

Annexe C – The effects of public subsidies on competition

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A report prepared for the Office of Fair Trading by Frontier Economics

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EXECUTIVE SUMMARY

The Office of Fair Trading (OFT) has asked Frontier Economics to undertake research into the possible negative effects on competition of public subsidies. Specifically, Frontier Economics has been asked to develop an economic analysis of when and how public subsidies might restrict or distort competition. Our approach has been to develop a practical framework for analysing competition effects that is based on, and supported by, the existing academic literature. The focus of our work has been on subsidies to firms rather than consumers.

Identifying subsidies of interest

There is no generally accepted working definition of what constitutes a public subsidy. From a theoretical perspective, a public subsidy exists whenever the prices paid by firms for their inputs are lower than they would have been in the absence of government intervention, or the revenues received are higher.

For the purposes of this study, this definition is not particularly helpful, as it captures a range of government activities that, while they may technically be subsidies, are unlikely to raise a competition concern. We therefore identify, as a first practical step, two broad categories of subsidy that may give rise to competition concerns.

- **Direct subsidies**, which are direct transfers of government funds assisting a firm or set of firms (for example a grant).
- **Indirect subsidies**, which are forms of government intervention that indirectly assist firms. This category would include:
 - certain types of government provision of public goods and services that are provided on a selective basis (for example, the building of an access road to an industrial estate);
 - government procurement practices whereby the government purchases goods and services at a rate significantly higher than that which a third party purchaser would pay in the open market; and
 - differential application of government regulation (for example, changing the tax treatment of certain entities).

The greater the extent to which a government activity is specifically targeted at a firm or group of firms, the stronger the argument for deeming it a subsidy of interest for this study.

Subsidies affect firm behaviour

We would expect subsidies to affect the recipient's behaviour if they are to be effective. Subsidies can affect at least one of three types of firm decisions:

- **Entry and exit decisions** can be affected:
 - directly – if the recipient's **avoidable costs** (**fixed** or **variable**) are affected, then the firm may enter a market or remain in a market in which it would otherwise have experienced difficulties; and/or
 - indirectly – if the pricing and output of the recipient and competitors is affected, potential competitors may not enter and one or more competitors might be unable to compete in the long term and so be forced to exit.
- **Pricing and output decisions** can be affected:
 - directly – if a subsidy affects the **variable costs** of a firm, it can be expected to affect the pricing and output decisions of the firm. This is also likely to result in the pricing and output decisions of rivals being affected; and/or
 - indirectly – if a subsidy affects the entry or exit decisions of firms, this can have an indirect effect on the pricing and output decisions of the firms remaining in the market.
- **Research and development (R&D) investment decisions** can be affected in two ways:
 - the quantity of investment – lowering the cost of R&D investment will increase the level of investment undertaken; and/or
 - the type of investment made – if subsidies are available for certain types of R&D (say product R&D), but not for others (say process R&D), this can affect the type of investment firms engage in.

In order to establish the type of firm behaviour likely to be affected by a subsidy, it is necessary to understand the type of costs that are altered by the subsidy. Competition is characterised by a process of rivalry in which firms use factors such as price, service or quality of product to attract customers away from their rivals. Changes to different types of firm behaviour will have different implications for both the competitive process and competitive outcomes.

Allocative, productive and dynamic inefficiencies could all arise as a consequence of market distortions caused by a subsidy. It is important, therefore, to understand which types of subsidy are most likely to affect competition.

Identifying when subsidies are likely to give rise to competition concerns

Not all subsidies are going to have a significant effect on competition, and so we provide a framework for identifying those subsidies that are most likely to do so. We begin by considering a number of questions with a view to screening out subsidies that are unlikely to have a material effect on competition, so that these are excluded from further analysis.

- What aspect of firm behaviour is affected?
- Does the subsidy have a differential impact on competitors in a market because it is selective in availability or asymmetric in effect?
- How concentrated is the market affected by the subsidy?

FIRM BEHAVIOUR

Subsidies that do not materially affect the behaviour of firms or their rivals will not give rise to competition concerns. Subsidies that are very small relative to the targeted activity will typically fall into this category. Subsidies that are not targeted at any particular firm activity or cost (for example a direct cash transfer not tied to any form of firm behaviour) will not typically be expected to affect economic decision-making behaviour. However, even then there are situations in which capital market imperfections can lead to firm behaviour (in particular entry and exit or investment decisions) being affected.

SELECTIVITY AND ASYMMETRY

Subsidies can give rise to a competition concern if they lead one or more firms to have a competitive advantage over other firms in the same or related market. Subsidies are most likely to have this effect if they favour one firm over another because they are designed or distributed in such a way that they have a differential impact on firms. A subsidy may have such an impact if it is:

- *Selective in eligibility criteria*: A subsidy is selective in eligibility if it is not available to all competing firms. This could arise because a subsidy is made available only to one firm or subset of firms within a market (for example, a subsidy made available only to firms below a given turnover, or using a particular technology). It could also arise where a subsidy is made available to all firms in a market but the amount of subsidy given to each varies.
- *Asymmetric in effect*: The impact the subsidy has in a market may be asymmetric. For example, a subsidy that is available to any firm locating in a particular area may be asymmetric in effect if some competing firms have already made their location decisions.

In order to identify whether a subsidy meets either of these two criteria, it is necessary to identify the economic market in which the recipient operates, as selectivity should be judged by reference to this market.

Subsidies may also have an effect on competition in a related market if the subsidised product is an input to another product, or if consumers buy the subsidised product alongside another product. Effects in related markets can arise even if there is no competition distortion in the subsidised product's market. In practice, however, the issue of whether competition in a related market is affected should be considered only in relation to larger subsidies.

MARKET POWER AND COMPETITION CONCERNS

The structure of the market, and in particular the extent to which firms have market power (the ability profitably to raise price above cost), is important for understanding whether a competition concern is likely. It is important to consider:

- market power before the introduction of the subsidy; and
- market power after the introduction of the subsidy.

In terms of pre-subsidy market power:

- if the market is strongly competitive (large number of firms and price close to cost), a relatively small subsidy is unlikely to lead to competition concerns. Competition will be unaffected as long as the subsidy is not so large that it prevents rival firms from competing with the subsidised firm; and
- if the market is monopolised (only one firm, and no potential competitors), the subsidy is unlikely to give rise to a competition concern. This is because there is no real competition for the subsidy to affect.

Subsidies can also create market power. For example, even in a largely competitive market, a significant subsidy to a single firm could alter the structure of the market (by driving out rival firms who are no longer able to compete effectively with the subsidised firm) leading to the creation of market power. When considering whether a competition concern is likely, it is important therefore to consider market power after the introduction of a subsidy as well as pre-subsidy market power.

Identifying whether the competition concern is likely to be material

Where a subsidy *is* likely to have an impact on competition, it is important to understand whether that impact is likely to be material. There is a range of relevant factors that relate either to the design of the subsidy or to the characteristics of the market that the subsidy is operating in.

- **The subsidy.** The way in which the subsidy is designed and operated can help determine whether the subsidy will have a material effect on competition. In particular:
 - the magnitude; and
 - the structure of subsidy payments.
- **The market.** The following market characteristics help determine whether the effect of the subsidy will be material:
 - market concentration;
 - product differentiation (how similar or different are the characteristics of the products supplied by competing firms);
 - the degree of asymmetry of firm size;
 - the importance of R&D competition in the market; and
 - the extent of barriers to entry and exit.

MAGNITUDE

The larger the subsidy in absolute terms, the larger will be the anticipated effect on firm behaviour and consequently on competition. When considering magnitude, however, it is also important to consider the *relative* magnitude of the subsidy. By this we mean the size of the subsidy in relation to the costs of the subsidised activity. For example, a marginal cost subsidy of £100k to a firm with marginal costs of £2 million is likely to have a different scale of impact on that firm's pricing and output behaviour relative to an equivalent subsidy of £100k to a firm with marginal costs of £500k.

STRUCTURE OF SUBSIDY PAYMENTS

This relates to whether a given amount of subsidy is paid in one period or spread over a number of periods. The structure of subsidy payments is particularly relevant to entry and exit decisions of firms. In particular:

- an upfront lump sum payment will increase the likelihood of entry; and
- a subsidy spread over a number of periods will increase the likelihood of keeping the recipient in the market.

These outcomes may be the objective of the subsidy but, if this is not the case, the structure of payments may lead to greater competition impacts.

MARKET CONCENTRATION AND PRODUCT DIFFERENTIATION

At the extremes of market structure (perfect competition and monopoly), subsidies are only likely to give rise to competition concerns if the relative magnitude of the subsidy is sufficiently large. For the array of market structures in between these two extremes, understanding where subsidies are most likely to give rise to competition concerns is less clear-cut. We first identify the circumstances in which a subsidy will have a large effect on *current* competition (measured in terms of the effect on rivals' pricing and profitability), and then the circumstances in which a subsidy will give rise to concerns regarding the structure of the market and the *future* health of competition. In so doing, we need to distinguish between subsidies that affect the pricing decisions of firms from those which affect the entry decisions of firms, as the two are analytically distinct.

Subsidies affecting pricing decisions

Subsidies that affect the pricing decisions of the recipient are most likely to give rise to competition concerns where the number of firms is small. This will be the case irrespective of whether product differentiation is strong or weak:

- where there is a small number of firms competing strongly (product differentiation is weak), effects on pricing are likely to be largest. The intensity of competition means that changes in pricing and profitability are more likely to result in exit, and the exit of a firm is more likely to lead to the loss of a significant contributor to the competitive process; and
- where there is a small number of firms, but competition is weak (product differentiation is strong), effects on pricing are likely to be smaller. Also, profitability is likely to be higher and hence exit is less likely. However, if exit were to occur, it would be a significant concern, given the small number of firms operating in the market and the relative weakness of competition.

Subsidies affecting entry decisions

A subsidy that results in an additional firm entering the market will be most likely to give rise to large effects (either price effects or exit) where the market is concentrated and product differentiation is moderate, (i.e. firms compete but not intensely). Entry in this case is likely to lead to large effects on existing firms' pricing, which potentially will result in the exit of one or more existing firms.

ASYMMETRIC FIRM SIZE

The discussion above was based on firms being broadly the same size and there being an equal degree of substitution across the products of the firms. This is not always the case. Markets may be characterised, for example, by a large firm facing a fringe of smaller competitors. The large firm will typically have achieved its position through some form of competitive advantage (for example, it may have a superior product or lower cost base) and/or incumbency advantage.

Subsidising the large firm will increase its competitive advantage, potentially further reducing competition in the market. The competition effect of subsidising a smaller or fringe firm is more ambiguous:

- if the subsidy allows the fringe to compete more effectively with the large firm, then competition in the market may be increased;
- however, if the subsidy primarily increases the intensity of competition between the existing fringe firms, it may have a negative effect on competition if it leads to the exit of existing fringe firms.

THE IMPORTANCE OF R&D COMPETITION

In markets where R&D activity forms a key element of non-price competition, R&D subsidies can have direct effects on firm behaviour and competition. Specifically, subsidies can affect R&D competition directly by changing:

- the quantity of investment; or
- the focus of investment (the type of investment made).

Subsidies can also affect the R&D decision indirectly by changing the future incentives to innovate. However, there is no general rule as to whether subsidies will increase or reduce the future incentives to innovate. This will depend on a range of factors including the intensity of product market competition, whether previous innovations have led to a 'technology gap' between firms, and if so whether the subsidy is received by the superior technology firm or its rival.

When R&D subsidies lead to cost reducing process innovations, their effects on competition will be the same as subsidies aimed directly at cost reduction.

BARRIERS TO ENTRY AND EXIT

Entry and exit barriers may be broadly defined as any feature of a market that gives incumbent firms an advantage over potential entrants, such that incumbents can persistently raise their prices above competitive levels without new firms entering the market. When considering the competition effects of subsidies, barriers to entry and exit are important in determining the magnitude and duration of the effects.

Typically, the higher are barriers to entry in an industry, the higher barriers to exit tend to be. Higher barriers to exit mean that firms facing a subsidized rival will be less likely to leave the market in the face of short run losses. Consequently, the competition effects of the subsidy may be reduced. However, if exit does occur, the competitive effects could be longer lived if the high barriers to entry make it difficult for firms to enter and return competition to its pre-subsidy level, once the subsidy ceases.

SUMMARY

The table below summarises the key factors that will affect the size of the competition effect arising from a subsidy.

TABLE 1: SUMMARY OF FACTORS AFFECTING SIZE OF COMPETITION EFFECT

<i>Factor</i>	<i>Competition effect</i>
Magnitude	The larger the subsidy (in absolute or relative terms) the greater the likely competition effect.
Structure of subsidy payments	The timing of subsidy payments matters. For pricing the effects are ambiguous. For subsidies that assist entry, a lump sum payment may be more likely to give rise to competition effects, whereas for subsidies that prevent exit, spreading payments may be more likely to give rise to competition effects.
Concentration and product differentiation (symmetric firms)	The implications of concentration and product differentiation depend on whether the subsidy affects pricing or entry and exit. For pricing, competition effects are likely to be greatest where the number of firms is small. For entry, competition effects are greatest where there are a small number of firms and product differentiation is moderate.
Asymmetric firms	Subsidising a large firm may increase its advantage and reduce competition. The effects of subsidising smaller firms depends on whether it allows them to compete more effectively with the large firm – if so, competition may be increased. If not, competition may be reduced if the subsidy leads to the exit of rival fringe firms.
R&D competition	R&D subsidies are important in markets where innovation is key to the competitive process. R&D subsidies can affect competition directly, by changing the amount and type of R&D undertaken. They can also affect competition indirectly, by changing future incentives to innovate.
Barriers to entry	Barriers to entry and exit are important in determining the magnitude and duration of the competition effect. High exit barriers can reduce the magnitude of effect. However, where exit does occur, high entry barriers can lengthen the competition effects of subsidies.

Recommendations

Our recommendations relate to:

- A screen to rule out subsidies unlikely to affect competition.
- Methods of subsidy design aimed at reducing harmful competition effects.
- The appropriate counterfactual.

SCREENING SUBSIDIES THAT ARE UNLIKELY TO CAUSE AN EFFECT

Analysis of the competition effects of subsidy is likely to be time consuming and resource intensive. It may be possible to use relatively simple screening measures, based on magnitude and/or market concentration, to rule out subsidies that are unlikely to give rise to competition concerns.

Magnitude

A screen based on subsidy magnitude could be used to rule out some subsidies. From a practical perspective, it is sensible to exclude very small subsidies, as these are unlikely to have substantial effects on behaviour. Moreover, it may not be necessary to use a sophisticated measure of the size of a subsidy as a screen, and absolute size could perhaps be used.

Market concentration

One may be most concerned about competition effects arising in markets that are already concentrated. A second screen based on the degree of concentration in the market pre-subsidy could therefore be used. The Herfindahl-Hirschman Index (HHI) could be used to screen out subsidies in markets where the HHI is below a certain level. Given that subsidy magnitude can affect the likelihood of a competition concern arising, the level of concentration at which a subsidy is deemed unproblematic could be linked to the magnitude of the subsidy, with the concentration threshold being reduced where the subsidy in question is large.

MINIMISING COMPETITION EFFECTS THROUGH SUBSIDY DESIGN

We have identified features in relation to subsidy design and the markets in which subsidies operate that could help lessen potential competition effects.

Subsidy design

- *Magnitude*: Subsidy value should be the minimum needed to achieve the subsidy's objective.
- *Selectivity and asymmetry*: Selective or asymmetric subsidies are most likely to give rise to competition concerns. Subsidy design should aim to set the selection criteria as wide as possible.
- *Competitive process for award of subsidy*: Where the objectives of the subsidy require selectivity in the award criteria (e.g. subsidies to SMEs), or where funding restraints require choosing between candidate firms, it will be important to ensure the correct allocation mechanism is used. In many cases, this will involve a judgement about whether a competitive or an administrative process will achieve the best outcome. While there is no allocation mechanism that is universally more

efficient, competitive processes can, in many circumstances, ensure that the subsidy is allocated efficiently.

- *Structure of payments*: The way in which subsidy payments are structured can matter and should be considered on a case-by-case basis.

Market characteristics

- *Concentrated markets*: Greatest concerns about competition effects arise in markets that are already concentrated. One should be particularly careful about subsidy award and design in relation to concentrated markets.
- *Large firms*: Care also needs to be taken when providing subsidies to large firms facing smaller rivals.
- *R&D subsidies*: R&D subsidies can increase the amount of R&D undertaken in the short run. However, it is possible that in the longer term subsidies may reduce the incentives of both the subsidised firm and rival firms to invest in R&D. Attention should therefore be given to the current intensity of product market competition and the degree of technological symmetry between competitors.

THE APPROPRIATE COUNTERFACTUAL

Any assessment of the costs of a subsidy must be carried out with reference to an appropriate counterfactual. In practice, two different counterfactuals might apply, depending on the question one is trying to answer.

