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Review of Employer Collective Measures: A Conceptual Review from a Public Policy Perspective

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Review of Employer Collective Measures: A Conceptual Review from a Public Policy Perspective

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Foreword

Launched on 1st April 2008, the UK Commission for Employment and Skills is a key recommendation in Lord Leitch's 2006 review of skills *Prosperity for All in the Global Economy: World* Class Skills. The UK Commission aims to raise UK prosperity and opportunity by improving employment and skills. Its ambition is to benefit individuals, employers, government and society by providing independent advice to the highest levels of the UK Government and Devolved Administrations on how improved employment and skills systems can help the UK become a world class leader in productivity, in employment and in having a fair and inclusive society.

Research and policy analysis plays a fundamental role in the work of the UK Commission and is central to its advisory function. In fulfilling this role, the Research and Policy Directorate of the UK Commission is charged with delivering a number of the core activities of the UK Commission and has a crucial role to play in:

- Assessing progress towards making the UK a world-class leader in employment and skills by 2020;
- Advising Ministers on the strategies and policies needed to increase employment, skills and productivity;
- Examining how employment and skills services can be improved to increase employment retention and progression, skills and productivities.
- Promoting employer investment in people and the better use of skills.

We will produce research of the highest quality to provide an authoritative evidence base; we will review best practice and offer policy innovations to the system; we will undertake international benchmarking and analysis and we will draw on panels of experts, in the UK and internationally, to inform our analysis.

This report is one of a suite of outputs of the Review of Employer Collective Measures study. The study reviews the effectiveness of levers to increase employer investment in skills on a collective basis, such as levies and tax incentives, in order to provide advice to Ministers on which collective levers might be most effective to introduce or expand.

This report is the first in the series and provides a review of the conceptual evidence regarding the propensity of employers to engage in training. It formed the bedrock of later stages of the study. All reports of the study are accessible on our website at www.ukces.org.uk.

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Table of Contents

Tables

Figures

Headline concepts, issues and conclusions

Employer

Individual employers are a crucial cog in the UK's training system, as they are the principal and, generally, only source of firm specific skills. Specific skills are fundamental to the competitive advantage of firms because they cannot be replicated by other firms.

There are two principal "best practice" investment rules that employers can use to decide optimal training investments: one more accessible, but not well suited to situations of risk and uncertainty (net present value or internal rate of return); the other more suited to risk and uncertainty, but in its infancy (real options pricing).

Based upon perfect information, these decision rules can provide a unique level at which investment in skills is optimised. However, imperfect information and other problems mean that, retrospectively, the employer may have over- or under-invested in skills.

The employer may find that they face barriers in translating their plans for investment in skills into practice: a lack of management skills, inadequate funding for training, etc. Small firms are a microcosm in which a number of these barriers coalesce, causing a failure to train.

Firm size is a crucial influence on the extent and nature of training, and the policy debate must address the issue of training in small firms. At the same time, the conceptual literature seems better suited to discussing the issues of larger scale and more formal training, more likely to be found amongst larger employers.

Sector

Sectors matter as they tend to be based around common technologies, common products or both. This suggests that there may be a fairly high degree of commonality in all but the most idiosyncratic, firm specific skills within a sector, but larger differences between sectors.

The firm's competitive environment has important implications for optimal levels of training. This is partly a question of market structure, but more importantly the firms' goals and product market strategies (where price competition is a less important driver of skills than product specification and quality).

Perhaps the most important finding at the sectoral level is the potential for spillover effects, where at least one firm benefits from the training investments by other firms. Under such circumstances, employers do too little training to produce the optimum sectoral outcome.

Insofar as firms in the sector benefit from such spillovers, they should also help to fund the increased levels of training necessary to exploit them.

Spatial dimensions

While the younger and more highly skilled/educated workers can often operate beyond regional and even national scales, the bulk of those in the labour market are restricted to operating at a regional or even sub-regional level.

As a consequence, geography can be as a significant influence on labour market conditions faced by individual employers as sectors. Thus, labour market policy (including sector-based policy) must have an important spatial dimension that recognises the role of regional development agencies, cluster strategies, etc.

Nation

Nation states are distinctive "systems", comprising a complex set of inter-related component parts that carry out certain activities, such as innovation and training. The system is so inter-connected, that modifying training may have unintended consequences for other parts of the system.

While it seems impossible to simply transplant a training system from one country to another, it seems likely that lessons can be learnt from other countries.

At the national level, employer training provision is likely to be a mix of over- and under-provision. Government failure may be one source of over-provision of certain forms of training. However, several factors suggest the need for government intervention:

- the existence of certain institutional problems (failure to measure training, failure to account for training and short-termism in financial markets);
- the potential importance of spillovers, which suggests that the private decisions will result in under-investment in employer training at the national level.

Insofar as firms benefit from such spillovers, they should also be expected to help to fund the increased levels of training necessary to exploit them at the national level.

Society

The socially optimal outcome attempts to capture all of the costs and benefits of investment in skills, quantitative and qualitative, to society as a whole. The social welfare calculation uses the social rate of discount to replace the private discount rate.

While some qualitative aspects of employer investment in skills may need to be taken into account from a social perspective, these do not appear to be as important as the quantitative effects of investments in firm and sector specific skills on economic performance.

The use of the social rate of discount in deciding the socially optimal level of investment is important. The social rate is generally lower than the private rate, in part because the risks of investment to society are lower than for the individual. Thus, society is more likely to accept investments with returns further into the future than the private decision maker.

State intervention

There is a case for State intervention in the market for employer training, but its strength depends on a number of factors, not all of which can be resolved from a review of just the conceptual literature.

Insofar as intervention can be justified, the conceptual literature suggests different forms of intervention may be appropriate for different types of skills:

- firm specific (idiosyncratic) skills – there is a case for tax breaks for firm specific training;
- sector specific skills – it seems more likely that these would be better encouraged through some form of levy system;
- non-sector specific (but not wholly general) skills are important because of the inequities created by sector specific interventions, such as levies – they can be handled in a variety of ways, of which sector to sector net payments is but one;
- general skills – will be dealt with under a parallel UK Commission project.

However, the principal conclusion is that there is a strong case for intervention at the sector level:

- there seem to be considerable grounds for believing there is a greater commonality of skill needs at the sector level;
- poaching undermines the private rate of return to sector specific skills training and, hence, collective, sector wide action is required;
- there are likely to be significant returns from increasing the pool of skills at the sector level;
- employers will be the main beneficiaries of the increased sector pool of skills and should be expected to contribute to the costs of developing that pool;

- employers are best suited to establishing what skills are needed within the pool, which appears to point to the need for greater employer involvement in the decision process.

The specific nature of employer training suggests strongly that, if a case can be made for government intervention, this should not be in the form of government provided or even government led training.

- In the main, the individual employer is the best arbiter of firm specific training and the sector-collective of firms is the best arbiter of sector specific training.
- A similar argument can be made for the development of local skills, which should involve employers in that locality.

Employers should be expected to foot their share of the bill for intervention, insofar as intervention (for example, to exploit spillovers) leads to improvements in firm performance that accrue to them. Taxpayers should foot their share of the bill insofar as interventions improve firm profits and, thereby, the corporation tax take.

Further research

The Conceptual Review has raised a number of issues about both the theoretical and empirical literatures. Some of these are important to the design of Collective Measures, some are more important to longer term developments to enhance firm performance in an increasingly weightless economy.

An example is the need to develop robust measures of training, which would enable training to be declared in company accounts. Such measures might enable the future introduction of tax breaks for training or training levies.

Such developments would also allow a more thorough evaluation of the costs and benefits of training, at the individual employer, sector and national levels.

Executive Summary

The presentation of the results of the Conceptual Review is organised around two principal research questions:

- What does the optimal amount of employer investment in skills and training mean and, does this differ from the perspective of the firm, the sector, the economy and society?
- Can public policy be used to reach, or at least move closer to the optimal level? Is intervention by the State a part of the problem? In what ways?

In addition, particularly under the first of these two headings, the Review considers:

- How would we know if the optimal level is currently being reached? Is it ever reached?
- What might be the reasons for suboptimal provision? In what ways might the market for training be failing employers?

Finally, a number of urgent topics for future research are outlined.

Optimality from firm, sector, economy and societal perspectives

Optimality at the employer level

Individual employers matter. Individual employers are a crucial cog in the UK's training system. While theory suggests that they may, under certain circumstances, provide employees with general skills, they are normally the only possible source for the provision of firm specific skills. According to the management, institutional and learning organisation literatures, specific skills are fundamental to the competitive advantage of firms because they cannot be replicated by other firms.

Optimality. Optimal investment in skills from an employer perspective occurs where the (discounted) sum of future benefits from the investment is just equal to the (discounted) sum of current (and future) costs of the investment. In this context, "discounting" simply means that the future flows are adjusted to be comparable with current flows.

There are two principal "best practice" investment rules that employers can use to decide optimal training investments. Discounted cash flow (DCF) techniques are the most accessible, but not well suited to situations of risk and uncertainty. Real options pricing models are more suited to risk and uncertainty, but are in their infancy in the context of decisions about investment in skills.

Using DCF and real options approaches, along with scenario modelling, has the advantage of formalising the decision making process and providing a time-consistent framework for exploring likely futures.

When is the optimum reached? Based upon perfect information about the future, *ex ante* decision rules such as DCF techniques can provide a unique level at which investment in skills is optimised.

Whether the investment decision proves correct *ex post* is normally judged by whether the rate of return achieved from the investment exceeds the cost of borrowing capital (the interest rate). If the rate of return is significantly less than the cost of capital, then this is an indication the firm has over-invested in skills and, if the reverse is the case, it is an indication that the firm has under-invested.

In practice, even the use of the most sophisticated techniques cannot guarantee that the *ex ante* training decision will prove optimal *ex post* (except by chance), unless all of the assumptions made in the investment calculation prove correct.

Decision makers then have to move to rules that better handle risk and uncertainty, such as real options pricing. In addition, these rules are used in generating scenarios, where the employer can explore how they will cope with potentially quite different outcomes.

Reasons for suboptimal provision. Product champions are notorious for developing and presenting a "best case" scenario. The assumptions and data developed by such individuals, particularly about future outcomes, need to be critically scrutinised. (This applies equally to product champions in government, as to those in firms).

There are a variety of barriers that may prevent firms from achieving the optimal level of investment suggested by their investment decision rule, including, management's capacity to train, managers' social skills and social capital, the failure of staff to cooperate with the training, difficulties in raising funding for training, etc.

Care must be taken in interpreting these barriers, for example, managers may argue that funding difficulties are a barrier to training when, in practice, they may not have constructed a sufficiently well argued business case or they lack the social skills to convince a financial institution to lend them the necessary funds.

Small firms are a microcosm in which many of the issues concerned with deciding and attaining the optimal levels of investment in skills are focused. Even simple DCF decision rules contain quite complex concepts, and collecting relevant information is time consuming and costly. Barriers multiply in small firms: management time is at a premium; scarce staff cannot be released for training; funds for training are inadequate; etc. One problem may form a disincentive to train, several problems combined may produce a complete impasse.

Optimality at the sector level

Sectors matter. Sectors matter in a very real sense when considering investment in skills. Sectors tend to be based around common technologies, common products or both. This suggests that there may a high degree of commonality in all but the most idiosyncratic, firm specific skills within a sector, but larger differences between sectors.

Sectors also differ in their maturity and rate of product and/or process innovation. Such factors also give rise to sector-specific implications for the mix and level of skills required, with more innovative sectors generally associated with higher optimal levels of training.

Optimality. The competitive environment within which firms operate (both product and labour markets) has important implications for optimal levels of training. This is partly a question of market structure, but more importantly an issue associated with the goals and product market strategies of the companies.

Theory suggests that optimal investment in skills may be lower under perfect competition than where there is some degree of monopoly power (e.g. the union voice model). Theory also suggests lower optimal levels of training in highly price competitive markets and higher levels where price competition is less important than product specification and quality.

Perhaps the most important finding at the sectoral level is that, even if employers take decisions that are optimal in the light of their private calculus, the skills outcome will not be optimal at the sectoral level, where at least one firm benefits from the training investments by other firms.

When is the sector optimum reached? Using a comparison of the returns to training at the firm and sector levels, it is possible to demonstrate that, in the presence of positive spillovers, the rate of return to investing in training is higher for the sector than the individual employer. The extent to which it is higher depends on the magnitude of the spillover effects.

For modest spillovers, there are declining returns to investment in skills, in the same way as for individual firms (though a higher optimal level of investment per firm). However, for significant levels of spillovers, it is possible to generate increasing returns to investment in skills at the sector level (as well as increasing returns to the scale of the sector).

If such spillovers are gradually exhausted over time, first the outcome with modest spillovers appears and, then, when finally exhausted, the optimal outcome at the sector level is achieved *via* the private calculus of individual employers.

Reasons for suboptimal provision. The present discussion focuses on the role of spillovers in driving a wedge between what is optimal from a firm perspective and what is optimal from a sectoral perspective. This can happen in several ways.

The first occurs where even the training firms benefit from the pool of trained labour within the sector, e.g. because:

- of positive interaction between trained employees in different firms;
- customers perceive the high sector skills as an indicator of high product specification and quality;
- employers are able to recruit highly skilled individuals.

Under such circumstances the private employer calculus produces an under-investment in skills at the sector level. Insofar as firms in the sector benefit from such spillovers, they should also help to fund the increased levels of training.

It is also possible to find discussion of negative spillovers at the sectoral level. An example is the case of the poaching of trained workers by firms that do not train, which results in an under-investment in training from a private perspective. It is quite likely that poaching has completely undermined the private rate of return to investing in sector specific skills. In this case, some type of system is required that penalises those who do not train and supports those who do.

Optimality at a spatial level

Geography matters. Certain types of individual are more mobile than others, both in terms of their willingness and ability to move to a different location and in the distance they are willing to travel to work. In particular, younger and more highly skilled/educated workers can often operate beyond regional and even national levels. However, the bulk of those in the labour market are much more restricted in terms of the location of potential employment.

As a consequence, geography can be as a significant influence on labour market conditions faced by individual employers as sectors. Thus, labour market policy (including sector-based policy) must have an important spatial dimension that recognises the role of regional development agencies, cluster strategies, etc.

Optimality. Each location will differ in terms of the nature of the local labour market. Some may be dominated by a single, major employer, which may have a strong influence over the skills demanded in the area and over the rates of wages paid. If the employer is in a declining sector, this may have important consequences for the level of demand for labour and the nature of the skills demanded.

While the nature of employers in a given area may be an important determinant of the demand for skills, the presence (or absence) of a skills pool may equally be an attraction (or deterrent) for an employer deciding to locate in or considering whether to stay in a particular

area. Thus, as with the national level, a geographical area should be seen as a system, in which component parts may take positively reinforcing decisions or may take decisions that detract from the performance of others.

As in the case of the sectoral level, even if employers take decisions that are optimal in the light of their private calculus, the skills outcome will not be optimal at the spatial level, where at least one firm benefits from the training investments by other firms in the area or is harmed by the failure of other employers to train.

When is the spatial optimum reached? The conceptual evidence suggests that, similar to technology spillovers relating to a given sector, there are likely to be local area spillovers which, again, on balance operate in a way that means that the private training decisions of employers in a given area will be less than optimum.

The conceptual literature has identified a number of potential types of geographical spillovers, including:

- neighbourhood effects, where individuals with low skills gravitate to and become locked in deprived areas. Such neighbourhoods may build a stigma that discourages employers from considering individuals located there for employment or training;
- spatial concentrations in education and skills that raise the performance of firms and the wages of individuals in those locations above what they would be in areas of lower education and skills;

Reasons for suboptimal provision. This occurs because both individuals and employers benefit in a variety of ways from the training undertaken by other employers in the area, but they do not take this into account when undertaking their private calculus about the returns to training.

As in the case of sectoral spillovers, even the training firms in a given area benefit from the pool of trained labour within the area, e.g. because:

- of positive interaction between trained employees in different firms;
- customers perceive the high area skills as an indicator of high product specification and quality;
- employers are able to recruit highly skilled individuals.

Likewise, there are negative spillovers from too low a level of training, as employers rely on recruiting individuals that other firms have trained.

Such spillovers require government intervention in order to be corrected. Nevertheless, the main beneficiaries of improvements to the skills available in a local area are the employers

based in that area and/or, depending on what happens to the rate of employment and wages of individuals in that area.

Optimality at the national level

Nations matter. Just as sectors and local areas are distinctive, so are nation states. Each can be viewed as a "system", comprising a complex set of inter-related component parts that function to carry out certain activities. The most widely studied of these activities is innovation (e.g. the "national innovation system"), but there is also interest in "national training systems".

Each nation state forms a unique system, of which the national training system is a part. As the parts of the national system are so inter-connected, changing one part – such as the training system – may have unintended consequences for other parts. This makes it extremely difficult, if not impossible, to transplant a training system from one country to another. However, this does not prevent lessons being learnt from other countries (e.g. the experience of countries in introducing R&D tax breaks or in using training levy systems).

Optimality. At the national level, optimality is a much more complex issue than at the individual employer, or even the sector or area levels. At this level of aggregation, it becomes increasingly difficult to distinguish between the national optimum outcome and the socially optimal outcome. Here, a somewhat arbitrary distinction is made, that non-financial or non-economic costs and benefits are omitted at this stage (but introduced at the societal stage), and some average cost of capital to business is applied rather than the social rate of time preference. In this sense, optimality would have to be judged on the grounds of the country's rate of growth, labour productivity improvement or total factor productivity change.

At the national level, employer training provision is likely to be a mix of over- and under-provision. Government failure may be one source of the over-provision of certain forms of training. However, the most pervasive part of the conceptual literature remains that of spillovers. Significant spillovers at the national level would suggest the outcome left to individual private decision makers will be suboptimal. If those spillovers are positive, on balance, the private decisions result in under-investment in employer training. Insofar as firms in the economy benefit from such spillovers, they should also help to fund the increased levels of training necessary to fully exploit them.

When is the national optimum reached? It is unlikely that the national optimum is ever reached – not only for the UK, but for all other countries. The important question here appears to be a relative one – as to how the UK's national system (or systems) of training performs relative to those of other countries. Even this is hard to judge, given that

governments intervene in training on social as well as economic grounds and a training outcome made on purely financial grounds becomes largely hypothetical.

Reasons for suboptimal provision. There are at least three groups of reasons why investment in skills may not be optimal at the national level:

- various forms of institutional failure;
- a systems failure;
- spillovers and externalities.

Institutional failures. The current difficulties in identifying optimal levels of training amongst employers, in part, is the result of the current failure to measure the extent and nature of training with any degree of accuracy. The measurement of research and development has shown that it is possible to design metrics for investments in intangible assets, including investments in skills. It is probably also worth exploring the process that health economists went through in developing the quality adjusted life year (QALY), where health treatments have many different effects, most of which cannot be valued by any easily observable process (e.g. there are no market prices).

The failure to develop common measures of training, when combined with current accounting practice of writing off investments in skills as a current cost, do not allow a proper assessment of the benefits of training. Writing training off against current profits or revenues also sends a message to shareholders and the markets that training expenditures have been wasted.

If financial markets are short-termist, then this works against investments in training where the benefits accrue in the longer term. Short-termism in financial markets also makes managers more short-termist, as their success is judged on the more immediate effects of their decisions and actions.

The conceptual literature highlights the failure of government interventions in the market for training. The skills most relevant here are sector specific and, often, firm specific in nature. The more idiosyncratic the skills are, the less likely government can successfully provide them. The conceptual literature suggests the need for this type of training to be demand led.

Systems failures. The education and training problem in Britain has been argued to be a fundamental and broadly based "systems failure". While a systems failure may be initiated by a single imperfection or failure in the system, the knock-on effects on other parts of the system can be severe and sometimes fatal. The returns to acting on any one dimension of the problem alone are generally relatively low, and there may be a need for wide ranging policy initiatives that involve more than just training or even the labour market.

Spillovers and externalities. Employers' decisions, based on their private calculus, will be suboptimal at the national level insofar as there are spillovers. Sectoral and spatial spillovers have already been discussed and appear to largely result in an under-investment in training. These include technology spillovers (sectoral and spatial), neighbourhood and local area effects (spatial), but there may be other sources as well, such as skills-technology complementarities, whereby higher skill levels give rise to higher innovative activity and higher innovative activity gives rise to increased demands for skills.

Optimality from a social perspective

Society matters. Society matters in the sense that the socially optimal outcome attempts to capture all of the costs and benefits of investment in skills – both quantitative and, more problematically, qualitative – to society as a whole. The present, rather naive distinction with national optimality mainly stems from the fact that the social calculation:

- adds in the non-financial or non-economic costs and benefits of training (the mainly qualitative elements); and
- uses the social rate of time discount (or social rate of time preference), which is generally lower than the private discount rate.

While the second of these appears important, the first appears somewhat less so in the context of employer training, which is likely to be primarily focused on firm or sector specific training, where the motivation is likely to be primarily financial or economic.

Optimality. The factors driving a wedge between what is optimal from the perspective of the employer decision and what is optimal from a sectoral or national level are again relevant here. The majority of these factors appeared to suggest greater under-investment in skills, the higher the level of aggregation (though it is difficult to be certain about this, given the increasingly "systems" orientated nature of the problem at higher levels of aggregation). In addition, there are a few other factors to take into account from a social perspective (see below), although these do not appear to be particularly important from a conceptual perspective.

What drives an important wedge between the national and social optimal outcomes, as we have defined them, however, is the government's use of a lower discount rate in the social welfare calculation (the social rate of time discount – the cost of capital set by Treasury for social rate of return calculations) than employers use in private decision making.

When is the social optimum position reached? It seems likely that the conceptual optimum point is never reached, again (as in the case of the national optimum), not just in the UK, but in all countries. The social dimension clouds international comparisons even further, for

example, some countries, such as the Scandinavian nations may utilise training interventions much more on equity grounds (e.g. to provide greater equality of employment opportunity) than other countries.

Reasons for suboptimal provision. The conceptual literature points to a wide range of different forms of market failure associated with investment in skill, most of which have been touched upon already. In addition to issues such as institutional failures and externalities, there are also some other potential forms of market failure such as public goods (which private firms will not be willing to supply) and merit goods (which society believes are good for individuals to consume). These additional sources of failure do not appear likely to be particularly important in the context of employer investment in skills.

Even if market outcomes are efficient (e.g. there is no evidence of market failure), the outcome for society may still not be equitable. In other words, there may be other largely social grounds for intervening in the market, for example, to ensure a greater equality of employment opportunities or equality of income. Again, it is not immediately apparent why employer investment in skills (given the nature of the skills involved) would be the relevant vehicle to overcome inequities.

Intervention by the State

There is a case for State intervention in the market for employer training, but the strength of the case depends crucially on a number of factors, not all of which can be resolved from a review of just the conceptual literature.

The optimal extent and form of government intervention also depends upon the extent to which the training that employers provide is firm specific, sector specific, and non-sector specific in nature. It is worth considering each of these cases in turn.

Finally, it is worth considering the issue of government failure in allowing State intervention at all and, if allowing it, what form it should take.

Firm specific (idiosyncratic) training

If employer training is highly firm specific (idiosyncratic), the spillover effects will be negligible (if any) and there is no way in which government could hope to provide courses giving the relevant skills. However, there are still grounds for believing that government should consider supporting such training, as the firm under-invests in such training because it only considers the effects on profits net of corporation tax.

A levy system does not seem the appropriate method of dealing with this problem. Other firms in the sector do not benefit from firm specific investments in skills, neither do other

firms in the economy as a whole. In addition, if the skills are so firm specific then it seems unlikely that any form of qualification linked to a licence to practice can be applied. The initial impression is that this form of training might best be supported by a tax break for investment in skills.

Sector specific training

The conceptual literature suggests that there are likely to be strong sectoral skill effects linked to commonalities in technology or in products and services. It might be expected, therefore, that there will be greater mobility of individuals holding sector specific skills within the sector than between sectors. Hence, there is a potentially important role for spillover effects between firms in the same sector, implying that, left to their own devices, employers provide less than the optimal level of training at the sector level.

Whilst slightly less clear cut, there still seems to be a strong case for such training to be demand led; employers within each sector should have a better view of the level and types of skills needed than government. Insofar as the necessary skill sets can be defined at sectoral level, it may be possible to design licences to practice. However, a levy system appears to be a potentially powerful method of manipulating the supply of sector specific skills. In this context, tax breaks appear to be a rather scattergun approach that may not meet the needs of the sector.

The present Report argues that sectoral intervention is probably the most important way of stimulating skills development in the UK. In summary:

- there seem to be considerable grounds for believing there is a greater commonality of skill needs at the sector level;
- poaching undermines the private rate of return to sector specific skills training and, hence, collective, sector wide action is required;
- there are likely to be significant returns from increasing the pool of skills at the sector level;
- employers will be the main beneficiaries of the increased sector pool of skills and should be expected to contribute to the costs of developing that pool;
- employers are best suited to establishing what skills are needed within the pool.

Non-sector specific skills

The conceptual literature suggests that optimising investment in skills at the sectoral level may still not produce an optimal outcome at the national level. There may be non-sector related spillovers in the sense that firms in the computing sector benefit from employers'

training in the engineering sector. Indeed, this was an important issue amongst firms paying levies in certain Industry Training Boards, such as the EITB, when there were clearly net flows of trained individuals to other sectors.

The matter is made more complex by the fact that, to some degree, both the recipient firm and the individual who moves sector may benefit from the move. The extent to which each benefits might help determine who should pay for the training to the training sector (e.g. payments to the training sector should reflect the relative gains to the recipient sector and the individuals). While this might be partly resolved by empirical evidence, such evidence seems unlikely to exist at present.

A number of possibilities are raised for future discussion, all based upon the assumption that the distribution of costs and benefits of sector specific skills *within the sector* can be resolved by levies or some other means:

- is it possible (or sensible) to draw up contracts that constrain the individual to the training sector for some time (e.g. contracts that keep the individual in the training sector for a set period of time);
- is it possible (or sensible) to use licences to practice and make these sector specific;
- is it possible to use LFS or other data to look at the cross sectoral flows of trained individuals, such that some scheme of cross-sectoral net payments can be designed;
- can the cross-sector flow issue be resolved by a tax break to sectors that are the main net losers of trained individuals to other sectors?

Government failure

While, from a conceptual view, there appears to be a prima facie case for State intervention in training, there are a number of provisos:

- the case depends crucially on whether the empirical evidence suggests that a number of the key variables (e.g. spillover effects) are of sufficient magnitude;
- the costs and economic distortions created by intervention may mean that living with some market failure or inequity may still be a better than attempting to remedy it.

What the conceptual literature is clear about is that employer training, in the main, tends to be firm specific or sector specific in nature. Again, the extent to which this is the case is an empirical question – although it may not be one adequately addressed in the empirical literature. The specific nature of employer training, however, suggests strongly that this cannot be government provided or even government led:

- by definition, Government is not equipped to design firm specific training only individual firms can do this;
- Government is likely to be poorly equipped to design sector specific training, a collective of firms in the sector can be expected to do a much better job of this.

