State aids

Making EU policy properly reflect geography and subsidiarity

SUMMARY

The use of state aids to industry is a poorly understood part of competition policy. Currently, the EU Commission presumes that state aids distort competition, yet it approves 98% of applications, often for social or distributional reasons. We argue that proper regulation of state aids should focus on two issues, the externalities generated and the inefficiencies arising from failures in competition between governments. We thus develop a new framework for EU policy and compare its implications with the existing practice of the EU Commission.

— *Timothy Besley and Paul Seabright*

Economic Policy April 1999 Printed in Great Britain

The effects and policy implications of state aids to industry: an economic analysis

Timothy Besley and Paul Seabright

London School of Economics; University of Cambridge

1. INTRODUCTION

When should action by an EU member state to assist the competitiveness of its own firms in world markets be of concern to other member states, and when is it a private matter between the government of that member state and its taxpayers/citizens? The use of state aids to industry by the governments of EU member states or by regional and local governments within those member states is probably the least well-understood domain of competition policy, and raises difficult political questions of enforcement and the allocation of powers.

State aids fall under the domain of international law, both the Treaty of Rome and the General Agreement on Tariffs and Trade (GATT). International law does not proscribe government support of industry outright, but it does require such support not to distort competition. It therefore becomes inescapable to answer the question of when distortion of competition is likely to result. Current EU policy towards state aids begins from a general presumption that such activity distorts competition and reduces economic efficiency, although in practice the Commission turns down only 2% of applications. This is because state aids in the EU are rationalized with reference to social and distributional objectives. However, it is hard to find a clearly stated rationale that underpins the current stance.

Competitors of firms receiving state aid are increasingly resorting to law to challenge them: Mederer (1996) reported that some 80 cases were pending before the European courts. This does not imply that the Commission is being unduly lenient: competitors

may be using the law strategically to harass other firms or simply to compensate for advantages that they gain from state aid. But it does imply the increasing need to justify the Commission's policy before a sceptical and potentially litigious audience.

This paper argues that the justification for regulating state aids requires an understanding of two key issues: the sources of externalities generated by state aids, and failures in intergovernmental competition that result in an inefficient outcome. We identify a set of principles to underpin an EU-wide policy based on our analysis of these issues. We compare findings from our framework with the existing practice of the Commission.

Our critique of current policy has two main strands. First, no systematic allowance is made for the possibility that geography matters and that an optimal allocation of production across the EU may require government intervention. One function of state aids can be to facilitate such an optimal allocation. Second, little attention has been paid in current thinking to the exact workings and consequences of intergovernmental competition in the presence of these externalities. Without this, it is hard to design an optimal policy that stems from clearly identifiable 'failures' of unregulated behaviour.

Our analysis has implications for other areas of regulation, such as attempts to limit tax competition. The European Commission's approach to state aids increasingly informs its approach to other aspects of EU economic policy. For example, moves to harmonize tax regimes within the EU have been growing in strength recently, partly because of a view that some forms of tax competition are 'a form of state aid', in the words of Commissioner Monti (*Financial Times*, 29/7/97). The Commission has also adopted a Notice on the application of state aid rules to direct business taxation, which will allow it to examine on a case-by-case basis all tax arrangements that in its view threaten to distort the common market. Clearly, if these other policies are to be well founded, it is important not only that the analogy with state aid be an appropriate one, but that state aid policy itself functions in a way that can reasonably be taken as a normative model.

The remainder of the paper is organized as follows. In the next section, we discuss some of the institutional background and some quantitative aspects of state aids policy. In section 3 we review the literature relevant to the state aids problem and summarize the reasons why the policy implications of this literature are so often conflicting and confused. This is a selective rather than an exhaustive review, to highlight the key issues. In section 4 we outline an analytical framework to reconcile the different approaches in the existing literature and show some of the main results that can be derived in this analytical framework. In section 5 we draw out the implications for policy of these results, taking care to distinguish those issues where the policy implications are relatively clear from those that will require further research. In section 6 we confront these implications with the actual practice of the Commission as revealed in decisions of the last few years. In section 7 we summarize the main unresolved questions and propose an agenda for future discussion. An appendix develops a formal model of bidding for firms in the presence of externalities based on the menu auction approach.

2. BACKGROUND

We begin by reviewing the definition of state aid as it has evolved in the European Union. We also discuss the evolution of opinion in the EU Commission and the policy stance towards such aid. State aid is notoriously difficult to define precisely. Four general guidelines are used by the European Union in identifying what constitutes state aid:

- Aid must be granted from state sources – directly or indirectly.
- Aid must provide recipients with a certain economic advantage over others that they would not have enjoyed in their normal course of business.
- Aid must favour certain undertakings in the production of certain goods.
- Aid must affect or distort trade between member states.

Aid takes many forms and the Commission identifies four broad categories:

- Group A aid constitutes direct transfers to firms, including grants and interest subsidies, and tax reductions.
- Group B includes equity participation and all forms of debt conversion.
- Group C contains those aid elements that stem from interest saved, such as tax deferrals.
- Group D covers guarantees.

Group A is by far the most quantitatively important category of state aid (Table 2).

All state aid is in principle prohibited, since it is viewed as distorting competition. Article 92(1) of the 1957 treaty states

> Save as otherwise provided in this Treaty, any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the common market.

However, there is plenty of scope for exceptions on distributional grounds. The main exceptions under Article 92(2) are aid of a social character to individual consumers without discrimination: for example, if a state chose to pay the electricity bills of the elderly. Aid is also permitted where it reduces the impact of natural disasters and there is a special clause associated with the former East Germany. Article 92(3) exempts state aids where they promote the economic development of a region with abnormally low living standards. Thus aid is permitted where there is serious under-employment, to develop certain economic areas and to promote cultural and heritage conservation.

Not every financial flow between a state and a firm constitutes state aid. In order to assess this, the Commission uses the Market Economy Investor Principle (MEIP). This states that any public funds provided to a private or public undertaking on terms that are more favourable than a private investor operating under normal market conditions would have provided to a private undertaking in a comparable financial and competitive

position consists of state aid. For example, a capital injection by the state is deemed to be aid if a private investor operating in similar conditions would not make a similar injection. The MEIP is hard to implement in practice because it often requires construction of complicated counterfactuals. Moreover, it is not particularly useful in classifying which state aids can be rationalized as dealing with market imperfections. For this purpose, the Commission sometimes uses explicit cost–benefit analysis (in deference to the requirement that the aid be proportional to the market failure it is designed to alleviate). It has not done so consistently in the past, but the New Community Framework for state aid to the motor vehicle industry formally introduces cost–benefit analysis with respect to regional investment aid. Draft Structural Funds regulations also adopt it as a requirement in the assessment of aid to large investment projects.

As Figure 1 shows, there was enormous variation in state aid granted in different countries of the European Union for 1994–6, as we would expect from the criteria for exception discussed above. Italy and Greece grant more state aids than other member states. In addition, as Figure 2 reveals, there is a significant amount of aid to the new *Länder* of Germany in terms of ecu per worker. Figure 3 shows the trends in state aid cases between 1987 and 1997. Table 1 confirms that Group A aid is the most important source of aid in quantitative terms.

All state aids implemented by member states must be cleared by the EU Commission.[1] Notification is made by the central government of the member state and is then forwarded to the Commission by the state's permanent representative in Brussels. The Commission then decides whether or not to authorize a particular aid. The proportion of all cases that give rise to negative decisions is very small (Table 2). Moreover, this proportion has fallen from between 2% and 5% in the late 1980s to under 1.5% since 1991. Yet even these few

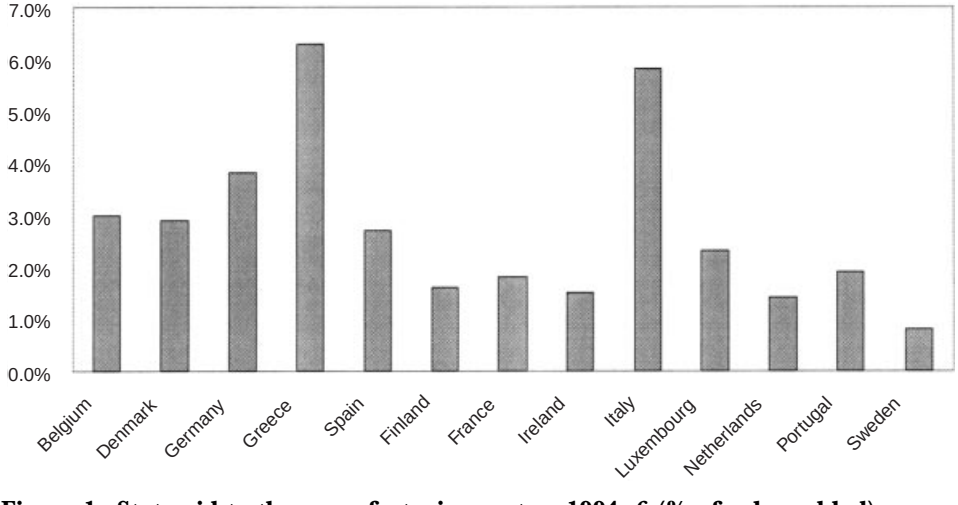

Figure 1. State aid to the manufacturing sector, 1994–6 (% of value added)

[1]There are exemptions for *de minimis* state aids that amount to less than 100 000 ecu over three years.

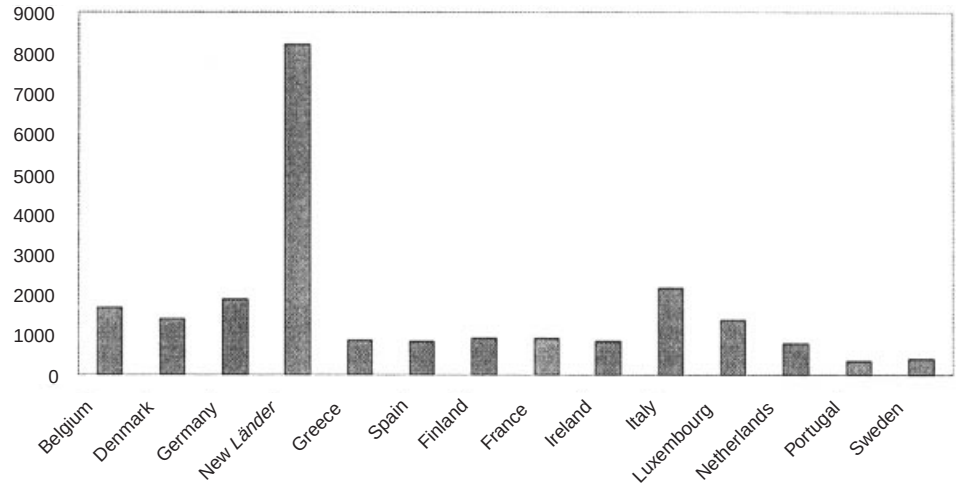

Figure 2. State aid to the manufacturing sector, 1994–6 (ecu per person employed)

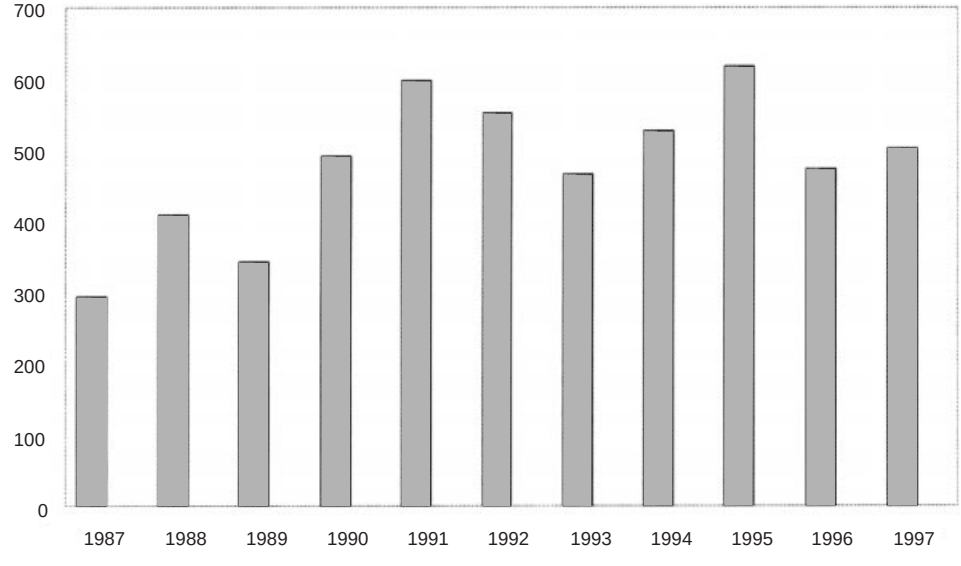

Figure 3. Trends in state aid cases, 1987–97 (no. of cases)

cases have often given rise to major political difficulties for the Commission, since the firms receiving aid deemed incompatible with the common market usually have powerful political backers (which is often why they received the aid in the first place). In these circumstances, the Commission needs to be able to explain convincingly what is special about the cases it has singled out for prohibition. It would be comforting if the economics literature provided a ready off-the-peg answer, but unfortunately it does not.

