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Financial Support to the Aviation Sector

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1 Introduction

1.1 Introduction

While it is generally acknowledged that air transport causes environmental damages that are not included in its price - so-called external environmental costs - it is sometimes argued that air transport covers at least its infrastructure costs. This argument is important in the discussion on distortions of competition between transport modes. Besides, aviation enjoys taxation advantages such as the exemptions from fuel taxation and from paying VAT on international flights.
Clearly, the issue of infrastructure cost recovery and subsidisation of air transport requires a more detailed analysis, which includes air transport, itself, the airline industry and also the aircraft industry. The question whether and to what extent the aviation sector is directly or indirectly subsidised is important both from the scientific and from the political point of view.

1.2 Objective of this study

The aim of this report, which is one part of a study on external costs of aviation commissioned by the Federal Environmental Agency of Germany (Umweltbundesamt), is to give a clear and transparent overview of the overall dimension of (direct and indirect) aviation subsidies. Foremost, the aim is to set up a methodological framework for analysing the support to the aviation sector. It defines the scope of analysis for such a study, identifies the subsectors and discusses the delimitation of systems such as airports. Furthermore, the different definitions of subsidies and their economic rationale are summarised and a categorisation framework for subsidies to be used for future empirical work is presented.

1.3 Structure of this report

This report is organised as follows. Chapter 2 first demarcates the scope of analysis. Subsequently, chapter 3 discusses various definitions of subsidies and ends with a proposal for a definition for further analysis. On the basis of this definition, Chapter 4 discusses a methodological proposal for the empirical analysis of financial support to the aviation sector. The methodology is illustrated in chapter 5 by means of examples of the financial support for the aviation sector in Germany, France and the Netherlands.

This report has mainly been composed on the basis of a background report by DIW (2001). The German and French case studies also were carried out by DIW. The Dutch case studies were carried out by IOO (2001).

2 Demarcating the scope of analysis

2.1 Introduction

Before we analyse the subsidies to the aviation sector in the next chapters, we start by suggesting a demarcation of the scope of further research. This is done by defining the aviation sector and air transport, and by suggesting further principles for analysis.

2.2 Definitions and principles for analysis

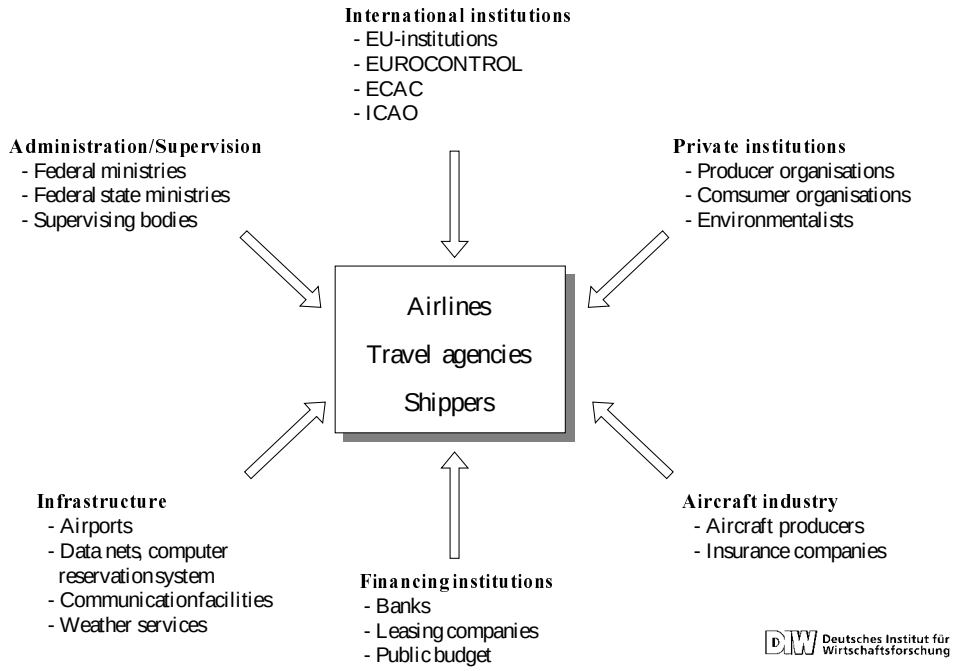
Definition of aviation sector

The aviation sector in general is characterised by a complex set of relations between different actors and institutions. Figure 1 shows the general composition of the aviation system. This report analyses the aviation sector in a narrower definition of economic subjects than given in Figure 1. Included are:

- On the side of infrastructure providers: the airports.
- The national air traffic control and Eurocontrol.
- On the side of air transport service suppliers: the airlines.
- On the side of vehicle suppliers: the aircraft industry.

Excluded are for example travel agencies, hauliers and their associations, handling agents, data networks and computer reservation systems and insurance companies.

Figure 1 The composition of the aviation sector



Definition of air transport in this study
The analysis of this study is limited on commercial flights only, e.g. military and private flight operations are excluded.

Institutional principle
As it holds true for all modes, airports belong to multi-modal infrastructures. Therefore, it is necessary to define the scope of airports (systems delimitation), in particular regarding the question how to treat rail stations, bus terminals and roads in the airport area. In this study we apply the institutional principle, which means that all facilities in the airport area are considered as airport infrastructure. Rail stations and similar facilities are thus included into the airport cost analysis as long as they are under financial responsibility of the airport authority (this is for example true with the Heathrow Express Terminal at London Heathrow). If rail stations are under financial and operating responsibility of rail companies the respective financial flows and costs are not counted as airport costs.

Subsidies versus induced costs
The decision for the institutional principle as the relevant one for system's delimitation implies that costs of rail stations in the airport are not included in the analysis if they are under responsibility of the rail company and not the airport authority. Nevertheless, the costs of these facilities are without any doubt induced by the aviation mode. This can also partly be assumed for newly constructed rail-links and access roads to the airport. However, an exact definition of to what extent these costs of links to airports have to be allocated to air transport is complicated, in particular for such rail-links which may serve also as commuting lines of suburban municipalities to the cities. A detailed discussion of these problems will be given in chapter 4 of this report.

The general principle applied in this study is to distinguish between subsidies to aviation on the one hand and induced costs on other modes on the other hand. Subsidies for airports are defined according to the institutional principle while the costs of rail stations, rail-links and access roads are considered as induced costs of air transport to other modes. Therefore they have to be dealt with separately (see chapter 4). A quantitative treatment of induced costs, however, is difficult for several reasons. First of all a case-to-case analysis would be necessary in order to analyse whether these facilities belonging to other modes than aviation make losses or even profits, how they are financed etc. The gathering of this data on induced cost would be time consuming and difficult.

Non-transport related business
Airports are complex, multi-product enterprises consisting of several business parts which develop specific activities that, once combined, allow the interchange between air and land transport modes and the interchange between the pure transport activity and commercial service activities. However, only a limited type of financial flows and subsidies can be split into flows related to air transport itself and those related to non-aviation business such as shops, restaurants, car-rental companies etc. Therefore, the definition used in this study is to include the whole area of an airport into the analysis of subsidies, e. g. to include both the aviation and the non-aviation business related facilities.

Territorial principle versus principle of flight origin

Problems of territorial delimitation occur in particular for airline subsidies such as exemption from VAT for international flights and from fuel taxation in general. We apply here the following procedure: The losses of fuel tax revenues due to the tax exemption are calculated for all take-offs of an airline independent on whether the takeoffs are in the home country or abroad. This means not to apply the territorial principle for fuel tax[1].

For VAT exemption for international flights we suggest to estimate the tax loss based on the principle of flight origin, e.g. for all flights starting from Germany the VAT-loss is quantified as German VAT-loss.

Cross-subsidisation issues

Cross-subsidisation between different business areas within airports are not analysed in this study.

[1] The territorial principle would imply to quantify the losses of tax revenues based on the fuel consumption of national flights and on fuel consumption of the share of international flights covering the national territory.

3 Defining subsidies

3.1 Introduction

In this chapter we start by discussing the problem and the economic rationale of subsidies. Subsequently, we discuss the various definitions of subsidies as they are used in practice by for example the European Commission. At the end, we propose a definition on which further analysis of the financial support to the aviation sector can be based.