The discussion also points to the fact that employers should be expected to foot their share of the bill for intervention, insofar as intervention (for example, to exploit spillovers) leads to improvements in firm performance. It points to the fact that taxpayers should foot their share of the bill insofar as interventions improve firm profits and, thereby, the corporation tax take.

Further research

Economic theory adopts a rather stylised view of training, which is more suited to analysing formal, significant and longer term investment in skills and much less suited to informal, ongoing, on the job training. Much more work needs to be carried out to redress this imbalance, drawing on current knowledge found in other disciplines.

From a conceptual perspective, current definitions and measurement of training are inadequate. There is a need to develop a "Frascati-type" manual that deals with the best practice measurement of training and related investment activities. Lessons from similar exercises, such as the development of QALY, should be taken into account.

Better measurement of training might provide support for the accounting profession in their search for accounting codes of practice that are more suited to firm investments in intangible assets.

Further research needs to be carried out to examine how useful the various best practice decision rules are in the context of real world decision making, particularly decisions concerning investment in skills.

From a conceptual perspective, education and (in this particular case) training spillovers are a central justification (though by no means the only justification) for government intervention in the market for skills. The formal definition of what constitutes a spillover needs detailed examination and, in the light of this, the precise size and nature of such spillovers needs empirical exploration.

Employee mobility appears as a key topic in several places:

- the duration of tenure of employees within a given company is a significant driver of the employer's willingness to invest in them;

- mobility (particularly of trained workers) between sectors would become a crucial issue if sector-based government initiatives to increase training, such as sector based levies, were introduced.

Empirical evidence on such issues seems to be extremely important, and such evidence may not exist at the moment, at least in sufficient detail and with the appropriate focus.

1. Aims and scope[1]

1.1 Background to the Collective Measures Study

The UK Commission has been tasked to,

> … provide a view to Government on the levers available to stimulate employer investment in skills and the cost/benefit options, including advice on whether there is a need to update and streamline the 1982 Industrial Training Board legislation for levies and whether there is a need for a new framework to support licence to practice schemes. In putting its advice together the UK Commission will need to reach a view on the wider economic impact of these policies, particularly in stimulating economic growth and improved competitiveness and their effectiveness in raising skill levels.[2]

The present Report is the first output of a series of linked projects that are intended to explore potential policy initiatives aimed at increasing (or, more accurately, optimizing) skills investment by employers on a collective basis. There are a range of potential collective measures that could be used to increase employer investment in skills, including levies, licences to practice and tax breaks for training. Figure 1.2 provides a common framework across all of the projects in the Collective Measures Study that allows a distinction to be made about the various potential measures in terms of their degree of compulsion (the horizontal axis) and the extent to which the measures are simply a transfer of resources in support of training or a more fundamental change in the institutional and cultural framework within which training takes place (the vertical axis).

Policies such as a levy or a statutory right to request training can be viewed as being essentially compulsory, forcing employers to carry out certain levels of training and penalizing them if they do not train. A levy system is largely a transfer of resources away from employers who do not train to those who do. The same is true in the case of tax breaks for investment in skills, which are a transfer of resources from tax payers to employers to subsidise training; tax breaks, however, do not have the same compulsive element as a levy system. The policy instruments in the top right hand corner can largely be viewed as "voluntarist" in nature. These policies are the natural consequence of the trend towards an increasingly demand-led training system in which employers actively participate and help guide the system.

[1] My thanks go to other members of the research team, as well as UK Commission staff, who commented on earlier drafts of this Report.
[2] UK Commission for Employment and Skills Grant in Aid letter, http://vvww.ukces.orguk/odf/080401%20Final%2OGIA.odf.

The present contribution to the Collective Measures study is the Conceptual Review of employer investment in skills, which provides the theoretical basis for the remainder of the study. The second part of the study will be an Empirical Evidence Review of the research on employer attitudes and behaviour in the labour market, and actual investment in skills. The third part of the work is the Policy Review, which reviews the available literature on the characteristics of policies which have successfully stimulated employer investment in skills in the UK and abroad. A Prioritisation Exercise with key stakeholders follows to prioritise which employer related policies will progress to the next stage, based on the evidence collated above. UK Commission will then use the results of the Prioritisation Exercise, along with the earlier material, to test out the potential costs and benefits of the preferred policies if applied in (parts of) the UK. The process is illustrated in the Figure below.

Figure 1.1: Overview of the Collective Measures Project

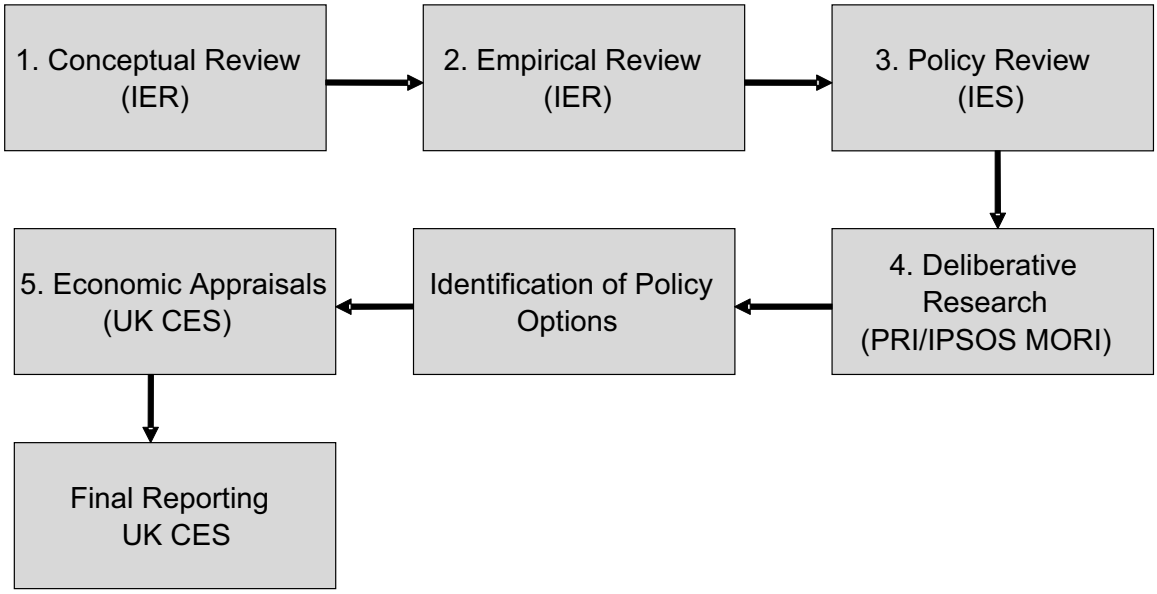
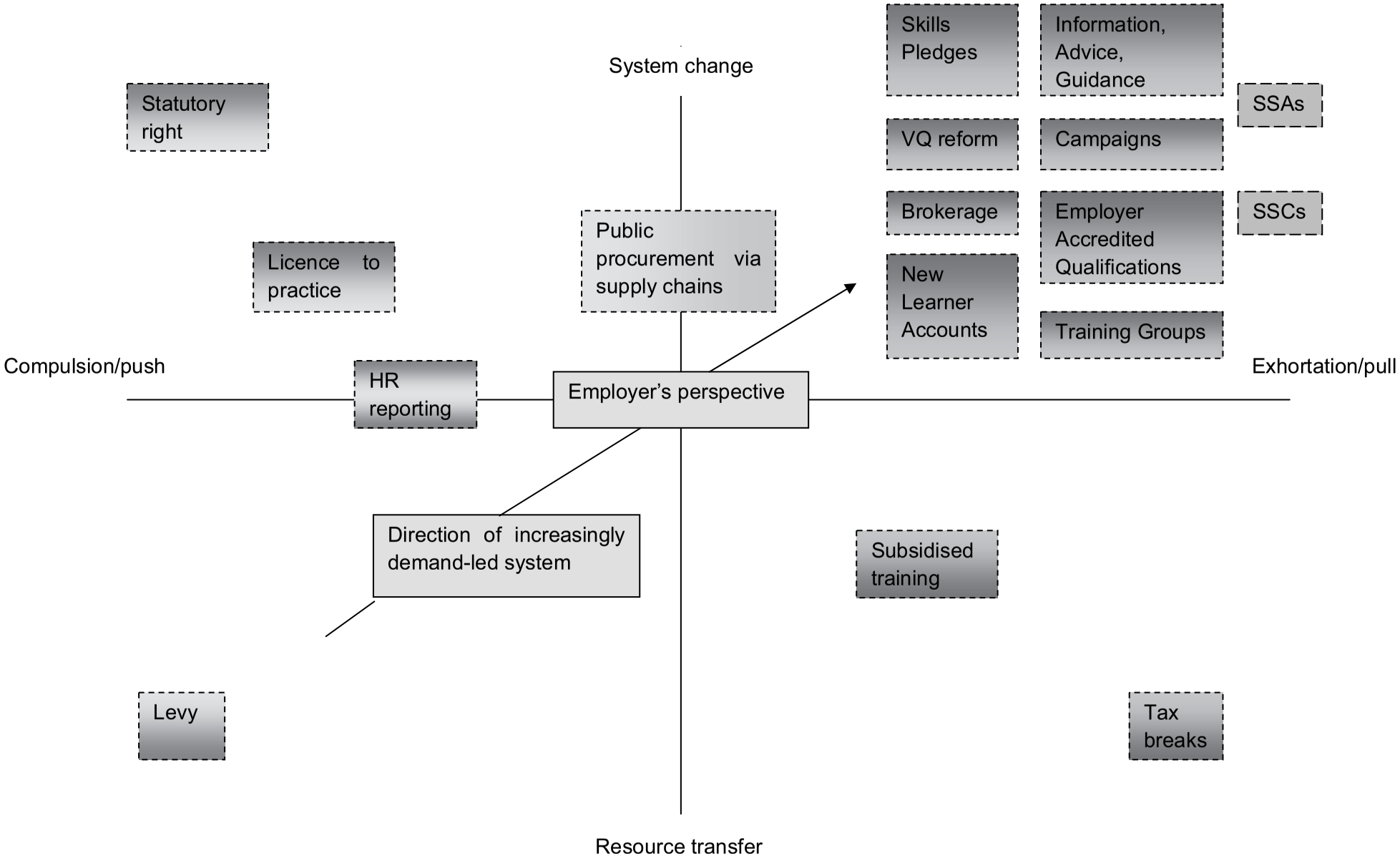


Figure 1.2: A typology of policies to stimulate (optimize) employer investment in skills



1.2 Aims of the conceptual review

The aim of the present report is to provide a review of the conceptual and theoretical literature with respect to employers' decisions about investment in employee skills. It considers the optimal and actual outcomes from an individual employer perspective, from sectoral and national perspectives, as well as the difference between the private and socially optimal outcomes. While the conceptual literature throws some light on the direction of the deviation of actual from optimal outcomes, the size of this deviation is an empirical question that can only be fully addressed from the Empirical Review of the literature.

The present review is designed to provide the conceptual and theoretical platform for understanding and organizing the subsequent empirical work and policy analysis. While the review will provide the economic rationale for the remainder of the Collective Measures study, the present Report also draws upon a wider literature outside of economics.

The remit of the project was to explore the conceptual literature to see whether it could throw light on a number of key issues:

- using economic (and other relevant) theory, provide an account of what might be expected to guide employer behaviour and investment in skills;
- to explore issues of "optimal", "under" and "over" investment and to identify how one might identify the optimal amount of employer investment in training and skills;
- consider how to assess, and what contributes to, whether the optimal level in theory is reached in real world conditions;
- identify and explain the factors that underpin market failure in respect of employer funded training, including public policy and institutional failures.

The key research questions identified for this phase of the study were:

- What does the optimal amount of employer investment in skills and training mean? Does this differ from the perspective of the firm, the sector, the economy and society?
- How would we know if the optimal level is currently being reached? Is it ever reached?
- What might be the reasons for suboptimal provision? In what ways might the market for training be failing employers?
- Can public policy be used to reach, or at least move closer to the optimal level? Is intervention by the State a part of the problem? In what ways?

1.3 Structure and coverage of the conceptual review

It should be recognised from the outset that employer investment in skills lies on a spectrum ranging from formalised training, particularly off-the-job training, which may require a significant resource commitment by the firm, through to informal on-the-job training, which requires relatively small amounts of firm resources. Most of the conceptual economic literature tends to be based upon this rather stereotypical model of off-the-job or formalised on-the-job training. The reality for the majority of the adult workforce, however, is that the vast bulk of learning may take place informally, on-the-job, through learning experiences arising directly from the work processes.

The present review of the conceptual literature covers four principal areas:

i. the first concerns the decision rules that can be used by employers in their training decisions. These include rules that would, in principle, lead to an optimal level of investment in skills, although there is also a brief discussion of whether such rules are applied and whether they would anyway result in the optimal level of training in practice;

ii. the second area of the literature concerns the issue of whether skills investment decisions taken by individual employers lead to the optimal level of training at the sectoral level. There are a number of reasons why this may not be the case, including the fact that individual firms do not invest optimally (see i above), there is imperfect competition in the product or labour market, and there are externalities or spillovers across firms at the sectoral level;

iii. the third area of the literature focuses on whether skills investment decisions taken by individual employers lead to the optimal level of training at the national level. Clearly, if these individual decisions do not result in an optimal outcome at the sectoral level (see ii above), they will also not be optimal at the national level. However, there are other reasons why sectoral optimality may not result in an optimal outcome at the national level, for example, there are other externalities and spillovers that are not sector specific, financial markets can be short termist in nature and past government policies may not have the desired effects on the skills system;

iv. the fourth area of the conceptual literature concerns the potential differences between private and social optimality in the market for training. This literature divides principally into the justifications for intervention based upon market imperfections and those based on the grounds of inequity. In addition, the distinction between the social and private rates of discount is considered.

During the discussion of these topics, it becomes clear that there is a further dimension to the issue of training – a spatial dimension. While some individuals are highly mobile in the sense that they can move their place of residence in response to employment opportunities or can commute long distances, many individuals are not, and have to compete for employment within a relatively limited local area. This helps to highlight a crucial policy issue – that of whether skills and training policies should be designed along sectoral lines or in terms of the locality in which individuals reside or, indeed, some mix of the two.

The structure of the present Report follows the four main areas set out above, highlighting, where appropriate, spatial issues, plus a concluding section. Section 2 outlines the main decision rules that employers might apply when considering making investments in skills, and the link between the use of such rules and optimal outcomes from the individual employer perspective. Section 3 discusses what factors determine whether individual training decisions lead to an optimal level of training at the sectoral level. Section 4 discusses what factors determine whether individual training decisions lead to an optimal level of training at the national level. Section 5 deals with the distinction between private and social optimality in the market for training. Finally, Section 6 provides the main conclusions and in particular, it explores the implications of the various factors that prevent optimal levels of training at the individual, sectoral and national levels for various types of policy intervention.

2. Employer decision rules

2.1 Concept of optimality

This section focuses mainly on two sets of decision rules:

- the first is often referred to as standard discounted cash flow (DCF) techniques[3], which includes the net present value and internal rate of return approaches. The present discussion focuses on the net present value calculation[4];
- the second group of techniques is most widely recognised as the options pricing approach, which has been widely applied in financial markets. In the present context, the discussion describes the real options approach, which has been applied to investments such as research and development (R&D), where there is a substantial amount of idiosyncratic risk associated with the investment.

In practice, both techniques apply discounting in order to put all relevant future costs and benefits on a common temporal footing (e.g. the present).[5]

Both techniques will select the optimal investment if all relevant future costs and benefits are known with certainty. In practice, these are rarely, if ever, known with certainty; they are generally, at best, associated with some degree of risk and, at worst, the values are uncertain.[6] Thus, it should be made clear from the outset, that, while each of these decision rules, based upon assumptions about the future, may suggest that a certain level and type of investment in skills is optimal (i.e. *ex ante*), in the fullness of time, when the actual costs and benefits materialise, the amount and type of investment may (almost inevitably will) prove suboptimal in retrospect (i.e. *ex post*). Note, however, the problem is not with the decision rule, but with the quality of information used within the decision rule.

[3] When such techniques are applied to investment decisions that include other, non-financial flows, the technique is often referred to as cost-benefit analysis and when it includes less quantifiable impacts on society, it is often referred to as social cost-benefit analysis

[4] NPV and IRR give identical results for most cost and benefit flows, but can give different results where the costs or benefits are concentrated at the end of the time horizon (an example would be investment in nuclear power, where the costs are concentrated at the front and back ends of the time horizon and the benefits fairly equally distributed in the intervening years).

[5] Discounting is simply the mechanism used to put all of the values involved into a common time frame – normally the time at which the decision to invest is being made. This is necessary because, even in the absence of inflation, £100 in one year's time is worth less than £100 now (as you can invest the £100 now at a rate of interest, i, and obtain £100(1+i) in one year's time). In other words, £100 a year ahead is worth £100/(1+i) now and, with compound interest, £100 in two year's time is worth £100/$(1+i)^2$ now.

[6] The distinction between risk and uncertainty is that it is possible to attribute a probability distribution to a situation of risk, but, in the case of uncertainty, this distribution is unknown.

2.2 Neoclassical theory, discounted cash flow techniques and human capital theory

Basic theory

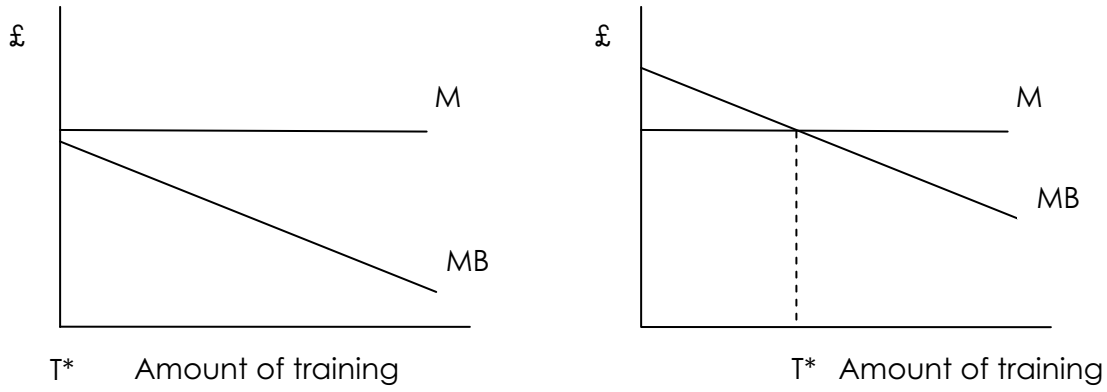
This section begins by outlining the very basic neoclassical approach which can be traced back at least to the seminal works of Mincer (1958) and Becker (1964). This theoretical framework not only provides a technique to determine the optimal level of training, it also provides some useful insights about who should fund training.

The neoclassical theory of investment in training is constructed in a competitive environment both in terms of the product and the labour market.[7] Each unit of output is sold at a constant price, P, and each person hour is hired at a constant wage, W, where prices and wages are determined by their respective markets. According to neoclassical theory optimal investment in training occurs at the point where the marginal costs of an extra unit of training are equal to the marginal benefits (Bosworth, *et al*. 1996, pp. 223-237, Saks and Haccoun, 2004 and many others). This is normally translated into a net present value or internal rate of return calculation, as the returns to training and, to a generally lesser extent, the costs of training, take place over an extended period of time.

Neoclassical theory assumes there are diminishing returns to investment in training, so each additional £1 spent on training gives rise to a smaller value of future benefit than the previous £1 spent. Figure 2.1 shows the diminishing returns as a downward sloping curve (MB – discounted marginal benefit) in each half of the diagram, and MC denotes the discounted marginal cost of training. This implies that there will be an optimal value of investment, T*, which will either be zero (discounted value of benefits are less than the discounted value of costs for even the first £1 spent on training – left hand figure) or positive (at the value where the net discounted marginal £1 spent on training gives rise to £1 of discounted marginal benefits – right hand figure).

[7] The present section maintains the standard competitive assumptions. Issues about what happens when such assumptions break down (e.g. asymmetry of information, bounded rationality, *etc*.) are dealt with later in the Report.

Figure 2.1 Optimal training



Consequently, where discounted marginal benefits exceed discounted marginal costs, training should be increased as this will raise the total net benefit of training, but where discounted marginal costs exceed discounted marginal benefits, too much training is being carried out and a reduction in training increases the net benefit to the firm.

In this section, neoclassical investment theory has been translated into a DCF framework, but it should not be assumed that DCF techniques – net present value and internal rate of return – can only be used in a neoclassical setting. NPV and IRR techniques can be applied to almost any investment decision. In the next section, the analysis assumes a perfectly competitive framework in order to establish some benchmark results. Again, however, NPV and IRR techniques can be applied just as well in a monopoly setting as that of perfect competition.

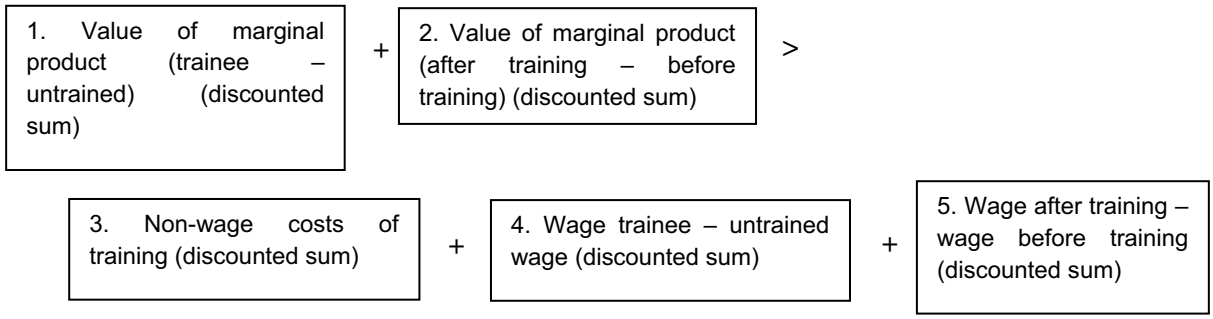
These DCF calculations can also be modified beyond dealing with the financial costs and benefits of investment in training decisions, to include more qualitative elements within a broader cost-benefit analysis. It is widely recognized in the conceptual literature that a wide range of benefits from education and training are qualitative in nature. However, in general, the more qualitative elements need to be quantified monetarily. There are a range of techniques available to do so, including "willingness to pay" measures.

Main elements of the training decision

The main elements in the economic calculation under the training decision are set out in Figure 2.2 and mathematically in Appendix 1 (Bosworth, *et al*. 1996, pp. 233-235). The figure has been constructed so the effects on output are shown on the left hand side of the inequality and the effects on costs on the right hand side. The present discussion is couched in the general context of whether there is a net benefit from an individual receiving

another unit of training. In practice, even if there is a net benefit, whether training takes place depends upon who bears costs and who appropriates the benefits of the training (e.g. the individual or the firm).

Figure 2.2 Elements of the training decision



Box 1 reflects the change in productivity of the individual being trained, during the training period. It is normally assumed that individuals are less productive during training than they would have been otherwise, although it may not always be the case in practice. In part the assumption of lower productivity reflects the fact that training diverts individuals away from their normal duties. The value in this box is the discounted sum of the value of output lost, where, under perfect competition, the value of output lost is the price of output multiplied by the reduction in the marginal product of the individual.

Box 4 shows whether the individual receives a lower, the same or a higher wage during the training period. As will be seen in the next section, this will depend on who receives the benefits, once training has been completed. A lower wage during the training period would help to off-set the lower productivity of the individual during training and be viewed as a positive thing by the firm, but not by the individual.

Box 2 reflects the change in productivity of the individual after the training period. The value in this box is the discounted sum of the value of output gained post-training, where, under perfect competition, the value of output gained is the price of output multiplied by the increase in the marginal product of the individual. The more effective is the training in raising the individual's productivity, the greater the gain in output.

Box 5 represents what happens to the individual's wage post-training. This shows whether the individual is able to appropriate some of the benefits of their increased productivity following training. The higher the post-training wage, the more positive training is for the individual, but the less so for the firm.[8]

Finally, Box 3 represents the non-wage costs of a unit of training. These would include any payments by the individual or the firm to educational or training institutions, as well as travel

[8] This basic, neoclassical model ignores the non-wage benefits of training.

costs to and from training. It would also include the purchase of books or other materials necessary for training, as well as the hire of any equipment used during training.

General and specific training

Whether training will be funded or not depends crucially on who bears the costs and who appropriates the benefits of training. Becker's conceptual differentiation between general and specific training has been widely utilized in the literature on the funding of training, although a more general framework based upon employee wastage and turnover rates has been proposed elsewhere (Bosworth, *et al*. 1994). The present discussion focuses on the simple Becker model first, showing how the previous inequality (Figure 2.2) collapses depending on the nature of the training. It then goes on to discuss somewhat more general cases of mixed training and less than perfect labour mobility.

Specific training raises the productivity of the employee within the firm providing the training, but not in other firms. Hence, in the case of specific training, the wage the individual can obtain outside the firm is determined independently of the amount of training received within the firm. General training results in skills that are useful in other firms, irrespective of which firm provides the training.

General training

In the simplest of neoclassical worlds, if training is general in nature, other firms in the market would be willing to pay a wage that reflects the post-training level of the worker's productivity. The worker will then move to such a firm if their present employer is unwilling to pay this higher wage. This means that the firm is forced to pay this higher wage and Box 2 cancels out Box 4 in Figure 2.2. The calculation collapses further as the wage of untrained workers is also equal to the value of their marginal product so one element of Box 1 cancels with the corresponding element of Box 4. This gives the outcome for general training shown in Figure 2.3 (see Appendix 1 for details).

Figure 2.3 Conditions under which firm will "invest" in general training

Marginal product of trainee – wage of trainee (discounted sum)	>	Non-wage costs of training (discounted sum)

What Figure 2.3 states is that, in effect, there are no conditions under which the firm will invest in general training. For general training to take place, the individual must accept a training wage which is not only less than that of an untrained worker, but less than their product at the margin. This wage has to be sufficiently less than their production to pay for

the non-wage costs of training. In other words individuals have to pay for their general training.

Thus, in a competitive labour market, with perfect labour mobility, no economically rational firm will fund general training. A firm that funded such training would have to set the worker's wage below their post-training level of productivity in order to recoup its outlays on training. This is not possible in a competitive labour market because other, non-training firms would be willing to pay a higher wage reflecting the trained worker's higher productivity.

Specific training

Specific training produces a quite different outcome. As specific training is only relevant to the training company and not to other companies, the training company can pay the individual the untrained wage even after training. Looking at Figure 2.2, this implies that the wage prior to, during and after training remains the same. Thus, Boxes 4 and 5 disappear and the inequality can be rewritten as in Figure 2.4 (again see Appendix 1 for details).

Figure 2.4 Conditions under which the firm invests in specific training

Value of the marginal product (trained – untrained) (discounted sum)	>	Non-wage training costs (discounted sum)	+	Value of the marginal product (untrained – trainee) (discounted sum)

In essence, the firm will invest in additional specific training if the value to the future output stream from that training is greater than the value of output lost during training and the non-wage costs of training. Following Figure 2.1, investment occurs if the initial inequality holds (that marginal benefits outweigh marginal costs) and will be expanded up to the point where equality exists (marginal benefits equal marginal cost).