In practice, EU policy in recent years has rested heavily on the distinction between generic and *ad hoc* aids, the former available to all firms, the latter granted to particular firms. There is more of a presumption of acceptability for generic schemes, while *ad hoc*

Table 1. State aid by group, 1990–2 (%)

Country	Group A	Group B	Group C	Group D
Belgium	94	0.25	3	2.75
Denmark	96	–	1.3	2.6
France	88	1	3	8
Greece	78	–	11	11
Ireland	96	3	–	1
Italy	96	3	1	0
Luxembourg	97	0	3	0
Netherlands	98	0	0	2
Portugal	91	0	3	6
Spain	95	0.5	4	0.5
United Kingdom	97	0	2.3	0.7

Source: European Commission (1995).

Table 2. Trends in negative and conditional decisions

Year	Total cases	Negative decisions (%)	Conditional decisions (%)
1988	410	3.4	2.2
1991	597	1.2	0.3
1994	527	0.6	0.4
1997	502	1.8	1.0

aids are treated as presumptively suspect. (Policy has not been consistent on this point, however.) In principle, this distinction is based on a reasonable idea: namely, that generic aids are more likely to be targeted at genuine market failures rather than to be motivated purely by the desire to shift rents strategically from other countries. In markets that are imperfectly competitive and in which a struggle for rent shifting takes place, the amount of subsidy that is optimal from the individual government's point of view will vary very much according to the strategic conditions in the industry concerned and the characteristics of the firm taking up the subsidy. A generic scheme that enables all firms to access a given level of subsidy according to pre-set conditions will be both a relatively ineffective and a relatively expensive way to engage in rent shifting. It is relatively ineffective because it sets common subsidy levels whether these are the appropriate ones or not. It is relatively expensive because it grants subsidies to many firms that do not thereby gain increased rents, in order to shift rents to the few that do.

3. THEORETICAL BACKGROUND

There are two key theoretical issues to consider. First, what is the source of externalities associated with state aids? Second, how does intergovernmental competition function to internalize these externalities? In this section, we discuss what existing theoretical literatures have to say about this. We draw on results from the strategic trade policy literature, the economic geography literature and the local public finance literature.

3.1. Sources of externalities

3.1.1. Strategic trade policy. There are many reasons why action by governments to support economic activity in their own state will impinge on other states. Most supportive of the EU's stand on state aids is the literature on 'strategic trade policy' (see, for example, Brander and Spencer (1985)). In this literature, countries compete with each other in a negative-sum game of individually rational, but collectively wasteful subsidies to industry, spurred by the prospect of poaching each other's profits in imperfectly competitive markets. Typically, a government precommits to a subsidy that changes prices and outputs in a particular market. The aim is to raise consumer and producer surpluses that accrue to their citizens. All countries are therefore better off if they can reach and enforce an agreement to forgo such subsidies. In this set-up, it makes no difference where firms choose to undertake their economic activity, so there is no purpose in governments competing to attract economic activity, and no benefits from such competition to offset against its possible costs. Instead intergovernment activity is primarily a form of rent shifting.

The framework of the strategic trade policy literature is restrictive, but a number of lessons can be drawn from it. Even if externalities between countries are not a sufficient condition for inefficient outcomes, they are at least likely to be necessary. In practical terms, it is important to demonstrate the existence of a substantial externality inflicted by the aid in question on the economy of some other member state before diagnosing a significant distortion of competition. Furthermore, the strategic trade policy literature shows that such an externality will typically be due to imperfect competition in the markets concerned (usually output markets, but potentially also markets for inputs). Only if the market is imperfectly competitive will a subsidy to one firm make a significant difference to the reaction function of a competitor. In the case of pure monopoly there is no problem, since there is no competitor to be harmed (indeed, subsidy to a monopoly may even enhance efficiency if it encourages pricing closer to marginal cost). Conversely, for competitive markets there is no problem, since a subsidy to one firm affects only its own profits, not the conditions faced by other firms.

Most of the strategic trade policy literature has assumed that firms' locations are fixed. However, this assumption can be relaxed. Bond and Samuelson (1986) and Doyle and van Wijnbergen (1994) have studied the role of tax holidays in attracting firms to particular locations. Black and Hoyt (1989) study how provision of local public goods can pay by attracting firms which then contribute to the tax base.[2] Haaparanta (1996) has applied the menu auction framework (used below) to these issues.

However, whether firms can migrate does not really change the fundamental character of these models, since in either case there is no social benefit to their locating in one jurisdiction rather than another. Consequently, action by one government to attract a firm

[2]Recent contributions to this literature also emphasize the importance of dynamic considerations, and of examining the question of whether governments are able to commit to future strategy (see especially Leahy and Neary, 1996; Karp and Perloff, 1990). These issues are of crucial importance in our framework, developed below.

from another jurisdiction produces no net benefit in terms of productive efficiency. It merely inflicts an externality (in terms of the lost rents) which is likely to have a negative overall impact on allocative efficiency. Interpreted in the context of state aids, this means that subsidies to firms will consequently be higher than would be efficient, and the subsidized activity will occur at a higher than efficient level. At least, this conclusion will be justified unless there are independent reasons for thinking that subsidies in the absence of the externality would have been below the efficient level. This might be because the activity in question was an international monopoly, potential entrants into which did not take account of the beneficial externality that their entry would create for consumers. Nevertheless, such arguments (even if plausible in theory) may be difficult to justify empirically.[3]

3.1.2. Public finance with multiple jurisdictions. Also relevant to thinking about state aids is the extensive public finance literature on multi-jurisdictional competition. The literature on tax competition has emphasized that the mobility of consumers or factors of production leads to externalities between governments in their tax-setting policy. Keen and Marchand (1997) consider the impact of the composition of public spending (and particularly its division between public goods valued by citizens/taxpayers and those valued by firms) on the incentives for capital to migrate between jurisdictions. To the extent that firms are taxpayers, state aids that attract firms to particular locations will generate fiscal externalities. Looking to attract mobile firms may also result in taxes being bid down as governments attempt to undercut each other.

3.1.3. Economic geography. The recent economic geography literature, inspired by Krugman (1991), has provided a better basis for thinking that there are externalities in the location of economic activity. They begin from Marshall's insight that location and production decisions of firms generate external effects on their host economies. In our context, factor and product market linkages are an important source of such externalities, as when a firm locates and thereby affects the market for skilled labour. Even though these are pecuniary externalities, government action (by taxes, subsidies or other means) can be justified if the economy is not otherwise first best, as when there is imperfect competition or unemployment.

Why are these insights important? They provide a reason why the distribution of economic activity across geographical space has consequences for efficiency as well as for equity, and why the profit-seeking decisions of private firms will not necessarily realize efficient outcomes. If a way can be found to alter firms' incentives so that they internalize the externalities associated with their location and production decisions, the spatial distribution of economic activity will be more efficient than if they continue to ignore these externalities.

[3]For example, Neven and Seabright (1995) estimate on the basis of a simulation model of the international aerospace industry that the positive consumer externalities from the entry of Airbus Industrie have been very much smaller than the negative profit externalities for the existing firms Boeing and McDonnell-Douglas. This implies that launch aid has been excessive from the point of view of the welfare of the world as a whole (though beneficial for Europe).

However, it is one thing to suggest that externalities should be internalized, another to discover an effective mechanism for doing so. A benevolent and omniscient government for the whole EU could in principle implement a pattern of locational taxes and subsidies designed to correct for geographical externalities. Thus understanding the nature of intergovernmental competition is still critical. This has not been addressed in the literature to date.

3.2. Intergovernmental competition

Of key importance in understanding the need to regulate state aids is a model of intergovernmental competition. In a world without externalities and many jurisdictions, Tiebout (1956) proposed the notion that intergovernmental competition would sort citizens into districts that reflected their tastes for local public goods. The Tiebout literature therefore emphasizes the benefits of decentralization in inducing jurisdictions to compete for sources of tax revenue by inducing citizens and firms to sort themselves into groups on the basis of their preferences for local public goods (Tiebout himself wrote about citizens, but others, such as Oates and Schwab (1991) have developed the analysis for firms). Tiebout showed that competition between governments would lead to Pareto-efficient outcomes provided certain (stringent) conditions were met, notably that the number of jurisdictions was at least equal to the number of types of consumer and that there were no externalities between jurisdictions (see also Pestieau, 1977). While this is a useful benchmark, the results do not survive relaxation of the rather stringent assumptions (see Bewley, 1981).[4]

Oates (1972) expounded the benefits of multi-jurisdictional policy making for somewhat different reasons. Decentralization allows different kinds and levels of public goods to be supplied in different localities. Centralized governments are supposed to be unable to practise such differentiation, either because they lack information about local preferences and conditions, or because they are constrained to make uniform provision for some other reason. However, they are able to exploit scale economies (important for such public goods as national defence) and to internalize externalities between localities (as when national highways benefit traffic between as well as within regions). For each

[4]The Tiebout framework reminds us that in practice it may be hard to define precisely what constitutes a state aid. In the pure Tiebout model, purchasers of local public goods sort themselves by their preferences until each jurisdiction contains only a single type of consumer. This consumer pays a tax equal to the marginal cost of producing this bundle of goods (free entry that implies that this is also equal to the average cost of production). Furthermore, just as in Arrow–Debreu equilibrium, the process of competition itself defines what constitutes the 'market price' of such a bundle of public goods, and each consumer pays the common market price. Once we adopt a more realistic perspective, we shall accept that not all firms in a jurisdiction will pay the same taxes: does it follow, therefore, that all firms paying less than the average tax rate are thereby receiving subsidies? EU law on state aids requires firms to pay a market price for goods and services provided by the state, which is relatively easy to define when these consist of goods that are also privately traded, such as land. But when they consist of access to infrastructure services, for which no private market exists, what is a 'market price'? How can we calculate the appropriate level of tax liability for a firm using the services of publicly provided roads and airports, below which access to these facilities should be deemed a state aid? This is not to say that such definitional problems are insurmountable, or that rough-and-ready answers may not be accessible. But it does imply that caution should be exercised before seeking to use central policy in a jurisdiction such as the European Union to place a brake on the process of government competition.

type of public good, therefore, there will be some level of government that optimally balances these advantages and disadvantages. But for many types of good, the presence of variations between localities is a positive benefit of decentralization. Not only will the playing field not be level (to adapt a much misused phrase), but it should not be.

Most of the other literature on intergovernmental competition focuses on cases where externalities between governments are important. It then reaches pessimistic conclusions on the efficiency of intergovernmental competition. The normal framework is one in which governments compete on a one-off basis and behave non-cooperatively. In the ensuing Nash equilibrium, there are gains from co-operation. Examples include excessive taxation of non-mobile factors with tax competition, and the excessive use of subsidies to shift rents in the strategic trade policy literature.