3.2 The problem and the economic rationale of subsidies

The term „subsidies“ and the scope of issues subsumed under this term are ambiguously defined and partly controversially disputed in the scientific community, in the field of statistical reporting and in the political debate. Different definitions exist:

- Rather narrow or rather broad definitions.
- Rather related to the instruments of subsidisation or related to the problems hoped to be solved (or at least to be eased with subsidies).
- Related to the scope of receivers of subsidies.

Additionally, terms such as „supports“, „financial aids“, „grants“, “concessions” etc. complicate a comparison of different concepts underlying the available studies of subsidies.

Usually, the term „subsidies“ is perceived as something with a negative image. This leads, in practice, to the phenomenon that the quantification of subsidies is sometimes rather narrow, sometimes rather broadly done, depending on the purpose of research or of political lobbying and unfortunately, often also depending on the institution. It seems therefore to be important to clarify that subsidies can have different, opposite impacts on the economy. On the one hand, they can increase economic welfare. On the other hand, they can also have negative impacts on allocative efficiency by stimulating economic agents to use resources in a sub-optimal way. Subsidies can also be seen as an extra distorting factor on top of existing externalities, such as environmental effects.

These few introductory remarks show already that the issue is a complex one and that it is useful to start with a general definition of subsidies which is free from evaluationary elements.

Generally, subsidies can be defined as all direct and indirect transfers of the state to selected economic subjects, which are granted to achieve a certain goal of public interest. Regardless of the form that subsidies take, their purpose is to alter the results created by otherwise free markets and unimpeded competition in a direction considered more consistent with the objectives of public policy. The effect of subsidies is to encourage the growth of subsidised industries relative to industries that do not receive subsidies and thus to alter the uses to which economy puts its resources.

This general definition is undisputed among economists. But as shown above, the evaluation and judgement of subsidies introduces controversies into the discussion. Götz (1966) remarks consequently: „Ein Begriffskern,

dass Subventionen finanzielle Begünstigungen Privater sind, steht fest. Alles übrige ist umstritten."

In an economically sound analysis of subsidies, a two-step procedure seems to be adequate. In a first step all subsidies based on this general definition have to be quantified. In a second step, the economist has to identify whether the subsidy in question is really suitable to increase economic welfare and to what extent negative impacts do exist. This second step is the most difficult one. On the one hand, practical empirical analysis of welfare increasing or decreasing impacts is complicated and often even impossible. It is in that context not only the extent of subsidisation but also the selective character of subsidies, e.g. the discrimination between economic subjects that has to be analysed. On the other hand, the evaluation of a state transfer as economically positive or negative, as necessary or not, depends very much on the political and historical culture and on the opinion which tasks the state has to support. It is often a political decision whether the state, as the granting institution of subsidies, wants for example to finance museums, theatres, swimming-pools and transport infrastructure and to what extent. To give another example, one could, for instance, justify aviation subsidies with the necessity to be an open-minded country, with connections all over the world to allow an exchange of ideas and culture. However, one could oppose aviation subsidies because of the considerable ecological problems the sector causes. Therefore, the evaluation of a subsidy as a negative or positive (or at least necessary) financial flow depends not only on economic justification but also on political and societal norms and judgements.

Starting point for an economic analysis of subsidies is the theory of market failures both with respect to supply and demand, and the theory of public goods (see Musgrave, 1966), which provide norms for defining public responsibilities. By identifying the prices as the only economic instrument which yields under certain conditions always a pareto-optimal economic equilibrium economic theory enables "to study systematic deviations caused by certain impacts and the impacts of public interventions on it" (Peters, 1985).

In terms of economics, subsidies are necessary and justifiable in the following cases:

1 They are granted in order to correct for market failures. Such market failures include external effects, the financing of public goods and of meritoric goods.
2 They are granted for redistribution of income.
3 They are granted for a certain, pre-defined time span, with the aim to ease structural economic adjustment crises in certain branches.

Disputed among economists is the question whether and to what extent subsidies for sustaining certain branches in order to guarantee the supply of national economies with important products and subsidies for R&D are justified.

Obviously, these points mentioned above are themselves not always unambiguously defined and are subject of interpretation. For example, financing of public goods depends on the economic paradigm of defining public goods. In economic theory, public goods are defined as goods from which uses and benefits nobody can be excluded, and for which an additional user does not cause any marginal costs on the other users (principle of non-exclusion and principle of non-rivalry of consumption). This definition is often confused with goods perceived to be in the public interest. For example public financing of

roads, rail lines and airports were traditionally justified with their assumed characteristics of public goods. If, however, we consider the fact that it is of course possible and for example for rail lines and airports common practice today to charge users (which means in fact to exclude non-payers from using the services), one can hardly argue with the characteristics of public goods. The same holds true for non-rivalry of use and consumption since additional users on an already fully utilised network impose delays and congestion costs on others.

It is even more complicated to indisputably justify subsidies as necessary to finance meritoric goods. Meritoric goods are goods whose prices, in the absence of state subsidies, would be too high to achieve a sufficient (desired) purchase and use of these goods. Traditionally education, theatres and museums are given as examples for such goods, but also public transport and rail.

Most difficult here, is to agree on what is the desired consumption of which goods. It seems to be clear that political and societal norms play an important role here.

There is also a controversial debate on external effects (here in the sense of external benefits), one of the economic reasons to justify subsidies. It is important to mention that the existence of external benefits per se is no sufficient condition to justify subsidies[2]. To argue with external effects is only sensible if they are set into relation to the internal effects, and if this yields that their impacts are considerable. However, in practice it is often complicated to decide whether the external effects of an activity are considerable compared to its internal effects. This shows again the problems of a sound empirical analysis of subsidies. To give an example, economists agree, that so-called basic research imposes external benefits and thus, justifies subsidies. However, disagreement exists already on the question whether this holds true for university libraries, grants to non-university research etc. Another, in particular among transport economists heavily disputed topic, are the so-called external benefits of transport infrastructure in general and of roads in particular. Although airports are not mentioned explicitly in this debate, one could subsume them under this issue too. The debate on external benefits of transport infrastructure which is very present in particular among German transport economists shows a confusion between benefits of an economic activity or good which are reflected in market prices and thus internalised, and genuine externalities (for example: train and plane spotting). In this report we will not go into the details of the theoretical literature and of empirical studies on external costs and benefits. The assessment of existing literature and studies on this issue and the conclusions from this are given in the report “External costs of aviation” (CE, 2002).

Subsidies, which are justified with social reasons or distributional aims, are another example of practical difficulties to decide whether the subsidy in question is economically sensible or not. It is certainly possible to argue with social policy as the reason for a broad range of subsidies for example in coal mining, agriculture, shipping industry etc. In order to define socially justified subsidies, the definition used in Boss and Rosenschon 1998 seems to be helpful. They define such subsidies as sensible, which are granted to a limited group of individuals outside the society where a return service for the

[2] It should also be mentioned that the existence of external benefits is no argument for not internalising external costs because the cause might differ.

payment received is not sensible[3]. For aviation this implies that subsidies to the airport industry granted with the "social" argument of sustaining employment do not belong to the justifiable subsidies. A further aspect is that often subject-related transfers might be a better solution than granting subsidies. This again can only be decided on a case-to-case basis.

Finally, the so-called adjustment subsidies granted for certain branches for a limited time can easily tend to become a long-term matter.

It is common practice today to apply a rather broad definition of subsidies which tries to count for all public interventions aimed at influencing economic subjects. In that broad definition subsidies include

- All measures related to the public budgets (that lead the public budget either to higher expenditures or to lower revenues).
- Non-budget related measures such as regulatory interventions, non-tariff trade obstacles etc.

3.3 The different definitions of subsidies in practice

After having discussed subsidies from the theoretical point of view, we will briefly review here the different definitions of subsidies used in practice by the European Commission, by the German Federal government, by the German Statistical Office and by the six German economic institutes. We include here the definitions used in Germany explicitly since Germany has a very lively debate and practice on how to define and quantify subsidies, which could be useful for the subject of this study.