Initial issues with the theory

The competitive theory provides a neat division that purports to explain who will pay for training, if training is separable into its specific and general parts. However, skill development may require a package of both specific and general training, which may imply joint funding by firms and employees. Given that individuals and firms will have different views about the costs and benefits, as well as different discount rates, it is not at all clear that the optimal amounts of specific and general training will emerge in the way suggested in the theory even in a neoclassical world.

The second main issue with the traditional distinction between specific and general training and, thereby, who will fund training, concerns the assumption of perfect mobility, attuned to

slight differences in the relative wages on offer. In practice, wages are only one of many factors that influence the individual's choice of employer or their choice of where to live. In addition, perfect mobility also ignores the costs incurred by employees when searching for a new job and the costs to employers of hiring new workers. As soon as some degree of immobility exists, the simple funding dichotomy associated with specific and general training begins to break down.

Thus, while there may be reasons why employers may tend to favour the funding of specific training and individuals the funding of general training, the neoclassical dichotomy between general and specific training is rather simplistic.

2.3 Real options theories of optimal investment

Training: a discretionary investment of the firm

Economics has tended to group certain types of investment as being "discretionary investments" of the firm. The contribution by Mueller (1967) was way ahead of its time, in recognising that discretionary investments, particularly the more risky ones such as R&D, were largely funded from profit. Even if additional, external funding could be raised, which is not always easy or cheap in the case of risky investments such as R&D, the extent of the external funding was still strongly influenced by the current profitability of the company.

A second complementary contribution, by Grabowski and Mueller (1978), makes the crucial distinction between "economic" and "accounting" profit. Economic profit, π^e, is a measure of the total "surplus" generated by firms and is equal to accounting profit, π^a, plus the discretionary expenditures on R&D, R, advertising[9], A, and training, T, that are expensed in the firm accounts (e.g. written off against profits or reserves, as recommended in accounting codes of practice), but which are investments that yield future benefits. Investment in physical capital, I, and payment of profits taxes, Tx, are made from retained (accounting) profit, whilst the remainder are dividends, D, which are distributed to shareholders.

Thus, combining the general ideas put forward by Mueller (1967) and Grabowski and Mueller (1978), economic profit comprises,

$$\pi^e = \pi^a + R + A + T = I + D + Tx + R + A + T \quad (1)$$

(Bosworth, 2005, pp. 62-63). In this theory, discretionary investments compete to be funded from economic profit – at this stage in its development, the theory said nothing about the feed-back of the investments into future profits, this came in later theoretical work.

[9] Advertising here refers to longer term investments in brand building, rather than short term campaigns, the effects of which are over within the accounting year.

Training as a risky investment – an analogy with R&D

Training is widely recognised as an investment in human capital assets, an intangible asset of the firm (Lynn, 1998, p. 14, and Brooking, 1996, pp. 43-61). Larger, more formal investments in training are also viewed as inherently risky, although perhaps not quite so risky as R&D. The riskiness of R&D and the availability of fairly robust measures of R&D activity have channelled the literature towards the question of R&D (rather than training) decision making under risk and uncertainty. However, in much of the R&D literature it is possible to substitute the phrase "formal training" for the acronym, "R&D".

According to Doctor, *et al*. (2001, p. 79), "R&D management, by its very nature, is characterised by uncertainty since effective R&D requires a complex interaction of variables". The authors state that "... uncertainty exists if an action can lead to several possible outcomes", where "... a challenging aspect of R&D management is to identify the likelihood or probability that these outcomes or events will occur".[10] (*ibid*. p. 80)

Limitations of traditional accounting and discounted cash flow (DCF) techniques

Boer (2005, p. 3) argues that many management teams have put increasing pressure on R&D budgets, when, in fact, R&D may have still proved to be a profitable investment. One source of the problem is that accountants are, by training, conservative in approach and, as pointed out above, treat R&D as an expense and not as an investment (*ibid*. p. 3). According to the author, this has the "... disadvantage of not allocating expenses at the same time frame as the anticipated results" (*ibid*. pp. 3-4). Another reason that R&D has been treated as an expense, again partly down to accounting problems, is that it is "... challenging to separate the value created by R&D from the other value-producing elements of the corporation" (*ibid*. p. 4).[11] The same is true for training.

This implies the need to move towards an "intellectual value solution", which involves the concepts of "intellectual property" and "intellectual" or "knowledge capital", as dimensions of intangible assets. (*ibid*. p. 6). The evolution of this new approach to the measurement of assets can be traced in the accounting, management and economic literatures (e.g. Brookings, 1996; Lynn, 1998; Wyatt, 2006). Intangible knowledge capital can be defined as the "... present value of the future stream of knowledge earnings" (Boer, 2005, p. 7),

[10] If probabilities can be attached to the various outcomes, then the outcome is risky, whereas, if these probabilities are not known, the outcome is uncertain.

[11] This problem has been largely overcome by using multiple regression analysis of profitability (or market value or productivity) on R&D expenditure and other control variables, on a more macroeconomic scale, and by estimating an R&D return at each stage of a product based on the risk-adjusted value before and after each R&D stage (*ibid*. p. 4).

although it is easier to define than it is to measure, at least with any accuracy. The interest by the accounting profession, however, has not resolved itself into specific policies.[12]

Doctor (2005, p 81) notes that, while DCF analysis can be used in R&D decision making, it is ",,, also easy to misapply or misinterpret DCF techniques, particularly in longer term R&D projects that involve high risk". The normal method of dealing with risk in DCF calculations is to use a rate of discount that reflects the perceived degree of risk associated with the project (Bosworth, 2005, pp. 333-334). In other words, an investment with no risk uses the risk free discount rate and the investment with risk adds a premium to the risk free discount rate that reflects the degree of risk involved (an alternative is to incorporate an insurance payment into the cost flows of the DCF calculation). The effect of this is that the higher risk investments always appear less favourable than less risky investments, other things equal. The real options method is different to this insofar as it comes from a "... perspective that risk can be a source of advantage, and risk-taking can be financially rewarding" (Boer, 2005, p. 8).

Doctor, *et al*. (2001, p. 81) also argue that standard DCF analysis often fails to deal with the implications of not pursuing the research project, in other words, the counterfactual. This is more clearly dealt with in the real options approach, although, in principle, it could also form part of the DCF analysis.

Real options approach to optimal investment

Standard real options model. An increasingly important approach to the valuation of strategic capital is the real options method. The term "real options" distinguishes decisions about whether to invest in new plant and equipment, training, R&D, *etc*., from investments in financial options relating to securities or commodities (Boer, 2005, p. 7).

Real options investment decision rules are based on models that can be traced back to the Black and Scholes (1973) formula for pricing European stock options[13] (Pennings and Lindt, 1997, p. 84). Based upon a number of assumptions, Black and Scholes (1973, p. 640) obtain a formula for the value of an option to buy a share of stock as a function of the interest rate, the variance in the return of the stock, time and the value of the stock. In this context, a real option relates to the right to make an investment in R&D (or training), rather

[12] "A project proposal was developed and considered by the IASB at its meeting in December 2007. At that time, the Board decided not to add a project on intangible assets to its active agenda. The Board acknowledged the importance of addressing the accounting issues relating to intangible assets, noting concerns with current requirements that lead to inconsistent treatments for particular types of intangible assets depending on how they arise. However, the Board noted that properly addressing the accounting for intangible assets would impose a large demand on the Board's limited resources." International Accounting Standards Board. http://www.iasb.org/Current+Projects/IASB+Projects/Intangible+Assets/Intangible+Assets.htm.

[13] European options, unlike American options, cannot be exercised prior to maturity.

than a financial option, but with the ability to do so or not to do so, depending on the prevailing conditions at the time of the decision.

In a very simple example, Dixit and Pindyck (1994, pp. 27-30) demonstrate the essential difference between a DCF calculation and a real options calculation, in which there is a value to waiting (see Appendix 2 for a more detailed description). In this example, there are two possible future streams of revenues from the investment. Further information is revealed between period 0 (the time at which the DCF calculation is made) and period 1, which helps to determine (in this simple example, determines) what the future stream of revenues will look like. Thus, a decision based on a DCF calculation at time 0 would weight the two future possible outcomes by the estimated probability that each will happen. The real options calculation looks at the benefit of making the decision one period ahead (period 1), when the further information is revealed. The difference between the two calculations is the value of waiting.

The Black and Scholes formula assumes that the underlying asset on which the option is contingent is traded (Pennings and Lindt, 1997, p. 84). Unlike financial options, however, real options are often not tradable, for example, the firm is not able to sell the right to undertake the R&D to someone else (e.g. firm specific knowledge is required to carry the R&D out in a way that will be beneficial to the firm).[14] Thus, obtaining a real options value of some investment, such as R&D, requires proxy statistical information on likely values of the research output. For example, Schwartz (2002, p. 15) illustrates the implementation of a real options methodology proposed for evaluating an R&D project for the development of a new drug, using typical parameter values from the pharmaceutical industry.

The Black and Scholes formula also assumes that the underlying asset value varies stochastically over time[15] around some underlying trend. Such an assumption is "... highly questionable for the value of innovative research projects", which are more likely to follow a jump process (e.g. a Poisson jump – Pennings and Lindt, 1997, p. 85). Such jumps would occur when the management acquires new information and revises its business plan. Dixit and Pindyck (1994, p. 85) argue,

> Often, however, it is more realistic to model an economic variable as a process that makes infrequent but discrete jumps ... [for example] one might model the value of a patent as subject to unpredictable but sizeable drops in response to competitors' success in developing related patents.[16]

[14] Some real options can be sold, such as land with the option of future development.
[15] E.g. geometric Brownian motion – see, for example, Dixit and Pindyck (1994, pp. 71-74)
[16] Such models treat changes to the asset price as a composition of two effects: "normal" and "abnormal vibrations" in value (see, for example, Merton, 1976, p. 128). A "normal" vibration can occur due to a temporary imbalance between supply and demand, changes in economic outlook, or other new information that cause marginal changes in the stock's value. This component can be modelled by a standard geometric Brownian motion, with a constant variance per unit time and a continuous sample path. "Abnormal" vibration occurs due to

Assumptions have to be made about, or proxies obtained for, the volatility of the returns, the trends in returns and the rate at which shocks (jumps) arrive, and their size. In operationalising a real options calculation for pharmaceutical R&D, for example, Schwartz (2002, p.16) assumes a 20 year patent life and a 20 year project life (10 years on development and 10 years generating cash flows), cash flows of $20 million per year, growing stochastically at 2% *per* year (the rate of inflation). The cash flow volatility parameters in the equations "... are obtained as the average implied volatility for traded call options of nine pharmaceutical companies ... .". Doctor, *et al*. (2001, p. 83) argue that a key difficulty with applying real options equations is in determining the volatility. They suggest that, in R&D cases, the volatility may be estimated by summing up large quantities of historical data on previous project outcomes of a similar nature.

Multi-stage real options models. A single project may comprise a range of real options, a number of which may be carried out, but some of which, if carried out, preclude others from being undertaken (see Appendix 3 for a more detailed discussion). Weitzman, *et al*. (1981) argue that it is crucial to see large R&D investments as a sequence of stages (see also Dixit and Pindyck, 1994, pp. 319-356). Kellogg and Charnes (2000, p. 2), for example, argue that in the case of new drugs,

> The development process is composed of several stages, during which the drug company gathers evidence to convince government regulators that it can consistently manufacture a safe and efficacious form of the compound for the medical condition it is intended to treat.

As in the simple example proposed by Dixit and Pindyck above, it is the ability not to go ahead with the project (in this case at the second stage) that improves the potential returns,

> It is exactly the possibility of termination before the end which encourages a sequential decision maker to go forward even though the standard cost-benefit criterion … looks discouraging. (Weitzman, *et al*. 1981, p. 57)

Real options models as an aide to decision making. The real options approach lends itself naturally to a variety of simulation exercises. Schwartz (2002, p. 16), for example, uses his model to generate 100,000 randomly selected paths of costs and cash flows. Doctor, *et al*. (2001, p. 83) argue that Monte Carlo methods can be used to simulate a large number of random outcomes, each representing a future path, and provide a range of values from different scenarios. The authors conclude that "... Monte Carlo simulation analysis has become established as a financial tool to help in risk analysis" (*ibid*. p. 84).

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the arrival of important new information about the stock that has more than a marginal effect on price – by its very nature, important information only arrives at discrete points in time. "Abnormal" vibrations can be modelled by a Poisson distribution (Merton, 1976) or other distributions, such as the Bernoulli jump process (Ball and Torous, 1983).

Doctor, *et al*. (2001, p. 83) conclude that "... 'options thinking' is itself a valuable tool, even in the absence of the ability to provide accurate option valuations in every circumstance." In particular, the use of decision trees (often associated with multistage projects) can help in: understanding the basic outline of a project, understanding the probabilities of success, developing the project gates and in facilitating the calculation of revised probabilities as the project progresses. Carlsson, *et al*. (2007, p. 95) take this one step further, by creating a support tool[17] for evaluating R&D opportunities in order to: "... (1) to detect shadow options that are not yet measurable in terms of cash flows, and (2) to include such options into the decision making with R&D portfolios."

Application of real options to the training decision. The adoption of a real options approach seems largely unnecessary for routine investments in training, such as the decision to train a new recruit to allow them to function efficiently within the existing organisation, where the activities the recruit will carry out are well known and understood. Where a real options approach is likely to be extremely important is where the firm is considering some major strategic change, such as entry into a new market or the same market in a different country, where new skills will be needed. Under these circumstances the risks are much higher and the timing of entry (and thereby the availability of the skills needed for entry) is crucial. Here training offers the firm an option – the ability to enter a new market – which has a value, which it may or may not exercise. The adoption of a real options approach would require a significant change in the firm's training decision making process.

2.4 Optimal versus suboptimal private investment decisions in training

The present discussion focuses on the application of the DCF and real options decision rules by companies. It outlines a number of issues that may determine whether employers take optimal investment decisions from a private perspective.

Measurement of training

A number of authors point to the effects of inappropriate measurement and decision rules adopted by organizations, which have an adverse impact on training decisions and on skill levels (e.g. Finegold and Levine, 1997). Even now, there is no common definition of training and most firms do not measure their training expenditure or the impact that training has on their performance (*ibid*. p. 120). Unlike R&D, there is no accounting requirement that firms report on their training expenditures in their annual report and accounts (*ibid*. p. 111).

[17] The Extended Project Portfolio Tool (XPT).

In developing longer term support for policy design, delivery, monitoring etc., it would be extremely valuable to develop better systems for measurement. In addition to the analogy with measuring R&D, it would be worth exploring the process that health economists went through in developing the measure of "quality adjusted life year" (QALY).[18] They were faced by the problem that health treatments have many different effects, most of which cannot be valued easily (e.g. there are typically no market prices).

Development of a multidimensional matrix with weights for education/training would enable more robust evaluation of various kinds of training inputs/programmes, thus aiding the process of identifying and prioritising interventions. The appealing feature of a QALY-type system is that it can potentially embrace the different elements contributing to skills (e.g. the different dimensions of academic, vocational, experience) to identify combinations of skill improvements to advance overall performance. Being able, in this context, readily to distinguish between different types of training at different levels would aid considerably the policy-making process, such that, for example, social equity priorities could be properly assessed against efficiency impacts in determining policy.

Translating academic results into practice

A puzzling difference between reported returns to various practices, but lack of adoption has been noted in the literature. The high performance work practices (HPWPs) literature, on balance, tends to be positive about the role of HPWPs (Bosworth, 2005, pp. 222-235). However, according to Tamkin, et al. (2008, p. viii), the take-up of HPWPs has been slow and many organisations have not adopted them. The authors argue that,

> The doubts of practitioners reflect concerns over what it might mean for individual firms and sectors, and confusion over which people management practices are likely to show the greatest link to performance. Many studies adopt complex measures which are outside the capabilities of most firms to replicate. In terms of a step change in employer behaviour what is needed are some measures that have been linked to performance, that employers can capture for themselves and which do not require considerable academic resource to make useful. (*ibid*. p. viii)

Product champions and biased calculations

In addition to coping with risk in discretionary investment decisions, the individuals making the decision to invest need to ensure that the expected future costs and benefits to be used

[18] Thanks to Ross Moloney for the information about QALY.

in the calculation are unbiased.[19] At first, whether the realised values of costs and benefits are consistent with those used in deciding the investment seem to be one element of the risk, but, in practice, the literature suggests that there is an inherent bias which under-estimates costs and over-estimates benefits. HM Treasury's Green Book, for example, states,

> This is a worldwide phenomenon that affects both the private and public sectors. Many project parameters are affected by optimism – appraisers tend to overstate benefits, and understate timings and costs, both capital and operational. ... To redress this tendency, appraisers should make explicit adjustments for this bias. (paras 5.61-5.62)

The bias comes about because those designing a project are over-optimistic and insufficiently critical about the assumptions they make (see, for example, Hardman, 2003, p. 18) and those bidding for funding for a project have pressure to offer too much at too low a cost. Bosworth (2005, pp. 334-336) reviews a range of studies that empirically support this result.[20] The important point, therefore, is not that the investment in question is risky, but that, "... there are important mechanisms at work that lead to a systematic bias – underestimating the overall costs of producing certain performance characteristics" (*ibid*. p. 336).

Adoption of decision rules

While Sections 2.2 and 2.3 presented what economists and accountants might refer to as "best practice" methods to underpin private decision making, it is not at all clear that the majority of firms adopt such methods – or, indeed, any method. At the present time, US government departments still report on payback periods[21], even though it is widely recognized that this form of investment rule is seriously flawed.

There are a number of surveys about the investment decision techniques used in practice, although these seem to focus on the behaviour of large companies. It appears likely that small firms are less rigorous in their investment calculations than large firms, adopting more *ad hoc* techniques. In the main, *ad hoc* techniques, such as payback tend to undervalue longer term investments, such as more formal training.

The evidence for large firms is that they tend to make more use of DCF (NPV and IRR) techniques, particularly for more strategic investments that carry higher risk (Alkaraan and Northcott, 2006). The authors report that, amongst large UK manufacturing companies,

[19] The psychology-economics literature sees this as a general problem – "The results of research on human behaviour should be taken into account because people react to the economic conditions as they perceive them, and this perception, evaluation and consequent decision-making may be biased." (Raaij, 1991, p. 797).
[20] For a recent study on public procurement of transportation projects, see Flyvbjerg, *et al*. (2002).
[21] http://www.eere.energy.gov/ - the US Department of Energy.

> The payback approach (PB) ranks second to NPV for non-strategic investments, with IRR ranking third, but this order is reversed for strategic projects. This suggests that managers are favouring DCF techniques (NPV and IRR) above less sophisticated approaches (e.g. PB) when it comes to more complex strategic projects. (*ibid*. p. 159)

It is clear that most of the firms also attempt to account for the effects of risk using one or more of a range of techniques, and the authors demonstrate that the use of these forms of risk analysis had increased significantly over the period since 1975.[22]

Alkaraan and Northcott (2006, pp. 164-165) note that the strategic benefits of an investment generally depend on its impact on competitive positioning of the firm (e.g. the effects on efficiency, quality, innovation, customer satisfaction, *etc*.). However, the benefits of improvements in competitive positioning are extremely difficult to measure and, other than attempts at benchmarking (which were thought important by the majority of firms), the importance attached to other techniques (such as real options) was minimal (*ibid*. p. 167). The authors report that,

> Overall, these findings suggest that the five recently developed analysis tools [to deal with risky strategic decisions] considered here have made little impact on strategic investment decision-making practice, despite the growing academic call for the use of such techniques to inform strategic investment decisions. (*ibid*. p. 168)

Alkaraan and Northcott (2006, p. 169), consistent with the findings of previous studies, confirm the growth in the use of all financial analysis techniques over time, with the use of DCF techniques and the use of multiple techniques now almost universal. However,

> ... the counter-intuitive finding of this study is that the choice and use of analysis techniques appear to be independent of the type of project being evaluated. That is, there is no significant difference between the use of techniques for analysing strategic and non-strategic projects, despite the very different natures and complexities of these projects. (*ibid*. p. 169)

In other words, the techniques most appropriate to the analysis of risky strategic investments are not being used. The use of the wrong investment decision rules may be one explanation as to why some companies do not invest in training (even though there is evidence that "training pays" – Finegold and Levine, 1997, pp. 110-111).

[22] Sensitivity or scenario analysis; raising the required rate of return; probability analysis; shortened payback period; beta analysis (CAPM models). (*ibid*. p. 163)

Economic rationality, imperfect information and bounded rationality

In standard neoclassical theory, economic rationality is generally taken to imply that individuals maximise their utility (satisfaction) and firms maximise their profits; other forms of behaviour are seen as economically irrational. However, while economic behaviour is invariably motivated, it is guided by "... preferences, expectations, values and norms" (Raaij, 1991, p. 800). Economic psychology tries to explain agents' behaviour by "... learning and decision processes, motivation, personality factors, perception, preferences and a number of other factors basic to behaviour" (ibid. p. 800). These processes tend to be explicit and extensive when making important, strategic decisions, but are more often routine and implicit in low-level decisions.

Economics has moved far beyond the neoclassical world, with its highly artificial assumptions, such as the existence of perfect information. Raaij (1991, p. 799), for example, argues that,

> Information about future developments is often not available, or is only available with broad margins of uncertainty. Business people do not know the plans of their competitors in time. Advertisers provide only positive information about their products. Complete information, or sometimes even a necessary level of information, is unattainable or unavailable in a market owing to the opposing objectives of the market parties. Sometimes it is even dysfunctional to collect complete information, for example in emergency situations.

The psychological model of economic behaviour argues that while agents attempt to behave rationally, they often fail to do so because of imperfect information and their failure to perfectly process the information that is available – so-called "bounded rationality".

> .. boundedly rational agents experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information (Simon, 1963).

Simon (1963) also proposed a simplified decision process, which he termed "satisficing", in which neoclassical optimisation would be a special case. Satisficing sets an aspiration level for one or more performance variables (e.g. productivity, profits, *etc*). When the outcome falls below its aspiration level, the agent involved searches for a solution that will improve performance. If such a solution fails to materialise, the aspiration level may be adjusted downwards, until it becomes attainable.

Transactions costs and internal labour markets

Transactions costs. The sorts of conditions addressed in the previous subsection (e.g. imperfect information, bounded rationality, etc.) help to explain the existence of firms (Coase, 1937). Such factors represent a cost of using the market and have become known as transactions costs (see Appendix 4 for a more detailed discussion). The existence of firms should be seen as a way of economising on these costs, such that the associated activities are carried out more efficiently within the firm than through a large number of contractual trading agreements between individuals (Bosworth, *et al*. 1996, pp. 271-272).

Internal labour markets. Once activities are locked within a firm rather than undertaken by the market, the role of market forces is no longer dominant and the conclusions of neoclassical theory are no longer necessarily relevant. The concept of internal labour markets, for example, which lie at the heart of the institutional (non-neoclassical) analysis of labour markets, can be traced back at least to the work of Kerr (1951, 1954). Doeringer and Piore (*op cit*. 1971, pp. 1-2) define an internal labour market as:

> .. an administrative unit, such as a manufacturing plant, within which the pricing and allocation of labour is governed by a set of administrative rules and procedures. ... to be distinguished from the external labour market of conventional economic theory where pricing, allocating and training decisions are controlled directly by economic variables.

This view of the operation of the firm appeared incompatible with neoclassical economics, even though the latter had little to say about what went on within companies, treating the firm as a "black box". Transaction cost theory (see above) at least gave a rationale for the coexistence of the two, based around a theory of market imperfections or market failure that leads to the existence of the firm and the adoption of non-market mechanisms within the firm. However, transaction costs theory does not, itself, spell out what these non-market mechanisms are that govern the internal operation of the firm.

The theory of internal labour markets formed an early attempt to establish how production is organised and paid for in the absence of market mechanisms and how these non-market activities and outcomes are reconciled with the market, when the firm has to trade with the market (e.g. when hiring labour or selling its product). Internal labour markets are argued to be characterised by skill specificity, on the job training and customary law. Doeringer and Piore outline the effect of these factors on the way in which internal labour markets operate:

- skill specificity means that firm specific skills are more important than general or transferable skills. Skill specificity may arise out of the interaction between employees and the technology they use. However, they emerge in most production

activities, as there is a constant modification of the processes used, resulting in a high degree of task idiosyncrasy. Only employees who have been operating the processes for some time can do their jobs efficiently, and they are the only people who can transfer this skill and knowledge to other individuals.

- on the job training is closely related to skill specificity. If the skill is very specific, relatively few individuals will be learning it at a given point in time and there are no economies of scale that could be attained through more formal training schemes, making on the job training more cost effective. In addition, a high degree of task idiosyncrasy means that the relevant knowledge cannot be disseminated by means of formal instruction.
- customary law refers to the role of habit and custom in the operation of internal labour markets. Customs tend to build up over time and represent a set of unwritten rules that govern many dimensions of work (e.g. absenteeism, discipline, the allocation of jobs, hours of work and pay). While custom does not preserve everything from the past, evolving slowly over time, it is still an important force, partly due to equity considerations. Equity requires that an employee is broadly treated the same today as they were yesterday (Bosworth, *et al*. 1996, pp. 264-265).

The concept of an internal labour market takes the firm as the boundary. In practice, a single firm may contain a number of internal labour markets, which may be associated with different occupations. Some employees may not be part of an internal market at all and their posts are always filled by turning to the external labour market, while they work alongside others that are part of an internal labour market (*ibid*. pp. 266-267).

Internal labour markets are characterised by job ladders. A closed ladder has a single point of recruitment at the bottom of the ladder and, then, all subsequent appointments on higher rungs of the ladder take place from within the firm. Different job ladders can exhibit different degrees of openness, as can different levels of a given ladder (e.g. lower managerial levels being mainly recruited from outside, with more middle level managers recruited from within and almost all top level managers appointed from inside the firm) (*ibid*. pp. 266-267).

It has been shown elsewhere that the acquirement of specific skills, in principle, has no implications for the individual's wage as this is determined by what they could earn elsewhere – and additional skills specific to that employer do not make such individuals more productive for other employers (*ibid*. pp. 233-235). Thus, wages can diverge from their market levels – the more so the more closed the ladder or particular rungs on the ladder.

On the other hand, internal labour markets are based upon job security and long term relationships between employees and the firm. A long employment relationship makes

other, non-neoclassical outcomes equally possible, particularly as wages diverge from their market level. Individual employees might be willing to invest in specific training, for example, by accepting a lower than market wage, in order to reap the benefits of job security and higher wages in the future. Employers might be willing to invest in general training insofar as they can reap the benefits of paying less than the market wage for the individual over some period of the individual's tenure with the firm.

In more recent years, the exploration of wages and remuneration has been increasingly interested in the design of pay and non-pecuniary reward systems to act as incentives to employees and to align employees' goals with those of the organisation. For example, efficiency wage models help to explain why some organisations pay higher wages – because this elicits greater worker effort and hence higher productivity. The reasons offered include: the organisation's wish to prevent shirking (Shapiro and Stiglitz, 1984) (since the cost of job loss is higher); to minimise labour turnover costs (Stiglitz, 1985); to diminish adverse selection (Weiss, 1980) in that offering higher wages will encourage 'better' workers to apply for jobs; and to improve worker morale (Akerlof, 1982).