The source of the problem is the conjunction of externalities and non-cooperative behaviour. The latter could be remedied by private negotiations or repeated interactions. However, where these fall short of a full remedy (which they seem likely to in practice), there is need for some kind of central regulator. Thus, the basic rationale for an EU state aids policy is best thought of as stemming from the failure of intergovernmental competition to achieve efficient outcomes in the presence of externalities.[5]

However, the prevailing model of intergovernmental competition has questionable aspects. Firms are assumed to be able to negotiate only with their own governments. This generates an inefficiency, since a firm can be induced to take account of the external benefits and costs of its production decisions only insofar as these affect its 'own' government, but not those of other countries. However, this is an unrealistic assumption in a world of multinational corporations – or even where a firm is potentially multinational. We would then expect their decisions to be influenced by the incentives that they could receive from other governments. This is explored further in section 4 below.

The impact of intergovernmental competition is also sensitive to the way in which governments' strategies are modelled. Typically, it is assumed that policy choices are the *levels* of particular policy instruments. However, an alternative is to consider competition in policy *rules*. For example, in the tax competition literature, the strategy of the government could be a function that specifies a tax charged for every level of investment in the economy. Which conception is appropriate will vary by circumstance, but it can make quite a difference to the results. In the case of state aids, a policy could simply be a subsidy paid to a firm for, say, every unit of capital that it invests in a particular location.

[5]The presence of negative externalities does not imply that state aids are excessive in strategic trade policy models if state aids merely return to firms some of the tax resources that have been inefficiently taken from them in the first place. Some have argued (like Brennan and Buchanan, 1980) that the normal processes of politics in the modern state are biased towards excessive taxation and the growth of a 'Leviathan' state. Competition between jurisdictions is therefore welcome, on this view, because it bids down overall taxation to more acceptable levels. Dye (1990) gives the flavour of this point of view in a US context: 'All governments, even democratic governments, are dangerous. Democratic political processes alone cannot restrain Leviathan. Among the most important "auxiliary precautions" the founders devised to control government is federalism [which] is not only competition between the national government and the states. It is also competition between the states. Indeed it is also, by extension, competition among the nation's eighty-three thousand local governments.' Regardless of the general plausibility of this view, it is worth remarking that the selective distribution of state aids to a minority of enterprises seems like a very indirect and distortionary way to reduce the overall burden of taxation on firms.

However, it could also be a rule that specifies a payment to the firm depending on a set of actions that it performs, in all countries in which it operates. Policies of this latter kind are more flexible, being able to describe policy contingently. They typically, therefore, have better efficiency properties. However, they give less empirical content to the theory as many more types of government behaviour are consistent with reasonable notions of equilibrium.[6] In the next section, we lay out such a framework and discuss its implications for the example of state aids policy.

4. AN ANALYTICAL FRAMEWORK

This section outlines a framework for thinking about intergovernmental competition for location of firms which uses insights from auction theory. There are four main components to the approach:

- Firms make decisions about where to locate and how much output to produce. Firms do not intrinsically 'belong' to one country rather than another, although they may choose to produce in one country rather than another.
- These location and output decisions of firms create external costs and benefits for the economy of the country in which they take place. Benefits to governments include tax revenue, reduction of unemployment, generation of knowledge spillovers, Marshallian labour market externalities and 'backward linkages'. More generally, they may encompass any kind of 'market failure' about which governments care. Costs include congestion and pollution. Costs and benefits differ across locations and firms' private decisions do not reflect these.
- Since firms do not appropriate all the benefits of their location and production decisions, governments have an incentive to compete to attract them. Governments can offer subsidies to firms contingent on their location and production decisions.[7]
- As well as creating externalities for the economy in which production takes place, firms' decisions create externalities for other countries. These may be geographical (as when the decision of a firm to set up a plant in Belgium creates a demand for labour or components in nearby northern France). Alternatively, they may consist in an impact on the profits of rival firms, about which governments are assumed to care, either directly or because of their implications for tax revenue. So, for example, a decision by a Japanese firm to produce televisions in Wales may affect the profitability of a television producer located in France, paying French taxes and employing French workers.

[6]This is well known in the industrial organization literature. Allowing firms to compete by offering supply functions allows a whole range of prices to be supported as Nash equilibria, whereas competing in quantities gives the Cournot outcome. Klemperer and Meyer (1989) show that adding uncertainty can reduce the set of equilibria.

[7]For the time being, we assume that these subsidies take the form of cash transfers and that there are no further restrictions on their nature. While a simplification, this assumption is not too unrealistic a representation of investment subsidies, tax holidays or employment subsidies. More generally, one could also imagine in-kind bidding in the form of infrastructure provision. Governments might also relax certain regulations, such as those on environmental or employment standards, to attract firms. Our presumption is that governments and firms have incentives to offer state aids in the form that is most beneficial to the firm.

We describe the process of intergovernmental competition as an auction in which governments are bidders who wish to have firms locate within their jurisdiction. Since there are benefits (and costs) that vary between locations, this is a private values auction. However, we begin by studying the case where all valuations are public information, discussing the implications of imperfect information below.

We begin by developing a benchmark where intergovernmental competition in the presence of externalities is efficient even when bidding involves externalities between bidders. This uses the analysis of Bernheim and Whinston (1986), who specify a menu auction (one in which bidders offer transfers to an auctioneer contingent on a full menu of allocations) and show that it can generate efficient outcomes even in the presence of externalities, provided that bidding strategies are 'truthful' in the sense that they reflect the bidders' true relative valuations of the various outcomes.[8]

The subsequent analysis relaxes certain of the assumptions. We first consider a single agent (the firm in our context) and many principals (the governments). Then we consider a dynamic setting with many firms and show that the efficiency result need not hold. We also consider institutional limitations on bidding and government failures as sources of inefficiency.

4.1. A benchmark

The possibility of an efficient outcome when governments compete to attract a firm that generates externalities is easily illustrated with a numerical example. Suppose that a single firm must decide whether to locate in one of two countries: A or B. The payoffs to countries A and B from having the firm locate in either country are

Outcome	Payoff
firm in A	(5, 0)
firm in B	(3, 3)

where the first element of the payoff vector refers to A's payoff and the second to B's. It is clear that there is an externality as the firm affects the payoff in the other country when it makes its location decision. In a menu auction, each government formulates a bidding strategy that offers a payment to the firm if it locates in either country. We assume that the firm is indifferent between the two locations. With these payoffs, country A has the highest private value from having the firm locate in its own country. However, social surplus is highest when the firm locates in country B. Hence, we need to show that a Nash equilibrium in bids that are truthful will lead to the firm deciding to produce in B.

Since country A has a true marginal willingness to pay of 2 for location in A and country B has true marginal willingness to pay for location in B of 3, the firm will get the

[8]'Truthfulness' is a refinement on the set of equilibria and one would have to believe that it is 'focal' in the set of bidding strategies that governments might use. Although this restriction on strategies might appear stringent, Bernheim and Whinston show that truthful bids are always (weak) best responses to other bids, even untruthful ones.

highest subsidy from locating in B and the efficient outcome will prevail. This logic is much more general, as Bernheim and Whinston (1986) have shown.[9]

What would be the effects of controlling state aids in a world corresponding to this case? Since outcomes are efficient, this could not result in better location and production decisions by firms. At best it might be able to yield the same outcomes as under government competition, but at lower levels of transfers to firms. In this example, collusion between the governments would be able to get the same location for arbitrarily low costs rather than the transfer of 3 that the firm is awarded. This might be particularly desirable if governments' overall ability to raise taxes is constrained below the efficient level (otherwise the payment of subsidies to firms can simply be covered from tax revenue raised elsewhere, albeit at some cost in tax distortions in other parts of the economy). The costs of such a policy would depend upon whether, in the absence of government competition, there were other mechanisms for inducing firms to take account of externalities to the host economies in their location and production decisions. So overall the rationale for state aids policy would be like that of any policy for limiting public expenditure, and the costs of such limitation would depend on the effectiveness with which the benefits otherwise yielded by public expenditure could be achieved by other means. In the present post-Maastricht climate for public finance in the European Union, such an argument may carry considerable weight.

In practice, though, it is far from clear what those 'other means' might be. A supranational authority (such as the European Commission) that knew the value of the external costs and benefits at all possible locations could simply implement a system of taxes and subsidies that gave the right fiscal incentives to firms. Quite apart from the question of whether a supranational authority could in practice know the value of these externalities as well as a national government, or would have as strong incentives to reflect them in its tax system, it is evident that in the European Union as it exists today such supranational fiscal powers do not exist. Alternatively, it could act as broker in an agreement between member states to restrict the levels of their state aids to firms. But such an agreement would have to ensure that incentives for production and location at the margin remained undistorted relative to those that would result from unfettered government competition, and it is hard to see how this could be achieved, since this would require knowing what firms would have bid in the absence of the policy.

This benchmark is extremely simplistic. In the remainder of this section, we relax some of the assumptions that we have made and consider the case for an EU-wide state aids policy as a consequence.

[9]The following example gives an intuitive argument that might be helpful in understanding the result. A few years ago in the East End of London, a team of gardeners went from house to house offering to clear derelict gardens. They did this by tipping the rubbish from the cleared garden into the garden of the next-door neighbour. This evidently created an externality ('environmental dumping', one might call it). However, it would be mistaken to think that the externality was not internalized in the process of bidding that went on between client and gardeners. The willingness to pay of any client for the services of garden clearance would depend not just on the value placed by the client on having a clear garden as opposed to having a garden in its original condition. It would also embody a component which is the value to the client of not having the garden next door cleared instead. The gardeners would visit that house whose inhabitant had the highest valuation of the difference between a cleared garden and one into which the neighbours' garden rubbish had been dumped. This would be the efficient house for them to visit.

4.2. Multiple firms: a dynamic extension

In practice, industrial location and production are made repeatedly over time and involve a number of different firms. Moreover, the magnitude of externalities to firms' decisions depends on the decisions made by those firms and by others in earlier and in later periods. There are both snowball and congestion effects, whereby the growth of economic activity in one particular location either increases the benefits of attracting further economic activity or raises the costs of doing so.

Here, we consider an extension in which different firms make location decisions at different points in time. On its own, this interdependence of the benefits of firms' decisions in time does not prevent efficient allocations, any more than their interdependence in space was seen to do in the single-period model. Indeed, if governments can commit to a single policy over time, then interdependence in time is exactly analogous to interdependence in space. A simple application of the Bernheim–Whinston argument shows that the auction process will lead to efficient allocations. All the arguments of the single-period model continue to apply.

We now extend our example to a multi-period setting in which two firms make location decisions in two different periods. There are four possible investment profiles with the payoffs to the two governments prior to subsidy payments in each case as given below. (The outcome (j, i) is when firm 1 locates in country j and firm 2 in country i.)

Outcome	Payoff
(A, A)	$(9, 0)$
(A, B)	$(6, 6)$
(B, A)	$(7, 7)$
(B, B)	$(0, 13)$

These payoffs have the property that, whichever government attracts the first firm, joint surplus is higher if the second firm does not locate in the same country. Joint surplus is maximized when country B attracts the first firm while country A attracts the second (the outcome (B, A)).

We now analyse this example with a dynamic version of the menu auction model with the timing as follows. First, the countries offer bids for the location of firm 1. Then the firm selects its location, which is fixed for the remainder of time. Next, the countries offer bids for the location of firm 2, which then locates in one of the countries. At this point, payoffs are realized.

Bidding with commitment will guarantee that the investment outcome is (B, A). However, without commitment, the investment outcome is (A, B). To see this, consider the payoffs to the two bidding countries after firm 1's decision has been taken. This will depend upon their payoffs conditional on the firm 1 decision. The logic of the static model says that we should consider the willingness to pay for firm 2. The firm will locate in whichever country this is highest. It is straightforward to calculate that if firm 1 locates

in A then country B wins the bidding for firm 2 and pays 3 to the firm in the process. If firm 1 locates in B, then country A wins the bidding for firm 2 and pays 6.

