperfect and asymmetric information) or where it is difficult for third parties to coordinate cooperation.[23].

In the TVMSL case, the Commission paid particular attention to the question whether Alcatel-Lucent, the main company in the consortium, would not be able to act as the central coordinator, even in the absence of State aid. The Commission was of the opinion that, to the extent that Alcatel-Lucent had strong incentives to embark upon the TVMSL project (in view of the potentially high profits), it should probably be able to propose the other partners a mechanism for sharing risks and revenues in a way which was sufficiently attractive to convince them to participate in the programme. The emphasis of the case thus shifted to the analysis of the incentive effect (see below).

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5.   Incentive effect

If there is a market failure, intervention by the State has the potential to increase economic efficiency. The existence of a market failure is, however, a necessary but not sufficient condition for State aid to be effective. To be effective, State aid must lead to the recipient of aid changing its behaviour. This is referred to as the aid having an "incentive effect".

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Whether State intervention results into a positive change in the targeted activity is the issue at stake. This impact may include the amount, scope or the timing of the targeted activity and, in regional aid cases, also the location of the activity. The incentive effect can (only) be identified by an analysis of the counterfactual, namely the level of targeted activity that would prevail in the absence of aid. The difference in activity between the outcomes with aid and without aid can be viewed as the impact of the aid measure and captures the incentive effect[24].

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[23] Decision, para 39.

[24] The analysis of the incentive effect is related to, but distinct from the analysis of external effects and the presence of a market failure. The analysis of the incentive effect investigates whether a particular company will, on its own, undertake a particular project. The analysis of external effects investigates whether the market achieves an efficient outcome. First, the analysis of incentive effects is only relevant if there is a market failure in the first place. Second, the absence of an incentive effect does not necessarily imply that there is "no" market failure: it is possible that a failure in the market is *alleviated* by the aid, but not solved entirely.

5.1. Methodology

1.53   Assessing whether an investment project is individually rational (profitable) for a company with State aid but not without will shed a direct light on the incentive effect.

1.54   The most common way to assess the commercial rationale of a specific project is by measuring its Net Present Value ("NPV"), i.e. the sum of the expected net cash flows resulting from the investment, appropriately discounted to their current value.

1.55   The appropriate discount factor in a NPV calculation is the opportunity cost of capital for the project concerned (the "cost of capital"). It typically corresponds to the rate of return that fund providers require for a project of that kind[25].

1.56   When the NPV of a project is positive, this implies that the project has an internal rate of return (IRR) that exceeds the required rate of return[26]. In other words, the project is worth carrying out.

1.57   Relevant factors in the NPV assessment are the amount and time path of expected cash flows and the risk associated with the project. The investment is thus, ceteris paribus, less profitable from the company's perspective when the risk and the start-up investment are high and when future cash flows are small or in the far future.

1.58   The more risky the project is, the higher the rate of return that fund providers will ask. When considering the cost of capital, however, it is important to note that fund providers are not necessarily concerned about the risk of the project as such, but rather about risk they cannot "diversify away" by investing in a large portfolio of projects or firms[27].

1.59   The valuation of R&D projects differs somewhat from "normal" investment projects, such as building a new production facility or entering

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[25] One way to measure the opportunity cost of funding is by calculating a weighted average cost of capital, where the cost of debt is the (tax adjusted) interest paid on bank debt and company bonds and the cost of equity may be determined with the well-known CAPM model (capital asset pricing model).

[26] The NPV and IRR methods are related. The NPV method is recommended, however, when it comes to comparing the profitability of different investment projects. See T. Copeland and F. Weston, *Financial Theory and Corporate Policy,* 3rd edition (1988), p. 31.

[27] R. Brealey and S. Myers, *Principles of Corporate Finance*, 4th Edition (1991) McGraw-Hill, p.181.

into a new market segment, in so far as it is not certain that a final product will eventually be sold. In this context the NPV analysis can be usefully extended to explicitly account for the likelihood that the project will fail in technological terms[28]. The possibility that a project will not pay off in the future because it fails technologically will then, ceteris paribus, translate into a lower expected level of future cash flows (i.e. the amount of cash flows in case of technological success times the probability of technological success).

Technological risk may also translate into a higher discount rate, to the extent that this risk cannot be diversified away[29]. This higher discount rate should in that case only be applied for the years in which the project effectively faces technological risk (i.e. not for the entire horizon of the project) and only for that part of the project that is affected by the technological risk[30]. In practice, it would seem more appropriate to apply a specific probability of success to the calculation of expected cash flows rather to use increased discount rates for the evaluation of R&D projects[31].