New institutionalist view. The theory of internal labour markets now looks a little dated, given the move to flatter, more flexible organisational forms, but it nevertheless still has some resonance with respect to large, hierarchical organisations. Its more modern face can be found in the new institutionalist approach to understanding corporate decisions on training. Finegold and Levine (1997, p. 109) for example, argue that the traditional human capital approach to skill investment tends to treat the firm as a black box, while new insitutionalists examine the institutional influences on managers' decisions to train. After identifying the strategies open to the companies, which may include alternatives to human capital investment, whether a company will make major investments in training depends on the presence (or absence) of a set of institutional factors, which include a cooperative industrial relations systems, strong internal labour markets, and government policies that support high skill strategies. This institutional approach offers potential environments in which training would be effective, but is not a theory of training *per se*.

2.5 Reasons for suboptimal provision from the employer's perspective

At the micro level, the literature has been concerned with a multitude of different influences and barriers that deflect organizations from an optimal investment in training. A number of studies have developed lists of such barriers, such as access to funding, availability of suitable training provision, *etc*. While these lists do not deal with the issue of whether the barriers reflect private or social failures in the system, many of them have been argued to be market failures.

Management as a barrier

The resource based theory of the firm focused on one principal barrier to the extent and quality of training. This barrier arises from a lack of time and resources amongst key personnel, such as managers, who would provide or help with the training (Penrose, 1959). In Penrose's theory, the rate of expansion of the firm is determined by the capacity of existing managers to train new staff. The equilibrium rate of expansion is determined by the training capacity of existing managers, subject to them being able to maintain the current output of the firm. Thus, while the firm would like to expand more quickly, it does not have the resources to do so.

A somewhat different barrier occurs where a particular manager or group of managers have a lack of skills. A lack of skills amongst the existing decision makers may result in a failure to invest optimally, for example, in the amount of training, type of skills provided, *etc*. (see, for example, Bosworth, 2001). The decision makers may not recognize this skill deficiency themselves, at the time, but it might be recognized by peer groups, or by the managers themselves in retrospect.

This issue links to the growing literature that suggests that the goals of the firm may be related to the qualifications and background of managers (Bosworth, *et al*. 1992; Barry, *et al*. 1997). It is not clear whether a manager with particular background and qualification is selected to run a firm with a particular goal or whether a manager with that type of background and qualification imposes that goal on the firm. The choice of the goal can have important implications for training, for example, a firm that looks to cut costs and move down market will have a very different view of training to one that looks to improve product specification and move up market. Again, from a private perspective, whether the goal is the most appropriate for the firm might only be recognized by peer groups, or by the decision makers themselves in retrospect. However, from a social perspective, it is imperative for the economy to achieve the optimal balance of goals (e.g. to have a sufficient proportion of firms moving up market, employing higher skill levels, paying higher wages and earning higher economic profits).

The literature on entrepreneurship and new business startups points to the barriers to success and growth posed by the lack of social skills and/or social capital of particular managers (Bosworth, 2005, pp. 144-155). Baron and Brush (1999) argue that,

> … one aspect of entrepreneurs' behaviour that may well influence their success is their *social competence* – the extent to which they possess and employ discrete *social skills* that enhance their ability to interact effectively with others (e.g. venture capitalists, potential partners, employees, customers).

Social capital refers to the sum of all resources (bearing in mind there may be synergies) potentially available to individuals from their relationships with others (Nahapiet and Ghoshal, 1998).

The WMRO (2006) also notes that many businesses fail to link training to their long term business strategy. This chimes closely with the "contingency theory" of high performance work practices. The debate about the role of HPWPs falls into one of two main strands of the literature (Youndt, *et al*. 1996, p. 837). The first is termed the "universal" or "best practice" approach, which implies a direct relationship between the adoption of any particular HPWP and the performance of the company. The second is the "contingency" perspective, which argues that the goals and strategies of the firm interact with or moderate (i.e. either augment or diminish) the impact of HPWPs on performance. Thus, according to the contingency approach certain types or combinations of HPWPs are better suited to work in tandem with the achievement of certain goals and strategies, depending on the specific situation of the organisation.

In a similar way, Huselid (1995) is concerned with the "fit" of the various HPWPs. The "internal fit" is concerned with the compatibility between the mix of HRM policies adopted and the extent to which complementarities emerge. The "external fit", on the other hand, is concerned with the compatibility of the portfolio of HRM policies adopted and the firm's goals and product market strategies.

Influence of staff on training

Training may be difficult where staff have negative attitudes to training (OECD, 2003, Chapter 5; WMRO, 2006, pp. 137-138). Some employees see the job as being "9-5" and have no interest in or commitment to learning, and some have a fear of training, particularly off-the-job training in a "class room" environment. This may particularly be the case amongst individuals with low basic skills, who may even find basic reading and writing challenging, and amongst older workers, who have not been in a learning environment for many years (Cully, *et al*. 2000). Statistics Canada (2002, p. 12), reporting on individual barriers to training argue that,

> A number of personal barriers were identified, including reticence to push for training; fear of training; an unwillingness to be sufficiently flexible to accommodate training; family responsibilities; an unwillingness to delegate work to attend training; a lack of commitment to training; and embarrassment at the need for training.

Didato (1976) argues that management often perceive training programmes as a threat to their security, sometimes making them openly defensive and, more often, silently resistive. Managers may feel threatened when their employees are selected for training, fearing that

the trained employee will displace them (see the discussion of internal labour markets, Section 2.4 above).

Even if reluctant workers can be persuaded to train, this does not guarantee a successful outcome – that they learn the skills they are taught or that they are willing to apply those new skills in practice as the opportunity arises.

There is also the problem of staff turnover, with the firm undertaking investment in staff who subsequently leave, taking their newly acquired skills with them. This may specially be a problem amongst firms prone to having their staff poached by another employer who has not invested in training (see Section 4.3 below).

Imperfect information

Employers and individuals may lack sufficient, reliable information on the quality and content of learning opportunities available, and the benefits that flow from different types and levels of investment in training (Keep, 2006). Leitch (2006), for example, argues that businesses find it difficult to value the indirect benefits of lower level training on staff turnover and improvements to morale and motivation, which, nevertheless, contribute to efficiency and performance.

Capital market imperfections

Capital market imperfections are associated with problems in raising funding to invest in skills (Keep, 2006). The firm's ability to raise funding may depend on retaining profits or borrowing against the assets of the business, both of which are easier when the business is profitable, but this may not be when training is needed the most. The WMRO (2006) argues that firms operating in price sensitive, low margin markets, do not have the business resources needed for training investment. The barrier posed by the need for employers to funding training[23] is also discussed by Finegold and Solskice (1988, p. 45), who note that,

> Financial institutions are reticent about lending without security for training, except for a few cases where returns from the training are high. This is not particular to UK financial institutions. Banks in most countries will not lend for ET purposes to individuals, unless the loans are guaranteed or subsidised or unless the bank has close connections and knowledge of a community. This likely reflects both moral hazard and adverse selection problems.

23 Similar problems face the individual, "There is limited access to state subsidy for most adult vocational training, particularly for maintenance, but also for tuition. Individual expenditure on training is in general not tax deductible. The unemployed likewise have limited access to funds: their retraining possibilities seldom relate to those areas in which there are vacancies." (*ibid*).

Other institutional imperfections

Finegold and Levine (1997, p. 111) argue that current accounting rules do not allow proper measurement of company investments in building a high quality workforce. Expenditure on such activities are treated as a cost and show up only as lower cash flows and lower accounting profits in the short run. Insofar as capital markets have imperfect information about human capital investments, which are extremely hard to monitor from outside of the company, then the market is unlikely to recognise their importance or be willing to fund them. The authors suggest that countries whose capital markets have somewhat richer information flows (e.g. Japan and Germany), also have less problem in monitoring such investments and are more likely to be favourably disposed toward them.

The Leitch Review of Skills (Leitch, 2006) argues that employers have concerns over the relevance of qualifications, particularly at the lower level. In addition, they see the provision of basic skills, such as literacy and numeracy, as the responsibility of the Government *via* the schools' system. While businesses may recognise that they have some responsibility for training beyond this basic level, such training is virtually impossible without these basic skills in place.

It may not simply be a lack of information about the nature and quality of training available to the employer (see the discussion of imperfect information above), but that the training that is available is of poor quality or inadequately suited to the employer's needs (WMRO, 2006, pp. 138-141). External providers of training would find it difficult to provide training in skills specific to any one firm. In addition, they may find it uneconomic to provide even specialist transferable skills if the numbers of trainees are too small.

Short termism

Short termism in the stock market can be treated as another potential institutional imperfection and, if the stock market is short termist, this has implications for those managers who have to satisfy their shareholders. In addition, each individual manager has a "time preference" and degree of "risk aversion". Higher private time preference rates discount the future more heavily (e.g. attach less importance to financial flows that are further into the future). Normally, individuals with higher time preference rates also tend to be more risk averse (as the present is better known than the future). Higher private time preference rates and higher risk aversion are likely to be associated with lower levels of investment in relatively risky, longer time horizon activities such as formal training.

Small firm issues

Small firms are a microcosm where a wide variety of such barriers are brought together – management skills and time, access to funding for training, *etc*. There is the cost to employers of giving low skilled staff time off work, as well as the lack of time for training due to work pressures.[24]

2.6 Summary of factors causing suboptimal investment

This section has outlined the two main formal types of decision rules that give the employer the best chance of determining the optimal investment in skills, bearing in mind that they are much more likely to be applied to formal than informal training. When combined with scenario analysis, these techniques provide the employer with a decision making framework that allows a thorough investigation of the likely costs and benefits of investment in skills. However, even the use of best practice decision rules in determining the investment does not mean that the outcome will be optimal, for a wide range of reasons, summarized in Table 2.1.

While both of these sets of decision rules allow, to varying degrees, for the risks and uncertainty that surround future events, their ability to ensure that the outcome is optimal *ex post*, depends crucially upon the quality of information used in making the decision, *ex ante*. As the future can rarely, if ever, be predicted with certainty, even best practice decision rules will not result in optimal outcomes in practice, except by chance. It is not the decision rule that is at fault, however, but the quality of the information used in taking the decision.

There is a tendency to think that private sector enterprises, at least, will be profit maximizing and, thereby, "economically rational" (again, see Table 2.1). In practice, non-owner managers may have other goals that are not consistent with profit maximization (e.g. salary, non-pecuniary benefits, status, etc.). In addition, owner managers, particularly of small businesses often have goals other than profit (e.g. control, status, work-life balance, etc.).

There are other issues surrounding the decision making process that can affect whether the outcome is optimal or not. For example, while product champions are generally seen as having a positive effect on pushing through important investments, their working assumptions and predictions have to be treated with considerable caution, as they tend to be biased towards the investment they are advocating. In addition, while employers often recognize the results of academic work (e.g. that training is profitable or that HPWPs

[24] The Employer Training Pilots are an attempt to reimburse employers for such influences, such as the cost of releasing employees during normal working hours, also giving extra support for small firms.

improve company performance), they often find it much more difficult to translate this into practical policies that can be successfully operationalised in their own company.

There are also a wide range of potential barriers that may prevent the employer from achieving their perceived optimal level of training (see second half of Table 2.1). Management capacity and management skills are seen by the conceptual literature to be crucial elements that intervene to produce a suboptimal level or type of investment. In addition, as the investment in skills is effectively embodied within employees, the willingness and ability of the workers to undertake the training, absorb the new skills and utilize them effectively in the workplace are crucial.

The other main barriers appear to be institutional in nature. There is growing concern about the ability of financial markets to provide funding for the development of intangible assets, such as investment in skills. This situation is not helped by the fact that standard accounting practice is to write off expenditure on training as a cost, within the year that the expenditure takes place. There is no recognition that larger, more formal expenditures on training may be an investment, the returns from which may be reaped over several or many years. These problems may be exacerbated if the financial markets are also short-termist, favouring more immediate rather than longer term returns on investments. If markets are short-termist, then this has a knock-on effect on managers, who also have an incentive to favour more immediate rather than longer term benefits.

Small firms are a microcosm in which many of these barriers appear to reinforce one another: management time is scarce, managers may lack the depth of skills necessary for optimal decision making, funding is scarce, etc. It seems likely that small firms will face a range of such barriers and, while they might be able to overcome one or perhaps two important barriers, larger numbers of barriers may make it almost impossible for them to carry out an optimal amount of training.

Table 2.1 Suboptimal provision from the employer's perspective

Reason	Likely direction of effect *vis a vis* optimum level	Comments
Decision rules and the decision process		
Imperfect measurement of training	-	Inability to measure the returns to investments in skills
Difficulties in interpreting academic findings	-	Inability to translate evidence of high returns to training/HPWPs into practical policies relevant to the firm
Product champions	+	Product champions tend to be biased towards the investment
Adoption of rules of thumb, such as payback	-	Crude rules of thumb tend to ignore longer term returns
Imperfect information	+/-	Drives a wedge between *ex ante* and *ex post* optimality
Economic non-rationality, imperfect information, bounded rationality	+/-	Failure to employ economic rationality may lead to over or under investments
Transactions costs and internal labour markets	+	Internal labour markets tend to emphasize skill development – but mainly specific skills and those gained informally / on the job
Barriers to investment in training		
Management time	-	Management is a key resource for most discretionary investments of the firm
Lack of management skills	-	Low management skills are likely to result in the adoption of a low-skills strategy
Older workers/less educated workers	-	The success of investment in training is dependent on the willingness and ability of workers to learn new skills
Imperfect information (about quality/content of training)	-	Employers do not know about the range and quality of training available
Capital market imperfections	-	Finance is restricted for investments in intangible assets
Current accounting practice	-	Accounting procedures treat training as a cost not an investment
Short-termism	-	A finance system that undervalues the future *vis a vis* the present will be biased against longer term investments
Small firm effects	-	Small firms are a microcosm in which many of the above effects are concentrated

Note: +/- implies that the effect is to take the level of training above/below the optimal level.

3. Optimal employer investment in skills from a sectoral perspective

3.1 Sectoral effects

Sectors clearly lie at the heart of skills initiatives, through the Sector Skills Councils (SSCs) and, formerly, through the Industry Training Boards (ITBs). Part of the rationale for this is set out in Jagger, *et al*. (2005), who argue that different sectors tend to have different skill demands, even though the exact nature of the differences in demand remain relatively poorly understood. These differences in skill demands underlie the rationale for the SSCs and the associated development of sector skills strategies. Given these differences, strategies designed to meet the needs of each specific sector are required,

> The UK comparative rankings in terms of both TFP [total factor productivity] levels and TFP growth range from the best of the comparative nations to the worst. This in turn means that most of the overall UK productivity position can be explained by the size of the high productivity and low productivity sectors. This suggests that the UK's productivity problem is not especially a national problem, but more a problem with a series of sectors. (Jagger, *et al*. 2005, p. xiii)

Other authors have also argued the importance of the sectoral dimension from a conceptual perspective, for example, in understanding technological change. Pavitt (1984), for example, proposed a taxonomy of industrial sectors based upon four categories: supplier dominated, scale intensive, specialized supplier and science-based. This taxonomy helps in understanding the sources of technology or innovation, the means of appropriation of the returns from new technology and the nature of the user needs with respect to the technology (Salazar and Holbrook, 2003).

The conceptual literature suggests several reasons why sectors may differ in terms of their skill needs and also why sectoral outcomes are not just a simple aggregate of the individual enterprises that comprise the sector. One of the most important determinants of the demand for skills at the sectoral level is the competitive environment within which firms operate; this involves both the product market and the labour market. A second major factor that operates at the sectoral level is the presence of spillovers or externalities, whereby firms within the sector benefit (or lose) from the training activities of other firms in the sector.

Imperfect competition

The present section deals with the effects of imperfect competition in the labour market. The outcomes described here are reported in detail in many of the standard labour economics texts (see, for example, Bosworth, *et al*. 1996, pp. 185-193). The discussion deals with the

special case of perfect competition in the labour market, to provide a benchmark against which to consider monopoly power (amongst sellers of labour), monopsony power (amongst buyers of labour) and bilateral monopoly (i.e. where there is both monopoly and monopsony power). Finally, the section briefly discusses the concept of labour market disequilibrium and equilibrating processes.

The present discussion is simply provided to illustrate the main implications of imperfections in the labour market. Standard economics texts also generally deal with oligopoly (a small number of suppliers of labour) and oligopsony (a small number of buyers of labour), where the wage level and employment outcomes are broadly similar to those of monopoly and monopsony (if somewhat less extreme), but with the added feature that wages can be sticky (they may not change with shifts in demand or supply, unless those changes are sufficiently large).

Perfect competition

A perfectly competitive market is one in which there are many buyers and sellers, so that no one buyer or seller can, individually, influence the wage rate, which is determined by the aggregate buyer and supplier activity within the market. The other rules of perfect competition must also apply, for example, that labour is homogeneous, buyers and sellers possess perfect knowledge of the market and are perfectly mobile. Under these circumstances the wage rate and level of employment are determined by the intersection of the market supply and demand curves. All workers are paid the same wage, which reflects the value of their marginal revenue product (the value of their contribution to production at the margin).

The outcome can also be shown to be a point of equilibrium. At wages below the point of intersection, labour demand exceeds labour supply, and there is a shortage of labour in the market, which results in firms bidding up wages. This incentive continues until wages reach the equilibrium level at which supply equals demand. If wages are above the equilibrium level, labour supply exceeds of demand and individuals searching for employment have an incentive to offer their labour services at a lower wage. Thus, wages fall until they reach the equilibrium level where supply equals demand. In perfectly competitive markets adjustment is assumed to be rapid, indeed, so rapid that the adjustment process itself can be ignored.

Implications for training. In this stylised environment, the implications for training are that, if it pays for one firm to train, then it pays for all firms to train. However, this is only likely to happen when there is some shock to the market, such as a change in technology, which, because of the nature of the market, affects all firms equally. In the main, markets based

upon price competition, rather than competition through product specification or quality, are unlikely to be significantly involved in on-going training activities. Competitive firms see no need for this unless an exogenous shock takes place (to which their natural reaction would tend to be deskilling rather than upskilling) and, anyway, would find it difficult to fund training as they only earn normal profits. On the occasions when training does take place, firms will only fund specific training (see Section 2.2 above).

Failures in the conditions for perfect competition

Conditions in the real world are far from those which characterise perfect competition. The failure of any one of the following will result in some degree of imperfection in the market,

- each market must trade in one homogeneous good, so that price is the crucial consideration when deciding to buy the good;
- there must have no significant barriers to entry into each market (e.g. no brand loyalties, and no technological or financial barriers to entry);
- there are no cost or other advantages in operating at a large scale (i.e. no increasing returns to scale);
- all factors of production are mobile and will move in response to price differentials – allowing capital, labour and raw materials to be moved from location to location;
- relevant information must be freely and equally available to all actual (and potential) market players (Goodwin, 2005, p. 7).

Imperfection in the market will be reflected in a smaller number of buyers or sellers than under perfect competition, with the quantities being traded generally being smaller than under perfect competition. The price at which the trade takes place also differs from the competitive outcome, but it can be lower or higher, depending upon which party has the stronger market power.

Monopoly and monopsony power, bilateral monopoly

Under pure monopoly there is just one seller (as in the case of a group of individuals who belong to a trade union), but many buyers. What is important for the monopoly supplier is not so much the demand for labour curve (the average revenue curve), but the marginal revenue curve. The marginal revenue curve is important because it reflects the fact that, each time the union supplies another unit of labour, it not only forces down the wage for the additional worker employed, but for all existing employees. The monopolist therefore supplies labour up to the point where the marginal revenue curve intersects with the supply

curve of labour. As the marginal revenue curve lies below the demand for labour curve[25], the upward sloping labour supply curve always intersects it at a lower level of employment than the perfectly competitive outcome. The going wage is picked out on the labour demand curve vertically above the intersection of the labour supply and marginal revenue curves, and lies above the perfectly competitive outcome.

Monopsony occurs in a market where there is one buyer of labour and many sellers (e.g. a single, dominant firm in a given local labour market). A monopsonist can offer any wage rate they choose, but the supply curve indicates how much labour will be supplied at that wage. If the employer has to pay the same wage to all employees, then the supply of labour curve is equivalent to the average cost of labour to a monopsonist. What is important to the monopsonist is not the average cost of labour, but the marginal cost of labour. Every additional worker they recruit not only requires the monopsonist to pay a higher wage for that unit of labour, but also to all existing workers. Hence the marginal labour cost curve is upward sloping and lies above the average labour cost curve.[26] The profit maximising monopsonist will equate the marginal cost of labour with its marginal revenue product, which is represented by the labour demand curve. This point of intersection occurs at a lower level of employment than the competitive outcome. The wage offered is picked out by a vertical line from the point of intersection to the labour supply curve, and is lower than the perfectly competitive wage.

Bilateral monopoly combines monopsony on the demand side (a single buyer of labour) with monopoly on the supply side (a single supplier or union). If both are profit maximisers then the buyer is interested in the marginal cost of hiring another unit of labour and the supplier is interested in the marginal revenue of supplying another unit of labour. They each have a preferred equilibrium, which will never be at the same level of wage (the preferred monopoly wage is higher than the competitive wage and the monopsony wage is lower than the competitive wage) and is only at the same level of employment by chance (but both employment levels are lower than the competitive employment outcome). The final outcome is obtained as the result of bargaining between the two parties involved and will depend on their relative strengths in the bargaining process. After negotiation between the two parties, the wage outcome could be above, below or (by chance) equal to the competitive outcome, but the employment outcome (for normal slopes of the relevant supply and demand curves) will be below the competitive outcome.

[25] If the demand for labour curve is a straight line, downward sloping from left to right in the wage employment space, the marginal revenue curve lies half way between the demand curve and the vertical, wage axis.
[26] If the supply of labour curve is a straight line, upward sloping from left to right in the wage employment space, the marginal labour cost curve lies half way between the supply curve and the vertical, wage axis.

Implications for training. The most obvious feature of both monopoly and monopsony power is that there is a lower level of employment than under competitive conditions. Other things being equal, this might imply that fewer workers will be trained. However, it has already been argued that high levels of price (as opposed to quality) competition are not conducive to training, perhaps except at times of major shocks. Hence, even though the number of employees is less than under perfect competition, the number trained may still be higher where there is monopoly or monopsony power.

The conceptual literature suggests that the presence of a union (monopoly power) may have a positive effect on investments in skills – the so-called "union voice" model (Freeman and Medoff, 1984). Freeman and Medoff argue that unions have two faces: a monopoly face (as predicted by standard economic theory, and outlined above) and a collective voice face, which represents the aspirations and needs of their members, as a substitute for exit (changing jobs). The union has a particular incentive to act for other, non-wage aspirations of its members if it competes for membership with other unions. The non-wage aspirations include continuity of employment, which may require the union to support innovation and investment in skills. It may also be linked with lower voluntary and involuntary staff turnover, which increases the returns to employer investment in skills and may lead to a sharing of the costs and benefits between the employer and the individual.

There appears to be little written about the effects of monopsony power (e.g. a single buyer of labour) on investment in training and skills by employers. However, monopsony power is likely to be more important for certain types of individuals (e.g. older workers, those – particularly women – with children, those with occupation-specific skills, and those with skills where the rates of return to investment in migration and training diminish with age) (Hirsch and Schumacher, 1995). While it is difficult to generalise across all of these groups, they appear to be types of individuals where employers would be relatively reluctant to train. However, the presence of monopsony power may give individuals an incentive to increase their general education and skills, insofar as this increases the range of potential employers and reduces the effects of monopsony power on the individual (Decreuse and Granier, 2005).

Disequilibrium and equilibrating processes in the labour market

Wage rigidity. The assumption that wages adjust rapidly to remove excess supply or excess demand, suggested by the theory of perfect competition in the labour market, is also open to question. The theory of internal labour markets (see Section 2.4 above), for example, removes the link with the external labour market in the wage setting process for most rungs of the career ladder. In internal labour markets, wage relativities and wage stability are

important, and provide incentive structures for the sharing of costs and benefits between workers and the firm.

For different reasons, such relativities also pervade Keynesian macroeconomic theory, for example,

> ... Keynes, when discussing the failure of money wages to fall in times of quite massive unemployment, regarded such downward inflexibility as being the product of a highly rigid structure of wage differentials. (Trevithick, 1976, p. 327)

In Keynes' world, a reduction in the real wage rate is brought about by price increases, which are met with much less hostility than attempts at cutting money wages. Keynes viewed it as rational that individuals and groups (trade unions) would resist relative reductions in money wages,

> ... any individual or group of individuals, who consent to a reduction of money-wages relatively to others, will suffer a relative reduction of real wages, which is a sufficient justification for them to resist it. (Keynes, 1936, p. l4)

The extent of disequilibrium in labour markets and the rates at which labour markets adjust to disequilibrating shocks formed an important empirical literature, mainly in the 1980s (e.g. Quandt, 1982; Goldfeld and Quandt, 1986; Quandt and Rosen, 1985). Insofar as this work suggests imperfect wage adjustment, which it does, then the external labour market is not sending the appropriate signals for education, training or labour mobility.

Implications for training. In addition, to this work, there is a conceptual model of dynamic skill shortages (Arrow and Capron, 1959). This model includes an element of imperfect information or foresight by decision makers, alongside education or training lags – in this respect it is similar to the "cob-web model" outlined below. In this instance, the wage adjusts slowly towards its long-run equilibrium position, but the equilibrium changes over time as the demand curve continues to shift outwards. Depending on the assumptions about the rate at which the demand curve shifts and the rate of adjustment of wages[27] it is possible to generate situations of growing shortages.[28] While this model has been largely applied to individuals deciding about their investment in skills, it could equally be applied to employer training.

Similar models have been hypothesized in which shortages can emerge even though the demand for certain skills is falling. This occurs because factors other than the wage, such as job uncertainty which results in psychological stress, cause the supply curve to fall more rapidly than the demand for labour curve. It was thought that this explained some of the shortages of craftsmen that emerged in the 1960s, despite a backdrop of a declining manufacturing sector

[27] The rate of adjustment of the wage may be related to the magnitude of the shortage.
[28] This type of situation was associated with the market for engineers in the early post-war period and, subsequently for electronic and software engineers.

(Bosworth, *et al*. 1996, p. 202). This produced a particularly difficult environment for employers who still required skilled individuals, but the economic conditions made training unviable.

Finally, there is the concept of "cob-web models" in which shortages send a signal to train, but training takes some while to complete, which creates a difference between the short and long run supply functions. The supply of skilled labour in the short run is assumed to increase with the wage up to the current, equilibrium level of employment, at which point it becomes vertical. In other words, there are no additional skilled people available to the market unless additional people train. The demand for labour curve is assumed to shift outwards from its current equilibrium position, to intersect at a point on the vertical supply curve. This causes the wage to rise sharply and provides a signal for more individuals to train. The number entering training is represented by the difference between the short- and long-run supply curves at the new, going wage rate – a number far in excess of that needed to equate the long run supply and demand curves. In practice, when these individuals all flow onto the market at the end of the training period, the market is only willing to assimilate all of them at a much lower wage than the one that temporarily prevailed during shortage conditions. This causes the wage to fall below the long run equilibrium position and some trained individuals leave the market for other jobs (they are assumed lost to the market in question). This causes wages to rise above the long run market level and the "cobweb cycle" begins to emerge.