Now each country can predict the outcome from the period 2 bidding game and can calculate its *net* payoff if the firm locates in A or B in period 1. (The term *net* here refers to the fact that transfers to firm 2 must be deducted.) These payoffs are given below:

Outcome	Payoff
firm 1 in A	(6, 3)
firm 1 in B	(1, 7)

The equilibrium of the period 1 bidding game is now computed relative to these net payoffs and will (using the usual logic) result in the joint net payoff-maximizing outcome. This is where firm 1 locates in country A, as joint payoffs with (6, 3) exceed joint payoffs with (1, 7).

This outcome is not only failing to maximize social surplus, it is also Pareto inefficient. Switching the investment outcome to (*B, A*) *holding the subsidies to the firms fixed* would make both governments strictly better off while preserving the firms' payoffs (including transfers) at the same level.

This inefficiency result is due to two things: the failure of governments to commit their future bidding strategies; and dealing with two separate agents (the two firms in this context). The problem arises only if countries' preferences for firm locations are interdependent. The appendix shows that separability of the payoffs across the two firms' locations implies that the outcome is efficient even without commitment. We would expect non-separability in many practical instances: for example, if a high-technology firm locates in one place and affects the externalities generated by later firms. Thus the possibility of inefficiency of this form is more germane when there is substantial interdependence in decisions over time, either because of locational 'clustering' effects or because of the effect of later decisions on the distribution of rents to existing firms.

Does this have particular policy implications? One possibility is to consider ceilings on allowable levels of subsidy (a complete ban on state aids would be a special case of such a policy, with the ceiling set at zero). This might seem plausible, since the inefficiency arises because governments are unable to commit not to compete against each other in the future. They therefore know that they will find themselves paying out subsidies to firms in the future, and their willingness to pay for location decisions today is distorted by their expectation of the likely subsidy burden in the future. For example, a government bidding for a firm in a high-technology industry today is likely to expect many competitor firms to come along in the future. It therefore knows that bids from rival countries will be high, since there is a reasonable expectation that this industry will generate large rents, and that therefore it will probably find itself obliged in the future to pay large subsidies to attract firms that would otherwise have been wooed away to the detriment of the domestic industry. This likely future burden makes it unwilling to bid its true intrinsic willingness to pay today. In these circumstances, it is tempting to conclude that an assurance of a cap on future subsidies tomorrow would make today's bids reflect

more accurately the true strengths of benefit yielded by today's location decisions, besides ensuring that less of the resources of domestic taxpayers disappeared into the pockets of the firm.

However, this argument is misleading. It is true that the bidding today will be more likely to yield efficient outcomes if there is an assurance that there will be a ceiling on the bidding tomorrow. However, the bidding tomorrow is the mechanism by which firms' location and production decisions are induced to take account of the external costs and benefits to the host economy. Therefore a ceiling on the bidding tomorrow can lower the expected value of state aids actually paid only by distorting tomorrow's decisions. The key issue is whether there exists a realistic alternative to a bidding mechanism as a way of internalizing the external effects of location and production decisions. Without such an alternative, it must be concluded that restrictions on state aids have a significant cost, which must be set against any benefits of avoiding the problem that we have identified.

To summarize, competition between governments may result in inefficient outcomes in a multi-period setting when more than one firm receives aid. This is particularly likely where imperfect competition or 'clustering' effects of locational decisions make the returns to later decisions in an industry heavily dependent on the results of earlier decisions. It is much less clear, however, that restrictions on the level of state aids are an appropriate response to the problem, since they alleviate the problem in current decisions at the cost of preventing future decisions from internalizing the external costs and benefits of industrial production to the host economy.

4.3. Institutional restrictions on bidding

The basic example developed above assumed that the governments have the ability to express their willingness to pay off in the form of bids. However, this is not always realistic. In some circumstances, there is a concern that some governments have deeper pockets than others and are able to 'outbid' other governments. In our first example, if country B were for some reason unable to bid 2, because of some revenue constraint, while country A had the capacity to do so, then the firm would end up locating in the inefficient location.

While this argument has a prima facie plausibility, it is questionable. Governments choose how much revenue to raise (within reasonable bounds). If governments that are more efficient tax raisers are able to bid larger amounts, then this ought to be reflected in the payoffs that underpin the bidding, and the argument that firms' decisions will be efficient, given the capacity to raise taxes, will be preserved.

There is a second context in which institutional bidding restrictions can be important. Consider, for example, a firm that is deciding on levels of output in existing plants (and seeking state aid to do so). Increases in its output may well impose costs on the economies of other countries that exceed the benefits to the host economy. However, it is not clear that other countries have any realistic means to ensure that the firm internalizes the costs.

In the case of a multinational firm, the most convincing answer is via 'aid linkage'. Consider a car firm negotiating with government A about support for its existing operations in that country. At the same time, however, it is also being supported by government B for producing output in country B. If this output imposes external costs on country A – perhaps through reducing employment in country A – then the willingness of government A to pay it state aid will be reduced. Consequently, the external effects of any negotiation with country B will be internalized because the firm has other relations with country A.

Since many of the firms that are large enough for state aid to have a distortionary impact are also large enough to be multinational, in principle there is a mechanism for the internalization of the most important international externalities even when the aid does not concern investment in new plants. However, in practice this mechanism may work only imperfectly. For one thing, firms may not actually be in receipt of state aid in the second country that is damaged by their receipt of state aid in the first country. In theory, so long as they pay taxes there is scope for negotiations over their tax liabilities, but most countries have rules requiring uniformity of tax treatment between firms. These rules could be changed (indeed, a special tax schedule requiring firms to pay a surcharge related to their receipt of state aid in other countries might do more to lower state aid levels than any amount of supranational enforcement). But in their presence it seems reasonable to conclude that international externalities may be internalized only imperfectly. Second, some large firms may be intrinsically limited by regulatory or other factors from freely operating across national boundaries (banks or airlines, for example), even if the market within which they operate is clearly international. It may therefore be difficult for the governments of other countries to find a means to oblige the firm to take account of the costs it imposes upon them.

It is important not to overdramatize these costs. Output increases in country A will cause some loss of rents to country B but some gain to the consumers of country B. The only circumstance in which the consumer surplus change reinforces rather than offsets the rent-shifting effect is when the state aid is used to finance predation designed to force rival firms out of the market, causing a long-run rise in the price of the product as well as a shift in rents. However, in the European Union predation is already illegal under Article 86, and there is no justification for using state aids policy as a means to enforce Article 86 by the back door.

Nevertheless, there are almost certainly cases in which the international externalities are large, are inadequately internalized by existing mechanisms of negotiation between firms and governments, and cannot be considered subject to the terms of Article 86. Aerospace may be one such industry (see Neven and Seabright, 1995). Semiconductors may be another. In both cases, the presence of learning economies in production (the dependence of variable costs on scale) make the externalities of one firm's production decisions on another very large. The benefits of some kind of restraint on state aid at the supranational level may be significant. Whether they warrant a state aid regime of the type currently in place in the EU is a more complex question, which we shall consider in section 5 below.

4.4. Government failure

We have so far assumed that the interests of the governments that implement bidding strategies are aligned with those of their citizens. If this is not true, our main argument for efficiency breaks down. To see this, suppose there is an agency problem in government so that the preferences of citizens and the government for the locations of firms diverge. This agency problem might be due, for example, to the government receiving bribes or contributions to election funds from certain groups that benefit from having the firm locate in a particular place.

Suppose then that the payoffs to the citizens from bidding are essentially as in the first example above. However, the governments' payoff is

Outcome	Payoff
firm in A	$(5 + v_{AA}, v_{BA})$
firm in B	$(3 + v_{AB}, 3 + v_{BB})$

where v_{ij} is the rent earned by the government in i when the firm locates in j. We will measure welfare as the payoff of the citizens ignoring the rents earned by politicians. Hence, it will remain optimal to have the firm locate in country B.

The firm will now locate in B (as it should from the point of view of the citizens) only if

$$1 + v_{AB} + v_{BB} > v_{BA} + v_{AA}$$

which says that the sum of the private benefits to the government and the social surplus gain from locating in B exceeds the private benefits to government from locating in A. Clearly, there are possible cases where $v_{BA} + v_{AA} > 1 + v_{AB} + v_{BB}$ and the firm ends up locating in A against the social surplus criterion (applied to the citizens' payoffs). Thus, the existence of political agency problems undermines the idea that bidding will allocate firms to their welfare-maximizing location.

These problems will arise only when the bidding countries have insufficient instruments in their political system to control politicians. In dynamic models with repeated elections, it may be possible to control such behaviour (see, for example, Banks and Sundaram (1996)). However, such control is likely to be incomplete and bidding may not, therefore, reflect welfare decisions.[10]

It is questionable whether a state aids policy motivated by failures in political systems to control their politicians is justified. At the very least, it is second best since the problem of political misrepresentation deserves attention directly. In the context of the European Union, it is also an unfortunate argument to deploy, particularly in the post-Maastricht era when member states are rightly concerned that the institutions of the EU should respect subsidiarity. It may be true (and often is) that subsidies to a particular firm are a waste of taxpayers' money. It is much less obvious that this waste is any business of the European Union.

[10]See Besley and Coate (1998) for a general discussion of inefficiency when governments are electorally accountable.

Similar points have been made in the context of competition between states in the USA. For example, Netzer (1991) concludes a review of studies of inter-state competition for economic development in the following terms:

> Economic development incentives are, for the most part, neither very good nor very bad from the standpoint of efficient resource allocation in the economy. With all the imperfections, the offering of incentives does not represent a fall from grace, but neither does competition in this form operate in ways that truly parallel the efficiency-creating operations of private competitive markets. Given the low cost-effectiveness of these instruments, there is little national impact, only a waste of local resources in most instances.

The argument from national government failure depends upon there being some assurance that government failure at the international level is less serious than it is at the national level. In particular, the vulnerability of the state aid process to capture by lobbying interests must be less severe at the international level. Given that international externalities may affect consumers as well as firms, this is by no means a foregone conclusion: firms could easily come to use the process of state aid control (much as they have come to use the anti-dumping procedures) as a means of strategic harassment of competitors in which the interests of consumers are inadequately represented.

A second version of the argument says that state aid control is a form of pre-commitment device that is credible only when it is enforced at a supranational level. Governments would like to be able to commit themselves not to give state aids (particularly of the kind that enables firms with existing plants to extract further aid by threatening to move their operations elsewhere). Domestic mechanisms do not have the credibility that attaches to international mechanisms. So, for example, it would be possible for domestic aid policy or even domestic legislation to enshrine a distinction between generic aid and *ad hoc* aid, and refuse to give *ad hoc* aid, thereby obliging firms to demonstrate a credible source of market failure before they may have access to aid. But domestic firms with sufficiently political influence will find ways round such policies, which are therefore better enforced supranationally.

This argument fails to explain why state aid control is a better candidate for internationalization than is any other branch of competition policy. Competition policy in general involves exactly such issues of credibility and enforceability at the national level. Internationalization is normally justified only when there are identifiable international externalities, and not merely as a means to enhance domestic credibility, unless this is specifically requested by the member state concerned (see the discussion of the 'Dutch clause' in Neven *et al.* (1993)). By analogy, therefore, the use of EU state aid control on credibility grounds should be something that individual member states should be free to sign up to, not something that should be imposed upon them.

In preliminary work, we are developing a model in which state aid decisions not only reflect the national interests of the host countries, but may also reflect the private interests of lobbies. This is a two-period model in which, prior to taking state aid decisions,

governments may choose whether or not to precommit themselves, at a cost, to a mechanism for ensuring rigour in state aid decisions (it is not specified how such a mechanism would be implemented). This choice can be made in a way that reflects national and not sectional interests. If there were no international externalities, countries would do so if the national benefits of increased rigour outweighed the costs of the commitment mechanism. But if state aid decisions in the second period involve significant negative international externalities, then it may be in individual countries' national interest to free ride on each other. In effect, if a significant proportion of the net costs of a country's government failure is borne by other countries, it may have a less than optimal incentive to precommit itself to a mechanism restricting the power of its lobbies.