3.3.1 European Commission

The most important rules for subsidies are laid down in the EEC treaty articles 92 to 94. According to article 92 the European Commission is requested to prohibit state aid which can endanger competition by favouring selected companies or economic branches and which affect trade between the member states. In contrast to other state interventions which are in particular prohibited in articles 30 and 95 of the EEC treaty, article 92 allows some exemptions, e.g. a certain degree of freedom for member states to grant subsidies. Most important for this study are the articles 73 up to 77 which contain special rules for state aid in the transport sector and which allow state aid related to services in the public interest. Furthermore, article 154 rules out that the EU contributes to the transeuropean networks (TEN).

In general, the EU strategy is to open up the national transport markets, however, to consider the specialities of the respective markets, too. Meanwhile aviation, shipping and other transport companies residing in the EU, have a guaranteed freedom of providing services. However, open markets, oriented towards competition, do not exclude the possibility of subsidies, which have to be controlled thoroughly. This control of state aid is more complex in the transport sector than in other branches since additionally further EU-regulations have to be considered. As far as aviation is concerned, there has been an attempt to strengthen this control of state aid. In 1994 the European Commission released regulations[4] on state aid for avia-

[3] The examples, they give, are: charitative payments of the state and for specific situations of emergency (drug addiction), aids for refugees, for disabled people etc.

[4] Application of articles 87 and 89 of the EEC-treaty to state aids in the aviation sector (see ABL. C350 from 10 October 1994, p.5).

tion which, in particular, underline the principle that state aid for aviation should be non-recurring.

The European Commission reports frequently on state aid. For this reporting the Commission categorises state aid as follows:

Group A: A1: general grants, interest grants, general R&D
A2: tax reductions (both regarding the tax volume and the tax rate) and reduced social taxes, sells or rentals of real estates in public property at lower prices then market usual
Group B: B1: equity participations (including taking over debts as equity participation)
Group C: C1: credits at lower interests, re-payable advances and loans
C2: extra-ordinary depreciation and reserves
Group D: guarantees

3.3.2 German federal government

According to its legal commitment from §12 StWG[5] the federal government reports in a 2-years frequency on aid from the federal budget to private companies and economic branches[6]. The scope of subsidies in this governmental report is restricted with respect to:

The institutions which grant subsidies
The report covers only those expenditures and reductions of tax revenues which affect the level of the federal budget. Not included are for example expenditures and tax revenue losses of the provincial and municipal governments, financial aids granted by the European Commission and subsidies granted by institutions such as Treuhandanstalt, the Office of Labour etc.[7].

The economic subjects who receive subsidies
The governmental report deals only with subsidies granted to economic subjects „outside the federal governmental administration". This definition excludes for example subsidies granted to the national rail company DB.

The purpose of subsidies
Explicitly mentioned are aid for:

- Economic adjustment of companies and economic branches.
- Sustaining companies or branches.
- Promoting productivity and economic growth, in particular by developing new production technologies.

Apart from this aid, the federal government report defines also aid as subsidies that are not paid to companies or branches but which are aimed at decreasing prices for certain goods and services for private households. However, this aid is only considered if it can be immediately counted to the economic process. An example is the state aid for housing and construction which eases private households buying houses and which influences at the same time the demand for construction.

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5 Stabilitäts- und Wachstumsgesetz StWG.

6 The last available report refers to the period from 1995 up to 1998 (see BMF 1997).

7 Subsidies granted by the latter are reported as additional information outside the actual report. ERP-aids are included in this additional information.

However, the report does not count transfer payments for purposes of social policy such as support for housing (Wohngeld) since these are dealt with in the governmental social report.

Furthermore, subsidies with the justification of public responsibilities are not included. This fact which is of major importance for this study concerns provision of infrastructure, subsidies for cultural institutions and for hospitals. It means that airport infrastructure investments as well as R&D for aviation are not included.

3.3.3 System of National Accounts (Federal Statistical Office)

The Federal Statistical Office reports frequently on subsidies, too. They define the term subsidies as „financial aids which the state grants to companies for purposes of running production in the context of economic and social policy, either for influencing market prices or for supporting income and production“ (see Statistisches Bundesamt, 1996). As this definition also shows, here are several restrictions on subsidies reported:

- Only running financial transfers, not transfers of assets to companies are defined as subsidies. The category „other running transfers of the state to companies“ is not included either, this concerns to a major part the payments of the federal government to the pensions for the staff of the national rail company DB.
- Such payments to private households and to the social insurance systems, which imply a relief for certain branches are not included.
- The Statistical Office reports financial aid only. Reductions and exemptions from taxes are not reported.

3.3.4 The consensus definition by the six leading German economic research institutes

Both the report of the federal government on subsidies and the reporting on subsidies within the SNA comprise only a part of what would to be considered as subsidies under economic aspects. Therefore, the six leading German economic research institutes have agreed on a broader definition which aims at quantifying all financial measures influencing the allocation within the company sector by selective financial advantages/aid. They define a so-called core subsidy as follows:

„Subsidies are granted by the state, which is defined in the system of national accounts (SNA). Receivers of subsidies are all economic branches, which are, according to the definition of SNA, belonging to the company sector. Financial aids are considered to be subsidies if they are restricted to certain economic branches, certain goals of economic policy, certain regions, certain production factors, companies of certain size or types.“ (see Fritzsche *et al.*, 1988).

While the federal government report mentioned above only treats the financial aid from the federal budget, the research institutes deal also with the other levels of public budgets, e.g. the budgets of the ‘Länder’ and municipalities, the ERP-aids aids and with transfers of assets to government-owned companies. Furthermore, apart from the core subsidies defined above, the definition comprises also so-called transfers with subsidising features, for example, housing subsidies to private households, aids to the social security systems and also aid granted by Treuhandanstalt. Also transfers to private non-profit organisations are considered as subsidies as

long as one can assume considerable effects on the economy. For the so-called transfers with subsiding characteristics the criterion whether it is considered to be a subsidy or not, is the selectivity of the recipients of the subsidy and the restriction of effects to one branch.

Meanwhile, due to controversies in the empirical quantification of subsidies, defined according to this consensus concept, each of the economic institutes again uses its own definition.

3.4 Proposed definition

In this study, we propose a broad definition, which analyses *all public interventions aimed at influencing economic structures*. This means that all direct and indirect measures related to the public budgets at all political levels, e.g. federal, provincial and municipal level are included, which lead either to an increase of expenditures or to a decrease of revenues of public budget. This means that also investments for government owned infrastructure are included. Furthermore, also non-budget measures such as regulatory interventions are analysed. The study will not go into the details of an impact analysis which would be necessary for evaluating subsidies as economically sensible or not. The study uses the categorisation of subsidies as described in section 3.4.1 and 3.4.2.

3.4.1 Direct subsidies

Direct subsidies can be defined as a government expenditure, which is directly paid to the economic subject in question without any market-based return-service of the recipient. It decreases the cost of producing a specific good or service and thus supports the production sale or purchase of a good or service.

In most countries, government expenditures on transport infrastructure such as roads, rail, ports, airports, waterways etc. have been justified with the argument they were an important framework condition for the national economy and economic welfare. As discussed in section 4.2, this is no sufficient justification for subsidising transport infrastructure. From this point of view, one would consider state expenditure on infrastructure as subsidies. However, the question of a return-service complicates the analysis as soon as users of transport infrastructure pay charges to the state or to a public authority, which operates infrastructure on behalf of the state. Is for example, the equity participation of the state (federal government, provincial government and municipalities) in airport infrastructure authorities to be considered as a subsidy? One would immediately affirm this if looking to the definitions of subsidies given by different institutions such as the EU, the economic institutes etc. However, how about the charges for infrastructure use (start and landing fees, parking fees for aircraft) and the prices to be paid for the different airport services? Provided, these charges and prices cover all economic costs of airport infrastructure, is it still justified to consider airport infrastructure as being subsidised?

Obviously, the issue of a market-based return service complicates the analysis. Therefore, for airport infrastructure we will apply a two step procedure with a first step compiling all government expenditures for airport infrastructure, and a second step estimating all airport infrastructure costs and comparing them with charges and prices paid by users of airports. This two-step procedure for airport infrastructure subsidies is detailed in section 4.2.

Indisputable direct subsidies are the taking over of deficits of transport companies (for example AirFrance) and public expenditure for R&D in the aircraft industry (Airbus, Boeing).