Extensive empirical testing took place, mainly in the 1970s (Freeman, 1971, 1975 and 1976), which largely supported the cobweb hypothesis in certain labour markets. However, while it is possible to see how cobweb models might be applied in the context of employer investment in skills, they seem much more applicable to individual decisions about education and formal training.

3.2 Production and technology related externalities and spillovers

Background

Why explore R&D? This section focuses on R&D (or technology) spillovers. There are many analogies between R&D spillovers and education and training spillovers, at least in the case of larger scale, more formal investments in training

- both are risky and, in addition, R&D generates new, if highly specialist knowledge and skills;
- the R&D literature can be used as an example of the development of new metrics, which conceptual and empirical work on training needs to emulate;

- the R&D literature largely focuses on sectoral spillovers involving broadly the same area of production or process technology.

The analysis of R&D spillovers also has the advantage that the empirical literature on R&D is somewhat better populated than the one relating to education and, more particularly, training spillovers.

The relevance of the R&D spillover literature, however, is crucially dependent on the skills of one firm in the sector being relevant to the skills of other firms in the sector, as outlined in Section 3.1. If skills are completely firm specific, it is much more difficult to envisage how spillovers would occur.

Development of new metrics for R&D. The work on the role played by R&D was preceded by research using patent data, as, at that time, measures of R&D were still in their infancy. R&D was first formally defined in the OECD "Frascati Manual" at the end of the 1950s. It was only in 1977 that the first SSAP 13 on the accounting standard for R&D was published in the UK (ICA, 1989), and it was towards the end of the 1980s before firm level data were sufficiently robust to test the own-R&D effects in the UK. The USA were some way ahead of the UK and the work of Griliches (1979, 1981) and Scherer (1982) largely unlocked the issues of own-returns and spillovers at the same time, but around a decade ahead of the UK.

A series of papers by Schmookler, which date back to around 1950, culminates in Schookler's (1966) seminal book on *Invention and Economic Growth*. The initial interest on the role of technological change that led to the empirical R&D/aggregate performance literature can be traced back to the seminal paper by Solow (1957). The original work on R&D was the effect of own-R&D on the performance of the sector or economy carrying out the R&D (in the main, firm data were unavailable or very poor at this time). Sector-based empirical models can be traced to the early work of Chris Freeman from the beginning of the 1960s, and perhaps best illustrated by Griliches (1964) and Taylor and Silberston (1973, pp. 54-78).

Appropriability, spillovers and the technology "pool". While issues of appropriability may have been well understood by patent lawyers for many years, they first emerged in the conceptual economics literature in the work of Nelson (1959) and Arrow (1962).[29] Both of these papers, in somewhat different contexts, deal, in particular, with the inability of individuals or organisations to appropriate the returns certain types of R&D, such as scientific research, and the policy consequences of this market failure. The analogy with

[29] Empirical estimates of the social returns to R&D had appeared one year earlier in the context of the invention and diffusion of hybrid corn (Griliches, 1958).

training is that the skills that firms engender in their employees are likely to be of use to other firms, particularly those in the same sector.

Even in the case of strong patents, appropriation is generally incomplete. For one thing, the full "disclosure" of an invention in a patent specification is part of the "price" the inventor must pay to obtain patent monopoly rights over the idea (Bosworth, 1987). However, there are many other ways that the R&D results spill out, for example, through publications and open technical meetings, consultations with employees of the innovating firm, hiring employees from the innovating firm, reverse engineering, *etc*. (Nelson, 1990; Patel and Pavitt, 1995, p. 19).[30] These various forms of spillovers create a "pool" of information and knowledge available to each firm. It can be envisaged that the training of individuals by firms might result in a similar type of pool.

The empirical literature has tended to measure the size of the pool available to each firm in one of two ways. The least sophisticated is to assume that the pool comprises all firms in the same sector, this makes the spillover effect "symmetric" for all firms in that sector (Griliches, 1992, p. S37). The more sophisticated is to attempt to produce a "pool" based upon the technological distance of one firm from that of others (e.g. Scherer, 1982). Technological distance can be based on similarities or differences in the international patent classes within which firms operate. Thus, technological distances differ from one pair of firms to another pair and the effects of the pool as a whole on any one firm can differ to that of other firms, and is termed "asymmetric" (Griliches, 1992, pp. S37-38).

Since the early 1980s an extensive R&D literature has emerged, which has thrown considerable light on the importance of externalities. Griliches (1992, pp. S43-S44) argues that,

> … there has been a significant number of reasonably well done studies all pointing in the same direction: R&D spillovers are present, their magnitude may be quite large, and social rates of return remain significantly above private rates. ... R&D returns account for half of the growth in output per man and about three quarters of the measured TFP growth, most of the explanatory power coming from the spillover component ... .

Griliches (1992, pp. S30-S31), however, notes that,

> The more difficult to measure and the possibly more interesting and pervasive aspect of R&D externalities is the impact of the discovered ideas or compounds on the productivity of the research of others. (Griliches, 1992, pp. S30-S31).

[30] Griliches' (1992, p. S36) definition of a "pure spillover" is that it has no cost to the firm that it spills over to. In practice, many of the "spillover" routes have some cost to the recipient firms and the "spillover" is therefore not "pure" in this sense.

Private and sectoral returns to R&D

The market imperfection or failure occurs because firms take decisions based upon their own private calculus and, as a consequence, they invest in R&D at a level below that which is optimum from the perspective of the sector (e.g. every firm that shares in the pool of technology created). In other words, the firm only invests up to the point where the private return to the next £1 of R&D is also £1. This calculation does not account for the fact that the firm would benefit from a greater industry (or economy-wide – see Section 4) investment in R&D; according to the spillover hypothesis, if there is an overall expansion in R&D, all firms with access to the pool benefit. The nature of training suggests there should again be an analogous outcome.

The result is that the return to the stock of R&D knowledge is higher at the aggregate, sectoral than the individual firm level (Griliches, 1992, pp. S34-S35); the derivation is presented in Appendix 5. In essence, the firm's output depends upon its inputs of tangible assets and intangible assets. Tangible assets are factors such as labour and capital, and intangibles are represented by its stock of R&D knowledge. Given these inputs, the level of output also depends upon the technology prevailing at the time of production, which includes any knowledge stock that spills over from other firms in the same technology pool. However, this knowledge stock is a constant as far as the firm is concerned, as its own decisions have no (significant) effect on the pool. There are diminishing returns to the firm's own tangible and intangible assets, so their optimal levels are set in the standard neoclassical way, reflecting the value of their marginal products.

However, the more that individual firms invest in R&D, the larger is the aggregate pool, the greater the output of the pool and the higher the "technology constant". The first implication is that, if individual firms in the pool could be encouraged to carry out more than the privately optimal level of R&D, the sector would benefit as the higher technology constant would raise the output of every firm within the pool. The second potential implication is that, at the aggregate (pool) level, there may be increasing returns to R&D knowledge and, almost certainly, increasing returns to the scale of production activity.

This result, backed up by the empirical findings with respect to the social returns to R&D, has led many countries to introduce tax breaks for R&D. According to the OECD (2007a)[31],

> R&D tax concessions are extensively used by OECD countries as an indirect way of encouraging business R&D expenditures. Special tax treatment for R&D expenditures includes immediate write-off of current R&D expenditures and various types of tax relief such as tax credits or allowances against taxable

[31] http://miranda.sourceoecd.org/vl=2084242/cl=28/nw=1/rpsv/sti2007/c-3.htm.

> income. Depreciation allowances are a third type ... . In 2006, 20 OECD countries had R&D tax credits, up from 18 in 2004.

However, governments support private R&D in a wide variety of ways, including the provision of highly qualified researchers via the university system, grants for research activities and the existence of government funded R&D units (Bosworth, 2005, p. 388). It might even be possible to expand the sectoral level of R&D using a levy system, but this might be difficult to operationalise and has not been discussed in the literature.

3.3 Suboptimal provision from a sectoral perspective

Anything that systematically prevents individual employers within a sector from reaching their privately optimal level of investment in skills will carry over to the sector level. Thus, if significant numbers of employers find it difficult to raise funding for investment in training, then training at the sector level will be lower than optimal. The fact that some employers find it easy to fund training does not mean that they will over-invest in skills, but that, other things equal, they will achieve their desired optimum level. Thus, under-investment by some employers is not off-set at the sector level by over-investment by other employers. Hence, many of the barriers to training summarised in Table 3.1 remain important at the sector level.

This section has argued that, as in the case of Jagger, *et al*. (2005), "sectors matter" because the outcomes at sectoral levels are not simply the result of an aggregation of individual firms (as outlined in the previous paragraph), for at least three reasons (see Table 3.1 for a summary):

- firm size and market power –
    - the number and relative sizes of firms in the sector are important in driving product market competition and, thereby, the goals and strategies of companies;
    - the number and relative sizes of suppliers and buyers of a given sector are also important in driving the relative degree of market power of the firms within that sector;
- the extent to which the sector sends the correct price signals for investment in skills, which depends upon the speed of adjustment in wages and other relative prices, the length of the period it takes to train an individual in new skills, etc.;
- the extent to which each firm within a sector can appropriate the benefits of training determines the extent to which individual firms can be left to their own devices and the extent to which some broader, sectoral level of cooperation or intervention is needed.

It is difficult to say what the "optimal" level of investment in skills is when looking at different market structures. However, it is possible to say whether the optimal level of skills and training is likely to be lower or higher than the benchmark level of skills and training under high levels of price competition (perfectly competitive product and factor markets). The most clear cut cases are those where there is monopoly power in the supply of labour (e.g. the presence of unions or professional bodies). Here the "union voice" model suggests union support for investments, such as training, that aid the future performance of the firm and continuity of employment. In addition, market structures (such as certain forms of oligopoly and monopolistic competition) will lead to an emphasis on product specification and quality competition. This emphasis is consistent with a higher skills/higher training strategy.

The conceptual literature is clear that suboptimal skills shortages and skill surpluses can emerge where wages show some degree of rigidity (unlike the perfectly competitive model where they are assumed perfectly flexible, even in the very short term). In essence, the greater the wage rigidity and the longer the training period before new supply emerges, the more likely skill shortages will emerge. There are perhaps stronger conceptual reasons for downward than upward wage rigidity, which can result in an over-supply of skills and over-investment in training, at least in the short term, when product demand is falling.

Finally, there are a range of possible reasons why private decisions produce suboptimal skills and training outcomes at the sectoral level – the so-called spillover and externality effects. The present discussion has illustrated this using the example of R&D, because there are similarities with the decision to invest in skills and the empirical work on R&D spillovers has mainly been carried out at the sectoral level (whereas human capital spillovers have largely been dealt with in a spatial/locational context). Positive spillovers of the type that arise from R&D imply that individual firms within the sector under-invest in R&D. In other words, that if all firms invested more than what they perceive is privately optimal, all firms in the sector benefit from this.

Table 3.1: Summary of factors causing suboptimal investment at the sectoral level

Reason	Likely direction of effect *vis a vis* optimum level	Comments	Example sector/profession
Market structure			
Perfect competition	Benchmark	Price competition – little need for training/no funding for training – when faced by shocks, inclination is to deskill	Various forms of farming (e.g. milk production)
Monopoly power	+	Union voice model	Unionised/higher union density sectors
Monopsony power	+/-	Incentives for individuals to undertake education / training rather than employer	Older / lower skilled individuals are unable to escape monopsony power
Specification and quality competition	+	Incentives for various forms of discretionary investments including training	Creative sectors and higher tech sectors
Disequilibrium and equilibrating processes in the labour market			
Wage rigidities	+/(-)	Send wrong signal re training	Most labour markets tested to date
Dynamic skill shortages	-	Failure of wages to adjust quickly enough	The market for engineers in the early post-War period; the market for electronic and software engineers during early phases of IT revolution; shortages of craftsmen in the 1960s, despite declines in manufacturing
Cob-web cycle	+/-	Imperfect information and lag in training cause sequential under and overshooting of optimal value	Graduate and professional groups (e.g. scientists, engineers, etc.)
Externalities and spillovers			
R&D spillovers	+	Used as an analogy with sectoral training spillovers	R&D active/R&D intensive sectors; other creative sectors

Note: +/- implies that the effect is to take the level of training above/below the perfectly competitive "benchmark" level.

4. Optimal employer investment in skills from a national perspective

4.1 National systems and traits

National systems and national systems of innovation

Just as sectors are distinctive, so are nation states. The challenge is for European Member States to achieve the changes needed for the implementation of the Lisbon Strategy – the decision taken by the European Council (March 2000) to attempt to meet a variety of aspirations (e.g. sustaining employment, economic reform and social cohesion in a knowledge-based society), to meet the challenges of increasing global competitive pressures. National systems are diverse across the EU and there is no single model that can be taken from any one country (whether in the EU or not) and then applied (Lorenz and Lundvall, 2006).

Much of the conceptual debate has focussed on national systems of innovation (or national innovations systems). "System" in this context refers to a set of interrelated components that are intended to work towards a common objective (Carlsson, et al. 2002, p. 234). A system comprises:

- Components – the operating parts of a system, may comprise actors and institutions (e.g. individuals, businesses, venture capitalists, university departments, and public policy agencies); artifacts that allow the components to operate and link the components together (e.g. transmission lines, the world wide web); institutions, laws and norms (e.g. regulatory laws and social norms);
- Relationships – link the components of the system and can be both market (e.g. trading links) and non-market (e.g. social links) in nature. The relationships transmit the actions of each component to at least one other component of the system, thereby affecting the behaviour and outcome for the system as a whole. The components are interdependent and cannot be divided into independent subsets.
- Attributes – denote the properties of the components and the relationships between them. These include factors such as economic competencies, organisational (integrative or co-ordinating) ability; functional ability and learning (adaptive) ability. These will define the likely success of the system in achieving its aims, for example, the function of an innovation system is to generate, diffuse, and utilize technology. Thus, the main features of the system are, "... the capabilities (together representing

> economic competence) of the actors to generate, diffuse, and utilize technologies (physical artifacts as well as technical know-how) that have economic value". (*ibid*. pp. 234-235)

Work on national innovation systems can be traced back some years (Freeman, 1988; Lundvall, 1988, 1992; Nelson, 1988, 1993) and has more recently been extended in a variety of ways. One of the simplest forms of a national system is represented by the input/output flows that take place between supplying and buying sectors (consumers and trade) (Leontief, 1941). Here the flows between sectors can be used not only trace the impact of multiplier and accelerator effects on industry structure and national growth, but also to explore potential technological spillovers between sectors (Scherer, 1982 and 1984), as opposed to within sectors (see Section 3.3 above).

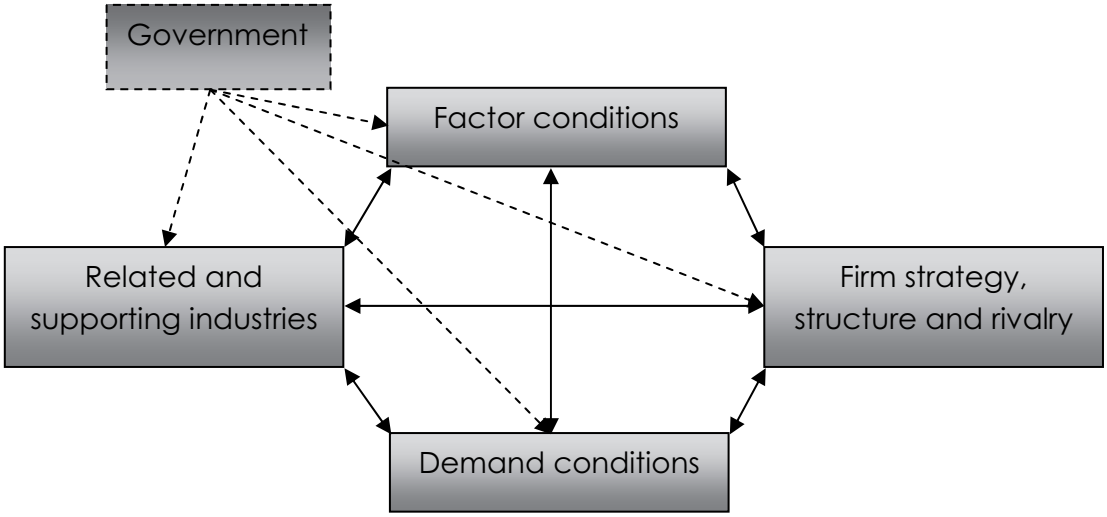
However, conceptual models of national innovation systems were further developed to include not just sectors, but firms and other organizations, primarily those working in science and technology, and the role of technology policy. Components of the system now include: R&D activities, universities, research institutes, government agencies and government policies. To date the relationships between the various components of the system have been explored at the aggregate level and, given the complexity of the system, even at the national level, the analysis has mainly been static or comparative static in nature (Carlsson, et al. 2002, p. 236).

Up to the present time, studies of national systems of innovation have given little or no attention to the subsystem relating to skills and human resource development (Lundvall, *et al*. 2002, p. 224),

> This includes the formal education and training, the labour market dynamics and the organisation of knowledge creation and learning within firms and in networks.

Porter's "diamond" loosely describes a somewhat more broadly based national system that says something about skills supply and demand, although even this is fairly limited (Porter, 1990).

Figure 4.1 Country competitive advantages



The four sides of the diamond comprise,

- factor conditions (skills, technologies, capital, etc.);
- demand conditions (especially "competent demand" as represented, e.g. by technically sophisticated customers);
- links to related and supporting industries; and,
- firm strategies, structure and rivalry (see Figure 4.1).

Although a national model, each economic activity is carried out by an industry and the model emphasizes the competition amongst actors within each industry. Little is said about the non-market interactions that are so often important in the literature on national systems of innovation. Skills supply (including management skills) form part of the factor conditions, while skill demands depend on the extent of "competent demands" for the products and services. Again, the model is essentially static or comparatively static in nature (Carlsson, *et al*. 2002, p. 236).

This lack of emphasis on the skills and human resources sub-model is extremely important. As Lundval, et al. (2002) argue,

> This subsystem will be confronted with very strong needs for social invention in the near future in all national systems and quite a lot of the peculiarities of national systems are rooted in this sub-system. (*ibid*. p. 224; emphasis added)

However, there has been some, largely separate interest in national training systems (e.g. the work of Finegold and the NIESR; Gill, *et al*. 1999; Greenhalgh, 2001).

Relationship between national, sectoral and individual outcomes

Section 3.1 noted that sectoral outcomes are not a simple sum of the individual (e.g. firm level) parts of the actors that make up the sector. This is even more clearly the case at the national level – the national outcome is not a simple sum of the outcomes across the different sectors of the economy.

Carlsson, *et al*. (2002, pp. 234), for example, in the context of national systems of innovation, note that the system as a whole is more than the sum of its parts and a change to one component or relationship between components can cause wide ranging and fundamental effects to the operation of the system, including its collapse. Feedback makes the system dynamic – allowing capabilities to grow or decline over time and, therefore, the configuration of the system itself can be affected and changed.

A further way in which the national outcome is more than the sum of the component parts concerns spillovers and externalities. Section 3.3 noted that the conceptual literature argues that there are potential technological spillovers across firms in a given area of technology or a given sector. There is also the possibility, however, that there can be spillovers that occur between sectors and spillovers that work in terms of other forms of networking, such as spatially, which may be partly or even largely irrespective of the area of technology.

4.2 Institutional barriers and government failure

It is impossible within the confines of the present project to consider all of the component parts of the "national system" relating to the role of training. This section, therefore, deals with a number of institutional issues that have been given quite heavy emphasis in the conceptual literature.

Accounting practice

It is widely thought that the UK has a high standard of accounting practice. However, the UK, in common with all other countries, has been faced by an increasing disjuncture between its accounting rules, which have evolved over many years to deal effectively with investments in tangible assets, and the growth and increasing importance of intangible assets. The inability to measure and declare the value of intangible assets means that it becomes increasingly difficult to borrow against tangible collateral in an increasingly weightless economy.

The conceptual literature clearly articulates the need for common metric for measuring firms' investment in training. Such a metric was developed for R&D in the late 1950s, in the

Frascati Manual, under the auspices of OECD. Thus, there was some prior knowledge about how to measure R&D (as well as some experimentation by government statisticians in collecting information about R&D), when the accounting profession came to design their accounting code of practice for R&D (SSAP 13 in the UK, and FRS-13, part of GAAP, in the USA). Subsequently, further modification has been made to produce definitions of R&D for tax purposes.

No such measure has emerged for training investments. The need for a common metric for investment in training is outlined in Finegold and Levine (1997, p. 111), who argue that,

> Without a common metric, analysts and investors have no way to know which company (if any) is investing a high or low amount – or to be able to track the success of such investments.

A metric of this type for training would be an essential precursor to the introduction of government support for training, for example, in the form of tax breaks or sectoral support in the form of a training levy. Finegold and Levine (1997, p. 119) go on to argue that,

> Governments need to restructure their accounting rules to put investment in people and in quality on a more even footing with investment in plant, equipment or research. These changes should occur in both the public and private sectors. ... International organizations, governments, industry and the accounting profession must work together to create standard measures of workplace investments that are comparable across time, across nations, and across companies. Only then can investors understand which companies are investing for the long term. Moreover, only then can international investors understand which nations have budget deficits, and which are investing in the future.

Current accounting practice is clearly at odds with optimal national investment in training. Unless the costs and benefits of training are both very short term, expenditure on training should be treated as an investment and amortized over the lifetime of the flows of costs and benefits. This is at odds with current accounting practice, which treats training expenditures as a current cost (written off against profits or reserves within the same accounting year). Writing them off in this way makes it appear, at least to an outsider, as if the firm has wasted its money on training, as they are a cost (which reduces profits or reserves) with no discernible benefit. The longer, more complex and riskier the investment, the more at ease accountants are to write them off in this way, while they would be happy to discount some known and certain future stream of financial flows. While accountants have been working on new codes of practice for intangible assets, so far, there has been no resolution to this issue.

Short-termism

UK financial markets are also thought to be of a high standard and Britain remains, at least at present, one of the world's major financial centres. Nevertheless, it has been suggested that UK markets, in particular the stock market, tend to be short termist (see Section 2.5 above in the context of the creation of barriers to training for the individual firm).

The "rational valuation formula" is that stock prices equal the discounted present value of expected future dividends (e.g. Miles, I993 and Cuthbertson, *et al*. 1997). While the null hypothesis is that stock prices reflect a "rational valuation of expected future income accruing to the stockholder", the alternative hypothesis is that the market is "inefficient" (Cuthbertson, *et al*. 1997, p. 999). However, such models can also be used to test a specific alternative to efficiency, that the market is short termist – in other words, that the market uses an excessively high discount rate when discounting dividend flows further into the future.

If this is correct, and the empirical evidence tends to support the short termist view, then it can have significant negative effects on investment in training,

> The short-term perspective of most British managers is reinforced by the pressure to maximize immediate profits and shareholder value. The historical separation of financial and industrial capital ... has made it harder for British firms to invest in training, with its deferred benefits, than their West German or Japanese competitors, particularly since the City has neglected training in its analysis of companies' performance ... . Without access to large industry-oriented investment banks, British firms have been forced to finance more investment from retained profits than companies in the other G5 nations ... . (Feingold and Soskice, 1988, p. 29)

Government failure

Whether government policies are successful or not is an empirical issue, the answer to which is likely to vary from policy to policy.[32] However, all such interventions incur costs and create economic distortions, which have to be taken into account when calculating whether intervention is warranted.[33] Booth and Snower (1996, p. 11) argue that,

> Ultimately [government support for training] must be financed by imposing taxes **or** cutting some other government expenditures. Since it is generally impossible to impose lump-sum taxes, taxing inevitably creates inefficiencies. Consequently, government intervention to correct for market failures in training generally means

[32] The potential success of government intervention is usually assessed in terms of its "additionality". This is the net impact of the policy initiative, after taking into account what would have happened in the absence of the intervention (the counterfactual). Additionality also takes into account the effects of "leakage", "deadweight welfare losses", as well as "displacement" and "substitution" effects (HM Treasury Green Book, Annex 1, para 2.).
[33] HM Treasury Green Book, para 3.3.

> the creation of new market failures or the withdrawal of socially desirable public goods.

Such distortions and costs may imply that living with some market failure or inequity may still be a better option than attempting to remedy it. Booth and Snower (1996, p. 10) argue that,

> The government, like the market system, may fail to act in the best interests of the public. Thus policy prescription must be based not only on market failure, but also on 'government failure'. Only if the cost of market failure outweighs the cost of potential government failure can a case be made for public provision or regulation of training.

In the case of employers' decisions about training, it was argued that the arguments of product champions should be treated with caution, as they often contain an inherent bias (Section 2.4). The same can be argued about government officials, who cannot always be relied upon to act in the public interest. Booth and Snower argue that,

> The incentives for promotion, status, and power within the civil service may lead officials to devise training programmes that are excessively bureaucratic and expensive. (*ibid*. p. 10)

The incentive to act in this way is greater the less likelihood of "getting caught". The outputs of training are often difficult to measure (Finegold, 1996, pp. 238-239), which lowers the chances of subsequent adverse consequences for the decision makers. Freedom to follow their own agendas also makes government officials open to pressure from special interest groups. Again, according to Booth and Snower,

> This 'representation failure' should not be seen as an aberration, a rare pathology. We expect everyone in the private sector to pursue their own self-interest; so when some of these people move into the public sector, it is surely unreasonable to expect their self-interest to become irrelevant to them. (*ibid*. p. 10)

Broadly similar arguments apply to politicians who are concerned with their position in their party and with their chances of reelection. As a consequence, politicians may adopt short term goals that enhance their position or programmes that cannot be properly evaluated for many years. In essence, politicians have a higher time rate of discount than is socially optimal (Finegold, 1996, pp. 244-245). Despite various departmental and other structural changes designed to distance vocational training initiatives from short term political pressures, training programmes continued to be closely linked with unemployment in the UK over the 1980s (Finegold, 1996, p. 244) and there may be strong pressures to do so again in the current downturn.

There is also a question as to whether the state will be more efficient at providing training than the private sector firms themselves (Booth and Snower, 1996, pp. 10-11). As noted earlier in the in the present Review, firms' funding of training is likely to emphasize specific over general skills (which they feel should be funded by the individuals or by government). In some cases, the skills needed by firms will be highly idiosyncratic, and cannot be provided as the result of some overarching government training programme. Even where skills are sector specific, there seem to be strong grounds that employers in that sector will know better than government what is needed.[34]

Booth and Snower (1996, p.11) argue that even state finance for training may be problematic (let alone state provision of training). They argue that government intervention is likely to be severely constrained by the need for rules and regulations that prevent the finance of training from pursuing political ends, and that such rules prevent government from intervening efficiently when training opportunities arise. There is also an equity issue here, however, as, in several places, the present Review argues that employers will be a principal (although probably not the only) beneficiary of a better system of training and, therefore, should contribute towards the costs of training.