4.5. Imperfect information

The basic framework assumes that all payoffs are known. There is, however, scope for uncertainty about the payoff of other countries and the cost to the firm of choosing different locations. In a private values auction with payoffs being private information, the auction mechanism that we have described suffices to achieve an efficient allocation of an indivisible good. However, this result cannot be generalized to auctioning more complicated objects. Additional complications arise when the firm's location includes a common component, so that the auction is partly common value.

We now have some general negative results (see Jehiel *et al.*, 1998) showing that auctions of complicated objects with externalities and imperfect information are generally inefficient. Thus, the generally positive results that we are suggesting for an auction theoretic perspective on state aids may appear overstated.

Our basic point that policy within the EU should stem from a coherent analysis of the failure of intergovernmental competition to achieve an efficient allocation is not affected by considerations of imperfect information. The real issue is, therefore, whether the European Union can develop mechanisms for the parties to reveal their private information and to achieve an efficient location of industry that dominate the kind of auction that we have used to model the process. Such a mechanism would have to achieve efficiency at lower cost than the intergovernmental competition model suggests. The same issue arises in markets that use auctions. Auctions, although not perfect, appear to be an institution that is robust and satisfactory to most parties.

5. POLICY IMPLICATIONS

5.1. General implications

One sobering implication of our discussion is that a state aids policy cannot simply be based on an attempt to distinguish between those aids to industry that rectify market failures and those that impose externalities on other countries. Because of the complex

nature of interdependencies between the location and production decisions of firms, aids that do the former will typically also do the latter. The key issue is whether the processes of government competition are able to internalize these externalities, and if not, whether a co-ordinated international policy of state aid control is able to improve the outcome.

Moreover, a policy which sought to outlaw all state aids that might impose externalities on other countries would be unrealistic. It would founder first on the inability even to define state aids as distinct from legitimate state activity. The state is involved in supplying all kinds of public goods, at prices that are not 'market prices' in any meaningful sense of the term, since the private sector cannot efficiently supply them. But even if some acceptable definition of state aids could be found, the only way to ensure that no such aids imposed externalities on other countries would be to outlaw state aids altogether. This is a general implication of much of the strategic trade policy literature. Although the official rationale for state aid control often appears to draw on the intuitions of this literature, in practice EU state aid control shrinks from so radical a conclusion, outlawing only a tiny proportion of those policy actions classified as state aid. This is plausibly attributed to the fact that, in practice, location makes a major difference – there are market failures that the location and production decisions of firms may either exacerbate or alleviate. Government intervention to alleviate such market failures is then legitimate, and the test of this cannot be whether there are cross-border effects.

Current policy presumes that *ad hoc* state aids are the most suspect. This might be justified by the reflection that *ad hoc* aids may also give rise to *ex post* bargaining between firms and governments, in which firms use the threat of relocation to induce governments to pay more than once for the same external benefits. Nevertheless, it should be recognized that state aid control of this kind would be essentially a device to enable governments to overcome their own bargaining weaknesses rather than a means to prevent them from inflicting damage on each other. The grounds for making such a policy compulsory (as opposed to inviting governments to sign up on an individual basis to a code of conduct) are therefore somewhat weak.

The conclusion that all and only *ad hoc* aids should be outlawed is not really tenable. Many imperfectly competitive industries may have only one or a very few firms that can realistically benefit from a generic scheme. This has two implications: first, that it is relatively easy to devise a scheme that looks generic but is in fact designed to benefit a particular named firm; second, that the market failures that arise in imperfectly competitive industries will often need to be addressed by measures that in fact benefit particular firms, and to prevent all *ad hoc* aids would be to leave such market failures unaddressed.

So the important policy question becomes two questions: is it possible to find criteria for identifying, first, generic aids that do distort competition, and secondly, *ad hoc* aids that are acceptable?

The first question is quite hard to answer. On the face of it, generic aid schemes would seem to be unlikely to distort competition provided that significant numbers of firms are eligible, and the criteria for eligibility do not arbitrarily exclude certain firms that

otherwise meet the purpose of the scheme. Schemes that in fact are taken up by very few firms are more problematic, and in these circumstances it seems appropriate to consider whether the generic aid is in fact an *ad hoc* aid in disguise.

However, there is no reason whatever to expect generic aids to lead to a uniformity of competitive conditions between countries. Only in a world in which geography were irrelevant would this be so. There is no distortion of competition implicit in, say, one country's choosing to subsidize environmentally friendly investment at a higher level than another. The importance of geography implies that we should expect the levels of taxes and subsidies that compensate for externalities to vary significantly between different locations – as, indeed, they need to do if they are to correct for the inefficiencies of location and production decisions taken solely on the basis of private profitability.

The second question is not much easier to answer. But some initial pointers can be given. First of all, *ad hoc* aids to firms that do not have significant market power are not likely to lead to rent shifting on an important scale. This market power need not be confined to output markets: a firm with little market power in output markets but with substantial market power in markets for a specialized input (say, skilled labour) could still use state aids to gain rents in this way (e.g., by poaching research scientists from other countries). However, given the similarity of technological processes across firms, market power in input markets will usually be exercised by firms also enjoying market power in output markets. A good beginning, therefore, would be to allow all *ad hoc* aids to firms with less than some threshold level of market power (which could in principle be analysed in the same way as is done for mergers or other anti-trust investigations). In effect, this conclusion reflects the fact that what matters is not whether the aid is intrinsically generic or intrinsically *ad hoc*, but whether the decision to grant it imposes a significant international externality. The *ad hoc*/generic distinction captures somewhat imperfectly the difference between aid that does and aid that does not create this type of externality.

Our analysis suggests that for multinational firms undertaking greenfield investment, where it is realistic to suppose that they can negotiate with several governments, there is no case for compulsory state aid control. The outcome of such competition will not always be efficient, but there is no reason to suppose that preventing state aids would improve matters, and it would remove from governments one of the principal means of internalizing locational externalities.

Matters are different where there are significant barriers to firms' moving their operations between countries, and where output decisions in one country may therefore impose significant externalities between countries that cannot easily be internalized in the negotiation process. In such circumstances, state aids may cause production and location decisions that internalize only one set of externalities (those in the home country), while failing to internalize those on other countries. But there are good grounds for requiring the case to be made with some care. It needs to be established: first, that the aid enables production to be at a level significantly different from what it would otherwise be; secondly, that this production affects the prices at which other firms in the

EU can sell their output, or the amount of output they can sell; and thirdly, that the cost of this externality more than outweighs any benefit to the host economy in terms of the alleviation of local market failures.

It should not be the function of state aids policy to determine whether each and every instance of state aid is an appropriate response to a particular market failure. Many cases are not, but those who bear the cost of inappropriately devised policies are overwhelmingly the citizens and taxpayers of the country granting the aid. The evaluation is appropriate only when it has been established that the aid creates an international externality that cannot be internalized by other means.

Nevertheless, if such an evaluation is to be performed, it is important for it to be performed rigorously. Current EU policy contains a very significant flaw as far as the market failure evaluation is concerned. The Commission has sought to ensure that the regions eligible for aid under Article 92(3) are the same as those eligible for Structural Funds. This policy has no justification, for it ignores the fact that state aids are those granted by member states (and therefore represent transfers between different regions of the same country), while the Structural Funds to a considerable extent represent transfers between member states. To put it another way, the fiscal resources required to pay for state aid have to come from within the country. If it is a rich country then it may be a legitimate use of resources to support other regions within that country even if these do not qualify for EU Structural Funds. If it is a poor country then transfers to a region eligible for Structural Funds may not resolve any market failures if they come from taxation levied upon other, even poorer regions.

Finally, the most important cases in which *ad hoc* aids impose major externalities are those in which the presence of the aid enables predatory behaviour on the part of the aid recipient. In such circumstances, Article 86 proceedings should be an adequate remedy.

To sum up, it is useful to distinguish generic aids and *ad hoc* aids, and for treating the former as presumptively legal even though it must be recognized that some apparently generic aids may really be *ad hoc* aids in disguise. It should be emphasized that it is legitimate for the terms of generic aids to differ between countries. For countries that suffer badly from acid rain to subsidize environmental investment more than others is no more a distortion of competition than for countries with relatively scarce labour to have higher wages: both represent an appropriate response of the price mechanism to relative scarcity, even if the good in question is in the former case a public good.

The prohibition of *ad hoc* aids to multinational firms undertaking greenfield investment is also hard to justify. Only when the firm in question is genuinely a national firm facing significant barriers to operating in other member states, and when the aid imposes externalities on other member states the cost of which outweighs any alleviation of domestic market failures, is there a defensible case for prohibition. Even here the most flagrant cases are ones for which Article 86 proceedings are likely to be an adequate remedy.

This is not to say that most state aids are desirable policy mechanisms. A great many of them are inefficient, a waste of taxpayers' resources. But those who suffer from them are

the taxpayers of the member states that grant them. Those member states that wish to sign up to a collective code of practice on state aids, backed by the resources of the Commission in making the aid-granting process more transparent, may find that collective action improves their ability to reduce the incidence of wasteful aid. But the application of EU state aids policy to recalcitrant and unwilling member states, in the absence of a clear identification of the damage they cause to other countries, has very little rationale in economic analysis, and risks stifling the legitimate and healthy process of competition between governments.

5.2. A proposed policy rule

The considerations that we have discussed above argue in favour of a policy rule that distinguishes between the compulsory elements of state aid control (those that should be binding on all member states) and those where member states may voluntarily sign up for a more rigorous form of monitoring and control. We begin with the compulsory component. We propose this in the form of a series of questions that the competition authority can pose, and a presumptive allocation of the burden of proof in response to these questions. We begin by presuming that the authority has identified a particular measure as constituting aid, on the grounds that a firm or group of firms is treated more favourably than other firms in the same jurisdiction:

1. Is the actual beneficiary of the aid (in the case of *ad hoc* aids) or any of the likely beneficiaries (in the case of generic schemes) in a position to exert significant market power in either output or input markets? If not, the aid can be declared legal.
2. If the answer to question 1 is 'yes', would this market power, in conjunction with the granting of the aid, create a significant net negative cross-border externality? If not, the aid can be declared legal.
3. If the answer to question 2 is 'yes', is the rationale for the aid grounded in the alleviation of a domestic market failure (and is the aid an appropriate instrument, in quality and quantity, for that end)? The standard of proof required to answer this question positively needs to be somewhat higher for *ad hoc* aids than for generic schemes.
4. If the answer to question 3 is 'yes', and the aid is for greenfield investment, it can be declared legal.
5. If the answer to question 3 is 'yes', and it is aid to an existing firm or firms, have the firm or firms concerned already received aid in respect of the claimed market failure in question? If not, the aid can be declared legal. If they have already received such aid, the aid is illegal.
6. If the answer to question 3 is 'no', the aid can be declared illegal unless it can be shown that there are significant benefits from permitting it that would outweigh the cross-border costs (the burden of proof lying on the country granting aid to show that such benefits exist).

In question 2, note the importance of identifying a net negative cross-border externality. It should not be enough merely to show that some third party (such as a competitor) might be damaged by the state aid in question, for there may be others (such as consumers) who would benefit. Given the bias of lobbying procedures towards the interests of firms, failure to emphasize that the net externality be substantial might easily lead to an unduly restrictive policy.

What purpose might be served by a more rigorous form of supranational monitoring and control? Countries might wish to sign up to this for one of two reasons. First, they might be seeking more credible commitment to more rigorous evaluation of the market failure rationale for state aid in the first place than they feel capable of undertaking on their own. One could imagine a code of practice or set of Brussels (or Geneva) Principles to which countries could choose to subscribe, and for the monitoring of which they might wish to draw on supranational expertise. This could operate even in circumstances where clear cross-border externalities had not been identified. Secondly, countries might wish to undertake supranational co-ordination of their bidding strategies in seeking to attract foreign direct investment. This may be either for the purpose of reducing the (explicit or implicit) subsidies paid to firms to locate in given areas, or to take account of the fact that initial location decisions are likely to change the economic benefits from location decisions in the future.