3.4.2 Indirect subsidies

Indirect subsidies are all governmental interventions and regulations which favour selected economic agents by reducing their costs or by guaranteeing purchases of their products. To these belong tax subsidies, price reducing subsidies, purchase subsidies, regulatory subsidies and guarantees.

The following types of subsidies are subsumed under the term “indirect subsidies”.

a Tax subsidies

To this type belong all forms of favouring economic subjects with respect to the tax subject, the tax rate and the volume of taxes to be paid, which affect public budgets by lower tax revenues. For this study, the most important issues are the general exemption of commercial civil aviation from paying fuel taxes and the VAT exemption of international flights (90% of all German flights). Furthermore, the exemption of airport authorities from paying real estate tax is an indirect subsidy. To be mentioned is also duty-free shopping which, however, was abolished for intra-EU flights in 1999. And finally, in some countries airport authorities do not pay corporate taxes at all or only reduced corporate taxes.

b Price reducing subsidies

Here the state decides not to charge market prices reflecting economic costs. State aids in form of credits at lower interest rates for airports is one relevant example for this study. Another example is land property of airport authorities attained below market prices.[8]

C Purchase subsidies

Here the state favours economic subjects by purchasing either more of a good or a service than market prices. Examples are either purchasing services without tendering or employing companies which did not submit the lowest bid in tendering procedures.

d Regulatory subsidies

This is a type of subsidy where the state allocates the demand for a good or a service to the target company/branch/sector (recipient of regulatory subsidies) by regulations, licenses and concessions, non-tariff trade obstacles, market access restrictions and excise duties.

e Guarantees

Guarantees are not monetary flows per se. The state guarantees for services and deliveries of goods from companies to third parties which become only real monetary flows if the target group of these subsidies can not achieve a payment for its goods or services from the buying company. An example for aviation is the sale of aircraft from Airbus abroad, where the state guarantees that these sales will be paid for, in the worst case by the state.

[8] However, as the case of Berlin-Schönefeld airport shows, a situation can also occur where airport authorities pay higher land prices than the market-based ones.

3.4.3 Subsidies for transport links and induced costs to other transport modes

These are public expenditures spent for providing road or rail-links between company sites, shopping centres, outside cities and – important for this study – airports. As discussed previously, the quantitative treatment of these expenditures and the final decision whether they are to be considered as subsidies is not easy for several reasons.
First, the discussion whether infrastructure expenditures are to be seen as subsidies if there are user charges paid, holds also true for the transport links treated here. As in the instance of airport infrastructure, actually a comparison between costs of these links and user charges paid would be necessary. This, however, is extremely complicated due to delimitation and allocation problems.
Second, usually not only the construction of transport links or rail terminals within the airport area but also operation requires public expenditures.
Third, often the public transport or rail links are also used by commuters living in the suburbs (for example: the S-Bahn to Munich airport) or serve for through-traffic to other cities (Rail link to Frankfurt airport) which requires an allocation of costs between aviation and other traffic.

Figure 2 summarises the different types of subsidies and illustrates them with examples for the aviation sector.

Figure 2 Subsidies in the aviation sector – template for analysis selected examples

Recipient of subsidy/ Type of subsidy	Aviation infrastructure			Air transport	Aircraft industry	Research & Development
	Airports	National Air Control	EuroControl	Airlines		
I. Direct subsidies						
	equity participations payment of investments and running costs	equity participations payment of investments and running costs	research grants (for example from EU)	equity participations take-over of losses from airline operations link-based aids (Berlin traffic up to 1990, partly for regional links between small and major airports)	Financing of airbus R&D costs	Financing of general research in aviation (for example: DLR)
II. Indirect subsidies						
Tax reductions/ exemptions	Exemption from paying real estate taxes Exemption from paying corporate taxes			Exemption from paying fuel tax VAT exemption on tax-free products on international flights[2)] VAT exemption of international air traffic VAT exemption of deliveries, construction work, maintenance activities, rentals and insurance of airlines loans at lower interest rates for operating certain types of aircraft Non-ordinary depreciation for aircrafts		
Price reducing subsidies						
Purchasing subsidies						
Regulation subsidies Guarantees	Guarantees for loans	Guarantees for loans		HERMES guarantees Guarantees for loans	Guarantees for payments of Airbus purchasers Guarantees for loans	
III. Induced costs to other modes	Links to public transport, rail, rail terminals within the airport area [3)] Road links [3)]					

[1)] EU, Federal government, provincial governments (federal states), municipalities. - [2)]Abolished for intra-EU flights in 1999. –[3)] Only qualitative analysis in this study

DIW Deutsches Institut für Wirtschaftsforschung

4 Methodological proposal

4.1 Introduction

In this chapter, we propose a methodology for further empirical analysis of financial support to the aviation sector. The methodological proposal is based on the general, broad definition of subsidies given in section 3.4 and the categorisation of subsidies into different types of direct and indirect subsidies. This means, that this methodology covers the first step of a two-step procedure to analyse subsidies only. The second step would imply a both qualitative and quantitative economic analysis of the welfare effects of subsidies, which would require comprehensive empirical incidence analysis. Such a second step would be further complicated by the fact that the necessity of subsidies is often based on general political objectives, cultural and social norms etc. Nevertheless, there are subsidies that are clearly questionable with respect to the underlying judgements and the economic effects. Due to the fact that this methodological proposal covers the first step of analysing subsidies only we will use the term financial support to the aviation sector rather than subsidies.

The methodology proposed for this study will be described separately for each of the agents and institutions in the aviation sector. This reflects the specialities of each institution (for example different characteristics of airports and airlines) and the different data situation. Starting point of analysis for all institutions and agents should be a financial flow analysis using the definition of subsidies given in section 3.4. For airport infrastructure and national air control in parallel a macro-economic approach of cost/revenue accounting should be applied. For other institutions and agents (airlines, aircraft industry, R&D, Eurocontrol) this macroeconomic approach would probably not be feasible due to methodological problems and missing data.

4.2 Airport infrastructure including national air traffic control

The main problem in this area is the question whether public funding of provision and operation of airport infrastructure is to be regarded as a subsidy, given the situation that users of this infrastructure pay charges and prices for using airports and their services. We suggest therefore to apply two main approaches and sources of information, namely a financial flow analysis and a cost/revenue account. Both approaches are described below and their advantages and disadvantages are discussed.

4.2.1 Financial flow analysis

Starting point for the first approach is the identification of ownership roles and financing principles for airport and air traffic control which differ from country to country and which differ within one country from federal state (or province/department) to federal state. Based on this, the financial flows are analysed with the aim to identify financial support received from the different administrative levels. In the focus of interest are the questions:

- Who pays for what?
- Who receives these payments?

It is thus a pure expenditure-based approach, which reflects the situation of a given year. Information bases for this approach are the regular business accounts of airports and air traffic control bodies. However, since from these sources the origin and destination of financial flows cannot be identified in most cases, the budget plans and expenditure reports of the different political levels are analysed additionally.

Examples of financial support, which can be identified with this approach are:

- Public financing of airport infrastructure (although to be cross-checked with user charges).
- Roads, rail and public transport infrastructure to embed airports into the transport system (however, as discussed in the previous section, finally to be decided by in-depths analysis).
- Equity participation of the state in airport authorities.

Apart from these examples which directly refer to real financial flows there are further types of financial support which cannot be directly taken from business reports or budget plans. They have to be estimated separately. Examples are:

- Resignation of the state on profit-participation.
- Tax exemption from real estate taxes.
- Tax exemption from corporate taxes.
- Land property of airports attained below market prices.

4.2.2 Cost/revenue accounts

The second approach follows the methodology of infrastructure costs and revenue accounting as it is regularly applied in Germany for road, rail, inland waterways and airports. The reasons for applying this second approach as a supplement to the financial flow analysis are:

- The aim of this approach is to estimate the full monetary economic costs of infrastructure provision and use in order to avoid the „random" character of high or low subsidies in a given reference year.
- By comparing costs with user charges the approach answers the question whether there is a return service for a public financial flow or not. The approach is thus necessary for deciding whether a flow is to be considered as subsidy or not.