4.3 Externalities and spillovers

This subsection deals with a variety of conceptual issues and results associated with the possible existence of spillovers and externalities linked to human capital. This discussion parallels that of R&D, which, because the main focus of R&D spillovers was the ability to pool technology, was dealt with in a sectoral context (see Section 3.3). In the case of human capital spillovers, these have generally been considered in a local, regional or national context and, hence, are considered in the present discussion of employer optimal investment at a national level. Some of these spillovers seem less relevant than others as they appear to relate to basic or general skills, rather than the more firm or sector specific skills that employers would normally be expected to invest in.

Education and human capital spillovers

Background. The existence of externalities and spillovers provides a similar reason for government intervention in education and, potentially, training. Educational externalities have been recognised at least as far back as Marshall (1890). Blaug (1968, p. 243), for example, outlines nine types of economic and non-economic spillovers that result from

[34] Booth and Snower (1996, p. 11) argue that even where the skills are not wholly idiosyncratic in this sense, broad government programmes would find it difficult to meet the skills nuances across the range of local labour market conditions and requirements.

improvements in education and Wolfe and Zuvekas (2000) outline a wide range of positive educational spillovers on social activities (e.g. civic activities, health, crime, etc.).

In the main, attempts to isolate human capital spillovers have focussed on the effects of the average level of education in different locations on the earnings of otherwise similar individuals in those locations (e.g. Rauch, 1993; Acemoglu and Angrist, 2000; Ciccone and Peri, 2006; Moretti, 2004a).[35] Hence, they are generally not sector related, but a spatial phenomenon.

The basic idea can be illustrated by comparing two individuals with identical personal and other characteristics, but working in two different locations where the level of education or skills is quite different. If, for example, the individual working in an area of high skills is paid a higher wage than the identical individual working in an area of low skills, then an externality exists by which the individual in the high skill area experiences a spillover of benefit from other peoples' skills.

Some of these locational studies are quite sophisticated. Moretti (2004b), for example, uses longitudinal, plant level data (which help to eliminate some of the issues of selectivity and endogeneity). In addition, this paper explores the role of "economic distance" in determining the strength of spillovers, showing that,

> ... spillovers decline with economic distance. ... aggregate human capital in the high-tech sector of the city matters more for high-tech plants than aggregate human capital in the low-tech sector of the city; and aggregate human capital in the low-tech sector matters more for low-tech plants than aggregate human capital in high-tech plants. (*ibid*. p. 657)

Several features of these spatial spillovers make them less relevant in the present context. The first is that they seem to relate more to general skills than to firm specific or sector specific skills. This makes them of less relevance in the context of the focus on employer investment in skills. The second feature is that these studies largely focus on individual earnings, rather than firm performance *per se*, which makes them somewhat less interesting from the present perspective, as it is not clear to what extent employers are also beneficiaries.

The local area spillover effects outlined above are somewhat different from those envisaged by Battu, *et al*. (2004). Here the productivity increasing "employment related" spillovers (e.g.

[35] The R&D literature also investigates the existence of spatial R&D or innovation spillovers. In general, the unit of observation is areal in nature – for example, both Funke and Niebuhr (2000) and Bode (2004) adopt West German planning regions as the unit of observation. The approach is then similar to the one described in the previous paragraph based upon technological distance, although, in the present case the analysis is based upon spatial distance. Knowledge is separated into that produced "locally" (e.g. within the region in question) and that produced "globally" (e.g. outside the region in question) (e.g. Bode, 2004, p. 44). The potential size of spillovers for any particular region is then related to two principal factors: the magnitude of the knowledge stock of other regions and the ease with which this stock can flow to the region in question (e.g. the closeness of one region to the others).

as envisaged by Blaug, 1968, p. 244) occur from the more to the less educated amongst employees in the same workplace.[36] Insofar as the associated skills are specific, then the firm can capture the benefits and invest optimally, but insofar as they are general and are captured by the workers, the firm may employ too few such individuals to optimise employee income. If employee incomes can be raised in this way, then there are also social benefits through higher taxes.

Endogenous growth – the "new growth theories"

Most goods and services, such as capital and labour are characterised by:

- rivalry – that only one person can make use of them at a given point in time;
- excludability – that one person (e.g. the owner) can prevent other individuals using them.

Knowledge is a non-rival good and, insofar as it is not wholly appropriable – in other words, insofar as there are knowledge spillovers – it is also non-excludable. Thus, according to Cortright (2001, p. 4),

> The centerpiece of New Growth Theory is the role knowledge plays in making growth possible. Knowledge includes everything we know about the world, from the basic laws of physics, to the blueprint for a microprocessor, to how to sew a shirt or paint a portrait. Our definition should be very broad including not just the high tech, but also the seemingly routine.

Free markets fail to produce adequate amounts of knowledge. In essence, there is a "free rider" problem. If there is no way to exclude others from benefitting from the knowledge an individual produces, there is no effective way of making them contribute towards paying for its production. To put it slightly differently, there is no way the producer of knowledge can capture revenues that reflect all of the benefits other individuals receive from knowledge and, as a consequence, they under-invest in knowledge from a societal perspective.

The result is that, while there may be diminishing returns to investing in knowledge at the individual employer level (e.g. each additional unit of knowledge adds less to income than the previous unit of knowledge), there can be increasing returns to investment in knowledge at the national level (as not only the individual making the investment benefits, but so do other individuals and groups within the economy). The implication is that, if society can raise the investment in knowledge sufficiently, the increasing returns to knowledge produces a source of endogenous growth that, in principle, can carry on without an upper bound.

[36] Based on a statistical analysis of the Workplace Employment Relations Survey, Battu, *et al*. (2004) report the existence of substantial and significant educational spillovers in the workplace, which are largely independent of the individual worker's own educational level.

While the theory is interesting and the implications for growth appear to be extremely important, knowledge is somewhat removed from skills and, more particularly, from firm or sector specific skills. Thus, this theory appears somewhat tangential in the context of optimal employer investment in skills – the more so, the more idiosyncratic the skills involved.

Skills and innovation[37]

It has been recognised for many years that innovation and the diffusion of technologies already in use elsewhere are dependent on the skills and competencies of the workforce (e.g. Solo, 1966; Amsden, 1989; Acemoglu, 1997). Solo (1966) argues that the presence of formally educated scientific and technical elites is a necessary but not sufficient condition for economic development to take place – development only begins when the skills of the middle mass of "mechanics and technicians" reaches a sufficient threshold. Amsden (1989, p. 9) similarly argues that, while "Salaried engineers are a key figure in late industrialization because they are the gate keepers of foreign technology transfers", nevertheless "... Korea was a successful learner [of foreign technology] partly because it invested heavily in education ..." (*ibid*. p. 23).

The link between education, skills, innovation and diffusion has been extensively explored in the literature. OECD (2007, p. 18) argues that a good and accessible education system facilitates the adoption and diffusion of innovation. In addition, human capital is a key factor in the adoption of new technologies and innovative practices. Evidence for this argument can be found throughout the international comparative case studies carried out by NIESR. Mason and Wagner (2002, p. 93), for example, argue that the greater skills of the German workforce, particularly intermediate skills, ensure that production moves smoothly, which frees up time for managers and workers to introduce strategic incremental process improvements. The NIESR case studies provide many other instances of the role played by human capital and, particularly, by intermediate skills.

[37] Based upon Bosworth (2008).

Given that the literature suggests that the private return to both skills and R&D are less than the social returns, this inter-relationship between skills and innovation indicates that the effects of one compound the other. Acemoglu (1997, p. 460) investigates the relationship between the two and finds the potential for multi-equilibria.[38] These frictions relate to the costs of search and mobility, as well as the uncertainty of which firm will be the future employer of any given individual. Two potential equilibria are described as follows,

> If a large number of firms are expected to adopt the new technology, workers expect their future productivity to be higher and are more willing to pay for general training. In contrast, there can also be a coordination failure equilibrium where firms do not adopt the innovation and workers choose a low level of skills. (*ibid*. p. 460)

Low skills equilibrium and low skills trajectories

Background. There is a further group of spillovers that are associated mainly with negative externalities. These include the concepts of "low skills equilibrium" and "deprived neighbourhood effects". The present discussion focuses on low skills equilibrium as a national, rather than a neighbourhood phenomenon (see Appendix 6 for a discussion of neighbourhood externalities). The literatures on poaching and labour turnover provide some insights about the causes of "low skills trajectories" that may eventually result in a low skills equilibrium.

Low skills equilibrium. Finegold and Soskice (1988) provide a number of explanations as to how an economy can get locked in a low skills equilibrium, for example, while neoclassical theory would suggest that the returns to training should be high when little training is being undertaken, in practice this not the case for a number of reasons[39], in particular, the low skills equilibrium has an essential spillover dimension that locks it in place,

> The low-skills equilibrium organisation of work means that the marginal productivity of skills for individual workers is below what it would be in an economy where a large enough proportion of the workforce was skilled to permit a high-skills pattern of work organisation. (*ibid*. p. 45)

[38] This is a study of labour market frictions rather than externalities, but the conclusions about the inter-dependence of technology and skills remain relevant.

[39] A further reason put forward is that, "A large proportion of the workforce does not have the basic education required to proceed to craft level vocational training; so a major prior investment is necessary." (*ibid*. p.45)

The crucial feature of Finegold and Soskice's (1988) argument, however, is that the education and training problem in Britain is a fundamental and broadly based "systems failure" (see Section 4.1 above). With a systems failure, the returns to acting on any one dimension of the problem alone are relatively low, but the returns to acting on the system as a whole can be much larger. Wilson and Hogarth (2003, p. 8) argue that, if there is a general systems failure, there is no simple solution, but a need for wide ranging policy initiatives that involve more than just the labour market.

Labour mobility and poaching. In the discussion of the firm's private calculus about training (Section 2.2 above), the costs and benefits of training were both discounted over the length of time the individual would continue to work for that company (or the expected lifetime of the company). This period depends crucially on the rate of labour turnover within the company – the shorter the expected tenure of employees, the lower the discounted sum of benefits from training, other things being equal.

There is some empirical evidence to suggest that labour turnover may not be independent of training.[40] Insofar as training increases (or decreases) the expected tenure of individuals within the company, this increases (or decreases) the period over which the benefits of training accrue. Following neoclassical theory, other things being equal, firm investments in more transferrable skills would be expected to decrease expected tenure and investment in specific skills to increase tenure.[41] Clearly, if employers have imperfect information about this link, they may under- or over-estimate the benefits of training.

The concept of poaching arises from neoclassical theory, that, where perfect competition prevails in both product and labour markets, there is no incentive for firms to fund general training. To make general training viable, the training firm would need to maintain the trained persons wage below the level they would get in other companies. If they tried to do this, the trained individual would simply move to a different employer who would be willing to pay that higher wage. Thus, the training firm would lose the money they spend on training and, in a highly competitive product market, this would put them at a competitive disadvantage.

[40] This is an empirical question. Green, *et al*. (2000, p. 261), for example, find little support for this hypothesis, stating that, "Overall, training has no impact on mobility in three out of every five cases; the remaining cases are split equally between those where training increases and those where it decreases mobility."

[41] (*ibid*. p. 261) "We find that training is more likely to lead to lower mobility when it is less transferable to other firms, is sponsored by firms, and where its objectives include increasing the identification of employees with corporate objectives."

The general view appears to be that poaching undermines the provision of any form of training that contains some element of general skills (e.g. Stevens, 1994). Thus, the overall view in the literature is that there is a need for some form of subsidy for the general element of training provided by companies (Acemoglu and Pischke, 1999), although there are some differences as to what form this should take. Booth and Snower (1995, p. 345), for example, suggest that government might pay a fixed proportion of the each firm's training expenditure, while OECD (1995, ch. 7) suggest tax breaks for training expenses.

It is perhaps not surprising that models that restrict labour mobility, unlike the perfect wage-based mobility of highly competitive markets, tend to find lower under-investment in general training. Acemoglu (1997, p. 460) argues that,

> ... with competitive markets, workers bear the full costs of general training. Whereas with labour market frictions, firms may be willing to pay part of the costs of training.

In effect, the existence of a market failure in general training is caused by the inability to write complete contracts between the worker and his existing employer (Becker, 1964, pp. 93-95; Grout, 1984). If the contract can be made complete, for example, through the inclusion of "exit penalties" imposed on the skilled worker who leaves before some agreed time after completing training, then the market imperfection or failure can be rectified.

In the absence of such contracts, however, labour market frictions still do not allow an optimal outcome. Acemoglu (1997) argues that, while workers might be willing to pay up to the present discounted value of the increase in their future earnings to the firm offering training, this is only equal to the optimal value of training in a competitive and frictionless labour market. Where frictions exist, such as uncertainty about the nature of future employers, costly mobility and search activities, then the individual will not receive the full value of their marginal product in their future jobs. Acemoglu (1997, p. 460) argues that,

> ... in an imperfect labour market future employers of a worker will also benefit from his skills. This is an externality that the decentralised labour market will not be able to internalise.

Low skills trajectories. Bosworth, *et al*. (1996, ch. 17) begin to sketch out a "systems model" in which there are some firms operating with high skills and high specification products and other firms operating with low skills and low specification products. Initially, labour turnover is low and the number of low-spec producers is small. If the accounting profit of the firm is the economic profit minus the costs of training to replace workers (see Section 2.2 above), $\Pi^e(H)-T(H)$ for the high-tech firm and $\Pi^e(L)-T(L)\approx\Pi^e(L)$ for the low-tech firm, then the high-tech firm will continue to prefer to be high- rather than low-tech as long as $\Pi^e(H)-T(H)>\Pi^e(L)$.

If labour turnover increases, however, this adversely affects the high-tech, high skills firm more than the low-spec, as they have to train replacement workers at least in the specific skills required. If at some point turnover becomes sufficiently large that $\Pi^e(H)-T(H)<\Pi^e(L)$, then there is an incentive for the high-tech firm to switch to become low-tech. If, in addition, the costs of moving from high- to low-technology production are lower than the switch in the opposite direction, there is always a ratchet type effect that tends to move the economy to a lower skills outcome. In addition, as the number of low technology producers increases, on average, the pool of general skills on the market becomes poorer and the costs of training replacement workers rises for the high technology producers, reinforcing the pressures to move to lower specification products.

This model is further developed by the same author in Wilson and Hogarth (2003). Again a distinction is made between high and low specification products.[42] Low specification products can be produced by many other firms and competition tends to be intense. The main emphasis of competition in such markets is on price and on unit costs, including labour costs. Such products tend to be characterised by long production runs, standardisation and economies of scale. These types of characteristics make it relatively easy to increasingly design the skill out of jobs over time, thereby reducing unit labour costs to a minimum at each point in time. In contrast, high specification products are more often characterised by non-rigid production processes and/or short production runs. Such production characteristics mean that there is little opportunity to design the skill out of jobs. Production requires a flexible and skilled workforce that can continually deliver new and modified products.

This conceptual approach links skills trajectories to the goals and strategies of the organisation, which can be proactive (e.g. in the case of an organisation that is always striving to improve product specification as well as to control costs) or they can be reactive (e.g. cases where, faced by increased competition from foreign, low cost producers, the organisation is forced to take action to increase efficiency and reduce its cost base, while, at best, maintaining the existing product specification). Both have implications for the "skills trajectory" that will be followed.

[42] The emphasis in the recent literature has been on product (or service) specification rather than product (or service) quality, and it relates to the position in the market at which the product or service is pitched (e.g. premium food products *versus* basic food products).

Firms that face increasing competition from low cost foreign producers may try to reduce production costs by reducing the need for skills in the production process. Designing-out the need for skills puts the firm on a low skills trajectory. Where this proves impossible or insufficient to maintain profitability, production may be shifted abroad or halted altogether. On the other hand, an organisation engaged more proactively in developing new and higher specification products and services is likely to be on a high skills trajectory, since such strategies require high levels of skill in order to be successful.

In this world, the goals of the company, management skills and employee skill needs are intimately bound together. The goals and product strategy of the company, the product specification, as well as the extent and quality of human resource management (HRM), work organisation, work design, *etc*. are all inter-related (Bosworth, *et al*. 2002; Keep, *et al*. 2003). The links between skill maintenance and development and all these are factors are not only complex but also dynamic in nature (consistent with the high performance work practices, HPWPs, and high performance organisation literatures, e.g. Bosworth, 2005, pp. 223-235 and Keep, *et al*. 2006). The decision making processes and, thereby, the management skills of the organisation play a central role, with particular emphasis on entrepreneurship and leadership.

This is a world in which there are potentially large short term savings from reducing investments in R&D, HPWPs, *etc*. and equally, for firms wishing to move to a high skills trajectory, they face a large investment to put together the bundle of activities necessary to be a successful product innovator. In addition, the time frames and the degrees of risk are quite different: moving down-market, to smaller investments in R&D and HPWPs can be almost instantaneous and risk free (in terms of the cost savings – not the future viability of the company), while moving up-market takes time to build up viable R&D and HPWPs, which are both risky in terms of their future income generation. Thus, there is again a ratchet effect in operation, where movement downwards is in some sense easier and less costly than movement upwards.

Either route, whether a low- or high-skills trajectory, can be optimal for individual firms. However, the country as a whole may be better off with a mix of trajectories that favours higher rather than lower skills. There is the tax issue discussed in Section 5.2, which drives a wedge between the private and social returns; this tax wedge is larger for the high skills, high income, high profit trajectory than the low skills trajectory. The social discount rate is generally lower than the private rate, favouring longer, rather than shorter (and riskier rather than less risky) solutions.

Ideally, a successful economy will have a mix of sectors, combining both new, maturing and mature products and services (up to the point at which production moves to lower cost areas abroad) (Wilson and Hogarth, 2003). By implication, this may involve a mix of low and high skills trajectories – what is important for a successful economy is to have the right balance (Wilson and Hogarth, 2003, p. 10).

4.4 Suboptimal provision from a national perspective

There is strong conceptual evidence that the national training system(s) in the UK – which are likely to differ to some degree across the four nation states – are complex, working imperfectly (if not failing) and will require a multi-faceted response to improve the national skills position (see Table 3 for a summary of all the points made in this section of the Conceptual Review). Changes to the national training systems need to be considered in the context of the broader national systems of innovation, such that institutional, policy and other changes to human resource development complement those of creativity, invention, innovation and diffusion.

The failure of the accounting profession to design new codes of practice to deal adequately with longer-term investments in intangible assets threatens to curtail, if not stop, the shift to an increasingly weightless economy. The work on the measurement of R&D that has progressed from a conceptual manual, through application in official surveys, to accounting codes of practice and, finally, into definitions for tax purposes, highlights what could be achieved in the measurement of human capital that would aid the investment in training decision. A further stage requires the proper treatment of expenditure on human capital that results in longer-term benefits to be treated as an investment and not a cost.

Short-termism amongst financial institutions may itself partly be a function of the failure to properly measure investments in and returns to investments in the more intangible forms of assets. It may also be a consequence of broader imperfections in information available to potential financial investors in the UK, which may be, in part, a reflection of the more “hands-off” nature of the sources of finance in the UK than in some other countries. If financial markets are short-termist, then this also spills over to company managers who are sensitive to what financial markets think of their company’s performance.

Despite some authors' vehement opposition to government intervention (e.g. Zerbe and McCurdy, undated), which seems more politically than economically motivated, the conceptual literature outlines strong reasons as to why the government should be circumspect in intervening in the funding of training and, more particularly, the provision of training. Government failure has to be weighed up against market failure in the supply of training. As a consequence, there are strong grounds for a system in which employers decide what training is required and in which they are encouraged to fund the training that they benefit from.

The conceptual literature is clear that, insofar as there are significant spillovers from investment in skills (which the empirical literature largely supports), these will result in an under-investment if the decision is left to the employers' private calculus. This occurs because there are decreasing returns to investment in skills at the individual employer level, but the potential for increasing returns to such investment (and increasing returns to scale) at the sector and national levels. Government intervention that encourages firms to invest in skills more than their private calculus would suggest can stimulate growth, potentially without limit. Despite their private calculus telling them otherwise, firms as a whole benefit from this expansion in investment in skills.

Finally, high levels of employee mobility and wastage lead to the development of a negative skills trajectory, in which employers investing in skills fail to earn the size of return that they expect, and may even make losses on their training expenditures, because employees leave the employer before all of the returns to training accrue. The adverse effects of wastage are accentuated where the employees who leave are poached by non-training employers – the non-trainers may benefit from some of the training whilst not bearing the costs of the training, thereby improving their profitability, while training employers do not benefit fully from the training, reducing their profitability below what it would otherwise have been. High mobility and, especially high wastage caused by poaching, can undermine the incentive to train, causing a downward skills spiral associated with a "ratchet effect", because it becomes easier and cheaper to move down than to move up the skills ladder. Poaching proved to be a major issue during the period of the Industry Training Boards in the UK, particularly when a trained employee moved between sectors.

Table 4.1 Suboptimal provision from a national perspective

Reason	Likely direction of effect *vis a vis* optimum level	Comments
Training as a system		
Systems imperfections and failure	**-/(+)**	The training "system" is more than the sum of its component parts and, when it operates imperfectly or fails, it may be necessary to adjust many components or relationships between components. While it is possible to think of imperfections that lead to over-investment in training, the literature suggests that the problems in the UK lead to under-investment.
Institutional imperfections and failure		
Accounting practice	**-**	The accounting profession have been unable to design new codes of practice to allow for the investment nature of training or to provide a value of a firm's stock of human capital.
Short-termism	**-**	The conceptual literature suggests that the way in which financial institutions operate in the UK may leave them with less information about the returns to training than in some other countries and therefore set a higher time rate of discount.
Government failure	**-**	The literature suggests that government is in relatively poor position to intervene in providing specific training – which is best left to employers – although, with certain safeguards, there may be grounds for government to provide funding for such training.
Spillovers and externalities		
Education and human capital spillovers	**-**	Decreasing returns to education and training at the individual firm level leads to under investment by employers when human capital spillovers are present. There is accumulating empirical evidence in support of spillovers at the sectoral level (re: technology spillovers), local and regional levels (technology and human capital spillovers) and, by implication, at the national level.
Endogenous growth – the "new growth theories"	**-**	Human capital spillovers can lead to potentially limitless growth if investment in education and training is expanded beyond the values that employers estimate based on their "private calculus".
Skills and innovation	**-**	There are complementarities between skills and innovation – higher skill levels in the population encourage greater innovation – higher innovation raises the demand for higher skill levels.
Low skills equilibrium and low skills trajectories	**-**	Higher wastage rates and employee mobility reduce the returns to employer investment in skills. The adverse effects are accentuated in the case of poaching, as non-training employers benefit at the expense of training employers. Downward skills spirals are particularly pernicious because there is a "ratchet effect", by which it is always cheaper and easier to move down than to move up.

5. Optimal employer investment in skills from a societal perspective

5.1 Introduction

Private *versus* social optimality

An analysis of whether outcomes are in some sense optimal has to be treated with caution, as there are many agents involved (see Bosworth, 2005, p. 366):

i. the performance of the private sector can first of all be judged against the goals that enterprises set for themselves, in particular:
    a. whether the product and labour market strategies that the firms adopt to achieve these goals are successful;
    b. whether some other product and labour market strategies would have produced a more successful outcome for the firm.
ii. the private sector goals set by managers may not be in line with those of shareholders (the issues of agency and corporate governance, *ibid*. pp. 157-182);
iii. and, even if aligned with shareholders, the goals still may not lead to a socially optimal outcome. In particular, on balance, companies may find it more profitable to adopt a low skills, low-wage trajectory, rather than up a high-skills, high-income trajectory, whilst, from society's point of view the opposite may be the case.

Where there is a difference between the privately and socially optimal outcomes, the government's goals are likely to diverge from those of private sector companies. Just as it is the role of governance structures to align the goals and strategies of managers to maximize the benefits to owners, it is the role of government to align the goals and strategies of companies, along with other players in the market, to maximize social welfare.

Social optimality was originally seen as a position of "Pareto optimality", which occurred under conditions of perfect competition (see Appendix 7 for a more detailed discussion). However, perfect competition requires a number of fairly extreme conditions to be met (small firms producing homogeneous outputs, competing only on price, operating with perfect information, etc.). In practice, few, if any, of these conditions were met in the real world. Lipsey and Lancaster (1956) then demonstrated that, if even a single optimality condition in an economic model is not satisfied, then the next best solution may involve changing other variables, so that their values are not those normally assumed to be optimal. In recent

years, following the work of Schumpeter (1950), optimality has focused on the conditions best suited to firms competing on product specification and quality, rather than price.

Coverage

The present Section deals with three main areas that can be used to justify government intervention in the market for training.

The first uses a direct analogy between the net and gross income of individual employees that is used to justify government intervention in the market for human capital. In this instance, the difference between gross profits and profits net of tax provides a similar justification for government to provide support for employer training.

The second topic concerns the issue of market failure and the ability of government to intervene and make the market for training work more efficiently. Many of the factors considered to be market failures have already been touched upon in earlier sections and are only briefly considered here. Two issues which have not been considered so far are those of merit goods and public goods. In addition, the use of market failures to justify government intervention should be treated with a certain degree of caution – it has already been argued that government failure has to be weighed against market failure, in other words, does government intervention improve on what the market would do anyway and, even if it does, do the benefits of government intervention outweigh the costs?

The final topic concerns the issue of equity as a justification for government intervention. Even if market outcomes are efficient (e.g. there is no evidence of market failure), they may still not be equitable. In other words, there may be other largely non-economic grounds for intervening in the market, for example, to ensure a greater equality of employment opportunities or equality of income.

5.2 Profits and corporation taxes: the case for intervention

The reasons for the lower than socially optimal investment in general training by individuals are widely known (Bosworth, *et al*. 1996, pp. 243-249). While the individual's decision lies outside of the remit of the present study, in practice, it is important to understand the principles of it (see Section 2.1 and Appendix 1), because it provides a direct analogy for government intervention in the provision of specific training by companies.

Appendix 8 sets out the individual's private calculus *versus* the social calculus in detail. The individual calculates the benefits of training based upon the discounted sum of the costs and benefits of training to them. While a key benefit is that general training raises their future income levels, the income relevant to them is their net of tax income. From society's

perspective, this ignores the increase in tax take that occurs when training raises the individual's gross income. As a consequence, left to their own devices, individuals under-invest in general training from a societal viewpoint.

This outcome is accentuated by the fact that the "social time preference rate" is generally lower than the equivalent private rate.[43] The government will generally operate with a lower discount rate than individuals, as it does not face – at least to anywhere near the same degree – issues of individual risk or imperfect knowledge about the probability of success.[44] This is a further reason why government views individuals to be spending less than the socially optimal amount on training, and will encourage an increase in spending above the level suggested by the private calculus.

What is more rarely emphasized in the literature (see, however, Bosworth, *et al*. 1996, p. 245) is that there is a direct analogy between government support for individual investments in general training and government intervention to increase firm specific training investments. There are some differences in the detail of the calculation. For example, while the individual will calculate the returns over their expected lifetimes (where higher earnings also affect their pension entitlements), the firm level calculation needs to reflect the expected tenure of employees who receive specific training and/or the life expectancy of the firm.