The appropriate form and institutional embodiment of this more rigorous form of monitoring and control is beyond the scope of this paper. But we hope to have clarified the boundary between those forms of supranational action that can be justified by a clear appeal to international cross-border effects and those that cannot.

6. THE EUROPEAN COMMISSION'S PROCEDURE IN EVALUATING STATE AIDS

This section comments on the European Commission's procedures in evaluating state aids. It draws on a companion paper (Besley and Seabright, 1998) which analyses a number of recent decisions taken by the European Commission to determine what appear to be the underlying principles that it applies to state aid cases. Our principal finding is that there is little or no coherent rationale behind the Commission's decisions. Moreover, they display no consistent tendency to identify cross-border externalities as a precondition for judging a given aid to be distortionary. In the light of our earlier discussion of the inconsistencies in the theoretical literature on the subject, this is perhaps less than surprising.

Decisions of the Commission tend to fall into two main categories:

- Cases of aid to firms in difficulty, which may be private sector firms at risk of bankruptcy, state-owned firms making losses or state-owned firms that the government wishes to privatize.
- Investment aid to ordinary profitable firms, usually under the umbrella of general schemes of aid in sectors or regions.

In practice, most of the difficult issues arise in respect of the first type of case. Their analysis typically involves the Commission in asking three main types of question:

- The 'asymmetry' question: does an alleged aid enable some firm or firms to enjoy cost or other advantages that are not enjoyed by its competitors?
- The 'cross-border' question: does an aid to firms in one member state impose significant costs on the economy of another member state?
- The 'market failure' question: does an aid contribute effectively to solving a real market failure in the member state concerned?

We note that the first question is asked in an ambiguous way, sometimes (rightly) to determine whether a firm enjoys advantages not enjoyed by other comparable firms at the same location, and sometimes to determine whether a firm is advantaged relative to its competitors at other locations. The latter is irrelevant from the point of view of efficiency (there will always be different conditions of competition in different locations, and their presence is what gives rise to gains from economic integration), but it is often a powerful motive inducing competitors to lobby against the advantages enjoyed by the firm in question. It appears above all under the guise of the 'level playing field' slogan, without which both theorists and policy-makers in our view would be much better off.

We note also that the Commission's practice in asking the cross-border question is not at all consistent. Sometimes the presence of a distortion of competition is inferred merely from a large volume of intra-EU trade in the sector in question. Sometimes (correctly) the Commission requires evidence of significant market power in the sector concerned. At other times, a high degree of competition in a given sector is treated as evidence that cross-border effects from state aid are large. We recommend that market power be treated as a necessary condition of the identification of cross-border externalities.

Finally, we note that the Commission does not consistently evaluate the effectiveness of aid in remedying market failures. If aid genuinely damages the economy of other countries (through cross-border effects), then for it to be justified requires not just that there be some market failure in the sector or region concerned, but that the aid be an effective means of alleviating it. However, although the Commission's practice is far from consistent, there have been a significant number of cases where the Commission has acted as a valuable and sceptical external scrutineer of the frequently unrealistic evaluations performed by the member states themselves.

It is difficult to know for certain in which circumstances the adoption of our proposed policy rule would have made a difference to the Commission's practice, since considerations of commercial confidentiality sometimes mean that published information consists of less than was available to the Commission when it took its decision. However, there are certainly cases where aid was refused in the absence of any evidence of a cross-border externality. For example, some have been refused almost entirely on the grounds of the inadequacy of the restructuring plan accompanying the aid proposal (Imepiel – 92/318/EEC; Intelhorce – 92/321/EEC; and Hytasa – 92/317/EEC). Paradoxically, these firms operate in such competitive markets (clothing and footwear, for example)

that, even with no restructuring at all, it is inconceivable that the aid would create anything like the distortion caused by a number of cases of approved aid (such as GAN (C20/97) or Thomson (C62/96)), even under the optimistic assumption that the restructuring plans proposed by the latter were entirely successful. It is harder to be certain that our proposed rule would have refused aid in the latter cases, but there is certainly a strong case for arguing that it would have done so.

Overall, the Commission often casts a sceptical eye over the unrealistic judgements made by member states when deciding how to use public funds for the benefit of firms. Such a scrutiny may be of very great assistance to the member states concerned. The Commission is on weaker ground, however, in identifying the circumstances that constitute genuinely defensible grounds for compulsory state aid control. These ought properly to involve the identification of a clear cross-border externality resulting from the aid in question.

7. CONCLUSIONS

This paper has set out a framework for analysing the case for regulating state aids policy in the European Union. We have suggested that the sources of failure in intergovernmental competition are not a direct consequence of externalities, but form particular failures in the policy process, due to limited commitment, restrictions on bidding and government failure. A policy towards state aids ought to flow directly from these failures rather than from a generalized hostility stemming from the idea that externalities are present. These ideas are significantly at variance with the mainstream of current policy analysis with regard to state aids.

Many of the points that we have raised in relation to state aid to industry have implications for formulating an EU-wide policy towards tax competition. It is inviting to move from the observation that tax competition results in cross-border externalities to a prescription for regulating such competition. However, as in the case of state aids, we would argue that this is hasty until a proper diagnosis of the failures of intergovernmental competition is achieved. Above all, moves to curb tax competition, like those to limit state aid, ignore any possible benefits of tax competition. We would emphasize in the case of tax competition that views taken on the sources and consequences of government failure are likely to be important in assessing the case against competitively determined taxes.[11]

Many issues remain unresolved, and further investigation is necessary in order to assess the robustness of these conclusions. Here we mention briefly one or two such issues. First, more should be known about the process by which firms and governments negotiate over aid. This would involve finding out about how local and national governments plan their efforts to attract economic activity, and the way in which firms plan their negotiating strategies when seeking to extract benefits from governments. This

[11]For some issues, see Kehoe (1989), Edwards and Keen (1996), and Boadway and Keen (1996).

would be valuable in casting light on the extent to which the menu auction model is an adequate representation of the negotiating process, as well as highlighting the various dynamic problems (including failures of commitment) to which the negotiating process may give rise.

Secondly, we need to know more about how to identify empirically the circumstances in which state aids give rise to inefficiency. The work we have described above has shown through stylized examples how and why inefficiencies may arise. But it is one thing to use stylized examples, and quite another to diagnose the real-world circumstances to which these examples correspond.

Thirdly, we need better empirical evidence about the effects of location decisions on the overall efficiency of production. The economic geography literature has argued, and we have assumed, that location decisions matter enough to make a quantitatively important difference to the overall efficiency of production. This assertion needs to be tested more rigorously: under what circumstances does location matter, and how much?

These questions alone (and we could cite others) provide a formidable agenda for future work. But we hope that we have already done enough to indicate that fundamental examination of the rationale for state aid control is both justified and necessary.

Discussion

Katharine Rockett

Institut d'Anàlisi Econòmica, CSIC

The overall approach of this paper and some of its more specific arguments can be quite useful in guiding our thinking about state aid. However, the efficiency properties of the menu auction approach that is used depend on stringent conditions that may only be met incompletely by many examples to which the guidelines are applied. Once these conditions are not met, extreme caution must be used in applying the guidelines. For instance, the efficiency of the menu auction relies on each country's ability to make its bids conditional on all locational choices of all firms – without exception. My own feeling is that the reasonableness or empirical relevance of the bidding of such subsidies is disputable.

Consider now some of the guidelines proposed in the paper. Rule 2 seems to be based on the idea that state aid may create a negative externality for other countries if subsidized firms have market power. Strategic trade theory tells us that, for instance, under Cournot competition, a small subsidy to a firm owned by the citizens of country A will increase the net profit of this firm, will decrease the net profits of every other firm in the industry and will increase consumer surplus everywhere. This means that only countries with an unusual number of firms involved in this industry will actually be worse off. Overall, I do not believe that a fair review of the strategic trade literature supports

the view that state aid in the presence of market power is likely to generate systematically negative externalities for other countries.

The link between market power and discrete locational decisions is less obvious than that between market power and output. Here again, the authors seem to rely on a profit-shifting argument: without market power, there are no rents to shift and hence no negative externality in the bidding game. This is only correct if externalities only result from rent-shifting incentives. In the presence of other types of externality, there is no clear link between market power and the efficiency of location decisions.

This comment underlines a general characteristic of the paper: it oscillates somewhat uncomfortably between a very general analysis using the menu auction benchmark that applies to all types of aid and externality, and more specific arguments that hold only for some types of state aid and/or some types of externality. Since some parts of the proposed algorithm are based on the general analysis and others appear to rely on more specific cases, the applicability of the algorithm as a whole is left somewhat in question.

Rule 4 of the algorithm follows directly from the lack of dynamic efficiency of the 'menu auction' when it is assumed that no credible commitment to future subsidies and investment decisions can be made. This part of the algorithm has a firm foundation.

Rule 5 distinguishes between first-time aid and repeated aid. The justification of this rule basically relies on the lack of dynamic efficiency, but it unduly restricts aid since some market failures (e.g., in the undertaking of a large, risky R & D project) can be alleviated by one-off aid while others (e.g., anything to do with marginal costs) probably require continuing aid. The paper implicitly limits allowed aid to certain types of market failure caused by the presumed inability to commit to future subsidies and investments. One might prefer a more case-by-case treatment of this issue, comparing the benefits of alleviating the types of market failure that require continuing aid against the degree of inability of governments and firms to commit to future actions. Moreover, if continuing aid is illegal, it is hard to see how the government could design an effective incentive scheme for the firm receiving the aid.

Finally, the entire analysis in the paper strictly applies only to cases where all firms are EU-owned and where the only options are locating in one (or several) EU countries or not locating at all. If some of the firms involved are foreign-owned or if some of the possible locations lie outside the EU, we can no longer be sure that, even in the static case, the menu auction will lead to an EU-efficient outcome. I would therefore add another step to the algorithm.

Based on these comments, I propose the following modified algorithm:

1. Are the firms concerned mostly EU-owned? If no, proceed to the next step with extreme caution. If yes, is the set of alternative locations mostly within the EU? If yes, proceed to the next step. If no, proceed with extreme caution.
2. Is the menu auction benchmark a good approximation of the subsidy-setting process in the case at hand? If no, wait for other guidelines. If yes, go to 3.
3. Does the beneficiary have significant market power? If no, aid is legal. If yes, go to 4.

4. Does the conjunction of market power (or any other source of externality) with state aid result in a significant (negative) cross-border externality? If no, aid is legal. If yes, go to 5. The presumption that there is such an externality is increased if aid is specific to a firm rather than generic.
5. Is aid for greenfield investment and without significant dynamic dimensions? If yes, aid is legal. If no, go to 6.
6. Efficiency defence: Is there any significant benefit from aid that outweighs the effect of cross-border externalities? If no, the aid is illegal. If yes, the aid may be considered legal.

Peter Birch Sørensen

Institute of Economics, Kobenhavns Universitet

This paper deals with an important EU policy problem. The analysis is well motivated, the paper offers a concise framework for the analysis of the state aid problem, and it tries to take the subsidiarity principle seriously by defining a stringent set of conditions that must be met before the EU Commission can impose a ban on a member country's aid to industry. However, the paper is also provocative by advocating a very liberal attitude towards state aids to industry. Essentially, the authors argue that all of the following conditions should be met before the EU Commission may proscribe a member state's aid to industry: (1) firms in the industry must have significant market power, (2) state aid must generate a substantial negative cross-border externality, and (3) the proposed state aid cannot be justified by the existence of domestic market failure or by other 'significant benefits' from the subsidised activity.