The first question one might wish to consider is whether there is a less distortionary subsidy that could achieve the same objectives as the subsidy under consideration. In this case, the appropriate counterfactual is found by identifying the objective of the subsidy and determining whether this objective could be achieved by other means.

The second question one might wish to consider is whether the distortionary effects of the subsidy outweigh the potential beneficial effects. In this case, the relevant counterfactual is the outcome achieved in the absence of the subsidy.

1 INTRODUCTION

1.1 Background

Subsidies remain an important policy instrument in the UK and have typically been justified on the grounds that they can be used to correct market failures. While it is true that subsidies can, in the right circumstances, correct market failures, there are usually alternative policy instruments, or at least alternative subsidy designs, so it is also important to weigh the benefits of a subsidy against its costs to ensure that the best intervention is chosen. The government is committed to ensuring that public funds are spent on activities that provide the greatest benefits to society, and that they are spent in the most efficient way.

In nearly all assessments of policies carried out by the government, the costs of the intervention are estimated as the 'opportunity cost' of the public funds that are committed to the problem i.e. the value of those funds invested in their next best alternative. However, estimating the opportunity cost of public funds is not necessarily the whole story. Cost-benefit appraisals will be incorrect if other factors that reduce economic welfare are omitted. For example, it is possible for a subsidy to have unintended effects on markets and such effects may vary either as a consequence of the subsidy design and/or market type. One such consequence could be inefficiencies arising from a restriction or distortion of competition. It is this issue which is addressed by this study.

The concern that government subsidies might restrict or distort competition and thereby harm efficiency and overall welfare is recognised by the OECD in its report "*Competition Policy in Subsidies and State Aid*".¹ More generally, the importance of preserving and encouraging competition is highlighted by the DTI and the OFT in their respective mission statements. The DTI's Competition and Consumer Policy Directorate describes its mission as being: "*to deliver a competitive framework for the growth of successful businesses and a fair deal for consumers.*" The OFT describes its goal as being: "*to make markets work well for consumers. Markets work well when fair-dealing businesses are in open and vigorous competition with each other for custom.*"

1.2 Objectives and scope

The OFT has asked Frontier Economics to undertake research into the possible competition effects of government subsidies. Specifically, Frontier Economics has been asked to develop an economic analysis of when and how public subsidies might affect competition in a detrimental manner.

¹ DAFNE/CLP(2001)24, 12th November 2001.

The focus of our analysis is on subsidies to firms rather than to consumers. Almost all government expenditure could be regarded as a subsidy to consumers (for example, the provision of public services such as street lighting or sickness and unemployment benefit). Given that it is clearly beyond the scope of this study to consider the competition effects of government expenditure as a whole, we limit our attention to only those subsidies provided to firms.

In developing this report we have sought to achieve the following objectives set by the OFT:

- provide a clear understanding of the circumstances in which subsidies can give rise to adverse impacts on competition and the nature of those impacts; and
- develop a report that is accessible to non-economists, and in particular, policy makers across government.

Our approach has been to develop a practical framework for analysing competition effects that is based on, and supported by, the existing academic literature. There is a considerable volume of academic literature focusing on the analysis of subsidies. However, the competition effects that subsidies can give rise to is the subject of only a few of these.² The most recent of these is the work by Garcia and Neven (2004), which was commissioned by HM Treasury. The remit of that work – which focussed particularly on the identification of when and in what circumstances the magnitude of distortions created by State Aids is likely to be greatest – is narrower than the current study.

The implication for this study is that it is necessary to look beyond the narrow subsidies literature. Specifically, the competition effects of subsidies can be informed by a wide range of literature across a number of fields, including classical microeconomics, industrial organisation, corporate finance and tax theory. The focus of our literature review has therefore been on evaluating the relevance of a wide range of papers, and synthesising and adapting these to develop an analysis of the competition effects of subsidies.

We are grateful to Professor Tim Besley, Professor Carl Christian von Weizsäcker and Professor Stefan Szymanski for their valuable assistance.

² The papers that are of most direct relevance to our analysis of the competition effects of subsidies are those by Garcia, J-A. and Neven, D. *Identification of sensitive sectors in which State aids may have distorting effects*, Final Report to HM Treasury, April 2004, and Harbord, D. and Yarrow, G. State aids, restructuring and privatisation, Chapter 5 in *European Economy*, European Commission, Directorate General for Economic and Financial Affairs, Number 3, 1999

1.3 Structure of the report

This report is structured as follows:

- Chapter 2 provides a discussion of our approach to identifying subsidies of interest to this study. We consider the range of government interventions which, for the purposes of this study, are classified as subsidies and have the potential to give rise to competition concerns.
- Chapter 3 outlines the ways in which subsidies can affect firm behaviour before discussing the different competition concerns that can arise from the granting of a subsidy. We distinguish between the allocative, productive and dynamic inefficiencies which subsidies can cause.
- Chapter 4 provides an analytical framework for assessing whether a subsidy is likely to give rise to a competition concern, setting out the factors we consider when analysing whether an adverse competition effect is likely to arise.
- Chapter 5 sets out the analytical framework for determining the size of the competition impact.
- Chapter 6 sets out some recommendations for ways to minimise the adverse competition effects of subsidies, based on the analysis in chapters 4 and 5.
- Annexe 1 provides a detailed discussion of the impact of subsidies on investment in R&D.
- Annexe 2 discusses firm decision making in the light of capital market imperfections.

2 IDENTIFYING SUBSIDIES OF INTEREST TO THE STUDY

Summary

There is no generally accepted working definition of what constitutes a public subsidy. From a theoretical perspective, a public subsidy exists whenever the prices paid by firms for their inputs are lower than they would have been in the absence of government intervention, or the revenues received are higher.

For the purposes of this study, this definition is not particularly helpful, as it captures a range of government activities that, while they may technically be subsidies, are unlikely to raise a competition concern. We therefore identify, as a first practical step, two broad categories of subsidy that may give rise to competition concerns.

- **Direct subsidies**, which are direct transfers of government funds assisting a firm or set of firms (for example a grant or low interest loan to a company).
- **Indirect subsidies**, which are forms of government intervention that indirectly assist firms. This category would include:
 - certain types of government provision of public goods and services that are provided on a selective basis (for example, the building of an access road to an industrial estate);
 - government procurement practices whereby the government purchases goods and services at a rate significantly higher than that which a third party purchaser would pay in the open market; and
 - differential application of government regulation (for example changing the tax treatment of certain entities).

The greater the extent to which a good or service is specifically targeted at a firm or group of firms, the stronger the argument for deeming it a subsidy of interest for this study.

2.1 Introduction

The objective of this study is to provide an understanding of the competition effects that can arise from public subsidies. The first step in achieving this is to identify the set of subsidies that might give rise to competition concerns. From a theoretical perspective, there is a wide range of government activities that may be considered to be subsidies. However only a subset of these are likely to have the potential to give rise to a competition concern.

In this chapter therefore we set out our approach to defining subsidies of interest for the purposes of this study. First, however, in order to provide context for the analysis, we set out the economic rationale for subsidies, and the framework for assessing whether intervention in the form of a subsidy is likely to be welfare enhancing.

2.2 The rationale for subsidies

Subsidies are one of a number of instruments government has at its disposal to achieve its objective of making society better off. Typically, a subsidy will be used either to correct for a market failure (for example to provide a public good or correct for an externality) or to redistribute resources in order to improve welfare.

If subsidies are to improve welfare, however, they should only be deployed where their net benefit is positive. The Treasury provides guidance to government departments and agencies on how interventions should be appraised, before public funds are committed. Indeed, any proposals for a new subsidy or continuation of an existing subsidy must be assessed in the context of a clear explanation of the market failure that is being addressed and an appraisal showing how the benefits from the intervention outweigh the costs. In this context, there is a range of important issues that surround the benefits of a public subsidy, for example:

- what types of market failures are subsidies best able to correct, particularly as a subsidy is only one of a potential set of policy actions?
- what types of subsidy would yield the greatest benefits?
- what evidence is available that a subsidy is impacting as expected?

Firms are only the intermediate step (or transmission mechanism) by which government intervenes to improve outcomes for society. The provision of a subsidy to a firm is not therefore intended directly to benefit the firm itself, but rather to encourage the firm to change its behaviour (say, by producing more or less of a good, or changing the way it produces the good) in a way that will result in an increase in overall consumer welfare. For example, in the absence of state intervention, firms may not be able to appropriate fully the return on their investment, as may be the case with R&D, and consequently may under-invest. In this case, by subsidising R&D, the government can incentivise firms to increase the level of R&D they undertake, resulting in an increase in welfare for consumers who benefit from the fruits of that activity.

Clearly, the benefits have to be weighed against the costs of the subsidy. An understanding of the above issues allows the policy maker to develop an assessment of the benefits that can arise from a subsidy. The benefits can then be compared with the potential costs. In nearly all assessments, the costs are

estimated as the opportunity cost of the public funds that are committed to the problem.

However, as noted earlier, estimating the opportunity costs of public funds is clearly not the whole story on the costs side. Cost-benefit appraisals will be incorrect if other factors which reduce economic welfare are omitted. For example, it is possible for a subsidy to have unintended consequences on the markets in which the subsidised firms operate (and in related markets) and such consequences may vary either as a consequence of the subsidy design and/or market type. One such consequence could be inefficiencies arising from a restriction or distortion of competition.

2.3 Identifying subsidies that may be of interest

From a purely theoretical perspective, a subsidy can be identified by comparing the full set of input prices faced by a given firm with the set of input prices the same firm would face in the absence of government intervention. Similarly, a subsidy is present when the revenues received by firms are higher than they would have been in the absence of government intervention.

However, from the perspective of this study, there are a number of practical difficulties associated with applying this definition. For example, the majority of employees of a firm will have received free education and healthcare. It would be difficult to identify the prices which the firm would have to pay for labour in the absence of government intervention, and the impact on competition between firms will be unlikely to be material in most instances.

For the purposes of competition analysis, the Market Economy Investor Principle³ (MEIP) is often taken as a starting point for discussing what constitutes a subsidy.⁴ Whilst this definition encompasses forms of subsidy which are granted to specific firms, it excludes those (such as changes to the general taxation regime) which are not aimed at a defined recipient or class of recipient. However, there may be a

³ This defines a subsidy as “any public funds provided to public or private undertakings on terms that are more favourable than a private investor would have provided in a competitive environment.” OFT (2004), ‘*Statement of Requirement for an Academic Study into the Effects of Public Subsidies on Competition*’

⁴ The OECD (“*Competition Policy in Subsidies and State Aid*”, DAFFE/CLP(2001)24, 12th November 2001) notes that there is no commonly accepted definition of a subsidy and that “subsidy definitions differ in the scope of policies which they consider and the definition of what it means for a firm to be favoured.” The paper comments that the range of definitions have the following elements in common: (a) a government policy which (b) affects competition in a market by favouring certain firms or sectors, and which (c) thereby reduces overall welfare. The paper focuses on three possible definitions of a subsidy. The first covers all policies which favour certain firms at the expense of others in an industry. The second considers those subsidies which discriminate between firms in the same country. The third definition focuses on differences in prices relative to benchmark prices to detect whether the firm is favoured (this approach is used by the OECD Agriculture Directorate in the agriculture sector).

range of government interventions that fall outside the MEIP definition, but reduce the input costs faced by firms, and may therefore have the same economic effect as subsidies falling within the MEIP definition.⁵

As a practical first step, we identify two broad categories of subsidies that may give rise to competition concerns: direct assistance to firms (e.g. grants, tax credits) and indirect assistance to firms (e.g. provision of infrastructure).⁶ We discuss each of these concepts in turn below.

DIRECT SUBSIDIES TO FIRMS

Direct subsidies can be defined as direct transfers and uses of government resources which assist a specific firm or set of firms. In practice, there is a number of ways in which they can be allocated, and some of the main mechanisms employed by the government are outlined below:

- grants (such as those offered to firms in return for setting up in Assisted Areas);
- soft loans (such as those made available through Regional Venture Capital Funds). Typically, soft loans have extended grace periods in which only interest or service charges are due, and not repayment of the principal amount. In addition, they may offer longer amortization schedules and lower interest rates than conventional bank loans;
- guarantees (including government guarantees of private sector loans). A long running example of this type of scheme is the Small Firms Loan Guarantee Scheme;
- tax exemptions (such as the exemption from corporation tax granted to charities);
- tax credits (where firms receive a corporation tax allowance for certain items of expenditure). For example, the R&D tax credit, introduced for SMEs in 2000 and for other businesses in 2002; and

⁵ We note in this context that the European Courts have been prepared to find that a transfer amounts to state aid in circumstances which may not be caught by the MEIP framework.

⁶ We note that our analysis includes the effects of cross-subsidy from public activities, which arises when a body receiving money for a statutory function uses some of this money, or the assets purchased with it, to support its commercial activities. The definition of subsidy includes input prices being below what they would have been in the absence of government intervention and/or revenues being in excess of what they would have been in the absence of intervention. This definition includes any cross-subsidies arising from government regulation because the definition focuses on whether revenues or costs change as a result of intervention, rather than the means by which such a change might be funded.

- business support services (such as Business Links, a Small Business Service initiative aimed at providing business advisory services to small and medium size firms).

There are two key points to note about this definition. First, when applying this definition to determine whether a government transfer should be classified as a subsidy, it is appropriate to apply the MEIP framework. For example, a government loan to a firm at the same rate that a private investor would offer is not a subsidy, whereas a loan made on more favourable terms than those which a private investor would have offered would constitute a subsidy. Second, direct subsidies are not limited to direct financial transfers but may also take a variety of other forms including, for example, business advice and support services such as specific training.

INDIRECT SUBSIDIES TO FIRMS

Governments can also intervene in ways that indirectly provide assistance to firms. These interventions can be similar in their effects to direct subsidies, and can also have the potential adversely to effect competition. The following broad categories of activity are relevant:

- *Government provision of public goods and services to firms:* One of the roles of government is the provision of public goods and services which would not otherwise be provided. If firms benefit from these goods and services, but do not pay the full market price for them, then from a theoretical perspective, this should properly be regarded as a subsidy. In practice, however, it is clear that even if the provision of a large proportion of public goods could be classified as subsidies, many of these are unlikely to give rise to competition concerns. We suggest that the greater the extent to which a good or service is specifically targeted at a firm or group of firms, the stronger the argument for considering it a subsidy that may be of interest to this study.
- *Government procurement:* Certain forms of government procurement can be regarded as a subsidy. In particular, if the government were to pay considerably more for the goods and services it procures than a third party purchaser buying on the open market, then this can be considered to be a form of subsidy. We note that, given EU procurement rules, the government cannot explicitly favour specific suppliers over others. Hence, subsidies arising as a result of government procurement practices should only arise in cases where the government purchases inefficiently (e.g. as the result of a poorly organised tender process).⁷

⁷ The OFT research paper by DotEcon "*Assessing the impact of public sector procurement on competition*", September 2004, discusses the competition effects of government procurement in detail. We do not therefore explicitly consider this issue further in this study.

- *Government regulation*: In certain circumstances, the differential application of government regulation might be considered to be a subsidy. For example, if the planning regime were relaxed in some areas to allow development, but not in others, this could confer an advantage on some firms and hence might be regarded as a form of subsidy. Similarly, it could be argued that subsidies exist where the government changes a particular regime such as the tax treatment of certain entities in a manner that impacts on firms unevenly. An example of this might be the decision to grant an exemption from corporation tax to charities.

In summary, the greater the extent to which government activity is specifically targeted at a firm or group of firms, the stronger the argument for deeming it a subsidy of interest for this study.

3 COMPETITION CONCERNS RAISED BY SUBSIDIES

Summary

We would expect subsidies to affect firm behaviour if they are to be effective. Changes in the behaviour of recipient firms can lead to changes in the behaviour of competitors. Subsidies can affect at least one of three types of firm decisions:

- **Entry and exit decisions** – Subsidies can impact on exit and entry decisions if they affect avoidable costs (fixed or variable costs) of firms and/or market prices.
- **Pricing and output decisions** – Subsidies can affect pricing and output decisions directly and indirectly.
- **R&D investment decisions** – Subsidies can affect R&D decisions by changing the quantity and type of R&D investments undertaken by firms.

Allocative, productive and dynamic inefficiencies could all arise as a consequence of distortions caused by a subsidy:

- **Allocative inefficiency** is caused by the price that a buyer pays for a product being different from the marginal cost of producing that product. Subsidies can give rise to allocative inefficiencies in the following ways:
 - directly, by affecting firms' pricing and output decisions and therefore causing the price which buyers pay for a good to diverge from the cost of producing that good; and
 - indirectly, by changing the number of firms in a market, and consequently affecting firms' output and pricing decisions.
- **Productive inefficiency** is when goods and services are not produced at least cost. Subsidies can create productive inefficiencies through:
 - protecting firms from the threat of competition, reducing their incentive to be efficient – if firms believe that the government will “bail them out” if they face bankruptcy, then efficiency incentives may be blunted; and
 - encouraging relatively inefficient firms to enter a market, causing relatively efficient firms to exit or enabling inefficient firms to remain in the market.
- **Dynamic inefficiency** occurs in the longer term when firms fail to carry out the right types of innovation. Subsidies can lead to dynamic inefficiency by:
 - encouraging firms to invest too much (or too little) in product and/or process development; and
 - encouraging firms to engage in the wrong type of investment.