Generally, the infrastructure/revenue accounting is applied at the global level, e.g. covers all airports and national air control facilities of a country. Thus, the answers derived from this approach are answers on the average. With this approach one can find out what the costs of airports and national air control are, to what extent users pay for these costs and conclude whether these facilities are subsidised by the public budgets. However, the question to what extent cross-subsidisation between profit-making and loss-making airports is present cannot be answered[9]. Furthermore, the approach uses a certain delimitation of the system, which means that only infrastructure costs and revenues are compared. Exemptions from other taxes (for example from paying real estate taxes or corporate taxes) are not included

[9] This would require the separate treatment of all airports. It would furthermore, cause methodological problems since the macro-economic cost/revenue accounts are applied on a social cost basis which would then have to be transferred to a case-study level. An overview on the profit-loss statements of airports from the available business accounts will be provided too. However, a detailed analysis for all airports is not possible.

but are out of the system's delimitation. Nevertheless, they would be relevant for further study and should be covered in the financial flow analysis. This shows that both approaches supplement each other.

In the following we briefly describe the methodology of this approach. Annex B gives more details on asset valuation. For reasons of data availability the approach considers airports and national air navigation together.

a Costs
The costs of infrastructure (airports and national air control) comprise:

1 Capital costs for:
   - New investments.
   - Replacement of assets.

Capital costs consist of depreciation of infrastructure assets and the interests in the sense of opportunity costs for infrastructure assets and the land value.

2 Running costs for:
   - Maintenance.
   - Operation.
   - Administration.

Starting point for estimating capital costs is to valuate assets, e.g. to estimate the value of the fixed capital formation. The available methodologies for this are described in Annex B.

b Revenues
At the revenue side one has to discuss first, who are the users of airport infrastructure, which services do they use and how are they priced, taxed and charged for these services. The answer on this question is not an easy one since the charging and taxation systems have evolved historically and are not always transparent[10]. It is obvious that all revenues have to be considered which are specifically related to air transport infrastructure. To these belong:

- Prices to be paid by users of services to the airport (for example for ground services, for baggage handling, freight handling services etc.).
- Direct charges related to use of infrastructure (start and landing fees, charges for the meteorological services, parking charges for aircraft, air navigation charges, security charges for security services).

We exclude here systematically all charges and taxes, which do not represent a specific transport burden (in comparison to other sectors).[11] That implies that VAT, income taxes, real estate taxes and other general taxes are not considered within the infrastructure cost and revenue account.

[10] An example is the road sector where in many countries – in absence of specific charges such as tolls – fuel taxes were introduced (and increased) with the aim to generate revenues for road financing. However, the revenues usually went to the general budget and are often used for other purposes.

[11] This principle is applied in German and Swiss transport accounts.

4.2.3 Differences between the two approaches

There are several differences between the first approach (financial flow analysis) and the comparison of infrastructure costs and revenues related to the use of this infrastructure.
First of all, the analysis of financial flows and identification of subsidies is an expenditure-based approach, which reflects the monetary flows of a given year but not economic costs. It is aimed at clarifying the questions i) Who pays for what? and ii) Who receives the money?. Depending on the chosen range of financial flows defined as subsidies or not (see the discussion on the different definitions of subsidies) this approach is suitable to identify all relevant financial support, however, always referring to the chosen reference year and thus being subject to fluctuations from year to year. Furthermore, the question whether there is a return service or not would require more in-depths analysis with other instruments.

The second approach reflects the full monetary costs of infrastructure provision and use. By comparing these costs with the transport related taxes and charges to be paid by users of this infrastructure the cost/revenue accounts answer the question: which costs of provision and use of infrastructure do occur and to what extent are these costs borne by infrastructure users via taxes, charges etc.? In this sense it is even not important to what extent the user contributions are then used for financing the infrastructure or for financing something else. This would definitely be another question, namely to compare the monetary costs of infrastructure provision and use on the one hand with the infrastructure expenditures spent from these user contributions on the other hand.

The disadvantages of the cost/revenue accounts, however, are that it is not possible to show who pays and who bears the costs. Furthermore, it does not show any further financial support such as guarantees and equity participation, and it is always referring to the system's delimitation, e.g. does not show further tax losses of public budgets due to relief from general taxes.

From this brief discussion of the features of both approaches and their advantages and disadvantages follows that a combination of them seems to be a suitable methodology for further study.

4.3 Eurocontrol

Eurocontrol, the European organisation for the safety of air navigation, has 29 member states. It was founded in 1960 for overseeing air traffic control in the upper airspace of member states and is today aimed at developing a unified air traffic management for Europe. Eurocontrol provides the following services:

- Managing European harmonisation and integration activities.
- Providing central flow management.
- Providing regional air traffic services.
- Collection air navigation charges.
- Conducting research and development.
- Providing training and advice for air navigation services.

The financing sources of Eurocontrol are:

- Contributions from member states.
- Bank loans for capital expenditure.
- Handling charge on route charges collected.

- Specific subsidies for research programmes (for example from the EU).

It is not obvious to what extent these financial flows have to be considered as subsidies. The fact that many countries are involved and that complicated payment mechanisms would require a large amount of empirical work. It is therefore proposed to exclude Eurocontrol from future empirical analysis.

4.4 Air transport

In general it is rather complicated to define whether financial support only favours airlines or also consumers via lower ticket prices. We prefer therefore to use the term financial support to air transport rather than to airlines. The methodology for analysing financial support to air transport is based on the financial flow analysis presented in section 4.2.1 for airport infrastructure. Starting point are the business accounts of airlines, the public budget plans and legal documents for identifying tax reductions etc. Examples of direct and indirect financial support, which could serve as a starting point for future empirical analysis, are:

- Equity participation of the state in airlines and the respective equity increases.
- Take-over of losses from airline operations.
- Link-based aids (Berlin traffic up to 1990, partly for regional links between small and major airports).
- Exemption from paying fuel tax for commercial flights (both scheduled flights and charters).
- VAT exemption of international private air traffic.
- Extra-ordinary depreciation for aircraft.
- Loans at lower interest rates for operating certain types of aircraft.

4.5 Aircraft industry

The experience from other studies dealing with the aircraft industry has revealed considerable difficulties to identify financial flows and costs. The reason is on the one hand the complicated and not transparent financing structure, on the other hand, confidentiality problems occur. Government support for the civil aircraft industry has taken various direct and indirect forms:

- Synergies between military (funded by governments) and commercial work.
- Funding of civil research and development.
- Direct financial subsidies for specific aircraft projects.
- Equity infusions (France).
- Debt relief.
- Government subsidies and supports to organise industry, so it is well prepared to face international competition.
- Efforts to steer aircraft demand toward domestic suppliers by government negotiations.
- Taxation rules that favour domestic manufacturers.
- Tax breaks.
- Export credits.
- Political assistance by offering counter-deals in other areas.
- Export guarantees.
- Guarantees against losses caused by exchange rate changes.
- Government's present and/or previous ownership of airlines in most European countries. Politicians had sufficient influence over publicly owned airlines to control the airlines' choice of aircraft manufacturers.

(Examples: British Government directed BEA to buy the British made BAC 1-11 as well as French Government pressed AIR FRANCE to buy the French made CARAVELLE.)

4.6 Research & development (outside aircraft industry)

The definition of financial support used in this study considers all research activities which can not be defined as so-called basic research and which are financed by public budgets. Furthermore, consultancy services are treated here as far as they can not be allocated to the other sectors/agents in the aviation sector.

4.7 Duty free shopping

Duty free shopping, e. g. VAT exemption on products sold at airports and in aeroplanes belongs to the indirect subsidies of aviation. In case of airports they can be seen both of a subsidy of the airport authority which skims monopoly rents from the turnover-related concession charges of duty free shops, and as a subsidy to passengers who benefit from tax-free prices. It is complicated to separate these two effects. To this the problem is added, that the sales before and behind the gates need to be separated for analysing tax losses due to duty-free shopping. Furthermore, it has to be mentioned, that since 1999 tax-free shopping has been abolished at least for intra-EU flights.