My main concern is that the authors dismiss the possibility that state aids may be used in a process of harmful fiscal competition as a means of lowering the net fiscal burden on production factors with high international mobility. The standard model of capital income tax competition considers a world with many symmetric countries where capital is supplied with infinitely high elasticity to each individual country whereas the aggregate supply of capital is supplied with finite elasticity to the world economy as a whole. In such a world, unfettered tax competition would lead to the vanishing of source-based taxes on capital, although this would be suboptimal from a global perspective by forcing governments to rely too heavily on other taxes. Thus, all countries would gain if some supranational authority could engineer a co-ordinated switch to a co-operative equilibrium in which capital income taxes were kept at a positive level that traded off the global distortions from capital income taxation against the distortions from other taxes. In short, the problem with unfettered tax competition is that individual countries act as if the supply of capital is infinitely elastic, whereas in the aggregate the supply elasticity is in fact finite. The analogy to the state aid problem is that state aid may be used as a means of selectively reducing the net tax burden on those types of capital that are particularly elastically supplied to individual countries.

Adopting the menu auction approach, the authors describe a framework of fiscal competition in which state aids are used only to internalize externalities from location

decisions. Under certain stringent conditions, unfettered fiscal competition will actually generate a globally efficient outcome in this setting. While interesting, the authors' analysis does not warrant the general conclusion that the harmful effects of fiscal competition stressed in the tax competion literature (and in the literature on strategic trade policy) are completely absent. By focusing entirely on the country-specific location rents generated by firms' location decisions, Besley and Seabright neglect the possibility that there may also be a common location rent from investing in Europe, arising from access to the European single market. This rent might be efficiently taxed, but without some fiscal co-ordination it will accrue disproportionately to (the owners of) mobile firms. Moreover, although the externalities from location decisions may justify state aid in some cases, there are certain industries where location decisions matter little for the efficiency of production and where governments nevertheless engage in fiscal competition with obvious distortionary results. For example, a number of countries and jurisdictions around the world have specialized in acting as tax havens for certain types of financial intermediation and financial services. The EU is currently trying to restrict such tax competition, which clearly makes it more difficult for other countries to enforce taxes on capital income. Yet by the criteria proposed in the present paper, it seems that such tax competition would not be restrained.

The authors claim that a high degree of competition in an industry will guarantee the absence of negative international spillovers from state aid to that industry, implying that the EU should not intervene in such cases. However, suppose an EU member state decides to give state aid to a domestic import-competing industry with an aggregate output level which accounts for a significant share of the competitive world market for that commodity. The subsidy will then generate a fall in the world market price by stimulating domestic supply, thus imposing a terms-of-trade loss on foreign producers. This is just a simple analogy to the well-known optimal tariff argument that a country accounting for a large share of demand in the competitive world market for some good may manipulate the international terms of trade in its favour by levying a tariff. Thus, to rule out the possibility of negative spillovers from state aid to industry, it is not sufficient that the industry in question be competitive; we must also require that the country in question has only a small share of the world market for the output of the industry.

The terms-of-trade effect referred to above is an example of a so-called pecuniary externality: that is, a spillover effect that is transmitted through markets and prices. This is in line with the very broad concept of 'externalities' adopted by the authors. As I read their paper, if the decision of a multinational firm to increase production in country A reduces the output and employment of a competing firm in country B, then B is justified in offering subsidies to the former firm for not raising its production in A. Should we really accept this type of justification for state aid to industry? Of course, in the presence of involuntary unemployment and other market distortions driving wedges between consumer prices and marginal costs, there may be a legitimate second-best case for subsidizing certain activities, but to find the optimal subsidy it would then be necessary to allow for the additional distortions generated by the taxes needed to finance the subsidies. I am concerned that we

may lend legitimacy to all sorts of subsidies by accepting the authors' very broad definition of the costs and benefits from firms' location decisions rather than sticking to the narrower conventional definition of genuine externalities.

Besley and Seabright observe that a government's lack of ability to precommit may force it to pay globally inefficient subsidies to existing plants even after it has already subsidized the same firm's greenfield investment. It seems to me that this observation would justify compulsory EU regulation of aid to existing plants rather than just the purely voluntary co-ordination by member states proposed by the authors.

My final comment relates to the proposed policy rules 4–6 in section 5.2 of the paper. Taken literally, these rules apparently imply that even a small domestic market failure would be sufficient to justify state aid to activities with considerable negative cross-border spillovers. But in an economic and monetary union, should we not require that there be some reasonable relationship between the domestic benefits and the costs to other member states? It seems to me that the EU Commission should be allowed to proscribe state aid when its domestic benefits are very small and its costs to other member states are documented to be substantial.

In summary, Tim Besley and Paul Seabright have done us a service by explaining carefully how state aids to industry may sometimes help to improve the international allocation of resources, and by pointing out several inconsistencies in current EU policy in this area. It may also be that many EU member states will welcome the rather liberal attitude towards state aid advocated by the authors. Nevertheless, in their eagerness to stress some hitherto neglected beneficial effects of state aid, I believe the authors unduly downplay the harmful effects stressed in much of the existing literature.

General discussion

Karl-Gustaf Löfgren argued that state aid to industries comes in so many variants that it will be very hard for a central authority like the EU to monitor. A ban on some sort of subsidy just creates incentives for the member states to find new disguises for their aid to local industries. Therefore, a liberal attitude towards state aid may be the only feasible approach here. Friedrich Breyer also felt that the paper's attitude to state aid was too close to social engineering and not liberal enough. Most of the time, the true reason for state aid to industries is rent seeking accompanied by inefficiencies on the country level. For instance, there may be a unionized labour market that creates unemployment. Workers then try to keep their rents by talking government into giving aid to industries in order to create additional employment. A country that gives way to this pressure and grants state aid will harm itself. Therefore, there is no need for a supranational institution to eliminate state aid to industries on a European level.

Thomas Hoehn pointed out that Article 92 of the Treaty of Rome is enforced as a system of notifications, i.e. as a system of *ex ante* control of state aids. This is different, for

instance, from Article 85 (cartel provision) or Article 86 (monopoly provision), which deal with *ex post* interventions. For a system of notification to work, one needs some simple rules for the bureaucrats in Brussels to enforce. The issue of state aid, however, is very complex and the proposed algorithm adds to this complexity. The proposal, therefore, has to be accompanied by a move to *ex post* control. Then only those few cases where large distortions are to be expected from a subsidy have to be analysed. Raquel Fernandez stressed how informationally demanding the suggested policy really is. It is going to require all governments to calculate the costs and benefits of having that firm locate not only in their own country, but also in every other possible country. The proposal is also politically difficult to implement because governments might be forced to subsidize a firm to locate in another country to avoid the firm locating in a third country. Stefan Szymanski highlighted the political-economy barriers to implementing the proposal. The Tiebout model and the strategic trade model seem to pose very few difficulties for Brussels in a political-economy sense. In a Tiebout model, Brussels is helping the taxpayers by banning state aid. In a strategic trade model, Brussels is helping the governments by banning state aid. But in the economic geography model, the efficiency issue and the distributional issue both arise. Banning state aid makes some regions lose. Therefore, it might not be enough to base the policy proposal on the efficiency criterion; how potential losers can be compensated will have to be considered explicitly.

Lucrezia Reichlin wondered why the issue of beneficial fiscal policy is completely absent in the analysis of state aid. In macroeconomics there is a broad literature about the nature of shocks, i.e. whether shocks are temporary or permanent. If shocks are temporary, then there is scope for Europe-wide fiscal policy as an insurance device. This type of beneficial government activity cannot be neglected when discussing the effects of a state aid policy. Philippe Aghion suggested looking at the dynamic aspects of a state aid policy. The attitude towards state aid may change as countries go through the business cycle. Government intervention in the form of subsidies may not be recommended during booms, but it can be beneficial during slumps. In a boom the state aid may generate negative externalities for other countries, whereas in a slump the policy intervention may create positive externalities. Therefore, national governments may want to intervene at a time that is not optimal from an EU-wide perspective. The role of the EU as a supranational authority, therefore, is to make sure that the state aid in the member countries is monitored and co-ordinated.

APPENDIX. A FORMAL ANALYSIS OF THE MENU AUCTION APPROACH

This appendix spells out the menu auction approach to state aids in a little more detail. It serves as background to section 3 of the paper.

The environment

The economy consists of two countries labelled $i \in \{A, B\}$. There are two time periods labelled $t \in \{1, 2\}$, and two firms, each of which makes an investment decision in each

period that is sunk for the rest of time. Firms are labelled according to the time period in which they make their investment. Each country is controlled by an exogenously given government. Countries/governments are indexed by subscripts; firms and periods by superscripts. In each period, one of the firms decides how much to invest in each of the countries. Government policy is in the form of a vector of subsidies conditional on the firms' investment decisions. The latter is denoted by $q^t = (q^t_A, q^t_B)$ where $q^t_j$is the amount invested in country j in period t. This is assumed to belong to some compact set Q^t. Each firm makes a private profit from investing in a particular country. The profit function of firm t is $\pi^t(q^t)$.

The governments' payoffs are denoted $V_i(q^1, q^2) + x_i$, where x_i is the quantity of some numeraire good that they consume. These payoffs may be quite general in character: they may involve locational externalities, changes in whatever rents to existing firms are internalized within the governments' objective functions – in short, anything the governments care about. We assume that each government has some initial endowment of the numeraire good (its tax revenue) denoted by y_i. Throughout we assume that each government has sufficient resources to cover its willingness to pay for any investment profile relative to its worst profile. This will guarantee that governments will not be resource constrained in the subsidy game.

Equilibrium subsidies

The subsidy schedules are chosen competitively by each government to maximize their payoff, taking the schedule chosen by the other government as given. Country i sets a subsidy for both firms for the period in which they are active in their investment decisions. In principle, one could allow investment subsidies that were unrestricted functions of the entire investment profile (q^1, q^2). Most of the literature tends to restrict these in rather severe ways. Our formulation will permit a government to offer a firm a subsidy that depends upon its total investment strategy, not just that in its own country. This is key to the menu auction perspective on policy and explains why, in principle, it can do a good job in dealing with externalities. Many existing analyses of intergovernmental competition restrict government policies in one of two ways. They frequently assume them to be linear in firms' decisions (as for a per-unit location subsidy) or else they restrict governments to conditioning their policy choices only on firms' decisions in their own country. Neither is very satisfactory as an a priori restriction on policy.

Our main restriction on subsidies is the assumption of limited commitment. While somewhat restrictive, we believe that it is natural for the context that we have in mind. The exact assumption that we make is as follows:

Assumption C. The governments can commit to making subsidies conditional on the investment decisions of the firm with which they are negotiating in the current period.

However, they cannot commit to subsidies conditional on the decisions of the firm in the next period.

We incorporate this assumption into the analysis by writing the subsidy schedule as $(s_i^1(q^1), s_i^2(q^1, q^2))$, $i \in \{A, B\}$. This creates an asymmetry – the period 1 subsidy cannot depend on future investment decisions, although the period 2 subsidy can depend upon period 1 investment given that the past investment is sunk. Subsidy schedules are time-consistent and in equilibrium form a sub-game perfect equilibrium.

Given a subsidy schedule, the investment decision of the two firms will be given by

$$\underset{q^1 \in Q^1}{\text{Max}} \, [\pi^1(q^1) + s_A^1(q^1) + s_B^1(q^1)] \tag{A1}$$

in period 1 and

$$\underset{q^2 \in Q^2}{\text{Max}} \, [\pi^2(q^2) + s_A^1(q^1, q^2) + s_B^1(q^1, q^2)] \tag{A2}$$

in period 2. The payoff to government i is

$$V_i(q^1, q^2) - s_i^1(q^1) - s_i^2(q^1, q^2) + y_i \tag{A3}$$

An equilibrium of the subsidy game is a vector of subsidies $\{(s_i^{1*}(q^1), s_i^{2*}(q^1, q^2))\}_{i \in \{A,B\}}$ and a vector of investment decisions (q^{1^*}, q^{2^*}), such that (i) $s_i^{1*}(q^1)$ is optimal against the other country in period 1 given the investment decisions induced by (A1), (ii) $s_i^{2*}(q^{1^*}, q^2)$ is optimal against the other country in period 2 given the investment decisions induced by (A2) and q^{1^*}, (iii) q^{1^*} solves (A1) given $\{s_i^{1*}(q^1)\}_{i \in \{A,B\}}$, and (iv) q^{2^*} solves (A2) given $\{s_i^{2*}(q^1, q^2)\}_{i \in \{A,B\}}$ and q^{1^*}. We work backwards to determine the equilibrium.