3.1 Introduction

The objective of a subsidy is typically to encourage undertakings to engage in an activity (for example, to enter a market or to invest in R&D) which would likely not have been undertaken in the absence of the subsidy. The effect of a subsidy may often be to favour one firm or type of activity over another, which can give rise to competition concerns. In understanding the competition effects of subsidies, it will often be necessary to explore both the primary, intended effect of the subsidy (which in some circumstances, may itself be anticompetitive) and any secondary, unintended (and potentially negative) effects of the subsidy.

Subsidies that affect competition can give rise to three broad categories of economic concern:

- allocative inefficiencies;
- productive inefficiencies; and
- dynamic inefficiencies.

It is important to note that subsidies can give rise to these effects even where they do not affect competition. Competition effects are simply a subset of the broader range of effects which can flow from subsidies and it is possible, therefore, for one or more of the inefficiencies listed above to arise as a result of the subsidy, even if the degree and nature of competition between firms in the relevant market remains unchanged.

In this chapter we briefly describe how subsidies may be expected to affect firm behaviour – if a subsidy does not affect firm behaviour then clearly it cannot give rise to competition concerns. We then provide a brief summary of the types of competition concern that can result from subsidies.

3.2 Subsidies affect firm behaviour

Subsidies can be expected to affect at least one of three types of firm decisions.

- **Entry and exit decisions** can be affected directly or indirectly:
 - if subsidies affect recipients' **avoidable costs (fixed or variable)** they can enable a firm to enter a market or remain in a market in which it has been experiencing difficulties; and
 - if they affect pricing and output decisions of the recipient and competitors, potential entrants may not enter and existing competitors might be unable to compete in the long term and so be forced to exit.

- **Pricing and output decisions** can also be affected directly and indirectly:
 - subsidies affecting a firm’s variable costs, can be expected to affect both the pricing and output decisions of the firm and its rivals; and/or
 - subsidies affecting the entry or exit decisions of firms are likely to have an indirect effect on the pricing and output decisions of the other firms remaining in the market.
- **R&D investment decisions** can be affected in two ways:
 - changing the quantity of investment – lowering the cost of R&D investment, will result in an increase in investment levels; and/or
 - changing the type of investment – if subsidies are available for some types of R&D investment (say product R&D), but not for others (say process R&D), the type of activities firms engage in can be affected.

The effect of subsidies on firm behaviour is discussed in detail in Section 4.

3.3 Concerns raised by subsidies

Competition is characterised by a process of rivalry in which firms compete with other firms (for example, on price, service or quality of product) for customers. When the competitive process works effectively, goods will be produced and allocated efficiently. When the competitive process is distorted, markets may no longer work as effectively. As subsidies have the potential to affect the behaviour of firms and the competitive process, we briefly highlight below ways in which these effects can give rise to inefficient competitive outcomes.

3.3.1 ALLOCATIVE INEFFICIENCIES

Allocative inefficiency refers to the inefficient use of resources across society. Markets are said to be allocatively efficient when consumers pay a price which is equal to the (marginal) cost of supply.⁸ A subsidy which affects a firm’s costs (e.g. by providing cheaper access to a key input) and impacts on the firm’s pricing and output decisions will affect allocative efficiency.⁹

⁸ We are interested in the social rather than private marginal cost of production. These may differ in the face of market failures. Correcting for differences in social and private marginal costs can form the underlying rationale for the subsidy intervention. Throughout, where we discuss marginal cost, we are referring to *social* margin cost as opposed to private marginal costs.

⁹ In practice, firms typically operate in markets which are not characterised by perfect competition and where prices are already, to some degree, above marginal cost. As a result, there are already some allocative inefficiencies in most markets. Since allocative inefficiencies already exist, albeit to varying degrees, the relevant issue is whether the grant of a subsidy exacerbates the allocative inefficiency further.

Allocative inefficiencies may arise in two different ways.

- *Directly*: A direct allocative inefficiency will occur as the result of a subsidy when the price charged by a firm consequently diverges further from the marginal cost of producing that product. Direct allocative inefficiencies can also arise where a group of firms (for example, all the firms in a particular industrial sector) benefit from a subsidy. This will have the effect of transferring scarce resources to that sector which might have been valued more highly elsewhere.
- *Indirectly*: By changing the number of firms operating in a market (for example, some subsidies are targeted at encouraging entry, or preventing exit). This change can affect the level of output and price which prevails in the market.

3.3.2 PRODUCTIVE INEFFICIENCIES

Productive inefficiencies will occur when firms do not seek to minimise the costs of production. Subsidies may protect firms from the full force of competition in a market, and thus may blunt the incentives to produce goods and services as efficiently as possible.

Subsidies can result in productive inefficiencies if they have one of the following effects.

- *Firms' incentives for efficiency are blunted*: In the absence of government intervention, the managers of firms realise that if they are inefficient, their profitability will suffer and ultimately, they may face bankruptcy. However, if they believe that the government will "bail them out" if they face the threat of bankruptcy, the incentive to be efficient may be blunted. This will be of particular concern where firms are the potential beneficiaries of repeat subsidies.
- *Relatively efficient firms exit the market or relatively inefficient firms enter*: Subsidies may be given to prevent firms exiting the market (for example, in a declining market) or to encourage firms to enter a market. However, the subsidy may not necessarily be given to the most efficient of the firms in danger of exiting the market. Moreover, by preventing the exit of one firm, another more efficient firm may be forced to exit. Finally, subsidies may encourage relatively inefficient firms to enter a market, potentially leading to the exit of more efficient suppliers.

3.3.3 DYNAMIC INEFFICIENCIES

Dynamic efficiency refers to firms making the correct level and type of investments in developing new products and processes. Unlike productive and allocative efficiency, economic theory is less clear about the relationship between

competition and dynamic efficiency. Specifically, the benchmark for dynamic efficiency is less clear-cut, and it is not so obvious that firms operating unfettered in a competitive market will achieve the dynamically efficient outcome.

One strand of the theoretical literature suggests that competitive markets provide greater incentives to innovate.¹⁰ However, a separate strand of the literature argues that monopoly provides the greater incentives to innovate.¹¹ Recently, theoretical and empirical models have attempted to combine these seemingly opposing views, suggesting that innovation increases with product market competition up to a point, but then declines.¹²

Nevertheless, we know that dynamic inefficiencies will occur if, over time, a firm does not make the 'right' investments to improve its product or minimise its costs. Subsidies can affect dynamic efficiency by affecting innovation at the firm level. In particular, subsidies can affect:

- the amount of innovation carried out – subsidies can affect R&D investments by changing the costs associated with undertaking R&D, and hence changing the volume of projects undertaken by firms. Subsidies can also affect dynamic efficiency indirectly by changing the incentives firms face to innovate; and
- the type of innovation carried out – for example, if subsidies are available for certain types of R&D investment (say R&D aimed at improving a particular type of technology), but not for others (for example process R&D), then this may affect the type of R&D activities firms engage in.

¹⁰ Arrow, K., *Economic Welfare and the Allocation of Resources for Invention*, in Nelson, R. (ed.), *The Rate and Direction of Inventive Activity*, Princeton University Press, 1962.

¹¹ Schumpeter, *Theory of Economic Development* (1911)

¹² Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P., *Competition and Innovation: An Inverted U Relationship*, Institute for Fiscal Studies, IFS Working Paper, W02/04, July 2003

4 IDENTIFYING WHEN SUBSIDIES WILL AFFECT COMPETITION

Summary

This chapter provides a framework for identifying when subsidies are most likely to affect competition. We consider a number of questions with a view to screening out those subsidies that are unlikely to have a material effect on competition.

- Which aspect of firm behaviour is affected?
- Is the subsidy selective or asymmetric in a market context?
- How concentrated is the market affected by the subsidy?

FIRM BEHAVIOUR

Subsidies that do not materially affect the behaviour of firms or their rivals will not give rise to competition concerns. Subsidies that are very small relative to the targeted activity will typically fall into this category. Subsidies that are not targeted at any particular firm activity or cost (for example a direct cash transfer not tied to any form of firm behaviour) will not typically be expected to affect economic decision-making behaviour. However, even then there are situations in which capital market imperfections can lead to firm behaviour (in particular entry and exit or investment decisions) being affected.

SELECTIVITY AND ASYMMETRY

Subsidies can give rise to a competition concern if they lead one or more firms to have a competitive advantage over firms in the same or related market. Subsidies are most likely to have this effect if they favour one firm over another because they are designed or distributed in such a way that they have a differential impact on firms. A subsidy may have such an impact if it is:

- *Selective in eligibility criteria*: A subsidy should be considered selective in eligibility if it is not available to all competing firms. This could arise because a subsidy is made available only to a particular firm or subset of firms within a market (for example, a subsidy made available only to firms with a given amount of turnover, or using a particular type of technology). Alternatively it could arise where a subsidy is made available to all firms in a given market but the amount of subsidy given to each firm varies.
- *Asymmetric in effect*: The impact a subsidy has in a market may be asymmetric even if all firms are in principle equally eligible. For example, a subsidy that is available to any firm locating in a particular area may be

asymmetric in effect if some competing firms have already made their location decisions.

In order to identify whether a subsidy meets either of these two criteria, it is necessary to identify the economic market in which the recipient operates, as selectivity should be judged with reference to this market.

Subsidies may also have an effect on competition in a related market if the subsidised product is an input to another product, or if consumers buy the subsidised product alongside another product. This effect on related markets can arise whether or not there is a competition distortion in the market for the subsidised product. We suggest that, in practice, the issue of whether competition in a related market is affected should be considered only in relation to larger subsidies.

MARKET POWER AND COMPETITION CONCERNS

The structure of the market, and in particular the extent to which firms have market power, will also be important for understanding whether a competition concern is likely. It is important to distinguish between:

- market power before the introduction of the subsidy; and
- market power after the introduction of the subsidy.

In terms of pre-subsidy market power:

- if the market is strongly competitive (large number of firms and price close to cost), a relatively small subsidy is unlikely to raise competition concerns. Competition will be unaffected as long as the subsidy is not so large that it prevents rival firms from competing with the subsidised firm; and
- if the market is monopolised (only one firm, and no potential competitors), then the subsidy is unlikely to give rise to a competition concern. This is because there is no competition for the subsidy to affect.

Subsidies also have the ability to create market power. For example, even in a largely competitive market, if a single firm receives a sufficiently large subsidy, it could significantly alter the structure of the market (by driving out rival firms who are no longer able to compete effectively with the subsidised firm) leading to the creation of market power.

SUMMARY

In summary, subsidies are unlikely to give rise to competition concerns where:

- the subsidy does not materially affect firm behaviour;

- the subsidy is neither selective nor asymmetric in effect; and/or
- the market in which the subsidy is given is highly competitive (and the subsidy is small) or monopolised.

4.1 Introduction

The following two chapters outline the factors which need to be considered in order to understand whether a subsidy is likely to affect competition and, if so, whether this effect is likely to be material. This chapter discusses the first of these questions. Specifically, it sets out the questions which should be considered in analysing a subsidy in order to determine whether it is likely to give rise to a competition concern. This will enable some subsidies to be ruled out at an early stage as it will be clear that they will not materially affect competition. It is necessary to consider the following issues:

- Which aspect of firm behaviour is affected?
- Is the subsidy selective in a market context?
- How concentrated is the market affected by the subsidy?

In the remainder of the chapter, we discuss each question in detail.

4.2 Which aspect of firm behaviour is affected?

The first question we consider is whether the behaviour of the firm is materially affected by the subsidy, and if so which aspect. This is important because if a subsidy does not affect the behaviour of firms to any significant extent, then it is unlikely to give rise to competition concerns. Moreover, the type of competition concern to which the subsidy may give rise will depend on the type of behaviour that is affected by the subsidy.

We briefly outline the different ways in which a subsidy can affect firm behaviour. We begin by setting out the effects of subsidy on firm behaviour using the classical economic *"theory of the firm"*. However, as the decisions made by firms are rarely as simple as those set out in traditional textbook economics, we outline the implications of relaxing some of the traditional assumptions about the behaviour of subsidised and non-subsidised firms. In particular, we consider extensions to the classical theory in terms of the modern finance literature.

In order to establish the type of firm behaviour likely to be affected by a subsidy, it is necessary to understand which costs the subsidy affects. However, in practice it will often be difficult to link a proposed subsidy to an effect on a particular type of cost (e.g. it may not be immediately apparent what effect a subsidy aimed at employee training will have on a firm's cost base). Therefore, we also set out

some intermediate questions which make it easier to establish the link between a particular subsidy and the type of costs affected.

4.2.1 THE EFFECTS OF SUBSIDIES ON FIRM BEHAVIOUR

Subsidies can affect three types of firm decision – pricing and output decisions, entry and exit decisions and investment (in R&D and product quality) decisions.

Pricing and output decisions

Firms must decide the volume of output to produce, and the price to charge for that output. Classical theory suggests that a firm should set its price such that the additional (marginal) revenue it receives from selling the last unit of the good is equal to the (marginal) cost of producing that unit. This is the point at which the firm maximises its profit – any further increase in output would be loss-making, as to sell an additional unit the firm would have to lower the price it charges for that unit below its marginal cost of production.

A subsidy may therefore affect the pricing and output decision of firms if it affects either the costs or the revenues the firm expects to receive. Below we consider:

- subsidies that affect costs which vary with output (variable costs);
- subsidies that affect costs which do not vary with output (fixed costs); and
- subsidies that affect the revenue a firm can earn.

A subsidy that affects a firm's **variable costs** will directly affect the pricing and output decisions of the firm. Specifically, a subsidy that reduces variable costs will result in the firm increasing the output it produces. Consider for example a subsidy aimed at increasing employment in a region. Suppose the government pays half of the salaries of workers in the subsidised firm. From the firm's perspective, the revenue it can earn remains the same, but the cost of producing an additional unit has fallen, and hence the firm may face an incentive to increase its output.

A subsidy which causes a firm to change its pricing and output decisions may also, indirectly, affect the pricing and output decisions of rival firms. The unsubsidised rival firm is faced with a subsidised firm that has lowered its prices. The rival firm must either match the price cut (with consequent loss of profitability, given that its costs have not changed) or face a fall in its output, as its customers switch to the cheaper subsidised rival.

A firm's **fixed costs** – costs the firm incurs regardless of the level of output it produces (for example, rent on a factory) do not affect its pricing or output decisions. This is because the firm incurs this cost regardless of the price it sets or the quantity of output it produces. Consequently, a subsidy of this type also

has no direct impact on the pricing and output decisions of rival firms as it does not change the output and pricing decisions of the subsidised firm. A fixed cost subsidy may, however, affect entry and exit decisions. If this is the case, it may indirectly have an effect on pricing and output decisions. If a fixed cost subsidy were to lead to entry, this would typically result in a fall in market price and an increase in market output.

Subsidies that affect the revenues a firm receives will directly affect pricing and output decisions. Consider a situation in which the government is the sole purchaser for a firm's output. Say the government pays £10 more per unit of output than private consumers would be prepared to pay. A subsidy of this type will affect the output and pricing decisions of the firm. Specifically, it will result in the firm increasing the output it supplies.

Entry and exit decisions

Firms take fixed costs into account when making entry or capacity expansion decisions. They will also take some fixed costs into account when making exit and capacity reduction decisions. It follows that subsidies which affect fixed costs may distort competition between firms.

A firm will decide to enter a market or to expand its capacity in a market by considering the future revenues it expects to receive from the investment and the future costs associated with the investment. If the revenues outweigh the costs then the firm will enter the market or expand its capacity.¹³ When taking this decision, the costs the firm considers are the total costs of the investment. This includes variable costs of production (e.g. labour costs, raw materials) and fixed costs (e.g. the capital costs associated with the purchase of premises). Hence, the level of fixed costs associated with the investment will be important in determining whether a firm decides to enter an industry or expand its capacity.

13 This analysis of entry and exit decisions, and investment decisions more generally, is based on the Net Present Value (NPV) concept – a firm will make an investment if the present value (i.e. the discounted value today of future revenue streams) of the investment is greater than the cost of the investment. However, we note that this assessment of NPV should include the option value of waiting – in line with the real options literature of Dixit and Pindyck (see: Dixit, A., and Pindyck, R., Investment under Uncertainty, 1994 and Pindyck, R., Irreversibility, Uncertainty and Investment, *Journal of Economic Literature*, Vol.29, No.3, Sept 1991, pp.1110-1148). This literature suggests that where the future value of investments is uncertain, investment decisions are irreversible and there is the opportunity to delay investment until more information is known, the option of waiting has a value which must be taken into consideration. Hence, the NPV rule must be modified such that the investment should only go ahead if the present value of the investment exceeds the cost of the investment by an amount equal to the value of the option to delay investment. We note also that the real options literature applies to entry and exit decisions as well as to 'pure' investment decisions. For example, with exit this implies that if a firm is loss making, but there is uncertainty as to future profitability and there are costs associated with exit and re-entry, the firm may not exit immediately – the option value of staying in the market may outweigh the short run losses the firm makes.