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Further, in investment projects such as R&D programmes, the company may have ways to control the time path of investment and thereby limit the consequences of possible negative outcomes. The NPV analysis can be extended to the sequential nature of decision making in R&D projects ("decision trees"), which allows for the possibility not to carry on with the project when the results at the R&D stage are disappointing[32].

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The NPV value is normally not calculated on the basis of one foreseeable development only. Rather different scenarios are considered with possibly

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[28] This method is sometimes referred to as the risk-adjusted NPV method (rNPV).

[29] Brealey and Myers (*supra* note 27 above, at p.197) argue that various sorts of "bad outcomes" may well reflect unique (i.e. diversifiable) risks which would *not* affect the expected rate of return demanded by investors nor, for that reason, the appropriate discount rate to evaluate the project.

[30] For instance, when the R&D project consists of a "base project" and a more ambitious part which can be seen as an "addition" to the base project (in the sense that, if the more ambitious part does not work out, the base part can still be used as a fall back), it would not be appropriate to apply a higher discount rate to the entire project as it would artificially reduce the value of (likely) future cash flows related to the base project.

[31] Cf. Brealey and Myers, *supra* note 27 above, at p.197.

[32] Likewise, one may assess the value of being able to wait with further investments until more information has been gathered about the prospects of the future market. In order to measure the value of this form of flexibility, the "real option approach" has been put forward (S. Myers, *Determinants of Corporate Borrowing*, Journal of Financial Economics (2007), p.146-176). Under this approach, the initial R&D investment decision is viewed as a purchase of a call option which allows the company to exercise the option whenever the circumstances are right. The practical difficulties of using this fairly sophisticated approach in the context of R&D project valuation appear significant, however. See also F. Pries, T. Åstebro and A. Obeidi, *Economic Analysis of R&D Projects: Real Option versus NPV Valuation Revisited*, les Nouvelles (2003), p. 184-186.

different inputs into the NPV calculation. The NPV can then be calculated for each possible outcome, and if a specific probability is attributed to each scenario, a final expected NPV can also be calculated.

Illustration: NeoVal (continued)

1.63   The analysis focused on whether the aid would lead STS to increase its level of R&D activity in comparison with what it would have done in the absence of aid.

1.64   A comparison with historical levels of R&D activity by STS revealed that the project represented an increase in R&D activity in terms of scope and speed. However, such a comparison does not by itself indicate that this increase was actually the result of the aid. The French authorities had indicated that with the aid, STS would perform NeoVal project in full, whereas without the aid a less ambitious project would be conducted (the "base project"). On the basis of revenue and cost forecasts provided by the company, the Commission analysed the level of profitability (in terms of Net Present Value) of the two projects, to see whether STS would not have gone ahead with the ambitious project in any event, even without the aid. The approach followed by the Commission is summarized in Table 1.

Table 1: net present values			
	Base project	NeoVal with aid	NeoVal without aid
Present value of the R&D investment expenditure by STS	I_1	I_2 - subsidy	I_2
Present value of the expected net revenues in case of success at the R&D stage	R_1	R_2	R_2
NPV of the project in case of R&D success at the R&D stage	NPV_1	NPV_2 + subsidy	NPV_2

The appropriate treatment of risk was also an issue in the analysis. Conceptually, one can distinguish between two types of risk: the technological risk at the R&D stage and the risk related to the subsequent commercialisation. The latter form of risk is normally already taken into account by the firm in the form of the cost of capital relevant to its business (here: STS' transportation business). The former had to be considered explicitly, given that the STS had not explicitly allowed for the possibility of technological failures in its NPV calculations[33]. The Commission thus computed the "critical" rates of technological success, below which STS would indeed need State support to make the whole project profitable enough for it.

1.65

To illustrate: assume that the probability of technological success is X for NeoVal (the probability of technological success for the base project is taken equal to 1, for simplicity). The expected pay-off of the NeoVal project not only depends on X, but also on what would happen when the NeoVal project fails in technological terms. Two extremes were distinguished: either STS would have no metro to sell and would have to start with a new development project almost from scratch, or STS would be able to use the fall back option of selling the base project. The latter would assume that STS develops the various features of NeoVal in parallel and that when the most risky aspect in technological terms, the energy storage, does not work out, STS could still sell a new metro with the other features ("fall back"). In the first case ("all or nothing"), the expected pay-off of NeoVal would be - I2 + X · R2. In order for NeoVal to be more attractive than the base project, X would have to be at least X' per cent. In the second case ("fall back"), the expected pay-off of NeoVal would be: - I2 + X · R2 + (1 - X) · R1. In order for NeoVal to be more attractive than the base project, X would have to be at least X'' per cent.