Each period of the subsidy game will have a Nash equilibrium in subsidy schedules associated with it. This kind of menu auction has multiple Nash equilibria and Bernheim and Whinston (1986) proposed a refinement called 'truthfulness' that picks out a unique pair of equilibrium schedules in most contexts, including this one. It has become standard in applications of the menu auction approach to lobbying and we will use it here. It requires that the relative values of subsidies conditional on any pair of outcomes should be equal to the relative values of the outcomes to the bidding governments. Below, we give a formal definition of truthfulness in this model.

In period 2, the governments will take the period 1 location decisions as fixed. Hence, the period 1 investment decision is carried around as a state variable. The form of the subsidies is determined using results from the literature, especially Dixit *et al.* (1997).

We assume that the two governments disagree about the preferred investments. Formally, for $i \in \{A, B\}$, define

$$q_i^2(q^1) = \underset{q^2 \in Q^2}{\text{ArgMax}} \, V_i(q^1, q^2)$$

as the preferred policy choice of government i. Then we assume that $q_A^2(q^1) \neq q_B^2(q^1)$ for all $q^1 \in Q^1$. We will focus on truthful equilibria. A period 2 subsidy schedule for country i is truthful relative to $q^{2'}$, given q^1, if and only if

$$s_i^2(q^1, q^2) = \text{Max}\{0, V_i(q^1, q^2) - [V_i(q^1, q^{2'}) - s_i^2(q^1, q^{2'})]\}$$

A period 2 investment choice and subsidy schedule $\{q^{2*}(q^1), \{s_i^{2*}(q^1, q^2)\}_{i \in \{A,B\}}\}$ form a truthful equilibrium given q^1 if $s_i^{2*}(q^1, q^2)$ is truthful relative to $q^{2*}(q^1)$ for $i \in \{A, B\}$. A straightforward application of Dixit *et al.* (1997) yields

Proposition 1. Let $\{q^{2*}(q^1), \{s_i^{2*}(q^1, q^2)\}_{i \in \{A,B\}}\}$ be a truthful equilibrium of the period two subsidy game, then

$$q_i^{2*}(q^1) = \underset{q^2 \in Q^2}{\text{ArgMax}} \{\pi^2(q^2) + V_A(q^1, q^2) + V_B(q^1, q^2)\}$$

and

$$\{\max_{q^2 \in Q^2} (s_j^{2*}(q^1, q^2) + \pi^2(q^2))\} = \sum_{k \in \{A,B\}} s_k^{2*}(q^1, q^{2*}(q^1)) + \pi^2(q^{2*}(q^1))$$

for $i \neq j, i, j \in \{A, B\}$.

Thus the policy outcome maximizes the joint surplus of the two governments. The optimal subsidy schedule will make the firm indifferent between selecting q^{2*} and deviating either to its private optimum or to the best payoff it can obtain by taking a subsidy only from the other government.

The subsidy reduces to a familiar form in the special case where the investment decision is a discrete choice about which country to invest in and the firm is indifferent as to where it locates. The country with the highest valuation wins and has to pay the valuation of its rival. This is a standard solution for the auction of a discrete object where the winner pays the valuation of the second highest type. This is the solution in King *et al.* (1993) and features in the example developed in the text.

To study the period 1 location decision, we observe that, viewed from the perspective of period 1, the payoffs to governments need to be adjusted to allow for the anticipated subsidies paid out in period 2. Hence for $i, j \in \{A, B\}$, define

$$v_i(q^1) = V_i(q^1, q^{2*}(q^1)) - s_i^{2*}(q^1, q^{2*}(q^1))$$

as the payoff to each government, taking account of the payments that it will make to the firm in the next period. The period 1 equilibrium is now easily characterized in relation to these. First, for $i \in \{A, B\}$, define

$$q_i^1 = \underset{q^1 \in Q^1}{\text{ArgMax}}\, v_i(q^1)$$

as the period 1 investment choice preferred by government i. Again, we assume that the two governments differ in their preferred investment profile, i.e., $q_A^1 \neq q_B^1$.

A period 1 subsidy schedule for country i is truthful relative to $q^{1\prime}$ if and only if

$$s_i^{1*}(q^1) = \text{Max}\{0, v_i(q^1) - [v_i(q^{1\prime}) - s_i^1(q^{1\prime})]\}$$

A period 1 investment profile and subsidy schedule $\{q^{1*}, \{s_i^{1*}(q^1)\}_{i \in \{A,B\}}\}$ form a truthful equilibrium if $s_i^1(q^1)$ is truthful relative to q^{1*} for $i \in \{A, B\}$. Applying the results of Dixit *et al.* (1997) again yields the following characterization of period 1 investment and subsidy schedules.

Proposition 2. Let $\{q^{1^*}, s_i^{1*}(q^1)\}_{i \in \{A,B\}}$ be a truthful equilibrium of the period 1 subsidy game, then

$$q^{1*} = \underset{q^1 \in Q^1}{\text{ArgMax}} \{\pi^1(q^1) + v_A(q^1) + v_B(q^1)\}$$

and

$$\{\underset{q^1 \in Q^1}{\text{Max}} (s_j^{1^*}(q^1) + \pi^1(q^1))\} = \sum_{k \in \{A,B\}} s_k^{1^*}(q^{1^*}) + \pi^1(q^{1^*})$$

for $i \neq j, i, j \in \{A, B\}$

The logic is similar here to that developed for period 1 with one government outbidding the other to have the firm locate. The payoffs are now defined by the modified surplus functions $v_i(.)$ rather than by the true surplus functions $V_i(.)$. This is key to the possibility of inefficiency in the period 1 investment decision. A government now looks forward to the effect that its bidding in period 1 may have on the surplus that it will earn in future bidding decisions.

Efficiency

This section investigates when the subsidy game described above yields a Pareto-efficient investment profile. The notion of investment efficiency is standard. An investment profile $(q^1, q^2) \in Q^1 \cup Q^2$ is efficient if there is no other investment profile $(q^{1\prime}, q^{2\prime}) \in Q^1 \cup Q^2$ such that $V_i(q^{1\prime}, q^{2\prime}) > V_i(q^1, q^2)$ for $i \in \{A, B\}$ and $\pi^t(q^{t'}) > \pi^t(q^t)$ for $t \in \{1, 2\}$. Note that we have defined efficiency to include profits of the firm as well. We now prove that, with time separable preferences, efficiency is guaranteed.

Proposition 3. Let $\{\{(s_i^{1*}(q^1), s_i^{2*}(q^1, q^2))\}_{i \in \{A,B\}}, (q^{1^*}, q^{2^*})\}$ be a truthful equilibrium of the subsidy game. Then if $V_i(q^1, q^2) = \alpha_i(q^1) + \beta_i(q^2)$ for $i \in \{A, B\}$, the investment profile that it generates is efficient.

Proof. With these payoffs, the period 2 investment decision does not depend upon the decision made in period 1. This follows immediately from the condition for equilibrium

investment in Proposition 1. Let q^{2*} denote the equilibrium period 2 investment. We can now write

$$v_i(q^1) = \alpha_i(q^1) + \eta_i(q^{2*})$$

where

$$\eta_i(q) = \beta_i(q) + \pi^2(q) + \beta_j(q) - \{\underset{q^2 \in Q^2}{\text{Max}}(\beta_j(q^2) + \pi^2(q^2))\}$$

Hence, using the equilibrium investment condition of Proposition 2,

$$q_i^{1*} = \underset{q^1 \in Q^1}{\text{ArgMax}}\{\pi^1(q^1) + \alpha_A(q^1) + \alpha_B(q^1)\}$$

This is clearly efficient.

In this case, preferences across investments in different time periods are time separable. The key observation is that the period 1 investment profile has no effect on the bidding strategies in period 2. There may still be externalities between countries at a point in time, but there are no intertemporal links in these. If the intertemporal additivity assumption does not hold, it is possible to generate inefficiencies.

REFERENCES

Banks, J. and R. Sundaram (1996). 'Long-lived principals, short-lived agents', mimeo.

Bernheim, D. and M. Whinston (1986). 'Menu auctions, resource allocation and economic influence', *Quarterly Journal of Economics*.

Besley, T. and S. Coate (1998). 'Sources of inefficiency in a representative democracy: a dynamic analysis', *American Economic Review*.

Besley, T. and P. Seabright (1998). 'Does intergovernmental competition result in efficient investments in the presence of locational externalities?', London School of Economics, mimeo.

Bewley, T. (1981). 'A critique of Tiebout's theory of local public expenditures', *Econometrica*.

Black, D. and W. Hoyt (1989). 'Bidding for firms', *American Economic Review*.

Boadway, R. and M. Keen (1996). 'Efficiency and the optimal direction of federal–state transfers', *International Tax and Public Finance*.

Bond, E. and L. Samuelson (1986). 'Tax holidays as signals', *American Economic Review*.

Brander, J. and B. Spencer (1985). 'Export subsidies and international market share rivalry', *Journal of International Economics*.

Brennan, G. and J. Buchanan (1980). *The Power to Tax: Analytical Foundations of a Fiscal Constitution*, Cambridge University Press.

Dixit, A., G. Grossman and E. Helpman (1997). 'Common agency and coordination: general theory and application to government policy making', *Journal of Political Economy*.

Doyle, C. and S. van Wijnbergen (1994). 'Taxation of foreign multinationals: a sequential bargaining approach to tax holidays', *International Tax and Public Finance*.

Dye, T. (1990). *American Federalism: Competition among Governments*, D.C. Heath, Lexington, MA.

Edwards, J.S. and M.J. Keen (1996). 'Tax competition and Leviathan', *European Economic Review*.

Haaparanta, P. (1996). 'Competition for foreign direct investments', *Journal of Public Economics*.

Jehiel, P., B. Modovanu and E. Stacchetti (1998). 'Multi-dimensional mechanism design for auctions with externalities', mimeo.

Karp, L. and J. Perloff (1990). 'Why industrial policies fail: limited commitment', CEPR Discussion Paper no. 450.

Keen, M. and M. Marchand (1997). 'Fiscal competition and the pattern of public spending', *Journal of Public Economics*.

Kehoe, P.J. (1989). 'Policy cooperation among benevolent governments may be undesirable', *Review of Economic Studies*.
King, I., P. McAfee and L. Welling (1993). 'Industrial blackmail: dynamic tax competition and public investment', *Canadian Journal of Economics*.
Klemperer, P. and M. Meyer (1989). 'Supply function equilibria in oligopoly under uncertainty', *Econometrica*.
Krugman, P. (1991). *Geography and Trade*, MIT Press, Cambridge, MA.
Leahy, D. and P. Neary (1996). 'International R & D rivalry and industrial strategy without government commitment', *Review of International Economics*.
Mederer, W. (1996). 'The future of state aid control', *Competition Policy Newsletter*.
Netzer, R. (1991). 'An evaluation of interjurisdictional competition through economic development incentives', in D. Kenyon and J. Kincaid (eds.), *Competition among States and Local Governments*, The Urban Institute, Washington, DC.
Neven, D. and P. Seabright (1995). 'European industrial policy: the Airbus case', *Economic Policy*.
Neven, D., R. Nuttall and P. Seabright (1993). *Merger in Daylight*, CEPR, London.
Oates, W. (1972). *Fiscal Federalism*, Harcourt, Brace, New York.
Oates, W. and R. Schwab (1991). 'The allocative and distributive implications of local fiscal competition', in D. Kenyon and J. Kincaid (eds.), *Competition among States and Local Governments*, The Urban Institute, Washington, DC.
Pestieau, P. (1977). 'The optimality limits of the Tiebout model', in W. Oates (ed.), *The Political Economy of Fiscal Federalism*, Lexington Books, Lexington, MA.
Tiebout, W. (1956). 'A pure theory of local expenditures', *Journal of Political Economy*.