Now consider the exit decision. If a firm chooses to exit, it will be able to save its variable costs (by definition variable costs vary with output, and hence can be expected to fall to zero if the firm ceases production). The firm may also save some fixed costs. However, there are two different types of fixed cost: avoidable fixed costs and non-avoidable (sunk) fixed costs. Fixed costs are avoidable if they are re-incurred on a regular basis or if they have a realisable value on exit.

Avoidable fixed costs will affect a firm's decision to exit an industry, as the costs are recoverable on exit. However, there are situations in which the cost of an investment (or some part of its cost) will be sunk and so will constitute a non-avoidable fixed cost. For example, capital costs associated with capacity in a manufacturing plant with no alternative use would be a non-avoidable fixed cost.

In contrast to avoidable fixed costs, non-avoidable fixed costs will have no effect on the decision to exit an industry.¹⁴

Changes to costs (through subsidies) which affect a firm's decision to increase or reduce its capacity or to enter or exit an industry will also affect the behaviour of other firms in the market. A firm's decision to enter an industry means that the existing firms in the industry are likely to sell less output at any given price. Consequently, entry of a new player is likely to lead rivals to change their pricing and output decisions. In some circumstances, the entry of one or more firms to an industry may cause the exit of one or more of the incumbent firms.

INVESTMENT IN R&D OR PRODUCT QUALITY

Decisions about investment in R&D or enhanced product quality are made in the same way as entry or exit decisions. The firm will estimate the anticipated future revenues it can earn compared with the future costs of the investment. If the anticipated returns exceed the costs of the investment, the firm will invest. There are two main types of R&D investment undertaken by firms:

- process innovation – an innovation which improves the production process; and
- product innovation – an innovation which results in a new or improved quality product.

Subsidies can impact on investments in R&D or product quality directly either by changing the quantity of investment or by changing the focus of investment (the type of investment made). Subsidies can also affect the R&D decision indirectly by changing the incentives firms face to innovate in the future.

¹⁴ When considering sunk costs, and their impact on firm behaviour, a key issue is timing. Subsidies that affect sunk costs prior to these being sunk will affect firm behaviour, whereas subsidies that affect sunk costs after those costs have been sunk would not be expected to do so.

Direct effects

A subsidy that lowers the cost of R&D investment (by reducing fixed or variable R&D investment costs) will result in an increase in the level of investment undertaken. A subsidy which affects non-avoidable fixed costs will typically not be expected to have an impact on the firm investment decision. Even if subsidies lead firms to invest in projects which would not have gone ahead in their absence, they will only have an impact on firm behaviour in terms of pricing and output or entry and exit decisions if the projects are successful.

A successful **process** innovation will reduce a firm's fixed or variable cost of production. The effects of reductions in variable and fixed costs are set out above in relation to pricing, entry and exit decisions.

The effect of a successful **product** innovation will depend upon whether the innovation creates a new product (market creating effect) or an improved version of an existing product (business stealing effect). In the case of an entirely new product (market creation), there is unlikely to be any effect on competition. In the case of a new version of an existing product (business stealing), the effects will depend upon the advantage conferred on the firm by the innovation. If the innovation creates a product that is better than those products produced by rival firms, then the firm can be expected to charge a price in excess of that charged by its rivals, and still attract customers. Conversely, the rival firms will be faced with a product that is superior to their own, and in order to maintain their output, they may have to reduce price (with a consequent loss of profit), or face a reduction in their output.

Finally, subsidies can also change the focus of investment undertaken by firms. In particular, if subsidies are available for certain types of R&D investment, but not for others, then this may affect the type of R&D activities firms engage in.

Indirect effects

Subsidies can also affect the incentives firms face to innovate. By providing subsidies to a firm to undertake R&D at the present point in time (and hence potentially to gain a competitive advantage over its rivals) one may also be changing both the incentives of rival firms to undertake R&D and the incentives of the subsidised firm to invest in R&D in future periods.

There is no single model or theory that predicts how changing the 'technology gap' between firms impacts on future incentives to undertake R&D. Rather, the outcome depends on a range of factors, including the type of R&D under consideration (process or product innovation, market creating or business stealing innovation), the R&D process (whether R&D is a 'winner takes all' patent race or step-by-step, and whether successful innovation in one period influences the likelihood of the firm being successful in the next period), the size of the existing

'technology gap' between firms in the market and the intensity of product market competition. These issues are discussed in greater detail in Annexe 1.

Extensions to the classical theory

The preceding sections suggest that subsidies will only affect firm behaviour if they directly affect the avoidable costs of the firm. This would imply that subsidies that affect non-avoidable costs (after they have been incurred) or subsidies that are financial transfers to the firm, but are not tied to any specific behaviour, should have no impact on firm behaviour. However, a key assumption underpinning this conclusion is that information is perfect and that financial markets work perfectly. Hence, if the NPV of an investment opportunity is positive, the firm will be able to access finance to undertake that investment, and the (opportunity) cost of that finance will be the same regardless of whether the firm uses internal finance, debt or equity.

There is a considerable volume of theoretical and empirical literature that suggests that, where information asymmetries exist (e.g. the managers of the firm having more information about the profitability of potential investments than outside investors), then capital markets will be imperfect, and the source of financing can affect firm behaviour.^{15,16} Annexe 2 provides a summary of this literature on capital market imperfections and firm decision-making.

This implies that financial transfers to the firm, even if they are not tied to any activity, may still affect firm investment decisions. The implication for our analysis is that one cannot necessarily ignore those subsidies that do not appear to be linked to specific firm activities as being unlikely to affect firm behaviour, and so competition. However, whether in fact they will do so, and in what way, will be dependent on the specific circumstances in question.

4.2.2 IDENTIFYING WHICH COSTS A SUBSIDY WILL AFFECT

In order to establish the type of behaviour likely to be affected by a subsidy, it is necessary to understand the type of costs which are altered by a subsidy. In practice, it will often be difficult to link a proposed subsidy to an effect on a particular type of cost (e.g. it may not be immediately apparent what effect a subsidy aimed at employee training will have on a firm's cost base). Below, therefore, we set out some intermediate questions which make it easier to establish the link between the subsidy and the type of costs affected.¹⁷ We consider the following three issues:

¹⁵ See: Hubbard, G., Capital-Market Imperfections and Investment, *Journal of Economic Literature*, Vol, 36, No.1, March 1998, pp.193–225; Harris, M., and Raviv, R., The Theory of Capital Structure, *The Journal of Finance*, Vol.46, No.1, March 1991, pp.297-355

¹⁶ This argument about imperfect capital markets is often used to support the case for subsidising entry and business expansion.

- the type of firm activity which is being subsidised and how specific this is;
- how that activity relates to the firm's costs; and
- the timing of subsidy provision.¹⁸

The following sections explore these factors in turn.

How specific is the activity being subsidised?

By this we mean whether the subsidy consists of the provision of general finance to the firm at one extreme or whether, at the other extreme, it is aimed at a very specific activity (e.g. providing training in an industry specific skill). The behavioural impact will vary according to:

- whether the subsidy consists of general financial support for a firm or whether it is conditional upon it being used for a particular firm activity; and
- where the subsidy is conditional upon being used for a particular firm activity, how narrowly defined that activity is.

In principle, a subsidy may be of such a general form that it could have an impact on a number of firm activities and therefore on a number of firm decisions. It may therefore be difficult to understand the implications of a subsidy for firm behaviour *ex ante*, as this will depend very much on the end to which the subsidised firm puts the subsidy. Where a subsidy is aimed at a particular activity, such as the provision of training, the range of behaviour it might affect is narrower. However, it may still be difficult to pinpoint with certainty the type of behaviour any given subsidy will affect. For example, a subsidy aimed at the provision of training, but not tied to any particular training activity, might be used to train different types of employees with different implications for firm behaviour.

The relationship between the subsidised activity and the firm's costs

Once the activity or range of activities which are affected by the subsidy have been identified, the next step is to understand the relationship between the subsidised activity and the firm's costs. Identifying the type of cost affected is key to understanding the response of the firm to the subsidy.

¹⁷ These questions are not an exhaustive list of the issues that should be considered, they are simply intended as a guide and it is important to recognise that the analysis will ultimately depend on the precise form of subsidy and the particular firms in question.

¹⁸ It is important to understand this because in some cases it will have implications for which firm decision-making is affected. For example, a subsidy which affects sunk costs may encourage a firm to enter a market before these costs have been sunk. However, once the firm has entered the market, a subsidy which reimburses the value of its sunk costs is less likely to have any effect on its behaviour.

In order to identify the type of cost affected by the subsidised activity, the first question to consider is whether the cost of carrying out that activity varies with the amount of output the firm produces. If it does vary, then it is likely that the firm's pricing and output decisions will be affected. If the cost does not vary with output, the cost should be considered as a fixed cost and the next step is to consider whether the cost of the activity could be avoided if the firm ceased production i.e. whether the fixed cost is re-incurred on an ongoing (e.g. annual) basis.¹⁹ If it could be avoided, then the subsidy may well affect capacity decisions and exit decisions as well as entry decisions. Finally, one must determine whether the fixed costs relate to innovation or quality improvement activities, in which case the subsidy may affect R&D decisions.

Establishing this relationship can be a difficult task since a subsidy may affect a number of different activities and thus a number of economic decisions. Furthermore, even a subsidy which is aimed at only one type of activity may affect more than one decision making process (e.g. an R&D subsidy which leads to a successful process innovation may affect a firm's variable costs of production and hence its price and output decisions.

The timing of the subsidy

It can be important to consider the timing of the subsidy in relation to the activity being undertaken. A subsidy provided to a firm which lowers the cost of making a *future* investment clearly impacts on the firm's decision to carry out that investment. However, the same subsidy provided to the firm *after* the investment has taken place is less likely to influence firm behaviour.

Consider a subsidy which lowers a firm's sunk costs (i.e. costs which cannot be recovered if the firm exits the market). If such a subsidy were provided to a firm which is considering entering the market, it may well encourage entry which would not otherwise have occurred. However, if such a subsidy were provided to a firm already in the market to reimburse some of the sunk costs after they have been incurred there would be no impact on firm behaviour, with the possible exception of the decision to exit (depending in particular on whether the subsidy is tied to remaining in the market).

An important qualification to this discussion relates to a situation where the *ex post* reimbursement of sunk costs creates an expectation that further subsidies will be granted in the future. Where such an expectation arises, the subsidy may lead firms already in the market to sink further costs, or encourage entry by potential entrants who might not otherwise have entered, in the anticipation that these costs will be reimbursed in the future.

¹⁹ It is worth noting that where the subsidy has a significant effect on output and pricing decisions, it may result in a step change in marginal cost such that all costs may vary as a result of the subsidy.

4.3 Is the subsidy selective in a market context?

Subsidies have the potential to give rise to a competition concern if they lead one or more firms to have a competitive advantage over other rival firms in the same or related market. In determining whether a subsidy is *likely* to have such an effect, it is necessary first to consider the ways in which a subsidy might favour one or more firms over their rivals. An important aspect of this analysis is market definition, as it is impossible to determine whether the subsidy favours a firm or firms over their rivals without an understanding of the market in which the subsidised firm operates.

In this section we:

- outline the ways in which a subsidy can favour one firm or group of firms over others;
- comment on defining the relevant economic market(s) in which the subsidised firm operates; and
- discuss whether a subsidy will affect competition in a market related to the primary market in which the subsidised firm operates (e.g. because the subsidised product is an input into a product in a downstream market).

4.3.1 DOES THE SUBSIDY HAVE A DIFFERENTIAL EFFECT?

A subsidy is only likely to give rise to competition concerns if it results in a change in the competitive position of one firm (usually the subsidised firm) vis-à-vis its rivals. Subsidies are most likely to have this effect if they favour one firm over another because they are designed or distributed in such a way that they have a differential impact on firms. A subsidy may have such an impact if it is:

- selective in eligibility criteria; or
- asymmetric in effect.

The following subsections outline the types of subsidy which could, in practice, be considered to be selective or asymmetric.²⁰

²⁰ We note that it is possible for a subsidy that is neither selective nor asymmetric in effect to have an effect on competition. For example, if a subsidy to all firms in an industry were to raise overall industry profitability, this could have the effect of attracting new entry to the industry, with consequent effects on competition. However, the purpose of our analysis is to identify the circumstances in which it is most likely that a subsidy will adversely affect competition, and we suggest that typically subsidies that are either selective or asymmetric will be more likely to do so.

Subsidies which are selective in their eligibility criteria

A subsidy should be considered selective in distribution if it is not available to all competing firms. Either of the following subsidy allocation mechanisms could thus be considered to be selective:

- A subsidy which is made available only to a particular firm or subset of firms within a market. For example, a subsidy made available only to firms with a given amount of turnover, even though all firms in the market commit to putting in place the same technology, would be selective in this way. This subsidy has the potential to give the subsidised firm(s) a competitive advantage over other non-subsidised firm(s) operating in the same market.
- A subsidy which is made available to all firms in a given market but where the amount of subsidy given to each firm varies. Those firms given the largest amount of subsidy may therefore gain a competitive advantage over those firms which receive a smaller subsidy.

Subsidies which are asymmetric in effect

Even if subsidies are not selective in terms of their eligibility criteria, they may still give rise to competition concerns. This is because the impact that the subsidy has in the market may be asymmetric. The following types of subsidy are examples of subsidies that could be considered asymmetric in effect.

- A subsidy that is available to any firm locating in a particular area may be asymmetric in effect if some competing firms have already made their location decisions. Suppose that the government offers to subsidise IT firms that set up in the North East of England. If there were currently no IT firms in England, then every new IT firm could incorporate the subsidy into its decision as to where to locate. Conversely, where there are existing firms that have already decided to set up in another part of the country, they may not be able to benefit from the subsidy as their location decision has already been made. The subsidy would then be asymmetric in effect as it benefits those firms that have not already made their location decision.
- A subsidy for a particular type of technology may also be asymmetric in effect. Suppose that the government decides to subsidise firms that operate waste disposal practices meeting certain environmental standards. Some firms may already have adopted a particular technology before a subsidy was available. They may therefore be placed at a competitive disadvantage compared to firms which had not invested in new waste disposal processes and were eligible for the subsidy as a result.
- If a subsidy favours a particular type of business model, it may also result in an asymmetric effect. Consider, for example, a sector with two firms, one

operating a high volume, low margin business, and the other operating a low volume, high margin business. If the marginal costs of both firms are subsidised, it will have a disproportionate effect on the high volume firm. Hence, even if all firms in a market are eligible for a subsidy, and even if all firms receive the same proportionate subsidy, there may still be an asymmetric effect.²¹

4.3.2 DEFINING THE MARKET IN WHICH THE SUBSIDISED FIRM OPERATES

In order to determine whether a subsidy may be selective or have an asymmetric effect, it is necessary to identify the market in which the subsidised firm operates.²² The OFT has published extensive guidance on how to define markets for competition purposes, and we do not therefore propose to discuss this in detail here.²³ Broadly, one should consider both demand-side and supply-side responses to changes in the relative prices of products, drawing on the conceptual framework provided by the SSNIP test.²⁴

There are two particular issues which arise specifically in relation to defining markets in the current context, namely:

- tracing the effects of a subsidy where the subsidised firm is active in more than one product market; and
- considering whether the price increase proposed by the SSNIP test (a 5 – 10% price increase) is the appropriate measure where large subsidies are involved.

²¹ This point is the converse of arguments in the tax literature on specific versus ad valorem taxes. In particular, with taxes, a tax on volume disproportionately affects the high volume operator relative to the low volume operator. See, for example, Michael Keen and Sofia Delipalla, *"The comparison between ad valorem and specific taxation under imperfect competition"*, Journal of Public Economics 49 (1992) 351-367 and Michael Keen, *"The balance between specific and ad valorem taxation"*, Fiscal Studies (1998) vol. 19, no.1, pp 1–37.

²² See John Fingleton et al for a discussion of the market definition in the context of state aid in *"Market definition and state aid control"*, European Economy Number 3, 1999, Chapter 4.

²³ The OFT has published various pieces of guidance in relation to market definition including the Competition Act 1998, *"Guidelines on market definition"* March 2000, *"Market Investigation References Guidelines"* March 2003 and *"Mergers: Substantive Assessment Guidelines"*, May 2003.

²⁴ The SSNIP test (Small but Significant Non-transitory Increase in Price) is used in defining markets by considering whether a hypothetical monopolist of a certain product could profitably impose a small but significant, non-transitory increase in price. The price rise assumed is usually in the range of 5–10%. The process is an iterative one. So, if the price rise would be unprofitable because consumers would switch to other products, then these are added to the initial product and the test repeated.