5 Case studies

5.1 Introduction

In the previous chapter, a methodological proposal was given for empirical analysis of financial support to the aviation sector. Within the framework of this study it was impossible to add a global or even regional assessment of the financial support on the basis of the proposed methodology. Therefore, we chose to take the European situation as a basis and execute case studies in three countries: Germany, France, and the Netherlands:

- Airlines: Lufthansa, Air France, and KLM.
- Airports: German airports, French airports, Schiphol Airport.
- Aircraft manufacturer: case study on Airbus.

In this chapter we summarise the results of these case studies, which were carried out by DIW (German and French case studies: DIW, 2001) and IOO (Dutch case studies: IOO, 2001).

The purpose of this part of the study is to provide indications of the net direct and indirect financial support to the aviation industry. It is not to assess the desirability of this support. Although the previous chapters provide an overview of arguments that are used to provide subsidies, it does not value these arguments for the obvious reason that such judgements are always contentious. As a result, the definition of direct and indirect financial support has been kept rather strict.

5.2 Airlines

Financial support to airlines can be split in the following parts:

- VAT exemption on international tickets.
- Fuel tax exemption (in the fiscal approach only).
- Tax-free sales on board of aircraft (excise duty and VAT).

Furthermore, there is direct state aid to airlines. In 1994 the EU developed rules aimed at preventing subsidies to commercial aviation. Direct state aid to Air France continued until at least 1996, however. The eight Survey on State Aid in the European Union reports that in the year 1994 the total aid to French Airlines was 1,571 million Euro, in 1995 this had dropped to 774 million Euro and remained almost constant in 1996 (764 million Euro). There are no data available on how this developed during the last years, however. Therefore, we left out direct state aid in the summarising table given below.

The amount of VAT and fuel tax exemptions are calculated as follows. VAT exemptions for aviation are only taken into account when competitive distortions are in place, i.e. when competing modes face different VAT regimes. The amount of VAT exemption is a product of the revenues from international passenger transport subject to VAT and a certain VAT rate.
Distortions in *domestic* air passenger transport are relatively small (KPMG 1997). However, in many cases there are significant distortions in the international air transport market.
We need to deduct a certain percentage of turnover from international flights that is subject to VAT. We used the following information derived from

(KPMG 1997) and assumed that no changes in VAT regime have taken place since then:

- In two EU Member States (France and Greece) aviation faces a competitive advantage in the *both* the international leisure and business market, as both international leisure and business travel by rail, sea and bus are subject to VAT and aviation is not.
- In eight EU Member States (Austria, Belgium, Denmark, Finland, Germany, Netherlands, Spain and Sweden), aviation faces a competitive advantage in the international *leisure* market, as international leisure travel by rail, sea and bus transport is subject to VAT and international business travel by rail, sea and bus is not.
- In the five remaining EU Member States (Ireland, Italy, Luxembourg, Portugal and the UK) aviation does not face a competitive advantage due to VAT exemption as both international air travel and international rail, sea and bus transport are exempt from paying VAT.

There is virtually no information available on the share of airline revenues that falls within each of these categories within the fifteen individual member states (KPMG 1997). Figures estimated by KMPG suggest that in total long-distance passenger transport, the leisure market is much more important in terms of turnover than the non-leisure market (p.57). Given this figure, we estimate that approximately one half on turnover generated from EU international air transport faces a competitive disadvantage due to its VAT exemption. If we apply this figures to the turnovers from Lufthansa, KLM and Air France and assume an average 7% VAT rate advantage, then we arrive at the figures given in Table 1.

Table 1 Direct and indirect support to airlines, in millions and Euro unless otherwise stated, for the base year 1998 (Air France: 1999)

	KLM	Lufthansa	Air France
general data			
total revenue		11,737	10,300
operating revenue	6,047		9,105
revenues transport		10,150	7,920
of which passengers	4,431		6,900
of which international	4,300	7,226	5,900
profit	111	732	155
passenger km	57,200	75,438	74,598
freight tonne km	3,930	6,221	4,596
fuel consumption (Mtonnes)	2,789	4,973	4,700
support			
VAT exemption international flights	155	253	206
kerosene tax exemption	854	1,523	1,439
tax free shopping in aircraft, only from & to the EU	64	p.m.	p.m.
total excl. fuel tax exemption	219	253 + p.m.	206 + p.m.
total incl. fuel tax exemption	1,073	1776 + p.m.	1,645 + p.m.

* Assuming for the fuel tax exemption an 80/20 split passengers/freight for KLM and Air France, and a 75/25 split passengers/freight for Lufthansa. VAT exemptions and tax-free shopping on board aircraft are 100 % allocated to passenger transport.

The amount of fuel tax exemption is the product of the number of litres burnt by an airline and an assumed fuel tax rate per litre. Currently, the average fuel tax paid by European road transport is about Euro 445 per 1,000 litres[12]. However, as the other competitor of aviation, rail transport, generally pays lower fuel taxes, we chose to work with the Euro 245 per 1,000 litres minimum fuel tax rate for diesel in the EU.

With respect to tax-free sales on board aircraft, only for KLM data were available. Based on a 1998 fictitious tax-free turnover of 91 million Euro, an average duty rate of 45% and a VAT rate of 17.5%, we arrive at tax losses of 64 million Euro.

5.3 Airports

Financial support to airports can be distinguished in the following parts:

- Direct financial support, generally for investments in infrastructure.
- Indirect support: tax-free sales for flights outside the EU (excise duty and VAT).
- Indirect support: corporate tax exemptions.
- Indirect support: real estate tax exemptions.
- Indirect support: ground costs exemptions.

Besides, some smaller direct subsidies were studied, but these were judged irrelevant.

Direct infrastructure subsidies

Due to the institutional principle, only infrastructure for which the airport is financially responsible is taken into account as a financial support in this study[13]. Costs for access infrastructure such as railway and roads to airports are not calculated, however they are financed by state and can be judged as indirect subsidies[14].

The situation for Schiphol is quite straightforward. Schiphol itself finances and maintains the infrastructure it is responsible for. Therefore the direct subsidy to infrastructure for Schiphol can be set at zero.

For the complete German air infrastructure system (17 airports, German air traffic control and the German meteorological services to aviation) the situation is more complex. Subsidies have been granted at federal, state and municipal level. Using a cost/revenue-account, the background study by DIW (DIW 2001) leads to the conclusion that, using a social interest rate of 2.5%, the balance between costs and revenues was almost neutral (only a 52 million Euro or 1.3% gap between costs and revenues). It must be said, however, that this interest rate is very low in an international perspective. For example, in the Netherlands the rate is 4% and in France 8%. Every percentage point added to the rate increases the gap between costs and revenues by 188 million Euro or about 5%.

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[12] Based on a sales weighted average fuel tax level in January 2001 across the EU, calculated with the database created for the CE study 'Fuel prices and excise duty policies in European road transport 1980-1999 (CE, Delft, 2000).

[13] As mentioned in section 3.4.3, there is great difficulty in the quantitative treatment of subsidies for transport links and induced costs to other transport modes, and the final decision whether they are to be considered as subsidies. IOO investigated many infrastructure projects around Schiphol and found only in one case reason to count the improvements of the roads around Schiphol as an indirect subsidy.

[14] See e.g. Treber, 1998.

The situation for the French airports is complex as the aviation industry and governments are highly integrated. Overall revenues from the aviation sector in 2000 amounted to about 1,200 million Euro, of which about 800 million Euro came from route charges, 180 million Euro from terminal charges, and about 215 million Euro from the civil aviation tax. Due to the complex structure of the French aviation financing, it was, however, not possible to allocate government expenditures to airport-related costs. Therefore, adequate estimates of net financial support to the French airports could not be made. Also, e.g. adequate estimates of corporate tax losses, real estate tax losses and ground use tax losses (if any) could not be established.

Tax free shopping
For Schiphol Airport an indirect assessment of the value of tax-free shopping was made. Direct data on duty-free sales ware not available. For this specific case, the base year was 2000, because tax-free shopping for intra-EU flights was abolished as of 1 July 1999. The assessment was made as follows: Schiphol is a monopolist when it comes to supplying locations for offering tax-free goods. Schiphol is therefore able to skim the profits of companies offering tax-free goods up till the point where these companies make a normal profit. The decrease of the value of concession income from the tax-free shopping area after the abolition therefore gives a good proxy for the amount of missing tax revenues. Based on a number of assumptions[15], it was found that a proxy of the missed tax income from the remaining tax-free shopping was about 16 million Euro in 1998. This is about 1.2 Euro for every passenger flying to or from destinations outside the EU, or about 2.3 Euro per LTO (flight) of these passengers.
For the German and French airports, no data on tax free shopping were available.