1.66

The critical rates obtained using this approach were all approximations, not exact figures (this is inherent to NPV analysis far into the future). Nonetheless, they did give some insight into the order of magnitude and the relevant factors. Following further analysis and with the assistance of other departments in the Commission (e.g. DG RTD), it became clear that the risk associated with the NeoVal project was indeed of an order of magnitude such that it could be reasonably be assumed that the aid was necessary.

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[33] Note: the net revenue figures in the table do not represent expected values but expected values conditional upon technological success.

Financing constraints

1.68 When a project has a positive NPV, it should in principle be undertaken as it will increase the value of the company. In this context, one should be wary of the argument that individual business divisions of large corporations lack the finance to make investments as a result of a company's policy with respect to the allocation of capital (investment budgets) among divisions. If the investment project of any particular division is profitable (given the appropriate cost of capital at the company level), one would expect the necessary capital to be allocated internally. Yet, internal allocations of capital may be part of the wider issue of designing appropriate mechanisms of incentives and control within the company. One cannot exclude that fixed budget or temporary cash constraints at the level of divisions may have a role to play in this respect, so that internal capital would not allocated despite a positive NPV.

1.69 It may thus be appropriate to make some allowance for such circumstances and conclude that there is an incentive effect despite the fact that the investment is profitable without aid but provided that the company is able to factually demonstrate that the division faces important financing constraints. There is however a risk that State aid may then be preferably allocated to companies which have ineffective mechanism of capital allocation. This approach is also potentially open to abuse to the extent that internal mechanisms for the allocation of capital can be designed (or presented) in such a way as to ensure that aid is required. Hence, safeguards are needed. Mechanisms elaborated in tempore non suspecto should be given greater credence. In any event, it would seem appropriate to confront the arguments of internal financial constraint with the more objective project valuation methods. A large discrepancy between the two approaches, in particular the presence of strong returns, might cast doubt on the claims of the division as to the financing constraints it faces[34].

1.70 Finally, it would appear that the reason as to why State aid is needed is also relevant for the form in which such aid should be allowed. Where State support is not needed to increase the profitability of a project, but rather to overcome financing problems in the early investment stages, it would be appropriate to limit the support to what is required to address that

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[34] Additional analysis should in those cases try to further ascertain the credibility of company's claims, notably by inspecting internal documents of the company such as business plans, and by verifying whether public statements or other pieces of information corroborate the claims of the company.

constraint. In other words, it should suffice for the company to receive a loan from the government (at an interest rate which is still compatible with maintaining a sufficient level of profitability for the project).

Illustration: NeoVal (continued)

In the NeoVal case, the French authorities claimed that the division faced short-term financing constraints limiting its set of options to do R&D. France argued that the division Transportation Systems (TS), to which STS is functionally attached, was required by the central management of Siemens to select those R&D projects which combine medium-term profitability with acceptable impact on the short-term financial indicators. In principle, each division has to be self-financing in terms of its R&D work, so that without aid the higher annual expenditures required for NeoVal would deteriorate the operational margin of division TS. France referred in this context to the clear requirement, set out in the Annual Report of Siemens AG 2006, as well as in internal company documents, that the operating margin of TS had to increase to 5 per cent of sales by March 31st, 2007 (while on September 30th, 2006, it amounted to 1.8 per cent of sales). In this context, without aid, the NeoVal program would probably not be carried out.   **1.71**

The Commission took this element into consideration in its evaluation since the existence of this constraint was sufficiently well established. Importantly in this respect, internal documents revealed that STS, before it applied to the French State for a subsidy, was on track to do the "base project", not the ambitious NeoVal project.   **1.72**

Illustration: SOITEC

In December 2006 the French authorities notified an aid measure in favour of the project "Bernin2010" of the French company SOITEC, an R&D&I project relating to the nanotechnology sector and aimed at developing a new generation of materials ("substrates") for the production of computer chips[35]. The total cost of the project amounted to EUR 53 million, the aid element being EUR 14.3 million.   **1.73**

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[35] Commission Decision of 10.07.2007 in case N 887/2006, *SOITEC - Bernin 2010*.

1.74   SOITEC indicated that even if the project was profitable in the long run, it would have difficulty finding outside investors, as the initial R&D expenses for the project would excessively reduce SOITEC's margins in the first years. This would dissuade investors from investing in SOITEC.

1.75   The Commission did acknowledge that asymmetric information might be in issue in this market context36, but did not go so far as to accept that SOITEC would be unable to find external finance for a project like Bernin if it were indeed sufficiently profitable.

6.   Distortions of competition and trade

1.76   As discussed above, State aid to a particular recipient will have an impact on the recipient's costs and/or revenue prospects and so can affect its decisions concerning entry, exit, output and input decisions. As a result, competitors will be affected.