The subsidised firm is active in more than one market

Where a firm produces a single product, it will be relatively straightforward to identify the product affected by the subsidy in order to define the relevant market in which this product competes. Where a firm produces a number of different products, the key is to establish which of the products will be affected by the subsidy. Once this has been established, the next step will be to define the relevant economic markets for the products affected.

It may in practice be difficult to trace the effect of the subsidy through to a particular set of products. Consider for example a firm which manufactures savoury snacks, confectionery and high energy drinks. The firm receives a subsidy to encourage R&D into new production processes. It successfully develops a new production or packaging process which reduces its variable costs of producing confectionery and snacks. At the point in time at which the subsidy is granted, it may not be possible to determine which products it will affect (as the outcome of the R&D process is not known). In these circumstances, identifying *ex ante* the products which will be affected is difficult, and there may be a need to look at a number of potentially affected markets.

Applying the SSNIP test to large subsidies

The standard SSNIP test framework is used to determine the extent to which products are substitutes by examining the responses of consumers (and suppliers) to a small but permanent price increase in the range of 5% to 10% for a particular product. However, where a large subsidy is involved, it may have such a significant effect that the subsidised firm changes prices by considerably more than 5–10%. A price change of this magnitude could lead consumers to switch products who would not have switched in the face of a 10% price change. In the case of large subsidies, therefore, it may be appropriate to think not just about a 5–10% price increase when applying the SSNIP test, but also to consider price changes of greater magnitude.

In practice, this issue is only ever likely to arise where the subsidy being granted has a significant impact on price. Where very large subsidies are involved, defining the relevant market for the subsidised products will be extremely important and must be undertaken with particular care.

Does the subsidy affect competition in a related market?

Defining the relevant economic market within which the recipient firm competes provides information on those products which are substitutes for the products of the subsidised firm. This relevant market will not include those products which may be complements to those of the subsidised firm.

A subsidy may have an effect on competition in a related market which is either vertically related (upstream or downstream) or horizontally related to the market for the subsidised product. Such an effect might occur regardless of whether there is an adverse competition effect in the market for the subsidised product (e.g. because all firms are equally affected) and whether the firm behaviour affected by the subsidy is pricing and output decisions, entry or exit decisions or R&D investment decisions. It is not possible to provide an exhaustive list of the situations in which such an effect might occur, but in order for there to be such an effect, three conditions must be satisfied:

- the subsidy must lead to a change in pricing and output decisions, entry/exit or R&D investment decisions in the market in which the recipient of the subsidy competes;
- the links between the primary and the related market(s) must be such that the change has a direct effect on behaviour in the related market; and
- the relationship between the firms in the related market and those in the subsidised market must be such that the subsidy has an asymmetric effect on firms in the related market.

The examples below illustrate how competition effects in related markets can arise as a result of a subsidy, first in the context of a vertically related market and then in the context of a horizontally related market.

Effect on competition in a vertically related market – an example

Background: widgets are used to ensure that beer retains its “fizz” when it is sold in cans. They are therefore an input to a separate downstream market.

Consider a situation where one manufacturer of widgets (Firm A) receives a subsidy but rival firms do not. Brewers and widget manufacturers typically enter into long term exclusive supply agreements for the supply of widgets. In this example, the subsidised firm (Firm A) has such an agreement with a downstream brewer (Firm C). This brewer will as a consequence of the subsidy be able to purchase widgets at a more favourable price than its rival (Firm D), which, due to the existence of the long term exclusive supply arrangements, must continue to purchase from the unsubsidised contracted supplier (Firm B). In this scenario, the subsidy affects competition in the downstream market.

Compare this with the following scenario. Only one widget manufacturer (Firm A) receives the subsidy, allowing it to lower its price. Competition in the widget market is therefore affected. There are, however, no exclusive supply arrangements: all brewers are free to source their widget requirements including Firm A. The subsidy does not therefore distort competition in the downstream brewing market.

Effect on competition in a horizontally affected market – an example

Consider a scenario where there are two rival manufacturers of games consoles (Box 1 and Box 2). Software produced to run on Box 1 will not run on Box 2 and vice versa, and so users of Box 1 will use Box 1 software and users of Box 2 will use Box 2 software. A subsidy granted to a Box 1 manufacturer but not to a Box 2 manufacturer which enables Box 1 to reduce price will affect competition in the console market. In addition, it will also affect competition in the games software market, as any increase in the number of Box 1 purchases will result in an increase in the number of Software 1 purchases. Thus, the advantage gained by the manufacturer of Box 1 as a result of the subsidy will also give the manufacturer of Software 1 an advantage because of the way in which the two products are consumed together. If, alternatively, software 1 and 2 could each be run on Box 1 and Box 2, then the manufacturer of software 1 would not be advantaged and competition in the downstream market would not be distorted.

4.4 How concentrated is the relevant market?

The structure of the market, and in particular the extent to which firms have market power (the ability profitably to raise price above cost) is important for understanding whether a competition concern is likely.²⁵ In this chapter we focus on the circumstances in which the structure of the market means that a competition concern is unlikely to arise. In the following chapter we consider the relationship between market structure and the size of the likely competition concern.

When considering the circumstances in which market structure means that a competition concern is unlikely to arise, it is important to consider:

- market power before the introduction of the subsidy; and
- market power after the introduction of the subsidy.

4.4.1 PRE-SUBSIDY MARKET POWER

In terms of pre-subsidy market power, we note that:

- if the market is highly competitive, then a relatively small subsidy will have no material impact on market outcomes and is unlikely to give rise to competition concerns; and

²⁵ The OFT Guidelines on Market Power provide guidance on the principles and techniques that should be used to identify whether a firm or firms have market power. The relationship between market power and subsidies is discussed at length in Garcia, J-A and D. Neven, *“Identification of sensitive sections in which State aids may have significant distorting effects”*, Final Report to HM Treasury (2004).

- if the market is monopolised (only one firm, and no potential competitors), the subsidy is unlikely to give rise to a competition concern as there is no competition for the subsidy to affect.

Highly competitive markets

In the textbook ideal of a perfectly competitive market, economic theory suggests that a subsidy will typically not give rise to competition concerns. Whilst it is recognised that perfectly competitive markets do not exist in practice, the economic principles underlying this conclusion remain of relevance in the context of an unconcentrated market with low barriers to entry.

- *Pricing and output decisions:* Consider a producer of potatoes who receives a subsidy which lowers his marginal costs of production, and therefore allows him to lower his price. The market in which the producer competes is unconcentrated and barriers to entry are low. An increase in the subsidised producer's output as a result of the subsidy will be small relative to the size of the market and will therefore have a negligible effect on the market price. Even if the subsidy resulted in some firms leaving the market, the overall impact on competition would be small. Once the subsidy is stopped, or if the remaining firms try to increase their price, new entry would occur, as barriers to entry are low. The caveat to this conclusion is where the subsidy is so large and non-transitory that it causes a substantial and permanent change in market structure.
- *Entry and exit decisions:* A standard assumption of the perfectly competitive model is that there are no entry or exit barriers so that the number of firms in the industry adjusts over time. Consider a subsidy which encourages entry by a firm which would not otherwise have entered the market. If the effect is that some of the firms in the market are no longer able to earn economic profits, they will exit the market (there are no exit barriers so their investment can profitably be transferred elsewhere) and the number of firms will readjust. Whilst the identity of the firms in the market may change as a result of the subsidy, the number of firms and the level of output and price will not be materially affected.

Monopolised markets

If a subsidy alters a monopolist's behaviour, there will typically be no effect on competition because the monopolist has no rivals. There are, however, two important caveats to this conclusion.

- A large subsidy may affect products that, under a standard application of the SSNIP test based on a 5–10% price change, would be in a separate market to that produced by the subsidised firm. A large subsidy to a monopolist might

in fact affect competition if the consequent price reduction were so large that it caused consumers to switch away from products in other markets.

- In the situation where firms are considering entering a monopolised market, and there is therefore potential competition, a subsidy to the monopolist may deter entry. Potential competition would be distorted and the implications could be large, given the absence of actual competition.

4.4.2 POST-SUBSIDY MARKET POWER

Subsidies also have the ability to create market power. For example, even in a largely competitive market, a significant subsidy to a single firm could alter the structure of the market (by driving out rival firms who are no longer able to compete effectively with the subsidised firm) leading to the creation of market power. Hence, when considering whether a competition concern is likely, it is important to consider market power after the introduction of a subsidy as well as pre-subsidy market power.

5 FACTORS AFFECTING THE SIZE OF COMPETITION IMPACT

Summary

This chapter outlines the factors that determine the size of competition effect a subsidy is likely to have. We have considered a range of factors relating to the design of the subsidy and the characteristics of the market that the subsidy is operating in.

TABLE 2: SUMMARY OF FACTORS AFFECTING SIZE OF COMPETITION EFFECT

<i>Factor</i>	<i>Competition effect</i>
Magnitude	The larger the subsidy (in absolute or relative terms) the greater the likely competition effect.
Structure of subsidy payments	The structure of subsidy payments matters. For pricing the effects are ambiguous. For subsidies that assist entry, a lump sum payment may be more likely to give rise to competition effects, whereas for subsidies that prevent exit, spreading payments may be more likely to give rise to competition effects.
Concentration and product differentiation (symmetric firms)	The implications of concentration and product differentiation depend on whether the subsidy is likely to affect pricing or entry and exit. For subsidies affecting pricing, competition effects are likely to be greatest where the number of firms is small. For entry, competition effects are greatest where there is a small number of firms and product differentiation is moderate.
Asymmetric firms	Subsidising a large firm may increase its advantage and reduce competition. The effects of subsidising smaller firms depends on whether it allows them to compete more effectively with the large firm – if so, then competition may be increased. If not, competition may be reduced if the subsidy leads to the exit of rival fringe firms.
R&D competition	R&D subsidies will be most important in markets where innovation is key to the competitive process. R&D subsidies can affect competition directly, by changing the amount and type of R&D carried out by the subsidised firm. They can also affect competition indirectly, by changing the future incentives firms face to innovate.
Barriers to entry and exit	Barriers to entry and exit are important in determining both the magnitude and length of the competition effect. High exit barriers can reduce the magnitude of effect. However, where exit does occur, high entry barriers can make the competition effects of subsidies longer lived.

5.1 Introduction

The previous section provided a set of criteria for identifying when a subsidy is likely to have an impact on competition. In this section we outline the factors that determine the size of competition effect a subsidy is likely to have. In so doing, we confine our analysis primarily to price and profitability effects on rivals.

We have considered factors relating to the design of the subsidy and the characteristics of the market that the subsidy is operating in:

- ***The subsidy.*** Subsidy design and operation can help determine whether the subsidy will have a material effect on competition. In particular its:
 - the magnitude; and
 - the structure of subsidy payments.
- ***The market.*** The following market characteristics help determine whether the effect of the subsidy will be material:
 - market concentration;
 - product differentiation (how similar or different are the characteristics of the products supplied by competing firms);
 - the degree of asymmetry of firm size;
 - the importance of R&D competition in the market; and
 - the extent of barriers to entry and exit.

We discuss each factor in detail below.

5.2 Magnitude of the subsidy

Both the absolute magnitude and the relative magnitude of a subsidy (i.e. in relation to the costs of the subsidised activity) are important in understanding the likely scale of the competitive effect. The relative magnitude of a subsidy refers to the size of the subsidy in relation to the costs of subsidised activity. For example, a marginal cost subsidy of £100k to a firm with marginal costs of £2 million is likely to have a different scale of impact on that firm's pricing and output behaviour relative to an equivalent subsidy given to a firm with marginal costs of £500k.

The following discusses the importance of relative magnitude in relation to pricing and output, entry and exit and R&D decisions.

5.2.1 PRICING AND OUTPUT

A subsidy that affects pricing or output decisions does so primarily by affecting the marginal costs of the subsidised firm. When considering the relative magnitude of such a subsidy one should do so with reference to the size of the marginal costs of the recipient firm. The greater the change in a firm's marginal cost, the greater the likely change in its pricing and output decisions, and consequently the greater the potential impact on rivals. By charging a lower price and increasing output, the subsidised firm would be expected to increase its share of industry sales at the expense of its unsubsidised rivals.

In practice, marginal costs can be difficult to measure – one needs to know a firm's variable costs at its chosen output level, current output, and how costs would change if an additional unit of output were produced. For example, if a firm is currently producing at capacity but wants to produce an additional unit, the marginal cost of that unit may be large (if the firm needs to invest in new plant or equipment to produce it) compared to the case in which the firm has spare capacity. An often-used proxy is average variable cost (AVC), which equals variable cost divided by the quantity of output produced. However, AVC will only equal marginal cost where marginal cost is constant at all levels of output. In many cases therefore, this proxy measure is not accurate, and care must be taken when using this to measure relative subsidy magnitude.

5.2.2 ENTRY AND EXIT

Entry decisions

A subsidy can affect a firm's entry decision if it reduces the firm's avoidable costs (variable costs or the fixed costs of entry). The magnitude of a subsidy affecting entry decisions should therefore be considered relative to the avoidable costs of entering the market. Increasing the scale of the subsidy in relation to these costs increases the likelihood that entry becomes a profitable option for the firm. However, the impact of the scale of the subsidy on competition will differ, depending on whether it affects fixed costs or variable costs.

Consider first a **fixed cost** subsidy. The magnitude of the subsidy will be important to the extent that it results in a firm entering a market where otherwise it would not have done so. However, further increasing the magnitude of the subsidy beyond the level necessary to cause entry will not necessarily have any additional impact on competition. It could simply increase the profitability of the entry decision (fixed cost subsidies do not affect pricing or output decisions). Hence with a fixed cost subsidy, magnitude is important to the extent that it leads to entry where it would not otherwise have occurred. However, once entry has occurred it is not necessarily the case that the larger the subsidy, the larger the effect.²⁶

This is not the case for a **variable cost** subsidy. A variable cost subsidy can affect both the entry decision and the pricing and output decisions once entry has occurred. In this case, further increasing the magnitude of the subsidy beyond the level necessary to cause entry can have additional effects on competition.

Exit decisions

A firm will typically choose to exit a market (or reduce capacity) if it is unable to cover the avoidable costs of operation. The magnitude of a subsidy that could lead a firm that would otherwise have exited the market to remain in that market should therefore be considered in relation to the avoidable costs of that firm.

As with entry, whether the subsidy affects avoidable fixed costs or avoidable variable costs matters. With avoidable fixed costs, the magnitude of the subsidy will be important to the extent that it leads a firm to remain in a market when it would otherwise have exited. Further increasing the magnitude of the subsidy will be unlikely to have an additional impact on competition, and will simply increase the profitability of the recipient firm. Increasing the magnitude of a variable cost subsidy will both reduce the likelihood of exit by the recipient firm and affect its pricing and output decisions. The impact of this on rival firms is the same as that set out in relation to the impact of pricing subsidies on rivals.

5.2.3 INVESTMENT IN R&D AND PRODUCT QUALITY

A subsidy can affect competition by making an otherwise unprofitable R&D investment profitable. The relative magnitude of a subsidy to R&D should be measured with reference to the costs of the project being undertaken. The magnitude of a subsidy to R&D can only have an impact from a competition perspective if it makes a firm undertake an investment it would not otherwise have undertaken. Further increases in the magnitude of the subsidy beyond the level required to induce a firm to undertake the additional R&D activity will simply increase the expected profitability of that project but would not be expected to affect competition. It is important to note that this would not be the case if the activity of R&D itself, rather than discrete projects, were subsidised.

The effect of the success of any given R&D project on competitor firms will vary according to the type of R&D that is subsidised (see Section 4.2.1).

²⁶ We note, however, that this assumes that fixed and variable costs are not substitutes and are consumed in fixed proportions (e.g. one cannot substitute capital for labour, in the event of a subsidy to capital). If this is not the case, then further increasing the magnitude of a fixed cost subsidy can affect the type of entry one observes (for example, the firm might switch to a more capital intensive business model, with lower variable costs (e.g. labour). This may give rise to potential allocative inefficiencies.

5.2.4 SUMMARY OF THE IMPACT OF MAGNITUDE ON THE SIZE OF COMPETITION EFFECT

TABLE 3: SUMMARY OF THE IMPACT OF MAGNITUDE ON THE SIZE OF COMPETITION EFFECT

	<i>Effect on competition</i>
Price and output	The larger the subsidy relative to the variable costs of the firm, the greater the effect on pricing and output, and consequently the greater the potential effect on competition.
Entry and exit	Whether the subsidy affects fixed or variable avoidable costs matters. With fixed avoidable costs the magnitude of the subsidy will only be important to the extent that it leads a firm to enter/remain in a market when it would otherwise have entered/exited. Further increases in the size of subsidy will not affect competition. Increasing the magnitude of a variable cost subsidy will both increase (reduce) the likelihood of entry (exit) by the recipient firm and affect its pricing and output decisions.
R&D	The magnitude of a subsidy to R&D is relevant to the extent that it makes a firm undertake an investment it would not have undertaken. Further increases in subsidy size would not be expected to affect competition.