Tax exemptions
In most countries, normal companies are obliged to pay corporate taxes and real estate taxes. An exemption of such taxes can be considered as indirect subsidy.
For the Dutch case, Schiphol neither pays corporate taxes nor real estate taxes. The former case is going to end: the European Commission recently decided that as of 2002 Schiphol will pay corporate taxes. The latter case was brought to court, but no decision has been made yet. Besides, Schiphol has a 'zero tariff' ground lease agreement with the government.
German airports have to pay corporate taxes, so there is no indirect subsidy here. Real estate tax exemptions and favourable ground use conditions have not been investigated.
The situation for the French airports could not be clarified.

In Table 2 the results for the different case studies are summarised.

[15] The assumptions are:
- 60% of Schiphol passengers are intra-EU passengers.
- In 1998, intra-EU passengers bought just as many tax free goods as other international passengers.
- In 2000, the other international passengers bought as many tax-free goods as in 1998.
- The price of normal concessions remained the same between 1998 and 2000.

Table 2 Direct and indirect support to airports in the year 1998 (all in Euro and in millions, except otherwise stated)

	type of support	Schiphol		Germany		France (ADP, Aéroports de Paris)	
		absolute	as % of revenues	absolute	as % of revenues	absolute	as % of revenues
general data							
revenues		553		3,121		[c] 1,384	
profit before tax		132	24 %	-73.1	-2,3 %	285	21 %
# pax		34.4		132.9		96.8	
tonnes freight (,000)		1,170		1,971		1,506	
support							
direct support for infrastructure[b]	cost	0	0 %	[a] 52	[a] 1.3	?	?
VAT and concession income from tax free shopping	revenues	16	3 %	?	?	?	?
corporate tax	profits	[d] 42		0	0	p.m.	p.m.
real estate tax	cost	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.
ground lease	cost	25-45	6 %	p.m.	p.m.	p.m.	p.m.
total (€ M)		51 + p.m.	**9 % + p.m.**	52 + p.m.	1 % + p.m.	p.m.	p.m.
per passenger flight intra-EU (€)*		**3.6**		**0.7+p.m.**		**p.m.**	
per passenger flight outside EU		**5.9**		**0.7+p.m.**		**p.m.**	

[a] Based on a 2.5 % interest rate. Every %point of interest increases this by 188 million Euro (5 % of revenues).

[b] Incl. German Air Control and services delivered by German Meteorological Service

[c] Only ADP (Aéroports de Paris, namely Charles de Gaulle, Orly and Le Bourget)

[d] Tax exemption will end in 2002; therefore, this figure has not been included in the total

* Assuming an 80/20 split of costs over passengers/freight for the Netherlands, and a 85/15 split for Germany and France.

From the results shown in the table above NO conclusions on the relative 'scores' of the three countries can be drawn! The numbers are too incomplete to make any judgements about such comparisons. The data for Schiphol are most complete, those for France least. Besides, different assumptions sometimes play a role, such as the 2.5% macro-economic interest rate in the German case study. Unfortunately the situation in France could hardly be clarified. The Dutch case study shows that tax-free shopping is, on a per flight basis, still a relatively important indirect financial support for passengers from and to the EU.

5.4 Aircraft manufacturing

In a background report to this study (DIW, 2001) DIW elaborates the Airbus case study, from the beginning of the company in 1970 till the announcement of the development of the A380 in December 2000. A very brief summary follows below.

In the United States, France, Great Britain and Germany the aerospace industry has always played a strategic role for the development of the national economy, and with a constant growth rate of 5% yearly, is regarded to be a key industry. The R&D share in the aerospace industry is approximately 15% of turnover, which is much more than in other sectors of industry.

Government support for the civil aircraft industry has taken various direct and indirect forms, which makes them very hard, if not impossible, to assess. Examples include synergies between military (funded by governments) and commercial work, funding of civil research and development, direct financial subsidies for specific aircraft projects, equity infusions (France), debt forgiveness, and guarantees against losses caused by exchange rate changes.

A landmark agreement in the support discussion was a 1992 US-EU Bilateral Agreement on Trade on Large Civil Aircraft. It said that governments could provide a maximum of 33% of development costs in refundable loans, and that these loans must be paid back within 17 years with interest. On top of this, the indirect subsidies were limited to 3% of the industry's turnover.

Based on numerous figures mentioned and listed in the background study, it can be estimated that total accumulated direct financial support for Airbus Industry amounts to $ 30-35 billion, which is about 11-13% of its accumulated turnover. This is probably a conservative estimate, for example because it only includes officially documented support to the Airbus company and does not include support to any of Airbus' 1,500 suppliers.

In order to convert this figure to aviation cost impacts, we have to assess to what extent the lower resulting aircraft prices influence final ticket or freight prices. A typical value of aircraft depreciation in DOC figures is about 20%. This implies that an indicative impact of the support to aircraft manufacturing on DOC would be in the magnitude of 2.5%. Assuming that DOC accounts for 55% of total operating costs, the impact on final ticket and freight prices could be in the order of magnitude of 1.5%.

5.5 Integration of results

In this paragraph we integrate the results from Sections 5.2 to 5.4.

Airlines

- The amount of direct subsidies to the airlines considered is low if not negligible, except for the substantial support given to Air France till (at least) some years ago. The most substantial advantages come from indirect subsidies: current low rate taxes or tax exemptions.
- The rate of indirect subsidies to all three airlines considered arrives at about 20 % of their operating revenue in case the fuel tax exemption is considered an indirect subsidy of 0.245 Euro per litre. In case this is not considered as such, the indirect subsidy as a result from missing VAT on international ticket (assumed 7%) amounts to some 5% of operating

revenue. The influence on ticket prices for passenger travel would probably be comparable.

Airports

- The amount of direct infrastructure subsidies to the airports considered is very limited in the Schiphol case. For the German airports, it is about 1% of turnover, if a cost/revenue-account is applied with an interest rate of 2.5%. With a higher interest rate this figure rises sharply. For the French case no data could be found.
- The most substantial support is indirect and comes from current low rate taxes or tax exemptions.
- In case of Schiphol, indirect subsidies as a result from zero-tariff land lease and tax-free shopping is estimated at about 9% of turnover. The current corporate tax exemption (about 8% of turnover) will end by 2002. The German and French case studies do not give data from which indirect financial support to airlines can be calculated.

Aircraft manufacturing

- The Airbus case study shows that accumulated subsidies over the last three decades amounted to about 11-13% of turnover.
- Based on a number of assumptions it is calculated that these subsidies have lead to about 1.5% lower ticket and freight prices.

The all over picture is that indirect financial support to the aviation industry is more substantial than direct support. Long distance air transport from and to the EU will generally benefit most from the indirect financial support (tax exemptions): this transport is exempt from VAT on tickets, has a high share of fuel in operating costs, and leaves the opportunity for tax free shopping.

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Financial support to the aviation sector

A methodological proposal for empirical analysis

Annexes

Report

Delft, October 2002

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A Excursus: Capital valuation

A.1 Introduction

The most important step of elaborating cost-revenue accounts for transport infrastructure is the valuation of the capital stock as a basis for calculating capital costs. With respect to the underlying accounting principles we can distinguish business accounting-based capital valuation on the one hand and macroeconomic capital valuation on a social resource basis on the other hand. Both approaches differ considerably. Capital values on a business accounting basis are often affected by taxation and accountancy laws without any relation to a social resource accounting basis. Therefore, the relevant principle for this project should be a social basis for cost estimation as opposed to a business or financial basis.

A second choice has to be taken between a direct or an indirect approach for the valuation of capital stocks. These two approaches will be described below.