1.77   The impact on competition and trade is intrinsically linked to the positive effect of the aid, as the mechanism that leads to a change of behaviour of the aid recipient is also causing the harm to competition and trade. In order to make sure that the overall balance for the EU can be considered positive, the third step of the balancing test considers the magnitude of the distortions of competition and effects on trade.

1.78   The effect of State aid on competition can be considered at two levels. First, at a very specific level, one can expect that the change of behaviour of the recipient will affect competitors to a different degree depending on market circumstances and will trigger different adjustments in their behaviour. For instance, a decrease in the marginal cost of the recipient, which leads to a fall in its price, will have an impact on the profits of competitors which increases with the degree of substitution between their products. Close competitors will be more affected. The reaction of competitors, which depends on the extent to which they are affected, is also determined by the type of competition which prevails. In some circumstances, a fall in price by the recipient will trigger an aggressive response by competitors. An increase in output might, in other circumstances, lead to an accommodating response by competitors.

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[36] *Id.*, para 66.

Similarly, an increase in R&D by the recipient might lead to an increase or a decrease in the R&D by competitors. In principle, the changes triggered by the behaviour of the recipient can be traced out and will depend on the competitive dynamics.

1.79 Second, at a more general level, the fact that State aids reallocates rents in the markets and interferes with the competitive process may have long term incentive effects. That is, firms anticipating that profits will be affected by State aids in addition to their own efforts may find it optimal to reduce the latter.

1.80 Overall, an assessment of the negative consequences of State aid on competition should consider the extent to which competitors are affected. This is relevant both for evaluating specific consequences in the market at hand and a as proxy for the significance of the systemic effects. Distortions should be considered less severe when competitors are less affected. Distortions can also be considered from the prospective of consumers and other things being equal State aid will be more attractive the more it leads to a benefit for consumers. Hence, in addition to the analysis on competitors, the competitive dynamics in the market should be examined to assess the consequences of State aid for the market as a whole with a particular focus on consumers.

1.81 Distortions of trade can be understood either as distortion of competition that arise across borders (i.e. distortion in the product market) or distortions in the location of investments (distortion in the input market).

Illustration: NeoVal (continued)

1.82 As regards the third step of the balancing test, potential distortions of competition and trade, the Commission observed that the potential impact of the R&D aid given to STS for the NeoVal project should be limited for several reasons.

1.83 First, the Commission considered that the aid did not have as a consequence that STS remains active on a market which it would have left in the absence of the aid. STS was planning to stay and invest in the metro market even without the aid, albeit in a less ambitious way (namely, by undertaking the base project APM03).

1.84 Second, and partly linked to the above observation, the Commission found it unlikely that the aid would crowd out rivals and distort their dynamic incentives to invest in R&D. The main basis for this finding was that the relevant product market, the market for turn-key driverless metro systems, was anticipated to grow quite rapidly over the next decade, leaving ample opportunities for other players. The Commission was also aware of some direct competitors of STS that had recently announced plans to introduce new metro systems. Additionally, a characteristic of the market for turn-key driverless metro systems is that is a fairly differentiated product market, with the various suppliers' products having particular strengths and weaknesses37. Accordingly, competing producers of metro systems would normally be somewhat shielded from the increase in competitiveness that STS would achieve by being able to undertake the NeoVal project instead of the base project APM03.

1.85 Third, in line with the finding that the aid would not prevent market exit by STS or distort rivals' dynamic incentives to invest in R&D, the impact on trade among Member States should remain limited. Neither did the Commission have indications that the aid would have as a result that economic activity within the Siemens group was shifted to France as a result of the aid.

7. Conclusion

1.86 In our view, the main benefit of an increased reliance on economic analysis in State aid control is to make the positive and negative implications of State aid more explicit and the evaluation of their relative magnitude more systematic. A more systematic assessment of the positive and negative effects of the aid, in particular for aid measures involving large amounts of aid, allows for a more precise sorting between desirable and undesirable aid.

1.87 A consistent implementation of the balancing test could contribute substantially to a policy shift towards both less and better targeted aid. Unfortunately, the implementation of a rigorous economic assessment is

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[37] For instance, metro systems such as NeoVal are based on rubber tyres, which makes them more useful on metro lines with bends and slopes than metro systems on iron wheels, which are used more on relatively straight metro lines. Further, the distance between metro stations, the frequency on the metro line and other customer preferences all have an influence on the demand for metro systems.

hampered by limited powers of investigation: obtaining much of the necessary information hinges on a sufficient level of cooperation by member States and the provision of information by third parties. It seems to us that further improvements in the investigative powers of the Commission are hard to dispense with.