5.3 Structure of subsidy payments

By structure, we mean whether a given amount of subsidy is paid in one period or spread over a number of periods. Setting aside the issue that £10 received today is more valuable than £10 received tomorrow, we are interested in comparing the effect of an one-off subsidy payment with the same subsidy payment spread over multiple periods.

5.3.1 PRICING AND OUTPUT

An one-off subsidy will have a smaller impact on the pricing of the subsidised firm than an equivalent sized subsidy spread over several periods if there are capacity constraints and so the recipients cannot readily expand output beyond a certain limit. Depending on the shape of its demand curve, the total change to a subsidised firm's pricing and output decisions may differ if it receives a front loaded subsidy relative to a spread subsidy. The price response to a large shock will not necessarily be equivalent to that of smaller shocks.

If capital markets function perfectly, the timing of price cuts by the subsidised firm should not have materially different effects on rivals to the subsidised firm. They should be indifferent between a large one-off price-cut by a rival and a series of

smaller price-cuts of equal overall magnitude. However, in a world where capital markets do not function perfectly, timing can impact on competition. For example:

- A front loaded subsidy might alter the subsidised firm's pricing and output behaviour to such an extent that the profitability of a rival firm in that period is substantially reduced. If that rival firm is credit constrained, such that it cannot cover its losses in that period, then it could be forced to exit.
- On the other hand, it may be easier for firms to convince financial backers that a one off decline in their profits is the result of a front-loaded subsidy provided to a rival firm, than to convince them that a smaller but longer lasting decline in profitability is the result of a subsidy as opposed to their inefficiency due to a lack of managerial effort. Lenders may find it relatively more difficult in this latter case to link the effect of the subsidy to the decline in profits, which could mean that firms are more likely to exit.

Whether a subsidy that is paid as a lump sum or one that is spread over time will have a greater effect on competition therefore depends on the precise circumstances in question.

5.3.2 ENTRY AND EXIT

Where there are no credit constraints and where there is perfect information about future outcomes, a firm would be able to calculate the stream of future income it expects to earn and the cost of producing the necessary output when evaluating its entry decision. Consequently, a subsidy paid in full to the firm in one period is no more likely to make the firm enter or expand than a subsidy of equivalent magnitude paid to the firm over several periods.

However, if there are credit constraints and/or imperfect information about the market, a front-loaded payment subsidy can make entry or expansion more likely, relative to a subsidy where payments are spread. This is for two reasons:

- If a firm does not have perfect information about its likely future income stream prior to entry, then it will make its entry decision on the basis of expected profitability. Once the firm enters the industry it will learn whether entry is profitable. If entry is not profitable then the firm will wish to exit as quickly as possible. Consider two entry subsidies of equal value, but where one is paid up front, while the other is spread over a number of periods and paid only if the firm remains in the industry. With the upfront subsidy the firm receives payment, enters the industry and, if entry is unprofitable, exits again as quickly as possible. With the spread subsidy, even if entry is unprofitable, the firm must remain in the market for a number of periods to receive its payments or exit and forfeit the subsidy. A subsidy that is spread over several periods and tied to remaining in that market is therefore more risky for the

firm than a front-loaded subsidy, as *ex ante* it knows it might have to stay in a potentially unprofitable industry for a longer period of time.

- If a firm is financially constrained, then a subsidy that is spread over several periods may not enable it to cover the upfront costs associated with entry even though it will receive the payments in subsequent periods. A front loaded subsidy to a financially constrained firm may be more likely to lead to entry or expansion than a subsidy of equivalent magnitude spread over a number of periods.

Regarding exit, a subsidy that is spread across many periods is likely to delay the exit of the recipient firm relative to a subsidy that is front-loaded (and not tied to remaining in the industry for a specified period of time). The subsidised firm must stay in the industry for a longer period of time to collect the subsidy.

5.3.3 INVESTMENT IN R&D OR PRODUCT QUALITY

If there are no credit constraints and perfect information, a subsidy paid in full to the firm in the first period of its R&D investment is no more likely to make the firm carry out the R&D than the equivalent subsidy paid to the firm over several periods. However, if there are credit constraints and/or information is imperfect, then a front loaded payment to a firm can make the decision to carry out R&D more likely, relative to a subsidy where payments are spread over several periods. This is for the same reasons discussed above under entry.

5.3.4 SUMMARY OF THE IMPACT OF THE STRUCTURE OF PAYMENTS ON THE SIZE OF COMPETITION EFFECTS

TABLE 4: SUMMARY OF THE IMPACT OF THE STRUCTURE OF PAYMENTS ON THE SIZE OF COMPETITION EFFECT

	<i>Effect on competition</i>
Price and Output	It is not clear whether lump sum payments or spread payments give rise to greater competition effects. A case-by-case assessment is required.
Entry and exit	For entry, a lump sum payment may increase the likelihood of entry, and hence may be more likely to give rise to competition effects. For exit, subsidies paid over a number of periods (by keeping the recipient in the market for those periods) can be expected to have a greater impact on competition than lump sum subsidies.
R&D	A lump sum payment may increase the likelihood of R&D being undertaken, and may be more likely to give rise to competition effects.

5.4 Market concentration and product differentiation

At the extremes of market structure (perfect competition and monopoly), subsidies are only likely to give rise to competition concerns in exceptional circumstances. For the array of market structures in between these extremes, understanding where subsidies are most likely to give rise to competition concerns is less clear cut.

We first identify the circumstances in which a subsidy will have a large effect on *current* competition (measured in terms of the effect on rivals' pricing and profitability), and then the circumstances in which a subsidy will give rise to concerns regarding the structure of the market and the *future* health of competition. Following Garcia and Neven²⁷, we suggest that two key factors are important in determining when the effects of a subsidy are likely to be largest:

- market concentration – the number of firms operating in the market; and
- the degree of substitutability of products (product differentiation) – which provides a measure of the intensity of competition between a given number of firms.

When analysing the effects of these factors on competition, we need to distinguish between subsidies which affect pricing decisions from those which affect entry (and exit) decisions, as the two are analytically distinct. In the analysis presented below, we assume that prior to the subsidy being awarded to a firm, the costs and market share of all firms are symmetric. The implications of asymmetry are discussed in the following section.

5.4.1 SUBSIDIES AFFECTING PRICING DECISIONS

Consider the effect of a subsidy that causes the recipient firm to lower its price. The effect on rivals' pricing decisions will depend both on the degree of market concentration and the intensity of rivalry between the firms (as measured by the substitutability of the firms products).

Holding the intensity of rivalry between the firms constant, as the number of firms in the market falls, the effect of the subsidy on rivals' pricing decisions increases. With fewer firms in the market, the recipient's output accounts for a larger proportion of total output (and a larger proportion of total industry output is subsidised), and hence this has a larger impact on rival firms' pricing decisions.

Alternatively, holding the number of firms in the market constant, as the intensity of rivalry increases (measured by product differentiation), the impact of the subsidy on rival firms' pricing decisions increases. As firms compete more

²⁷ Garcia, J-A. and Neven, D. *Identification of sensitive sectors in which State aids may have distorting effects*, Final Report to HM Treasury, April 2004

intensely, rivals must implement a larger price reduction in response to the price reduction of the subsidised firm or face a consequently larger reduction in the quantity of output they can sell.

In summary, competition effects, as measured by changes in the pricing decisions of rival firms, will be:

- largest in markets characterised by a small number of firms competing intensely (products are close substitutes); and
- smallest in markets characterised by a large number of firms competing less intensely (i.e. products are differentiated).

Often, however, market concentration will be correlated with the intensity of competition in the market (broadly, more competitive markets will tend to have more firms operating within them). This suggests, therefore, that one would need to know more about this relationship, and about the nature of competition in the particular market in question, to reach a firm conclusion as to the size of the effect of a price subsidy.

We are also concerned, in terms of the future health of competition, about the impact of the subsidy on the likelihood of exit, and the consequences of exit. Exit will depend upon not only the effects of the subsidy on rival firms' prices and profits, but also on their existing level of profitability. Where this is low pre-subsidy, exit is more likely, as even small effects on pricing and profitability may lead firms to exit. This is most likely to be the case where competition between firms is intense.

From a competition perspective, we will be most concerned about exit in the following circumstances:

- where competition is already weak, and hence a further diminution of competition can have significant consequences for the future health of competition in the market; or
- where competition is strong, but where there are only a small number of competitors, such that the loss of a competitor leads to the loss of a significant contributor to the competitive process.

We will be least worried about exit in markets characterised by strong competition and where there are many players, as not only is competition already strong, but the loss of a rival does not significantly degrade the degree of competition remaining in the market.

Drawing the above analysis together, we suggest that subsidies that affect the pricing decisions of the recipient are most likely to give rise to competition concerns in the following circumstances:

- where there is a small number of firms competing strongly – effects on pricing are likely to be largest in these circumstances. The intensity of competition means that changes in pricing and profitability are more likely to result in exit, and the exit of a firm is likely to lead to the loss of a significant contributor to the competitive process; and
- where there are a small number of firms, but competition is weak – the size of the effect of the subsidy on pricing is likely to be smaller, and profitability is likely to be higher, and hence exit is less likely. However, if exit were to occur, it would be of significant concern, given both the small number of firms operating in the market, and the relative weakness of competition.

In contrast, subsidies that affect the pricing decisions of the recipient are least likely to give rise to competition concerns where the market is unconcentrated:

- where competition is intense, even if the subsidy results in the exit of a firm, the contribution of that firm to the degree of competition in the market is likely to be limited; and
- where competition is weak: the effects of the subsidy are likely to be smaller, a small effect is unlikely to lead to exit, and if exit does occur the contribution of the exiting firm to the degree of competition in the market is likely to be more limited.

These conclusions complement the findings of Garcia and Neven.

5.4.2 SUBSIDIES AFFECTING ENTRY DECISIONS

Consider the effects of a subsidy which causes an additional firm to enter the market. The effect of this will again depend on both the degree of market concentration and the intensity of rivalry between the firms (as measured by the substitutability of the firms' products).

Holding the intensity of competition between firms constant, as the number of firms in the market increases, the impact of entry on rival firms' pricing and profitability declines. The larger the number of firms in the market, the closer price will be to the competitive level, and hence the smaller the effect of an additional firm entering the market.

Alternatively, holding the number of firms in the market constant, the relationship between the impact of entry and the intensity of competition (as measured by product differentiation) is as follows:

- where products are strongly differentiated, such that firms are competing in 'niches', the effects of entry on rivals' pricing and profitability will be small in the case of symmetric product differentiation. If product differentiation is asymmetric, there may be large effects on *individual* firms if the product of

the entrant is a close substitute for their particular products. However, one would still expect the overall market effects to be relatively small;

- where there is little product differentiation, and hence firms are competing intensely, entry will have a limited impact on the pricing and profitability of existing firms. The more intense the degree of competition in the market, the closer price will be to the competitive level, and hence the smaller the effect of an additional firm entering the market; and
- between the two extremes of little product differentiation on the one hand and strong product differentiation on the other, the impact of entry on rivals' pricing and profitability will first increase as product differentiation increases and then decline as product differentiation becomes strong.

Overall, therefore, the impact of entry on rival firms' pricing and profitability will be strongest where product differentiation is moderate, and the market is concentrated and weakest where rivalry is intense and there are many firms in the market.

As with subsidies affecting pricing decisions, there will be a further impact on competition if entry leads to the exit of existing firms. Again, these conclusions complement the findings of Garcia and Neven.

5.4.3 SUMMARY OF THE EFFECTS OF CONCENTRATION AND PRODUCT DIFFERENTIATION ON THE SIZE OF COMPETITION EFFECT

TABLE 5: SUMMARY OF THE EFFECTS OF CONCENTRATION AND PRODUCT DIFFERENTIATION ON THE SIZE OF COMPETITION EFFECT

<i>Effect on competition</i>	
Pricing and output	For subsidies affecting pricing, competition effects are likely to be greatest where the number of firms is small.
Entry and exit	For entry, competition effects are greatest where there are a small number of firms and product differentiation is moderate.

5.5 Asymmetric firm size

The discussion above was based on firms being broadly the same size. However, this is clearly not always the case and markets can be characterised, for example, by a large firm facing a fringe of smaller competitors (i.e. asymmetric firm size).

In asymmetric markets, subsidies can be distributed in two ways – either fringe firms or the dominant firm receives the subsidy. Subsidising a fringe firm can

reduce the competitive advantage of the dominant firm and might be expected to increase competition. Conversely, allocating a subsidy to the dominant firm is likely further to increase the asymmetry in firm size by increasing the competitive advantage of the dominant firm and reduce the degree of competition in the market.

However, there may be circumstances when allocating a subsidy to one or more fringe firms can have a negative effect on competition. To understand when this might be the case, it is important to understand how the distribution of firms has arisen – that is, why there is an asymmetric market structure.

There are many factors that may contribute to the existence of a dominant firm facing a competitive fringe. Some of the most common are discussed below.

- The dominant firm benefits from economies of scale so that serving a large proportion of customers will entail a cost advantage over smaller rivals.
- The dominant firm is more efficient than the rival firms, but not as a result of scale: “better not bigger”. For example, the dominant firm has a superior product such that smaller firms may compete by offering a cheaper but lower quality alternative or by offering niche products.
- The dominant firm benefited from a first-mover advantage and is protected by barriers to entry. For example, the dominant firm may have locked in the majority of customers and smaller rivals survive by serving those customers that have a significant preference for their product.

Below we focus primarily on the static product market implications of subsidising either the dominant firm or the fringe. However, we note that if a firm has achieved its competitive advantage through efficiency or innovation, then while subsidising a fringe firm in a manner that overcomes that competitive advantage may increase competition in the short term, it may blunt firm incentives to strive for efficiency or to engage in R&D in the longer term. This is because firms may believe that the rewards to such activity are likely to be eroded by subsidies provided to their less efficient or innovative rivals.

5.5.1 PRICING AND OUTPUT

A fringe firm receives the subsidy

An important issue is whether subsidising a fringe firm primarily results in the fringe firm competing more effectively with the dominant firm or more intensely with other fringe firms.

In the first case, the subsidy may result in an increase in competition. In the second case, the effect on competition will depend on whether the advantage conferred on the fringe firm results in the exit of rival fringe firms.

The likelihood of the subsidised fringe firm being able to compete with the dominant firm depends on the nature and the size of the dominant firm's competitive advantage and the magnitude of the subsidy. The larger the subsidy, and the smaller the competitive advantage of the dominant firm, the more likely it is that a subsidy will allow the fringe firm to compete more effectively with the dominant firm. This increase in competitive pressure on the dominant firm could come at the expense of the other fringe firms in the market. If the subsidy does not result in the subsidised fringe firm competing more effectively with the dominant firm, it may instead have the result of simply increasing the intensity of competition between existing fringe firms. This may have a negative effect on competition if it leads to the exit of one or more of the existing fringe firms.

Subsidy size and the size of the dominant firm's competitive advantage are relevant regardless of the source of the dominant firm's advantage. However, there are some differences depending on the source of the advantage as the examples below illustrate:

- *Dominant firm benefits from economies of scale:* A marginal cost subsidy may lower the fringe firm's cost enough to allow it to compete at no cost disadvantage relative to the dominant firm for the period of the subsidy. To benefit fully from the marginal cost reduction the fringe firm would have to be able to increase capacity by a sufficient amount to accommodate the increase in demand induced by a price reduction. Such an expansion might increase competition if it allowed the fringe firm to compete more effectively with the dominant firm. However, it might have a negative effect on competition if instead, it led to the exit of either fringe firms or the dominant firm itself.
- *Dominant firm has a superior product:* A marginal cost subsidy may lower the fringe firm's costs by a sufficiently large amount that the subsidised firm is better able to compete with the superior product offered by the dominant firm. By offering its lower quality product at a lower price, the fringe firm may be able to attract customers from the dominant firm. However, in lowering its price, the fringe firm may attract customers from the other fringe firms instead. The subsidy may have a negative effect on competition if it leads to the exit of rival fringe firms or the dominant firm itself.

The dominant firm receives the subsidy

Subsidising the dominant firm will increase the competitive advantage of the firm vis-à-vis its rivals. The dominant firm will be able to further increase its output and lower its price. This will allow the firm to increase its market share relative to its fringe rivals. The concern this raises will depend on whether the increased competitive advantage of the dominant firm results in the exit of fringe firms.

5.5.2 ENTRY AND EXIT

The key issue is whether the subsidy results in the entry of a firm that will challenge the dominant firm or the entry of an additional fringe firm and that results in the exit of existing fringe firms. The larger the magnitude of the subsidy, and the smaller the competitive advantage of the dominant firm, the more likely it is that a new entrant will be able to compete effectively with the dominant firm. Such new entry would in most instances be pro-competitive. However, there are circumstances in which this may not be the case, for example if market demand is insufficient to support two firms at minimum efficient scale so one of the firms has to exit.

The entry of an additional fringe firm will increase the intensity of competition between the fringe firms but is unlikely to significantly increase the competitive pressure on the dominant firm.