The firm's decision to invest in specific training is based upon the fact that the discounted sum of the cost of the investment is less than the discounted sum of the net profits that it generates (either through reducing future costs or increasing future revenues). However, the additional profit stream that it generates is taxed by government and, thus, the benefits to the firm are the net of tax stream of additional profits generated. However, society benefits from the additional gross profits that are generated by the training investment, which go to the government in the form of corporation taxes. As firms only take into account the effects of training on their net of tax profits, they under-invest in specific training.

The size of the wedge between the private and social returns caused by profits taxes is just under 30 per cent for large companies and just over 20 per cent for small companies.[45] As well as the additional taxes raised by expanding training to the social optimum level and paid by the individual firm, there are the multiplier effects that accrue from the first and subsequent rounds of spending of these increased tax revenues – which also give rise to further tax revenues.

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[43] At the time of writing, HM Treasury's Green Book notes that, **"**The discount rate is used to convert all costs and benefits to 'present values', so that they can be compared. The recommended discount rate is 3.5%." (para 5.49). However, there are some special cases (*ibid*. Annex 6). It is not clear how the present recession has affected this rate, as bank rate and other interest rates have fallen sharply.

[44] As it works with the overall or aggregate probability of success, where for sufficiently large numbers of individual investments, the aggregate outcome will be the mean of the distribution.

[45] http://www.hmrc.gov.uk/rates/corp.htm.

Just as in the case of individual investment in general training, the difference between the firm and societal outcome for specific training is accentuated by the fact that the social rate of discount is lower than the equivalent private rate chosen by firms.

5.3 Market failure

All of the factors that drive a wedge between the actual and optimal outcomes comprise elements of market failure and are of relevance to the discussion here. However, as these have been considered in detail in Chapters 2 to 4, they are not all repeated again in the present section. Two further sources of market failure are dealt with in the literature, those of public goods and merit goods. These are defined and discussed in more detail in Appendix 9.

Appendix 7 provides a brief overview of the change in emphasis in the social welfare literature. In particular, it argues that, while there is still a recognition of the potential need for interventions to ensure static efficiency (e.g. providing goods at the lowest possible price), these need to be balanced against their consequences for dynamic performance (e.g. encouraging the flow of new or modified goods of higher specification and quality). This continues to produce an inherent tension amongst policy makers in the area of anti-trust and those seeking to promote innovation and growth.[46]

Static welfare effects

There are several areas covered in the present Review that seem to relate more directly to static than to dynamic efficiency. These include the existence of labour market power (e.g. monopoly, monopsony or bilateral monopoly power in the labour market). The theory shows the market outcomes from these are always suboptimal in a Pareto sense, with too few individuals employed and wages set at either too high or too low a level (depending upon who holds the market power).

At first sight it seems that, in the presence of monopoly power of some form, other things being equal, not only are too few individuals employed, but too few would be trained. However, two things need to be borne in mind:

- there is little or no role for employer training under perfect price competition, except perhaps when there are exogenous shocks to the sector and, even then, price sensitive firms would prefer deskilling to skill increasing strategies;

[46] The recent government encouragement of the Lloyds TSB and HBOS merger, even though it breaks competition guidelines, is an example.

- the static inefficiency of monopoly power has to be set against the question whether larger, more monopolistic firms are more dynamic, investing more *per* employee in R&D, training, *etc*.

What is more important than market structure are the goals and product market strategies that firms adopt. While there may be some tentative links between market structure and goals and strategies, they are not obvious. For example, oligopolists in one market may produce homogeneous products and compete wholly on price, while similar sized oligopolists in another market may produce highly differentiated products and compete almost wholly on product specification and quality; other things being equal the skills needed by the first sector will be lower than those needed by the second.

From a traditional welfare perspective, smaller firms might be perceived to be better than larger. In principle, the government can intervene to reduce transaction costs, thereby making them smaller *vis a vis* governance costs, and increasing the amount of activity that takes place through the market rather than the firm. One way of doing so might be in cutting "red tape", although this may also increase the scope for opportunism, which might have the opposite effect.

In practice, the literature on internal labour markets suggests that firms (particularly larger firms) are an environment which is suited to on-the-job training and the development of specific skills. If these skills are beneficial to firm performance, they may be an explanation for the success of companies as a form of production structure.[47] If there are advantages in organising production in this way, the government might intervene to lower governance costs, which would have the effect of encouraging production through the firm rather than the market.

Dynamic welfare effects

The general view of the conceptual literature appears to be that the dynamic welfare effects caused by spillovers and externalities have the potential to dwarf the more static effects perceived by neo-classical theory. These spillovers occur because knowledge, in particular, has the main features of a public good (i.e. it is non-rivalrous – one person's consumption does not preclude another person's consumption – and non-excludable – once provided it is difficult or impossible to stop anyone consuming the good).

[47] There may be a corresponding dynamic argument that could be developed, that firms appear to have the potential to improve dynamic performance over that of individuals. This lies in the fact that they form silos for the creation of firm-specific advantages, through specific training and organisational learning (as well as investments in R&D, *etc*.). Access to capital for investment in intangible assets is, on balance, easier and cheaper for companies than individuals. However, such arguments are not a direct part of the existing transactions cost literature.

The present review has shown that, while there may be diminishing returns to investing in R&D at the individual firm level, the public good nature of knowledge producing activities such as R&D mean that there may be increasing returns to such investment at the sector or national levels.[48] As these spillovers cannot, by definition, be captured by the individual investors, it implies that there is under-investment from society's viewpoint unless the government intervenes.

As noted in Section 4.3, however, these arguments based on knowledge spillovers appear to be less relevant the more specific the skills in question. More specific skills tend to be more tacit in nature and less able to drive spillover effects. However, sector specific skills may be able to drive sector spillovers (in a similar way to which R&D contributes to the pool of knowledge in a given area of technology). In addition, there may be some spillovers between sectors when different sectors share some common skills.

The effect of poaching is to drive out sector specific training, leaving only firm specific training present. It has been shown (see Section 4.3) that firms that do not train are able to attract trained individuals away from firms that do train. The non-training firm not only has a competitive advantage because of its lower costs (because it does not train), but also the training firm does not reap the rewards of its investment in training because the trained individual moves before the stream of returns is complete.

Two other aspects of the conceptual results in this area are relevant to the issue of spillovers. The first is that there seem likely to be synergies between R&D, invention, innovation and human capital. The most obvious likely linkage is that higher levels of human capital seem to make invention, innovation and the diffusion of new technologies easier and more successful. While an innovative economy will demand high skill levels to innovate, the subsequent consequences of technological change on the demand for skills may be either skill enhancing or deskilling.

The second issue is that the various factors which lead firms to choose to move down market and design skills out of the production process seem to have a ratchet effect. In general, it appears, conceptually at least, to be easier and cheaper to move down market than to move up market. If moving down market means that the firm can cut its investments in R&D, training, *etc.*, as well as to employ a less skilled and less expensive workforce, this can give rise to immediate savings which improve profitability (intangible asset stripping), at least for some period. This might be particularly attractive if the management team or the stock market is short termist. However, re-establishing an HR or an R&D department

[48] More precisely what the results show is a strong likelihood of increasing returns to scale at the sectoral and national levels, and the possibility of increasing returns to investment in training. The precise outcome depends upon the size of the relevant parameters in the production function, which is an empirical issue.

requires a long term development of high level skills, changes to the way in which the firm is organised and managed, as well as changes to the culture and ethos of the firm. The returns for this may take many years to emerge. This ratchet effect which works to make movement in one direction (down) easy, but movement in the other (up) difficult means that policy makers have to guard carefully against the development of downward spirals (e.g. low skills trajectories).

5.4 Equity considerations

A market outcome may be efficient, but it may still not be considered fair. However, different perspectives on fairness can produce quite different interventions and outcomes, for example,

> ... pursuing a strict libertarian approach implies maximising rights and liberties, but doing so may not maximise overall happiness thus creating tensions with a utilitarian approach. (DCLG, 2007, p. 14)

There are three main alternative operational forms of equality,

- equality of opportunity – governments should ensure everyone has the same opportunity to use their talents and should mitigate the effects of race, gender, inheritance, *etc.*;
- equality of outcome – everyone should have an equal share of resources produced by an economy;
- equality of process – people in the same situation should be treated in the same way (e.g. a fair trial) (DCLG, 2007, p. 14).

The Equalities Review (2007, Annex A) proposes the following definition of equity,

> An equal society protects and promotes equal, real freedom and substantive opportunity to live in the ways people value and would choose, so that everyone can flourish. An equal society recognises people's different needs, situations and goals and removes the barriers that limit what people can do and can be. (DCLG, 2007, p. 15)

The Equalities Review (2007, pp. 127-130) develops a listing of "central and valuable capabilities for adults". This contains ten principal domains, one of which is a section particularly relevant to training, relating to the "capability to be knowledgeable, to understand and reason, and to have the skills to participate in society", for example, being able to:

- attain the highest possible standard of knowledge, understanding and reasoning;
- be creative;
- be fulfilled intellectually;

- develop the skills for participation in productive and valued activities, including parenting;
- learn about a range of cultures and beliefs and acquire the skills to participate in a multicultural society;
- access education, training and lifelong learning that meets individual needs;
- access information and technology necessary to participate in society.

There are many conceptual welfare issues surrounding how to proceed with the problem of reducing inequalities, which will come to the fore as policies are designed and introduced with the aim of reducing inequality. The Equalities Review proposal to measure inequality in outcomes, the degree of choice and control that individuals have in achieving outcomes and the presence of discriminatory treatments and processes, with a view to developing a simple Equalities Scorecard, is certain to raise conceptual issues as well as political debate. Nevertheless, the index of multiple deprivation (which does not seem to be discussed in the Equalities Review) has proved useful, at least in understanding the degree and nature of spatial inequalities (e.g. Noble, *et al*. undated and Noble, *et al*. 2008).

5.5 Suboptimal provision from a societal perspective

The rationale for government intervention in the market for training is that, left to their own devices, the individual decision makers, undertaking their own private calculus do not provide the socially optimal level of training. While there are some exceptions, the bulk of the conceptual literature suggests that, left to their own devices, private decision makers would under-invest in training from a societal viewpoint.

There is no shortage of potential justifications for intervention, including market imperfections and failures, as well as equity considerations. However, there is equally concern over the issue of government failures. Government needs to be able to show that they not only improve on the market outcome, but also that the benefits of the improvements that they make exceed the costs. In this respect, employer training is a very distinctive area because the skills tend to be specific to the sector and, in some instances, to the individual employer. The greater the degree of specificity of the training, the less successful the government seems likely to be as a provider of the training.

Table 5.1 Suboptimal provision from a societal perspective

Reason	Likely direction of effect *vis a vis* socially optimum level	Comments
Profits tax		
Net *versus* gross profits	**-**	Firms base their investment decision on the impact of training on their net profitability – this ignores the benefits to society from the tax take from profits
Principal justifications for government intervention		
Market failures	**-/(+)**	A variety of factors, such as institutional failures, imperfect competition, spillovers and externalities etc. drive a wedge between the private and social optima. Most of the factors result in the private calculus resulting in a lower than optimal investment in training from society's point of view.
Equity	**-**	The need to ensure equality of opportunity, outcome and/or process.
Government imperfections and failure		
Government failure	**-/+**	The inability of government to successfully intervene in the provision of or the funding of training. This may result in a failure to raise training to the socially optimal level or the over provision of the wrong sorts of training.

6. Conclusions: implications for government intervention in the market for training

This section discusses the main conclusions of the present Report (a discussion of future research is outlined in Appendix 10). The conceptual literature paints a fairly clear picture of what may have happened to the market for training in the UK, as well as suggesting some policy options.

Firms may not always use best practice decision rules and, in general, they operate under conditions of imperfect information, hence, they will make mistakes with regard to their decisions about investments in skills. Making mistakes might suggest that while some employers might under-invest in training, other employers over-invest. However, there are a range of possible barriers to investment in skills that may prevent employers from achieving their optimal levels (e.g. capital market imperfections, lack of information about the quality and content of training courses, *etc.*). These barriers may produce a systematic downward bias that reduces investment in skills below the optimal level.

How important such barriers are is an empirical question, but it would seem surprising if they were the principal source of market failure in UK training, although they are probably significantly more important for small firms than for large. Firms are present because they are more efficient than the market in organising production. If, according to their private calculus, training would be profitable, it seems likely that they would find ways to overcome such barriers, including lobbying government.

The conceptual literature offers a likely explanation as to why employers do not perceive anything other than the most specific forms of training to be profitable. The explanation is that if the training develops a level of general skills, they will lose their trained people to non-training firms. The effect of this on the employer's calculus is that, at best, they do not recoup their investment in training and, at worst, they have supplied competitor companies with free trained employees. Even if it is the individual, rather than the competitor, that receives the benefit of the training through higher wages, the training firm may still make a loss on its investment in skills.

Neoclassical theory assumes a simple dichotomy between general and specific skills – general skills can be utilised by any employer, while firm specific skills are only relevant to the individual firm in question. While it is possible to think of examples of both of these types of skills, most skills lie somewhere between these extremes. In particular, from a conceptual perspective, there is a convincing ring to the argument that "sectors matter". It seems highly likely that some combination of technology/process and product/service produces a commonality in skills needs that make sectors distinct from other groupings within the economy.

If this is the case, then the conceptual literature is able to throw further light on why there is a need for collective action at the sector level. The literature on spillover effects suggests that firms in a given area of technology benefit not only from their own efforts to generate new technology, but from the size of the pool of technology generated by all firms in the sector. While this argument is most clearly articulated in the context of investments in R&D, there seems to be a direct analogy between the case of R&D and training in sector specific (not firm specific) skills. The theory suggests that all firms in the sector would benefit from an increased pool of skills at the sector level.

This theory also has implications for who should pay for the costs of increasing this pool of labour. Insofar as firms in the sector are the main recipients of the benefits of an enlarged pool of skills, then they should also pay to help increase the size of the pool. The most obvious method of intervention would be a training levy, although the benefits have to be weighed against the costs of intervention (see Figure 1.1). The administrative costs of a levy appear likely to be higher than some other possible forms of intervention, such as tax breaks, but such costs may be outweighed by the benefits of the sectoral, employer led focus that a levy brings. A sectorally oriented licence to practice for certain key occupations might produce a similar result, although it is not clear whether the costs of obtaining such licences would be borne by the individual or the employer.

The main argument is that insofar as investment in the pool of skills increases firm profits, other things equal, then firms should collectively pay a contribution up to the point where the marginal costs at the sector level are equal to the marginal benefits (assuming that there are diminishing returns to investment in skills at the sectoral level). If, after paying this contribution, firm profits are still higher than they otherwise would have been, there may be some case for government support for training, as, even collectively, firms will only take into account the net of tax benefits of the training pool.

While “sectors matter”, they are not watertight containers within which skills permanently reside. One of the key problems with the previous levy system in the UK, at least for some sectors, concerned the flows of individuals between sectors. The more important these flows are, the more the spillover problem becomes a regional or national training problem, rather than a sectoral problem. While this is an empirical issue, the conceptual literature still points to sectors as the most natural way of arranging training interventions.

Insofar as one sector can be shown to source their trained employees from another sector, then it might be possible to design some compensatory financial flow based upon the size and direction of the net flow of trained individuals between any pair of sectors. However, this may be problematic for several reasons: first, not all individuals moving between sectors draw upon their previous training in their new job; second, such a scheme would add another layer of administrative complexity. While it may not pay to introduce such a scheme across all sectors, it may be possible to address the problems of any sector that is particularly disadvantaged by net outflows.

At more other, generally more aggregate levels than the sector, the conceptual review of the literature tended to highlight the role of government intervention in areas associated with more general education and skills, which largely lie outside the area of employer investment in skills. The same is largely true in the consideration of the social returns to training. One exception here, however, was the fact that firms consider the effects of firm specific (idiosyncratic) training on their profits net of tax suggests that there may be rationale for government support for such training. A natural route for such support would be a tax break, although such breaks have to be carefully designed to avoid deadweight welfare losses.

A number of other, mainly institutional failures, were considered, some of which, such as the need for better measures of training activities and outcomes, seem to complement any form of intervention in the market for training. Such measures of training are essential to enable the introduction of other policies, such as tax breaks or levies. Indeed, if it is known how much firms currently train, then a tax incentive can be offered on additional training over and above this amount, thereby avoiding deadweight welfare losses.

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Appendix 1 Discounted cash flow model of the training decision

A1.1 Types of training

Economists attempt to summarise the most important features of training by distinguishing between informal and formal training and between general and specific training. Specific training raises the productivity of the employee within the firm providing the training, but not in other firms. Hence, in the case of specific training, the wage the individual can obtain outside the firm is determined independently of the amount of training received within the firm. General training results in skills that are useful in other firms, irrespective of which firm provides the training.

In a competitive labour market, with perfect labour mobility, no economically rational firm will fund general training. A firm that funded such training would have to set the worker's wage below their post-training level of productivity in order to recoup its outlays on training. This is not possible in a competitive labour market where the non-training firms would be willing to pay a higher wage reflecting the trained worker's higher productivity. A company would only consider providing general training where other forces create immobility of labour between firms. Some degree of immobility makes all training to some degree specific in nature.

A1.2 Optimal investment by the firm

Under standard competitive conditions, employees are paid a real wage, W, in accord with their marginal physical product, MP, at time t,

$MP_t = W_t$ (A.1)

Current production from workers will be lower than normal during training, perhaps even zero. At the same time, insofar as the employer funds training, the costs of the firm rise above the level in the absence of training. While training has a negative impact on the current profitability of the firm, it will still be undertaken if it results in a sufficient rise in future revenues or reduction in future costs, compared with their levels without training.

Training is profitable for the firm if,

$$\sum_{t=\tau_0}^{\tau_1} \frac{MP(0)_t - MP(M)_t}{(1+i)^t} + \sum_{t=\tau_1}^{\tau_2} \frac{MP(T)_t - MP(M)_t}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa_t}{(1+i)^t} + 1 \sum_{t=\tau_0}^{\tau_1} \frac{W(0)_t - W(M)_t}{(1+i)^t} + \sum_{t=\tau_1}^{\tau_2} \frac{W(T)_t - W(M)_t}{(1+i)^t} 2$$

(A.2)

where,

- $MP(M)_t$, $MP(O)_t$ and $MP(T)_t$ = output of untrained individual, trainee and trained employee = value of their marginal product at time t
- $W(M)_t$, $W(M)_t$ and $W(T)_t$ = real wage rates of corresponding workers
- κ_t = non-wage expenditure on training per period for τ_1-τ_0 periods
- τ_2-τ_0 = the period over which the costs and returns to training take place (where τ_2 may not take the same value for the individual and the firm)
- i = going rate of interest or discount.

1. Loss of output in training period (discounted sum)	+	2. Gain in output after training period (discounted sum)	>	3. Non-wage costs of training (discounted sum)	+

4. Difference in wage during training (discounted sum)	+	5. Difference in wage after training (discounted sum)

If individuals are paid a lower wage (box 4) during training than before, this value is negative and helps to fund the training. The firm continues to train additional workers, until inequality (2) is replaced by an equality for the very last trainee.

A1.3 General training

Under competitive conditions, both trained and untrained labour are paid the value of their marginal products. First, this implies that $W(T)_t=MP(T)_t$ and, second, that $W(M)_t=MP(M)_t$. Hence, inequality (2) collapses to,

$$\sum_{t=\tau_0}^{\tau_1} \frac{MP(0)_t - W(0)_t}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa_t}{(1+i)^t} \quad \text{(A.3)}$$

In the absence of some third party (such as the government), the employee must accept a wage sufficiently lower than the marginal product during the training period to finance the direct and indirect costs of general training. In other words, the employee must pay for general training themselves.

A1.4 Specific training

When training is completely specific, the employee's productivity within the firm is raised by training, but their productivity within other firms remains at the pre-training level. The employer can pay labour at the outside wage W(M)t in every period, even though the

employee's contribution to the output of the firm after training would suggest a higher wage. Hence, W(O)t=W(T)t=W(M)t and inequality (2) becomes,

$$\sum_{t=\tau_1}^{\tau_2} \frac{MP(T)_t - MP(M)_t}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa_t}{(1+i)^t} + \sum_{t=\tau_0}^{\tau_1} \frac{MP(M)_t - MP(0)_t}{(1+i)^t} \qquad \text{(A.4)}$$

Improvements to future output (discounted sum)	>	Non-wage training costs (discounted sum)	+	Output losses during the training period (discounted sum)

The firm invests in training as long as the present value of the additional future output is greater than or equal to the present value of the training outlays (both direct expenditures and lower output during the training period). As $W(0)_t=W(M)_t=W(T)_t$, the individual would never choose to fund training.

Appendix 2 Options pricing: the value of waiting

Options pricing theory suggests waiting can have an economic value (Bosworth, 2005, pp. 336-337). In the case where there is greater certainty over the likely outcome if the investment is delayed, then waiting is likely to have a positive value. This is demonstrated in a simple example provided by Dixit and Pindyck (1994, pp. 27-30).

The example assumes that the value of the investment in the current period is known, but in the next period two outcomes may occur, which will then continue infinitely far into the future. The value of the investment in the current period, 0, is £200, but in the next period, 1, it may be either £300 (with probability q) or £100 with probability (1-q); these values then continue infinitely far into the future (i.e. through periods 2, …, ∞). Suppose the cost of the investment is 1600.

The NPV calculation at time zero uses the probability weighted, expected future flow of returns, $E(P_t)$. If q=0.5 then P_0=£200 and $E(P_1) = E(P_2) =$…=£200, and the NPV is,

$$NPV = \sum_{t=0}^{\infty} \frac{200}{(1+0.1)^t} - 1600 = 2200 - 1600 = 600 \qquad \text{(A2.1)}$$

where the discount rate is 10%.

It is assumed that the uncertainty over the outcome is resolved between period 0 and 1, and which of the two possible streams occurs will be known. The NPV for the delayed project, at time 0, can now be written,

$$NPV = 0.5\left(\sum_{t=1}^{\infty} \frac{300}{(1.1)^t} - \frac{1600}{1.1}\right) + (0.5)0 = 773 \qquad \text{(A2.2)}$$

At time 0, the calculation still reflects the two possible outcomes and the probability of each occurring. However, the calculation now also reflects the fact that, if it the £300 stream occurs, the investment will be profitable and the firm will invest, but if the £100 stream occurs, it will be unprofitable and abandoned.

The NPV with one year's delay is £773 compared with only £600 for "immediate exercise of the option to invest". As the Dixit and Pindyck (1994, p. 28) note,

> "..if our choices were to invest today or never invest, we would invest today. In that case there is no option to wait for a year, and hence no opportunity cost to killing such an option, so the standard NPV rule applies. We would likewise invest today if next year we could disinvest and recover our $1600. Two things are necessary to

> introduce an opportunity cost into the NPV calculation - irreversibility, and the ability to invest in the future as an alternative to investing today."

The difference between the two NPVs, £773-£600=£173, is a measure of how much the firm would be willing to pay for the option of waiting. The option to invest has an economic value which disappears if the investment is made. The value of the option arises from avoiding the downside risk which is still present if the investment is made immediately.

Appendix 3 Multi-stage investments

If the returns to investment are treated as an all or nothing decision, when, in fact there are separate phases to the investment, it is possible to reject a research project that could have significant value (Bosworth, 2005, pp. 342-343). Weitzman, *et al*. (1981) set up a two stage model in which the net rewards are NR_1 and NR_2 at stages 1 and 2 respectively, such that the total reward is $NR=NR_1+NR_2$. However, NR_1 and NR_2 are random variables with the following probabilities,

$$NR_1 = \begin{cases} \overline{NR_1} + \sigma_1 \text{ with prob } 0.5 \\ \overline{NR_1} - \sigma_1 \text{ with prob } 0.5 \end{cases} \quad \text{(A3.1)}$$

$$NR_2 = \begin{cases} \overline{NR_2} + \sigma_2 \text{ with prob } 0.5 \\ \overline{NR_2} - \sigma_2 \text{ with prob } 0.5 \end{cases} \quad \text{(A3.2)}$$

Ignoring discounting and assuming, $\sigma_1>\sigma_2$, NR is also a random variable with mean, $\overline{NR_1} + \overline{NR_2}$ and variance, $\sigma_1^2 + \sigma_2^2$. The costs of the investment can be written as K_1 for the first and K_2 for the second stage. If the problem is viewed as a single, "all or nothing" decision, the investment would not be undertaken if,

$$E[NR] = \overline{NR_1} + \overline{NR_2} < K_1 + K_2 \quad \text{(A3.3)}$$

However, treating the problem sequentially, the investor can stop at the end of the first round if $NR_1 - \sigma_1$ is drawn, allowing the net return to be written,

$$NR = -K_1 + 0.5(0) + 0.5\left[-K_2 + 0.5(\overline{NR_1} + \overline{NR_2} + \sigma_1 - \sigma_2) + 0.5(\overline{NR_1} + \overline{NR_2} + \sigma_1 + \sigma_2)\right] \quad \text{(A3.4)}$$

and investment should occur if NR>0. It is possible to show that the investment is profitable as long as,

$$\overline{NR_1} + \overline{NR_2} + \sigma_1 > 2K_1 + K_2 \quad \text{(A3.5)}$$

Undertaking phase 1 is analogous to buying an option to undertake stage 2, where the cost of that option is K_1. It can be seen that for sufficiently large σ_1 and sufficiently small K_1 the investment should proceed. The authors point out that,

> "*Ex post* it may look as if R&D costs of K_1 were wasted under such circumstances [if $\overline{NR_1} - \sigma_1$ occurs], but that would be the wrong way of viewing the problem. It is exactly the possibility of termination before the end which encourages a sequential decision maker to go forward even though the standard cost-benefit criterion … looks discouraging." (*ibid*. p. 57)

Appendix 4 Transaction costs

Coase (1937) addressed the question as to why firms exist, or "Why co-ordination is the work of the price mechanism in one case and of the entrepreneur in the other" (Coase 1937 p. 74). Coase's answer to this question was that there must be a cost to using the price mechanism – transaction costs – and that the existence of a firm should be seen as a way of economising on these costs (Bosworth, *et al*. 1996, pp. 271-272).

In a similar view to Pareto optimality (see Appendix **), if markets were perfect, then all production would take place by individuals (not firms) and be traded in the market. Table A4.1 sets out the conditions under which the market would be chosen and those factors that make it more likely that production will take place through the firm.