A.2 Direct valuation of assets

The direct valuation of the capital stock requires an inventory of all assets in the mode considered. With this method the asset types are directly evaluated by estimating the costs which would occur if it were intended to replace the whole infrastructure with assets of equivalent quality. Thus, the existing physical assets have to be measured in terms of indicators such as length, width and number of runways, buildings, equipment etc. and to be valuated by unit replacement costs. This approach requires to define asset groups which are depreciation-relevant, homogeneous and practicable regarding the availability of unit replacement costs. Furthermore, comprehensive information on infrastructure or characteristics for different parts of airports are necessary in order to determine the asset's value of these parts.

The direct valuation method is mainly used if the data necessary for the perpetual inventory concept (long investment time series) are not available, or in cases where initial values for applying the perpetual inventory concept in future studies have to be elaborated.

A.3 Indirect valuation of assets by modelling approaches (perpetual inventory concept)

Due to the huge expense of labour and time the direct valuation of assets by inventories is usually not applied within the SNA. Most OECD-countries use the perpetual inventory method, often based on an initial value obtained by direct asset valuation. The main idea of the perpetual inventory concept is to capitalise time series of annual investment expenditures by cumulating the annual investments and by subtracting the value of those assets, which exceeded their life-expectancy (written down assets). This general idea can be refined by more sophisticated approaches which use probability functions for the written-down assets. Both the main principle and the refined approach are described below.

The indirect valuation by using perpetual inventory models requires detailed and long time series on annual investment expenditures, information on life expectancies of assets, and initial values.

A.3.1 General description

The main principle of the perpetual inventory concept is to calculate the asset's value by cumulating the annual investments and by subtracting either the value of those assets which exceeded their life-expectancy (written down assets) or the depreciations. This principle is expressed in the equations below and visualised in Figure 3:

$$VG_{t+1} = VG_t + I_{t,t+1} - A_{t,t+1} \quad (1)$$

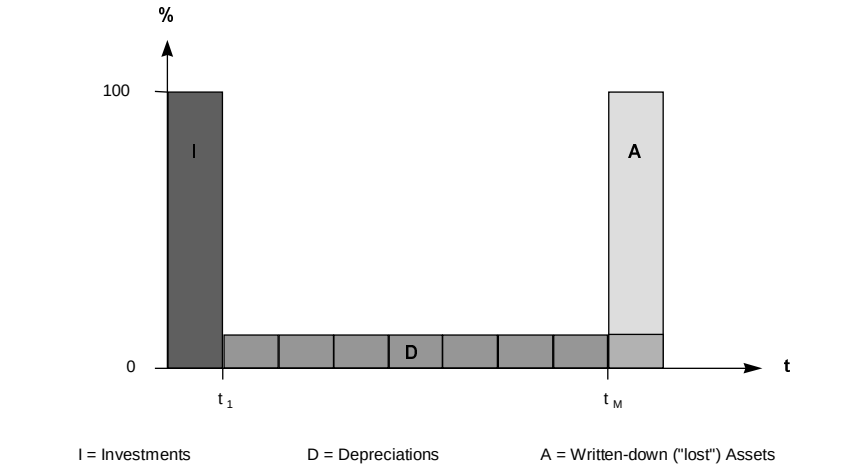
$$VN_{t+1} = VN_t + I_{t,t+1} - D_{t,t+1} \quad (2)$$

with:
- VG_t : Gross value of assets at time t
- VN_t : Net value of assets at time t
- $I_{t,t+1}$: Investments during t, t+1
- $A_{t,t+1}$: Written-down assets during t, t+1 (assets which exceeded life-expectancy)
- $D_{t,t+1}$: Depreciation during t, t+1

As shown in these formulas the perpetual inventory method can be applied for estimating the **gross value** (gross concept) and the **net value** (net concept) of infrastructure assets. The gross value contains the value of all assets which still exist physically in the considered year, e.g. which have not yet exceeded their life expectancy. Thus, $A_{t,t+1}$ denotes those assets which could not be used any longer or which were shut down. It is assumed that the assets are properly maintained and can be used until they exceed their defined life-expectancy.

Within the net-concept the annual depreciations $D_{t,t+1}$ are considered. The net value of assets describes the time-value of all assets, which have not yet exceeded life-expectancy. According to the international conventions of the SNA, most countries use a linear depreciation method.

Figure 3 Interrelation between investment, written-down (“lost”) assets and depreciation - the case of a single asset



Source: DIW.

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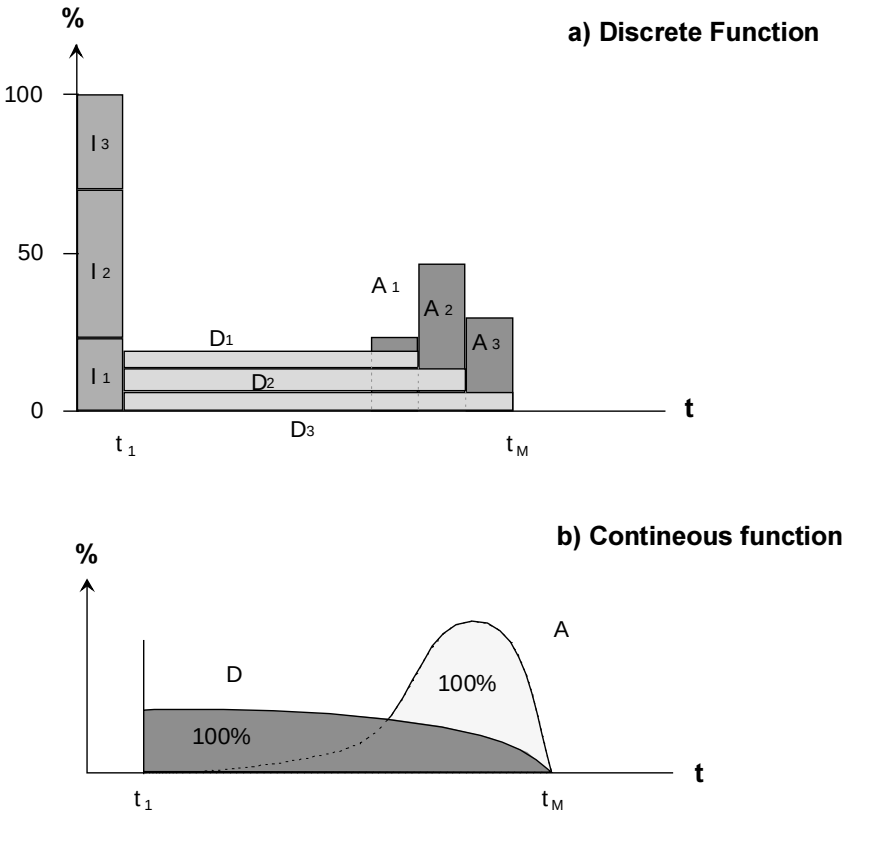
A.3.2 Refined perpetual inventory models with survival functions

In contrast to simple perpetual inventory models, the refined models assume that the life-expectancies of assets within an investment-vintage are dispersed on the mean value. A probability function, the so-called survival-function, is estimated which describes the share of assets, which are still in use. The inverse function which describes the written-down assets $A_{t,t+1}$ was estimated as a polynom of third degree in Germany (see Figure 4). Sweden uses for example for the road sector a survival curve of the Winfrey-type.

The use of probability functions implies that not single assets but technically homogeneous groups of assets (earthworks, bridges/tunnels, terminal buildings, pavement and equipment) are considered. For these asset groups long investment time series have to be available. The difference between the more simplified approach of considering single assets and the more refined approach with asset groups is shown in figure 3 and figure 4. Figure 3 illustrates the interrelation between investment, physical "loss" of the asset and depreciation for a single asset while figure 4 demonstrates the interrelation between these categories for an asset group (for example runway pavement). The approach shown in figure 4 considers the fact that the investment spent for an asset group consists of parts with different life expectancies which are dispersed within an interval around the mean. Although for example also in the German method for all elements of the investment I1 - In a linear depreciation is applied, the overall asset group shows in fact a degressive depreciation due to the underlying type of probability function for the written-down assets (as shown in the lower part of figure 4).

Figure 4 Interrelation between investment, written-down assets and depreciation - the case of an asset group



I = Investments D = Linear Depreciations A = Written-down ("lost") Assets

Source: DIW.

DIW Deutsches Institut für Wirtschaftsforschung