Similar considerations apply for exit and R&D or product quality investments.

5.5.3 SUMMARY OF THE IMPACT OF ASYMMETRIC FIRM SIZE ON THE SIZE OF COMPETITION EFFECT

TABLE 6: SUMMARY OF THE EFFECTS OF ASYMMETRIC

	<i>Effect on competition</i>
Pricing and output	<p>If the fringe firm receives the subsidy, the competition effect will depend on whether the subsidy allows it to compete more effectively with the dominant firm, or increase the intensity of competition between existing firms. In the former case this may result in an increase in competition. In the latter case it may have an adverse competition effect if it leads to the exit of one or more fringe firms.</p> <p>Subsidising the dominant firm will increase the competitive advantage of the firm. This will allow it to increase its market share relative to its fringe rivals. The concern this raises will be greater where it results in the exit of fringe firms.</p>
Entry and exit	<p>With entry, the issue is whether the subsidy results in the entry of a firm that will challenge the dominant firm or the entry of an additional fringe firm and whether this results in the exit of existing firms.</p> <p>If the entrant is able to compete with the dominant firm (and the market is able to support two large players) then competition may be increased. The entry of an additional fringe firm will increase the intensity of competition between the fringe firms but is unlikely to significantly increase the competitive pressure on the dominant firm. The competition concern this raises will depend on whether it leads to fringe firm exit.</p>

5.6 R&D activity

The extent to which R&D activity is significant in a market is an important factor when seeking to understand the likely competitive effect of R&D subsidies. In markets where R&D activity forms a key element of non-price competition, R&D subsidies may have a significant effect on competition. R&D subsidies can have direct effects on firm behaviour with resulting effects on competition. Subsidies can also have indirect effects on firm behaviour by affecting the incentives of firms to innovate. The direct impact of an R&D subsidy and its indirect impact on firms' incentives to innovate are discussed in detail in Annexe 1.

Subsidies can affect R&D decisions directly by increasing the quantity of investment undertaken or by changing the nature of the investments. However, they will only have an impact on firms' pricing and output decisions and entry and exit decisions if the investments lead to successful innovations. If successful, the effects on firm behaviour depend on whether it is a process or product innovation.

When subsidies lead to cost reducing process innovations, their effects will be the same as subsidies aimed directly at cost reduction. The effect of a product innovation will depend upon whether the innovation creates a new product (market creating effect), or merely a new version of an existing product (business stealing effect). In the case of a new product (market creation), there is unlikely to be any effect on competition. In the case of a new version of an existing product (business stealing), the effects will depend upon the advantage conferred on the firm by the innovation (see Annexe 1).

Three factors will be key to indirect effects:

- whether the subsidized and non-subsidized firms have similar technologies, or whether there is a technology gap;
- if the firms are asymmetric in technology, whether the subsidized firm is a leader or a laggard; and
- the strength of product market competition.

5.7 Non-price competition

Understanding the magnitude of the competition concern raised by a subsidy requires an understanding of the importance of both price and non-price competition in the affected market. In addition to competing on price and R&D, firms may compete on additional factors including brand, quality and range. Two important issues to consider regarding non-price drivers of competition are whether non-price drivers of competition are important in the market affected by the subsidy and whether the subsidy affects any of these drivers.

First, the impact of a subsidy on prices can matter less in the presence of strong non-price drivers of competition. However, this does not imply that one should be less concerned about subsidies in markets if they impact on non-price drivers of competition.

5.8 Barriers to entry and exit

Entry and exit barriers may be broadly defined as any feature of a market that gives incumbent firms an advantage over potential entrants, such that incumbents can persistently raise their prices above competitive levels without new firms entering the market.²⁸

High barriers to entry will clearly reduce the likelihood of a given subsidy encouraging new entry. Moreover, the higher are barriers to entry in an industry, the higher barriers to exit tend to be, and so the less likely it is that firms will exit a market following a subsidy to one firm in that market. However, if a subsidy were to result in the exit of a rival firm, the level of entry barriers will affect the likely scale and duration of the impact on competition following that exit. The higher are entry barriers in the market, the larger and longer lasting will be the effect of exit on competition.

In summary, where barriers to entry and exit are large, subsidies are less likely to affect market structure. However, when subsidies do result in exit, the competitive effects are likely to be longer lived, as the high barriers to entry will make it difficult for firms to enter and return competition to its pre-subsidy level, once the subsidy ceases.

5.9 Summary

There are many factors relating to both the design of the subsidy and the market in which the subsidised firm competes that will affect the size of the potential competition effects. These are summarised in the table below.

²⁸ For more details on barriers to entry see: Barriers to entry and exit in UK competition policy – OFT Research paper 2, March 1994.

TABLE 7: SUMMARY OF FACTORS AFFECTING SIZE OF COMPETITION EFFECT

<i>The impact of magnitude</i>	
Price and output	The larger the subsidy relative to the variable costs of the firm, the greater the effect on pricing and output, and consequently, the greater the potential effect on competition.
Entry and exit	Whether a subsidy affects fixed or variable avoidable costs matters. With fixed avoidable costs, the magnitude of the subsidy is important to the extent that it leads a firm to enter/remain in a market when it would otherwise have entered/exited. Further increases in subsidy size will not affect competition. Increasing the magnitude of a variable cost subsidy will both increase (reduce) the likelihood of entry (exit) by the recipient firm and affect its pricing and output decisions.
R&D	The magnitude of a subsidy to R&D is relevant to the extent that it makes a firm undertake an investment it would not have undertaken. Further increases in subsidy size would not be expected to affect competition.
<i>The impact of the structure of payments</i>	
Price and output	It is not clear whether lump sum or spread payments are likely to give rise to greater competition effects.
Entry and exit	For subsidies that assist entry, a lump sum payment may be more likely to give rise to competition effects. For subsidies that prevent exit, subsidies paid over a number of periods (by keeping the recipient in the market for those periods) can be expected to have a greater impact on competition than lump sum subsidies.
R&D	A lump sum payment may increase the likelihood of R&D being undertaken, and hence may be more likely to give rise to competition effects.
<i>The impact of concentration and product differentiation</i>	
Pricing and output	For subsidies affecting pricing, competition effects are likely to be greatest where the number of firms is small. In concentrated markets, concerns will arise where product differentiation is both large and small.
Entry and exit	For entry, competition effects are greatest where there are a small number of firms and product differentiation is moderate.

continued

TABLE 7: SUMMARY OF FACTORS AFFECTING SIZE OF COMPETITION EFFECT *cont'd*

<i>The impact of asymmetric firm size</i>	
Pricing and output	<p>If a fringe firm receives the subsidy, the effect on competition depends on whether the subsidy allows it to compete more effectively with a dominant firm, or increases the intensity of competition between existing fringe firms. If the fringe firm competes more effectively with the dominant firm this may increase competition. Increasing the intensity of competition amongst fringe firms may have an adverse competition effect if it leads to the exit of one or more fringe firms.</p> <p>Subsidising a dominant firm will increase its competitive advantage. This will allow the firm to increase its market share relative to its fringe rivals. The concern this raises will be greater where it results in the exit of fringe firms.</p>
Entry and exit	<p>The issue is whether the subsidy results in the entry of a firm that will challenge the dominant firm or the entry of an additional fringe firm and whether this results in the exit of existing firms.</p> <p>If the entrant is able to compete with the dominant firm (and the market is able to support two large players) then competition may be increased. The entry of an additional fringe firm will increase the intensity of competition between the fringe firms but is unlikely to significantly increase competitive pressure on the dominant firm. The concern this raises will depend on whether the increased intensity of competition leads to exit.</p>
<i>The impact of R&D activity</i>	
	<p>R&D subsidies will be most important in markets where innovation is key to the competitive process. R&D subsidies can affect competition directly, by changing the amount and type of R&D carried out by the subsidised firm, and indirectly, by changing the incentives firms face to innovate in the future.</p>
<i>The impact of non-price competition</i>	
	<p>There are two important issues to consider: whether non-price drivers of competition are important in the affected market; and whether the subsidy affects these drivers. The first is important because the greater the role of non-price factors, the smaller will be the impact of a subsidy which only affects the price charged by the subsidised firm. It is also important to consider whether, if non-price factors are important, the subsidy confers a competitive advantage on the subsidised firm with respect to these factors.</p>

continued

TABLE 7: SUMMARY OF FACTORS AFFECTING SIZE OF COMPETITION EFFECT *cont'd*

The impact of barriers to entry

Barriers to entry are important in determining both the magnitude and length of the competition effect. High entry and exit barriers can reduce the magnitude of effect by making entry and exit less likely. However, when exit occurs, high entry barriers can make the competition effects of subsidies longer lived, by making entry more difficult once the subsidy has ceased.

6 RECOMMENDATIONS

This chapter sets out some recommendations in relation to:

- A screen to rule out subsidies unlikely to affect competition.
- Methods of subsidy design aimed at reducing harmful competition effects.
- The appropriate counterfactual.

6.1 Screening subsidies

A full analysis of the competition effects of a subsidy is likely to be a relatively time consuming and resource intensive task. We are not suggesting that such an analysis should be carried out in the case of every subsidy. Rather, it may be possible to use relatively simple screening measures to rule out certain subsidies. For example, one may be able to screen on the basis of:

- subsidy magnitude; and
- market concentration.

6.1.1 MAGNITUDE

A simple screen based on subsidy magnitude could be used as a first stage to rule out some subsidies, which are unlikely to give rise to competition concerns. From a practical perspective, it may be sensible to exclude very small subsidies, as these are unlikely to have substantial effects on firm behaviour. While the analysis in chapter 5 suggests that it is the relative size of the subsidy (relative to the cost of the activity being subsidised) that is important, at this stage of the analysis it may not be necessary to use a particularly sophisticated measure of the size of a subsidy, and hence absolute size could perhaps be used.

6.1.2 MARKET CONCENTRATION

At the two extremes of market structure (perfect competition and monopoly) subsidies are unlikely to lead to competition concerns unless the magnitude of the subsidy is so large that it results in a significant change to the market structure. There is, however, a spectrum of degrees of concentration in between these extremes, and most real world markets will fall into this space. A second screening process could therefore be used, which is based on the degree of concentration in the market before the subsidy is given, and which draws on the preliminary screening process which is used by a number of competition authorities in relation to mergers.

The Herfindahl-Hirschman Index (HHI)²⁹ could be used as a measure of the absolute degree of concentration in the market pre-subsidy. One could screen subsidies in markets where the HHI is below a certain level as being unlikely to give rise to competition concerns. However, as described above, the magnitude of the subsidy can affect the likelihood of a competition concern arising. The level of concentration at which a subsidy is deemed unproblematic should therefore be linked to the magnitude of the subsidy, with the concentration threshold being reduced where the subsidy in question is very large.

6.2 Minimising competition effects through subsidy design

We have identified a number of features in relation to subsidy design and the characteristics of the markets in which subsidies are implemented that could help to lessen the potential competition effects.

6.2.1 CHARACTERISTICS OF THE SUBSIDY

- *Magnitude*: Subsidy value should be the minimum amount needed to achieve the subsidy's objective (this is already a key principle in the design of most subsidies) to ensure that any distortion as a result of the subsidy is kept to a minimum. This will be especially important where the subsidy affects variable costs, as the larger the variable cost subsidy, the greater will be the effect on competition (see Section 5.2).
- *Selectivity and asymmetry*: A subsidy is only likely to give rise to competition concerns if it results in a change in the competitive position of one firm (usually the subsidised firm) vis-à-vis its rivals (see Section 4.3). Subsidies are most likely to have this effect if they favour one firm over another through either selectivity in eligibility criteria or asymmetry of effect. When designing subsidies therefore, the aim should be to set the selection criteria as wide as possible.
- *Competitive process for award of subsidy*: Where the objectives of the subsidy require selectivity in the award criteria (e.g. subsidies aimed at aiding SMEs), or where the level of funding is such that a choice must be made between candidate firms, it will be important to ensure that the correct mechanism is used to allocate the subsidy. In many cases, this will involve a judgement about whether a competitive or an administrative procedure will provide a better outcome. From an economic perspective, it is often argued

²⁹ In the context of merger analysis, competition authorities (including the OFT, the Competition Commission and the European Commission) will look at measures of the degree of concentration in the market. Concentration measures can be indicators of the ability of firms to exercise market power; thus, in the context of a merger, they can be used as a preliminary screen for analysing the likely effect of the merger. There are a number of possible measures of the degree of concentration in a market and the Herfindahl-Hirschman Index (HHI) is one which is frequently used as it takes account of the differences in size of the various market participants.

that it is preferable to use a competitive procedure (for example, an auction). Efficient allocation requires that a subsidy should be assigned to whoever values it most. Typically, this will be the most efficient firm. An administrative procedure could achieve this if the administrator knew the valuations of the potential subsidy recipients. However, this will rarely be the case. In an auction, bidders reveal their valuations, and hence an auction can overcome this information problem. However, there are also situations in which an administrative procedure may be preferable to an auction. For example, where there are small numbers of bidders, where there is a possibility of collusion or where it is desirable to assess recipients across a number of criteria, it is less clear that an auction will provide a better outcome than an administrative procedure.³⁰ In summary, while there is no allocation mechanism that is universally more efficient, competitive processes can, in many circumstances, ensure that the subsidy is allocated efficiently.

- *Structure of payments*: The way in which subsidy payments are structured matters (see Section 5.3). While there is no payment structure that is unambiguously best from a competition perspective, our analysis suggests:
 - a lump sum subsidy can make entry more likely relative to a subsidy where payments are spread over time;
 - entry subsidies focused on fixed costs are likely to be less distortionary than those focused on variable costs (see Section 5.2). The fixed cost subsidy encourages entry but will not affect the firm’s ongoing pricing and output decisions;
 - for pricing and output, the least distortionary subsidy structure depends on the precise characteristics of the market and the firms in question (see Section 5.3.1); and
 - lump sum subsidies are likely to have a smaller impact on exit decisions than spread payments (see Section 5.3).

6.2.2 CHARACTERISTICS OF THE MARKET

- *Concentrated markets*: Greatest concerns about competition effects arise in markets that are already concentrated. There is a need to be particularly careful about subsidy award and design in relation to concentrated markets (see Section 5.4).
- *Large firms*: Care also needs to be taken when providing subsidies to large firms facing smaller rivals. Such subsidies will typically increase the

³⁰ For a full discussion of the efficiency properties of auctions, see for example Klemperer, P, “Auction Theory: A Guide to the Literature”, *Journal of Economic Surveys* 1999, 13 (3), 227–286, Milgrom, P, “Putting Auction Theory to Work”, Cambridge University Press 2004

competitive advantage of the large firm and may therefore reduce competition (see Section 5.5).

- *R&D subsidies*: R&D subsidies can increase R&D undertaken by firms in the short run. However, it is possible that subsidies may reduce the incentives of both the subsidised firm and rival firms to invest in R&D in the longer term. Attention should therefore be given to the current intensity of product market competition and the degree of technological symmetry between competitors (see Section 5.6).

6.3 The appropriate counterfactual

Any assessment of the costs of a subsidy must be carried out with reference to a counterfactual. One cannot properly analyse the effects of a subsidy without giving thought to what the appropriate counterfactual should be. In practice two different counterfactuals might apply, depending on the question one is trying to answer.

The first question one might wish to consider is whether there is a less distortionary subsidy that could achieve the same objectives as the subsidy under consideration. In this case, the appropriate counterfactual is found by identifying the objective of the subsidy and determining whether this objective could be achieved by other means.

The second question one might wish to consider is whether the distortionary effects of the subsidy outweigh the potential beneficial effects. In this case, the relevant counterfactual is the outcome achieved in the absence of the subsidy.

ANNEXE 1: THE IMPACT OF SUBSIDIES ON INVESTMENT IN R&D

There are two main types of R&D investment undertaken by firms:

- process innovation – an innovation which improves the production process; and
- product innovation – an innovation which results in a new or improved quality product.

There is no single consensus view of the relationship between competition and firms' investments in R&D and product quality. As a result, it is harder to draw firm conclusions about the likely effects subsidies may have on firm incentives to undertake investments in product quality or R&D.

However, we know that a firm's decision about whether to invest in R&D or enhanced product quality is made by comparing the future revenues it can earn with the future costs of the investment. If the anticipated returns exceed the costs of the investment, the firm will make the investment. Alternatively if investment options are mutually exclusive, the firm will rank the options and choose the one with the highest return.

Subsidies can impact on investments in R&D or product quality directly by changing the quantity of investment, or by changing the focus of investment (the type of investment made). Subsidies can also affect the R&D decision indirectly by changing the future incentives firms face to innovate. We discuss both the direct and indirect effects below.

Direct effects of subsidies on R&D

As with entry and exit decisions, when determining whether to undertake an R&D investment, a firm will compare the anticipated future revenues with the future cost of the investment. Hence, a subsidy that lowers the cost of R&D investment (by reducing fixed or variable R&D investment costs) will result in an increase in the level of investment undertaken.