Table A4.1 Characteristics of markets

	Perfect markets	**Imperfect markets**
Individual	Unbounded rationality	Bounded rationality
Information	Perfect total symmetrical	Imperfect partial asymmetrical
Motivation	Honesty	Opportunistic
Transaction costs	Zero	Positive

Source: Bosworth (2005, p. 23)

Imperfect information, bounded rationality and opportunistic behaviour create risk and uncertainty when trading in the market. In effect, they form the source of transaction costs that are reflected in the need to devote resources to: “(i) discovering potential suppliers; (ii) establishing market prices and qualities; (iii) negotiating supply and other contracts, bearing in mind the difficulties in drawing up complete contracts, specifying the transactions to be implemented in the future under different contingencies; (iv) monitoring the conditions and terms of the contract; (v) enforcing the terms of the contract; (vi) terminating contracts where necessary; (vii) reducing uncertainty and risks.” (*Ibid*. p. 22)

In principle the production of a given good could be accomplished through the co-operation of a number of independent individuals who conclude separate contracts with each of the other individual producers for every exchange that takes place. In practice, the kinds of problems described in the previous paragraph make the design of watertight contracts difficult. This is further complicated by the need for larger and larger numbers of contracts as the production process becomes more complex. In the extreme case, where n factors each have to co-operate with all other producers, there is a need for n(n-1)/2 bi-lateral contracts. Where n is even moderately large, the transaction costs of this arrangement would be high, even if contracts were relatively simple to draw up. In practice, the need to

redraw contracts every time a new exchange needs to take place and the difficulties of drawing up long term contracts make production entirely through the market even less likely (Bosworth, *et al*. 1996, p. 272).

The optimal scale and scope of a firm can be given a neoclassical interpretation. The Coasian theory argues that the existence of a company depends upon the relative efficiency of the market and the firm. This depends upon the relative magnitudes of "transaction costs" *vis a vis* "management costs". Thus, in principle, the optimal size (and scope) of a firm is determined where the marginal costs of internalising an (additional) external transaction is equal to marginal costs of organising that transaction *via* the market. Increased efficiency of management and improved organisation of the firm increase its potential size, other things being equal; improvements in the way the market operates tend to reduce the size and number of firms.

Appendix 5 Diminishing returns to R&D at the micro level with increasing returns at the aggregate level

Adopting a Cobb-Douglas (log-linear) production function,

$$Y_i = AX_i^{1-\gamma} K_i^{\gamma} K_{ij}^{\mu} \quad \text{(A5.1)}$$

where

- Y_i is output of firm i
- X_i denotes tangible inputs of firm i
- K_i is the R&D stock of the firm
- K_{ij} is the R&D pool j from which the i^{th} firm receives R&D spillovers
- other parameters are constants.

As the individual firm cannot influence the size of K_{ij} (the aggregate pool), it experiences diminishing returns to both tangible and intangible inputs, γ<1, and constant returns to scale, (1-γ)+γ=1.

Using the standard neo-classical method of determining optimal factor inputs (i.e. setting the value of the marginal products of the inputs to their price levels) yields,

$$\frac{K_i}{X_I} = \frac{\gamma}{1-\gamma}\frac{P_X}{P_K} = r_i \quad \text{(A5.2)}$$

Equation (2) shows the equilibrium ratio of R&D stock to tangible inputs, given their prices, PX and PK. Substituting from equation (2) into equation (1) yields,

$$\sum_i Y_i = \sum_i AX_i (\frac{K_i}{X_i})^{\gamma} K_{ij}^{\mu} = \sum_i AX_i r^{\gamma} K_{ij}^{\mu} = Ar^{\gamma} K_{ij}^{\mu} \sum_i X_i \quad \text{(A5.3)}$$

Noting that $K_{ij} = \sum_i K_i$ and that $X_{ij} = \sum_i X_i$, then

$$\sum_i Y_i = A(\frac{\sum_i K_i}{\sum_i X_i})^{\gamma} K_{ij}^{\mu} \sum_i X_i = AX_{ij}^{1-\gamma} K_{ij}^{\mu+\gamma} \quad \text{(A5.4)}$$

Hence, at the pool level, there are increasing returns to scale, (1-γ)+(μ+γ)=1+μ (as long as μ>0) and, potentially, increasing returns to investment in R&D, if μ+γ>1.

Appendix 6 Neighbourhood effects

Neighbourhood effects relate to negative (deprived area) or positive (advantageous area) spillovers that arise from living in a particular location. Hills (2007, p. 17), for example, illustrates this using externalities in housing consumption, where, if one house falls into decay, the problem may spread to neighbouring properties. In turn, this may result in people outside of the area building up adverse perceptions of the neighbourhood, which can affect property values across the whole of the neighbourhood. The outcome can be a downward spiral, where the neglect of one or a small number of properties can spread across the neighbourhood as a whole.

A research question which has come to the fore in recent years concerns whether there is a neighbourhood effect on labour market outcomes. For example, do individuals with identical characteristics, other than the neighbourhood in which they live, have different labour market outcomes. In particular, other things equal, do individuals from deprived neighbourhoods have more adverse labour market outcomes (e.g. lower probability of employment, longer durations of unemployment, *etc*.) than those who live in "well-to-do areas".

As DCLG (2008, pp. 12-13) argues, if a deprived neighbourhood is just a spatial agglomeration of individuals with poor skills, the principal policy instrument may be one aimed at individuals (improve individual skills), rather than aimed at the neighbourhood. If, however, there is some neighbourhood effect over and above the individual skill and compositional effects, even though the latter may be the more important (as DCLG suggest, p.13), then there may be justification for government intervention at the neighbourhood level.

Neighbourhood effects can be viewed in the context of "local interactions models", as well as "externalities" and "spillovers",

- in local interactions models, agents' information, preferences, choices and/or outcomes are directly affected by the behaviour of other agents in the local area, rather than being mediated by markets (Conley and Topa, 2003). Such models assume that interactions between individuals and a set of neighbours occur locally, where the degree of interaction is defined by some measure of social or economic distance;
- neighbourhood effects relate to the impact of neighbours' characteristics and behaviour on individual socio-economic outcomes (Dujardin and Goffette-Nagot, 2007, p. 3). Neighbourhood effects, therefore, are a form of externality or spillover, such that the characteristics of other individuals or families in a local area can

adversely (negative externality) or positively (positive externality) influence the socio-economic outcome of each individual in that area.

Social interactions are referred to as non-market interactions to emphasize that they are not regulated by the price mechanism. Given there is no market price involved in the interaction, the results of social interactions can be viewed as an externality or spillover[49], in which the individual's actions and outcomes are affected by their reference group (e.g. family, neighbours, friends or colleagues). In the literature, such a network is viewed as part of an individual's social capital. Social capital is argued to be the sum of the resources (bearing in mind there may be synergies) potentially available to individuals from their relationships with others (Nahapiet and Ghoshal, 1998). Social capital reflects the agent's ability to mobilise resources from their network of social contacts and relationships, to enhance the individual's or enterprise's performance (Batjargal, 2005).

Certainly, there is an expectation of neighbourhood spillover effects. Several examples can be given. First there is the possibility that the existence of a high proportion of unemployed in a given area might result in a culture of worklessness (Ritchie, *et al*. 2005, p. 3).[50] This might be characterised by the existence of lower incentives for formal work because peers are also unemployed, there is a strong informal economy and joblessness is not seen as being problematic because aspirations are low. There is a growing theoretical and empirical literature, which suggests that neighbours are likely to affect individual socio-economic outcomes through peer effects and role models, influencing the acquisition of human capital, individuals' attitudes toward work and the dissemination of information about job opportunities (Dujardin and Goffette-Nagot, 2007, p. 3). A second spillover effect occurs where information about job opportunities is passed by word of mouth within a neighbourhood.[51] Thus, individuals still searching for work might receive less and less information, the higher the proportion of unemployed and inactive in the local population and the longer the period such individuals have not been in work.[52]

[49] While this is the general view adopted in the literature, some degree of caution should be adopted in treating the results of social interactions as pure externalities. Being part of a network and benefitting from the network will generally involve some form of social exchange, whereby each individual in a network is required to contribute to others in the network as well as benefitting from it. Actively contributing to a network will have opportunity costs of time and effort, and may even involve economic expenditure by individuals in the group.

[50] For example, the lack of successful older individual role models in deprived areas may influence the motivation and attitude to work amongst younger individuals (Wilson, 1987).

[51] This may particularly be the case amongst the lower skilled who rely more on personal contacts and other informal search mechanisms (Topa, 2001; Bayer et al. 2005).

[52] A role for communication through family, friends, trade unions, *etc*. in job search can be found in LFS data (current work on a project for DWP), but it does not appear to be of the same order of magnitude as a number of other job search measures, such as Jobcentres. In a somewhat different context, that of the diffusion of knowledge and technology, spatial spillovers appear to be extremely important. This work points to the, "... necessity to take into account the increasing importance of collaboration networks in the process of knowledge

There are two further important features that appear relevant to both understanding neighbourhood effects and to the design of policy responses to alleviate such effects:

- neighbourhood problems may be a "systems" problem (see the discussion of low skills equilibrium above), involving multiple interacting influences, some of which are individual and some of which are spatial. Berthoud's (2003) analysis, for example, suggests that, while a single barrier may affect the probability of an individual finding work, facing a number of barriers may make it next to impossible without some form of intervention or help (see also Ritchie, *et al*. 2005 and Hirst, 2005);
- there are "sorting effects", one of which concerns the sorting of individuals (and families) into the neighbourhoods in which they live and the other to the sorting of employers into the places they produce their goods or supply their services. Take the sorting of individuals; there is a tendency for individuals with lower skills and poorer employment history to have lower incomes and to gravitate to more deprived areas. Thus, it is not necessarily that individuals in deprived neighbourhoods find it difficult to obtain employment, but that individuals who find it difficult to find employment tend to live in poor neighbourhoods. Likewise, from a policy perspective, interventions might have the effect of obtaining jobs for individuals in deprived neighbourhoods, only to have them move out to less deprived areas and to be replaced by other, incoming individuals who don't have work.

diffusion and to assess better their consequences in terms of the geographical distribution of innovation and growth" (Autant-Bernard, *et al*. 2007, p. 346).

Appendix 7 Welfare optimality and intervention in the market for training

A7.1 Pareto optimality

The standard DCF decision rules for specific and general training decisions are based upon the assumption of perfectly competitive markets (Appendix 1). Such markets are a fundamental requirement of the Pareto view of welfare optimality, which purports to ensure that the goods that people want to buy are supplied at the lowest possible cost and price. A typical definition of the outcome is,

> "A given economic arrangement is efficient if there can be no [other] arrangement which will leave someone better off without worsening the position of others". (Musgrave and Musgrave, 1976, p. 67)

or, more recently, DCLG (2007, p. 8) note that an outcome is Pareto optimal (or Pareto efficient) when there is no way to make someone better off without making someone worse off. This very strict rule appears to be based upon the still widely held assumption that utility of different individuals cannot sensibly be compared. Inter-personal comparisons are unnecessary if one person can be made better off without others being made worse off – a so-called "Pareto improvement".

A7.2 Search for inter-personal welfare comparisons

The search for measures that allow interpersonal comparisons of utility continue (see for example, Elster and Roemer, 1991, Layard, 2005 and Equalities Review, 2007).[53] Such measures would allow more general guidelines for welfare improvements than Pareto efficiency. Such measures could, for example, inform actions based upon the Kaldor-Hicks efficiency criterion, that, a policy enhances efficiency if the individuals who are made better off could in principle compensate those made worse off (Kaldor, 1939; Hicks, 1939). This need has led the government to adopt a "rule of thumb" in assessing the distributional impact of policy intervention,

> "Broadly, the empirical evidence suggests that as income is doubled, the marginal value of consumption to individuals is halved: the utility of a marginal pound is inversely proportional to the income of the recipient. In other words, an extra £1 of consumption received by someone earning £10,000 a year will be worth twice as much as when it is paid to a person earning £20,000 per annum." (H.M. Treasury Green Book, Annex 5)

[53] This work can be traced back to Bentham (1789) and through the work of Von Neumann and Morgenstern (1944).

This rule of thumb is reiterated in DCLG (2007). Note that this is not proposed as a welfare rule that can be used to replace Pareto optimality (otherwise it seems to have the implication that all incomes should be the same), but as an indicator of potential inequity, which may have a bearing on welfare.

A7.3 Theory of second best

Many of the studies that are critical of government intervention perceive the justification as being one of seeking to impose the economic conditions that underpin Pareto optimality (perfect competition, perfect information, *etc.*) (see, for example, Brownstein, 1980). It is possible that, perhaps, a few economists and politicians see it this way, however, the work of Lipsey and Lancaster (1956) moved the debate in quite another direction. Their paper demonstrates that if one optimality condition in an economic model is not satisfied, then the next best solution may involve changing other variables away from the values normally assumed to be optimal. While this theory was developed in the macro context of a general equilibrium system, it nevertheless can also apply at the microeconomic, in partial equilibrium cases. If, for example, a monopoly producer is polluting the environment, removing the monopoly and replacing it with competition would make things worse, as the level of production under competition is higher than under monopoly.

A7.4 Schumpeterian competition

A second factor that makes any suggestion of trying to replicate the Pareto conditions redundant is that Pareto optimality is wholly static in nature. The concept of Schumpeterian competition, however, largely relegated the static Pareto world to be a special case. Schumpeter (1950, Chapters 5-8) presented a new view of capitalism where monopolies are relatively common and, while persisting for some time, are then swept away by what he called the "perennial gale of creative destruction" (Schumpeter, 1950, p. 84). This destructive force is driven not by competition through costs and prices, but "... competition from the new commodity, the new technology ... competition which strikes not at the margins of the profits of the existing firms but at their foundations and their very lives" (*ibid*. p. 84).

It is the potential for a (temporary) monopoly that offers the incentive to carry out R&D and other creative activities, and to innovate. This concept has become embodied in global intellectual property protection rights (IPRs), such as patents, industrial designs and copyright (Bosworth, 1987). IPRs offer the individual protection for their creative output for a set period, which gives them the potential to earn monopoly profits. This legal protection over inventions and other creative outputs provides an incentive to invest in R&D and other

creative activities. The aim of the legal framework is to expand creative activities, which otherwise would not take place, to the point where the dynamic welfare gains are just equal to the static welfare losses. The existence of both static and dynamic welfare dimensions produces a tension between anti-trust and innovation policy (Katz and Shelanski, 2005).

A7.5 Implications for skills

The question arises as to what the skills bases of the "Pareto optimal" world and the world of "Schmpeterian competition" would look like, and how they would differ? This is clearly an empirical question, but the conceptual literature suggests that perfectly competitive product and labour markets have few if any resources for activities such as R&D and training. In addition, competitive markets focus on costs and on price competition, which is more consistent with a low than a high skills trajectory.

The world of Schumpeterian competition emphasizes a continual stream of product and process innovations, with infrequent introductions of radical, general purpose technologies (according to some "long wave" or "Kondratieff cycle"), interspersed with longer periods of increasingly more modest, incremental inventions (Freeman and Soete, 1997, pp. 17-22). While the invention and innovation processes themselves require high level skills, it is less clear whether the new technologies, once introduced, are skill enhancing or skill reducing; this is an empirical question. Nevertheless, on balance, the Schumpeterian world seems to be one of relatively high (and potentially increasing) skill levels *vis a vis* the intensely competitive Pareto world.

Appendix 8 Private and social returns to the individual's investment in general training

A fundamental reason why private and social returns to individual investment in general skills differ is that the individual calculates the private rate of return based upon their take home pay (i.e. earnings net of tax including fringe benefits) and the direct costs of training borne by the individual, while the government calculates the social rate of return using gross (i.e. pre-tax) pay and the total costs of training, including those borne by the government.

Hence, the individual, undertaking their private calculus, will undertake investment as long as,

$$\sum_{t=\tau_1}^{\tau_2} \frac{(1-\rho(T))W'(T)_t-(1-\rho(M))W'(M)_t}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa_t}{(1+i)^t} \quad (1)$$

where,

- W is the net wage
- W' is the gross wage
- ρ(T) and ρ(M) denote the tax rates for the higher and lower skill levels respectively (where, in general, ρ(T)>ρ(M))
- for simplicity κ includes both the direct costs of human skills investment and foregone wages borne by the individual.

The government, on the other hand, acting in the best interests of society as a whole, sees investment in skills as profitable if,

$$\sum_{t=\tau_1}^{\tau_2} \frac{W'(T)_t- W'(M)_t}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa'_t}{(1+i)^t} \quad (2)$$

where κ' are the total direct costs of the education (ie. those borne by society as a whole), including the lower productivity of the individual during the training period. Investment takes place up to the point where expression (2) becomes an equality, which is the socially optimal level.

For simplicity, equation (2) uses the same rate of interest, i, as equation (1). Note that, if government used a lower risk adjusted discount rate than private individuals, this would further increase the optimal societal expenditure on human capital investment.

It is possible to show that the expression for the social rate of return is the sum of the individual and government elements. From inequality (2) we can write,

$$\sum_{t=\tau_1}^{\tau_2} \frac{(1-\rho(T))W'(T)+\rho(T)W'(T)-(1-\rho(M))W'(M)-\rho(M)W'(M)}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\kappa t+\gamma t}{(1+i)^t} \quad (3)$$

where **γ** denotes the direct expenditure on education per student by the government and taxes foregone during the training period.

Ignoring non-pecuniary factors, individuals will invest up to the point where the NPV=0 for the last trainee. Using this in inequality (3), then the government's investment decision can be written,

$$\sum_{t=\tau_1}^{\tau_2} \frac{\rho(T)W'(T)-\rho(M)W'(M)}{(1+i)^t} > \sum_{t=\tau_0}^{\tau_1} \frac{\gamma t}{(1+i)^t} \quad (4)$$

This shows that one of the factors that drives a wedge between the private and social optima is that the individual's calculation is net of tax and the government's is gross of tax. Government will top up the individuals' investment in human capital such that (4) becomes an equality.

The government will generally operate with a lower discount rate than individuals, as it does not face issues of individual risk or imperfect knowledge about the probability of success. This is a further reason why government views individuals to be spending less than the socially optimal amount on training, and will increase their own spending above the level suggested in inequality (4).

Appendix 9 Remaining market failures: public goods and merit goods

This appendix deals briefly with the issues of public goods and merit goods. Neither of these concepts, both of which have been used to justify government intervention in the market, appear particularly important in the present context. Opinion as to what comprises a public good has changed somewhat over the years. Even education tends not to be treated as a pure public good today and so it is fairly clear that specific skills are unlikely to fit into this category. Likewise, while certain basic and general skills might be seen as being merit goods, specific skills again to do not appear to fit naturally into this category.

Public goods

Pure public goods have two characteristics,

- they are "non-rivalrous", such that each individual's consumption of such a good does not diminish other peoples' consumption of that good; and,
- they are "non-excludable", that is to say, that, if the good is provided, no one can be excluded from consuming the good (Samuelson, 1954, p. 387) – the "free rider" problem.

However, the view about what constitutes a public good in practice and how a public good should be delivered have changed significantly over time.

With regard to the issue of what constitutes a public good, Besley and Ghatak (2003, p. 4) prefer to separate them into two types:

- market supporting public goods; and
- market augmenting public goods.

In their view, the key (perhaps the only) market supporting public good is the provision of law and order and (possibly) national defence. They argue that,

> "If the legal system is weak, then goods that would normally be considered private goods can effectively become public goods. For example, consider the extreme case where formal property rights cannot be enforced at all." (*ibid*. p. 5)

What they view as market augmenting public goods are those generally recognised by economists, they include those whose provision bring social as well as private benefits, such as health and education (*ibid*. p. 7).[54]

They argue that a market supporting good, such as the law, is best provided by government (*ibid*. pp. 4-5), although the precise way in which this is implemented (e.g. civil versus common law) has important implications for the relationships between the political and legal systems and the efficiency with which the economy operates (Glaeser and Shleifer, 2002). With regard to market augmenting public goods, Besley and Ghatak (2003, p. 3) argue that it is no longer necessary to accept that this type of public goods would necessarily be provided by the government. They argue that government intervention could be through partnership with the private sector or the "third sector", comprising voluntary and community organizations (see Section 5.3.7 below on government failure).

As noted elsewhere in this Conceptual Review, firms do not view the provision of basic skills, which are primarily general skills, as their responsibility. This is primarily seen as the responsibility of the government, the individual, voluntary and community organisations. However, while the public goods argument does not suggest that the provision of basic education and skills are the sole responsibility of government, when coupled with the merit goods and inequality arguments, it appears that the prime responsibility, if not the whole responsibility, will rest with government.

Merit goods

The concept of merit goods was introduced by Musgrave (1957, 1959). Merit goods refer to those goods that the government feels it should intervene to increase consumption of on social grounds (e.g. education), while demerit goods are those government sees necessary to tax or ban on social grounds (e.g. prostitution or drugs). Musgrave provides the following example of justification for intervention in the case of a merit good,

> "The apparent willingness of the public to provide for a second car and a third icebox prior to ensuring adequate education for their children is a case in point." (Musgrave, 1957, p. 341)

Paternalism is often linked with merit goods, where justification for government intervention in housing consumption (education, *etc*.), is that, while some people, if simply given the equivalent in money, would spend it in ways against their own or their family's interests, tax payers would nevertheless be willing to have money transferred to low incomes families if

[54] Contentiously, they argue (*ibid*. p. 7) that, "In universities, research is a public good which generates externalities that travel far beyond the campus, but teaching is not a public good in this sense." It is not clear from the discussion in Section 4.3.1 that education should be excluded in this way.

the money has to be spent on housing, but not if it can be spent on anything the recipient chooses (Hills, 2007, pp. 16-17).

More recent definitions of merit goods generally refer to goods which the government should supply, even though this interferes with aggregated individual "willingness to pay" decisions. The existence of merit goods, which do not reflect market preferences, creates new difficulties in designing policy interventions – such that standard "willingness to pay" concepts can no longer be used as a welfare proxy.

One justification for intervention with regard to merit goods concerns the different information sets held by individual consumers and policy makers.[55] This argument has been couched in terms of using the existence of asymmetric information as a justification for the provision of merit goods,

> "The consumer ... may lack basic information on the product necessary for a correct choice between market alternatives." (Head, 1969, p. 215)

An example might be the taxation of cigarettes (a demerit good), where individuals do not fully understand the dangers of smoking.

However, Mann (2006) points out that the state can only make a welfare improvement if it systematically knows about certain issues better than the majority of individuals. In addition, the state has to weigh the size of the utility gain from increased consumption of the merit good (or decrease in consumption of the demerit good) against the utility loss from feeling "over-ridden" (i.e. the individuals' the loss of control over their decision making).

If the imperfection in the market is caused by asymmetric information, the case can be made that, in some instances, the state should supply information about the good, rather than the good itself (e.g. health warnings on cigarette packets). However, Mann (2006) argues that there are many instances in which it is very difficult to convey information in a way effective enough to change consumption behaviour. On the other hand, the provision of information (as a merit good), will generally do less damage to the individual's utility from loss of freedom than the provision (and enforced consumption) of the merit good itself.

One potentially worrying consequence for traditional neoclassical models of the consumption decision is that government intervention disturbs the preference order of the goods that individuals consume. However, the literature has moved on to suggest that individuals do not have a single preference order, but several or multiple orders. Brennan and Lomasky (1983) suggest that individuals have at least three preference orders, which may be inconsistent with one another: market preferences; reflective preferences; and political

[55] Musgrave, *et al*. (1969, p. 143) argues that, "... preferences should be imposed with certain limits by a chosen elite, be it because its members are better educated, [or] possess greater innate wisdom …".

preferences. In each case the individual might respond, "I want …", "I should…" and "society should…", for example, "I want to buy a packet of cigarettes", "I should give up smoking" and "society should restrict the sale of cigarettes".

This distinction becomes important in the context of external preferences. External preferences relate to instances in which one individual obtains satisfaction/dissatisfaction from the experiences of another individual, but is not willing to or is unable to pay for that external satisfaction to ensure an optimal supply of it. A key form is some type of psychological externality, for example, where the utility of one individual is affected by the consumption behaviour of other individuals – a vegan is adversely affected by the meat consumption of others.

> "Goods that cause psychological externalities in such a way that the state could increase utility by banning, subsidising or taxing them are not public goods. The term demerit goods would, for want of a better terminology, better describe that phenomenon." (Mann, 2006).

Mann (2006) brings together these various justifications for intervention on the grounds of merit goods with the example of schooling. He argues that, based upon classical economic theory, schooling would be a private sector activity, but suggests that three merit goods arguments can be used to justify public investment in schooling[56],

- a good schooling system with full participation may be a condition for a prosperous society, but, as this information is not available to every household, state intervention is necessary;
- most adults may have the reflective preference that schooling is important, but their "market" preference as parents may be to make their children to work, while the "market" preference of children might be to play instead of go to school. Making schooling compulsory, makes individuals act in accord with their reflective preferences;
- those who choose schooling for their children may also have a strong preference for their neighbours' children also to go to school to avoid living in an area full of illiterates. If this is an "informed majority position", overall welfare could be increased by making schooling compulsory.

Similar arguments could be put forward about government intervention in the market for basic training.

[56] A non-merit argument for public intervention can be made on the grounds that public investment in schooling enhances economic growth.

Appendix 10 Suggestions for further research

There is an urgent need to develop appropriate measures of training. It will be very difficult to design appropriate policies, implement them and to assess their success or failure, without appropriate and reliable measures of training and human capital. While extensive work appears to have been carried out by the accounting bodies on measures of training, as yet, this has not resulted in new codes of practice. Many of the SSCs have been active in defining the competencies relevant to their sectors, which may be of use in developing measures of training. There seems to be a need to review what the position is currently and establish some basic rules, perhaps drawing upon the experience of the development of measures of R&D.

It has been argued above that, in general, the results with regard to the size of social returns to investments in human capital, R&D, *etc*. caused by spillover effects are positive and significant in magnitude (see Project 2 for further discussion). However, none of the papers looked at to date employ multi-level modelling techniques and, therefore, may over-estimate the significance of the pool or local area effects.[57]

It is not immediately clear from the literature whether the policy changes (such as the introduction of SSCs, *etc*.) have filled the gap identified by Finegold and Levine (1997, p. 119),

> "Perhaps the greatest way in which governments can encourage greater and more efficient private-sector investment in skills is by improving the quality of information about employment and training providers that the market requires to operate effectively."

It seems important to establish whether this remains a key issue.

In addition, since the work of Finegold and Solskice (1988), relatively little work appears to have taken place that treats the training problem as a system failure. The work on neighbourhood effects, low skills equilibrium and trajectories, the interaction between skills and innovation, as well as many other aspects of the conceptual literature all point to the "systems" nature of the training problem. There is still a strong possibility, therefore, that policy interventions relating to training and skills alone will fail to produce the expected or desired impacts on firm behaviour and performance (which seems to be the view of the Scottish and New Zealand skills' strategies).

[57] "Fitting a model which does not recognise the existence of clustering creates serious technical problems. For example, ignoring clustering will generally cause standard errors of regression coefficients to be underestimated." (Browne and Rashbash, undated).

Conceptual economic frameworks tend to operate best at the more formal end of the training spectrum and where training forms a discrete and significant investment by the firm. These assumptions make decision rules, such as net present value and real options pricing, more relevant, and the derivation of “optimal outcomes” easier. However, this approach largely overlooks the more incremental, informal training activities, which may be more important for the majority of firms and bulk of employees. Here, training might be facilitated by re-designing work and job design. There seems to be a need to review this literature, which is probably largely empirically based, to see if any general conceptual rules emerge.

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