Subsidies can also, however, change the focus of investment undertaken by firms. In particular, if subsidies are available for certain types of R&D investment (say product R&D), but not for others (for example process R&D), then this may affect the type of R&D activities firms engage in.

Even if subsidies lead firms to invest in projects which would not have gone ahead in their absence, they will *only* have an impact on firm behaviour in terms of pricing and output or entry and exit decisions if the projects lead to successful innovations. The extent to which successful R&D leads to effects on rival firms' decisions is described below.

DIRECT EFFECT ON RIVALS – PROCESS INNOVATION

The magnitude of the effect of a successful process innovation on rival firms depends on a number of factors, including the degree to which rival firms can replicate the innovation and the extent of the cost advantage conferred by the innovation. If other firms can replicate the innovation easily and quickly, the firm which innovated first has only a short period of time in which to gain an advantage in revenue or profit terms before its rivals catch up.

The effect on rivals will also depend on whether the process innovation significantly lowers marginal costs, and on the extent to which costs are important in determining the effectiveness of a firm's competitive position. An innovation is considered to have a drastic effect if it lowers marginal cost to such an extent that it falls below the price charged by the firm's rivals. If this occurs, the firms that have not innovated will not be able to compete effectively and will therefore exit the market unless they are able to replicate the innovation in a reasonable time scale.

DIRECT EFFECT ON RIVALS – PRODUCT INNOVATION

Firms also undertake R&D activity that is focussed on product innovation. The effect of a product innovation will depend upon whether the innovation creates a new product (market creating effect), or merely a new version of an existing product (business stealing effect).

In the case of an entirely new product (market creation), there is unlikely to be any effect on competition. In the case of a new version of an existing product (business stealing), the effects will depend upon the advantage conferred on the firm by the innovation. If the innovation creates a product that is better than those products produced by rival firms, then the firm could be expected to charge a price in excess of that charged by its rivals, and still attract customers. Conversely, the rival firms will be faced with a product that is superior to their own, and in order to maintain their output, they may have to reduce the price they charge (with a consequent loss of profit), or face a reduction in the output they can sell.

Indirect effects of subsidies on R&D

Subsidies can also affect the future incentives firms face to innovate. By providing subsidies to a firm to undertake R&D at the present point in time (and hence potentially to gain a competitive advantage over its rivals) one may also be changing both the incentives of rival firms to undertake R&D and the incentives of the subsidised firm to invest in R&D in future periods.

There is no single model or theory that predicts how changing the 'technology gap' between firms (by subsidising one firm to undertake greater amounts of R&D) impacts on future incentives to undertake R&D. Rather, the outcome depends on a range of factors, including the type of R&D under consideration (process or product innovation,

market creating or business stealing innovation), the R&D process (whether R&D is a 'winner takes all' patent race, step-by-step, and whether successful innovation in one period influences the likelihood of the firm being successful in the next period), the size of the existing 'technology gap' between firms in the market and the intensity of product market competition.

A recent paper by Aghion et al provides a synthesis of the various effects driving the incentives to innovate.³¹ The paper considers innovation incentives in relation to the difference between pre-innovation and post-innovation profits. Their model is one where two firms compete to make cost-reducing investments (i.e. successful process innovations), and these are made in a step-by-step fashion (i.e. if there is a gap between the two in terms of innovation, then the laggard must first catch up with the leader before it can become a leader). The two firms can be in one of two situations at any point in time:

- symmetry, there is no technology gap between the two firms, and there costs will be the same; or
- asymmetry, there is a technology gap between the firms, and one firm is a leader (lower cost) and the other a laggard (higher cost).

The paper shows that two factors are central to the incentives to innovate. The intensity of product market competition, and whether there is in fact a technology gap between the firms, such that one firm is a leader (low cost) and the other is a laggard (high cost).

In order to understand the impact of subsidies on incentives to innovate, we must first understand the relationship between product market competition and the technology gap on incentives to innovate. Below, therefore, we consider the effects of strong and weak intensities of product market competition on the incentives for firms to innovate.

INTENSE PRODUCT MARKET COMPETITION

In terms of the technology gap between firms, there are two initial states of the world, one where there is no technology gap, and firms have symmetric costs, and one where there is a gap, and firms' costs are asymmetric.

- *No technology gap – firms' costs are symmetric*: In this situation, both firms have a strong incentive to innovate, in order to "escape competition". By innovating, the firm will gain a cost advantage over its rival, which will result in a lessening of the intensity of product market competition and an increase in the profitability of the firm.
- *Technology gap – firms' costs are asymmetric*: Consider first the incentives for the laggard (high cost) firm to innovate. If the firm innovates, and catches up with its

³¹ Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P., "Competition and Innovation: An Inverted U Relationship", Institute for Fiscal Studies, IFS Working Paper, W02/04, July 2003

rival in terms of costs, it will face intense product market competition. Consequently, the firm may be unlikely to substantially increase its profits as a result of innovating, and hence its incentives to innovate may be relatively weak. The leader (low cost) firm already enjoys a cost advantage in the market, and knows that its rival does not have a strong incentive to innovate. Consequently, the leader's incentives to innovate may also be relatively low.

WEAK PRODUCT MARKET COMPETITION

Again, there are two initial states of the world, one where there is no technology gap, and firms have symmetric costs, and one where there is a gap, and firms' costs are asymmetric.

- *No technology gap – firms' costs are symmetric*: In this situation, both firms face weak product market competition, and hence there is relatively little extra value to innovating to become the leader firm. There may therefore be a limited incentive to innovate.
- *Technology gap – firms' costs are asymmetric*: Consider first the incentives for the laggard (high cost) firm to innovate. If the firm innovates, and catches up with its rival in terms of costs, it will face weak product market competition. Consequently, the firm may be able to substantially increase its profits as a result of innovating and reducing the cost advantage of the leader firm. Its incentives to innovate may be relatively strong. The leader (low cost) firm enjoys a cost advantage in the market, but knows that its rival has a strong incentive to innovate. Consequently, the leader's incentives to innovate may be relatively strong, in order to retain its advantage.

The effect of subsidy on firm incentives to innovate

From the above, it is clear that the impact of subsidies on firm incentives to innovate will depend both upon the intensity of competition in the market, and the relative positions of firms in terms of innovation – is there a technology gap between firms in the market? In the latter case, the effect of the subsidy will also depend on whether the subsidy is given to the leader or the laggard. We consider the effects of subsidy on innovation incentives for the case where product market competition is intense, and for the case where it is weak.

INTENSE PRODUCT MARKET COMPETITION

Consider first where product market competition is intense:

- *No technology gap*: Firms have a strong incentive to innovate due to the "escape competition" effect. Subsidising one firm moves the market to a leader/laggard position. As discussed above, with intense product market competition, once a technology gap arises, the laggard firm may have weaker incentives to innovate.

Hence the effect of the subsidy may be to reduce future incentives to innovate, this will however, also depend upon the size of the 'technology gap' created.

- *Technology gap*: The effects of the subsidy now depend on whether the laggard or the leader receives it. If the laggard receives the subsidy, the market may move to neck and neck competition in which case the incentives for both firms to undertake further R&D are increased. On the other hand, if the leader receives the subsidy, this increases further the technology gap between the firms and may further reduce the (already weak) incentives of the laggard to innovate.

WEAK PRODUCT MARKET COMPETITION

Consider now the case where product market competition is **weak**:

- *No technology gap*: Firms have relatively weak incentives to innovate (the "escape competition" effect is not particularly strong). Subsidising one firm moves the market to a leader/laggard position. The laggard firm now faces an increased incentive to innovate in order to obtain the higher profits available when it overcomes the leader's cost advantage. This will however, also depend upon the size of the 'technology gap' created by the subsidised R&D.
- *Technology gap*: The effects of the subsidy depend on whether the laggard or the leader receives it. If the laggard receives the subsidy, and reduces/removes the technology gap, the incentives for both firms to undertake further R&D are weakened. If the leader receives the subsidy, this will further increase the technology gap between the firms. This may either increase or reduce the incentives of the laggard firm to innovate, depending on the size of the technology gap created.

Summary

A range of factors will influence the impact of subsidies on firm incentives to innovate. The examples above provide an illustration of the types of factors that need to be taken into account. In particular, they show that the strength of product market competition, the 'technology gap' between firms and which firm receives the subsidy will all influence whether subsidies lead to increased or reduced incentives to engage in R&D in future periods.

ANNEXE 2: CAPITAL MARKET IMPERFECTIONS AND FIRM DECISION MAKING

A key finding in relation to the classical theory of the firm is that subsidies will only affect firm behaviour if they directly affect the avoidable costs of the firm. This implies that subsidies that affect non-avoidable costs (after they have been incurred) or subsidies that are financial transfers to the firm, but not tied to any specific behaviour, should have no impact on firm behaviour.

A key assumption underpinning this conclusion, however, is that information is perfect, and financial markets work perfectly. Hence, if the NPV of an investment opportunity is positive, the firm will be able to access finance to undertake that investment, and the (opportunity) cost of that finance will be the same regardless of whether the firm uses internal finance, debt or equity.

However, there is a considerable volume of theoretical and empirical literature which suggests that where information asymmetries exist (in this case, say, the managers of the firm having more information about the profitability of potential investments than outside investors) capital markets will be imperfect, and the source of financing can affect firm behaviour³². Specifically, this implies that financial transfers to the firm, even if they are not tied to any activity, may still affect firm investment decisions. The implication for our analysis is that one cannot necessarily ignore those subsidies that do not appear to be linked to specific firm activities as being unlikely to affect firm behaviour, and so competition.

While it is beyond the scope of this report to present a detailed summary of the new financial literature looking at this issue, we present a number of simple examples from the literature to illustrate how the source of financing may affect firm decision-making behaviour. In particular, we consider how informational asymmetries can have an effect on financing in the context of:

- credit constraints;
- external finance (debt or equity) being more expensive than internal finance (retained earnings); and
- non-profit maximising behaviour on the part of managers.

Credit constraints³³

When financial institutions make loans, they are interested in the profitability of those loans. This will be determined by the interest rate they receive on the loans, and the

³² See: Hubbard, G., Capital-Market Imperfections and Investment, *Journal of Economic Literature*, Vol, 36, No.1, March 1998, pp.193–225; Harris, M., and Raviv, R., The Theory of Capital Structure, *The Journal of Finance*, Vol.46, No.1, March 1991, pp.297–355

riskiness of the loans (i.e. the likelihood that the borrowers will default). In theory, the institution can set the interest rate at a level that clears the market (i.e. the supply of loans equals the cost of those loans).

However, the interest rate can alter the riskiness of the stock of loans. This can happen through two routes. First, the interest rate can 'sort' the borrowers – as the interest rate rises, borrowers with a higher probability of default will continue to seek loans, as they are less concerned about the price they must pay for that loan (i.e. the interest rate), because they perceive their probability of repayment to be low. Borrowers with a high probability of repayment will 'purchase' fewer loans as the interest rate increases.

Second, the interest rate can change firm behaviour by affecting the types of projects firms undertake. Specifically, as the interest rate rises, firms will be more inclined to take on high risk/high reward projects at the expense of low risk but low reward projects. This is because as the interest rate rises, the returns to firms of successful investments decline.

In a world of perfect information, these problems do not arise – lenders can observe perfectly the riskiness of potential borrowers (in terms of their default risk) and can observe the riskiness of projects undertaken by firms. Lenders can therefore stipulate who they lend to and what projects they will fund.

When information is imperfect, however, lenders find it difficult to distinguish between different categories of borrowers, and may prefer to ration credit rather than raise the interest rate to the level that clears the market. In this world, even if a firm offered to pay a higher rate of interest, the lender might not provide finance, as it would view the borrowing firm as a higher credit risk.

In practice, to overcome these informational difficulties, banks and other financial institutions use a range of screening devices (such as qualifications of directors, track record of directors etc.) to determine who they provide loans to. It is often claimed that it is this type of screening that leads to SMEs in particular being credit constrained.

In this world, therefore, there may be firms which have profitable investment opportunities available to them, but which they are unable to take due to a lack of finance. Hence, the provision of a subsidy, even if it is not tied to any activity, may still result in a change in firm investment behaviour as it enables a firm to undertake investments previously not available to it due to credit constraints.

Internal versus external finance

There is a range of theoretical and empirical literature which looks at firm financing. One of the key results of this literature is that internal finance (retained profits) can be

³³ See: Stiglitz, J., and Weiss, A., *Credit Rationing in Markets with Imperfect Information*, *The American Economic Review*, Vol.71, No.3, June 1981, pp.393–410

cheaper than external finance (debt and equity). The implication of this literature is that there may be a range of investments which would be profitable and which firms would undertake if they had access to internal finance, but which are unprofitable (and hence not undertaken) if firms must rely on external finance. A financial transfer, such as a subsidy, even if it is not tied to any activity, increases the internal finance available to firms, and hence may allow them to undertake investments that would have been unprofitable had the firms to rely on external finance.

This wedge between internal and external finance costs can arise for a variety of reasons³⁴.

- *Transaction costs*: When firms enter capital markets in order to raise finance they incur transaction costs. These costs may include both the cash costs of paying for financial services necessary for the transaction and any internal management costs associated with the transaction. These costs are not incurred with internal finance.
- *Monitoring costs*³⁵: With asymmetric information, lenders and investors are less well informed about the prospects for success of any given project than is the borrower. In addition, however, lenders may not be able to monitor either the outcomes of investment decisions, or whether firms have undertaken all the actions necessary for the project to succeed. This may give borrowers the incentive to put less effort into ensuring the investment is successful because the borrower only receives a fraction of the return on the project if it is successful, with the remainder going to the investor/lender. Alternatively, the borrower may have an incentive not to reveal truthfully the success of a project.

The lender or investor can overcome this by monitoring the activities of the borrower. However, if monitoring is expensive (in the literature this is known as costly state verification), this raises the cost of finance facing the borrower. Again, therefore, this can result in the cost of external finance (which is subject to costly monitoring) being greater than the cost of internal finance (which is not subject to monitoring costs).

Non-profit maximising management³⁶

The classical theory is also based on the assumption that the management of a firm are profit maximisers. However, with the separation of ownership from control (e.g. where

³⁴ Myers, S., The Capital Structure Puzzle, *The Journal of Finance*, Vol.39, No.3, Papers and Proceedings, Forty Second Annual Meeting, American Finance Association, San Francisco, CA, December 28–30, 1983, pp.575–592; Myers, S. and Majluf, N., Corporate Financing and Investment Decisions when Firms have Information the Investors do not have, Working Paper No. 1396, National Bureau of Economic Research, July 1984

³⁵ Townsend, R., Optimal Contracts and Competitive Markets with Costly State Verification, Staff Report No.45, Carnegie-Mellon University and Federal Reserve Bank of Minneapolis, June 1979

³⁶ See Harris, M., and Raviv, R., The Theory of Capital Structure, *The Journal of Finance*, Vol.46, No.1, March 1991, pp.297–355 and Jensen, M., and Meckling, W., Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure, *Journal of Financial Economics*, V.3, No.4, Oct 1976, pp.305–360

the shareholders and managers are different people) this may not necessarily be the case. A strand of the literature has looked at the implications of this for financial structure. This literature suggests that conflicts may arise between management and shareholders because managers do not receive the entire benefits from their profit maximisation activities but bear the entire costs of these activities. Hence managers may have incentives to engage in non-profit maximising behaviour by purchasing unnecessary goods – expensive offices or corporate jets, or investing in high profile prestige projects that may not be profit maximising.

Again, with perfect information, this problem does not arise, as shareholders can perfectly monitor managerial behaviour and constrain non-profit maximising behaviour. However, with imperfect information shareholders may not necessarily be able to observe managerial behaviour, and hence cannot constrain managers to the same extent.

One can overcome this conflict of interest through financial structure – the more equity managers hold in a firm, the more closely aligned are their incentives with those of other shareholders, and the more likely they are to seek to maximise profits. Increasing managerial equity holding could be achieved by increasing the proportion of the firm that is financed by debt. Additionally, debt commits the firm to pay cash, and so limits the free cash available to managers to pursue non-profit maximising activities.

The implications of non profit maximising managers for subsidies are twofold:

- first, if firms do not necessarily act as profit maximisers, then we can no longer say with certainty what the effect of a financial transfer to the firm will be – in particular, it is possible that the firm will undertake additional investments (even if they are not necessarily profitable); and
- increasing the internal finance reduces the proportion of equity managers hold in the firm.

In summary, therefore, when we relax the assumptions of perfect information and profit maximising behaviour used in the classical theory, the result that pure financial transfers (that are not tied to specific firm activities) do not affect firm behaviour may break down. The modern financial economics literature provides an array of different empirical analyses and theoretical models outlining the various ways in which this may happen. The implication of this for our analysis is that we cannot ignore those subsidies that do not appear to be linked to specific firm activities as being unlikely to affect firm behaviour. However, whether in fact they do affect firm behaviour, and if so the way in which they do so, will be dependent on the specific circumstances in question.