

Ideopolis Driver 2: Building on what's there:
What cities and policymakers can learn
from endogenous growth and the new
economic geography



An *Ideopolis* Working Paper

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March 2008



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- Basing urban policies on the findings of several years of academic literature makes intuitive sense. But, in practice, too often it is easy for policymakers at a national, regional and local level either to ignore academic findings, because they can be inaccessible, or at the opposite extreme to take academic findings too literally without recognising the caveats. This paper seeks to review what policymakers can and cannot take from three key areas of urban economics.
- Our concern is that a group of well-publicised ‘superstars’ such as Silicon Valley dominate discussions of economic growth and cities. But while these are important examples, it is not clear how much it is possible to generalise policies from them to support economic growth in other cities.
- There is a wide range of academic theory and empirical research which can be used to explain the lessons behind growth for ‘normal’ cities. This tends to be lost in a maze of technical language and abstract mathematics. The primary aim of this paper is to explain in non-technical form the lessons for policymakers and cities from three bodies of economic work:
 - Endogenous growth theory
 - New economic geography
 - Quantitative work on the ‘drivers’ of growth in cities.
- These theories provide lessons for policymakers both about what might have gone wrong in the past – ‘jam-spreading’ – and what also which policies might help different cities thrive in the future, in the more devolved environment that the Sub National Review of Economic Development and Regeneration is seeking to create.
- The paper also addresses a subsidiary aim: to review the underpinning theory for The Work Foundation’s work on drivers of successful cities in the knowledge economy and to highlight areas where more evidence is needed.
- The paper is based on a literature review of academic studies. Primarily these involve the theoretical and empirical modelling of economic growth in cities. These models are representations of reality. They allow us to examine the general processes lying behind economic performance. But because they remove details which are theoretically seen as unimportant, they may ignore many important factors behind urban growth, such as regulation, institutions, or very local cultural differences. While there are many lessons to be learned from these approaches, it is important to recognise their limitations when it comes to practical policies for specific cities.

Endogenous growth theory

- Endogenous growth models show policymakers that investments in knowledge – such as design, research and development – can lead to economic growth. This means that it is the internal processes within a city, region or nation state which lead to increases in the stock of knowledge and therefore economic growth. For cities this suggests that university and research-intensive industries are important for urban growth, and that these should be priorities for economic development. An important caveat is that these are clearly not the only sectors that matter to city growth, nor can some cities ever attain the nanotechnology cluster they may aspire to as they do not have the skills and research advantage required to attract specialised firms.
- Endogenous growth theory also provides substantial evidence that knowledge sharing occurs in specific geographical areas. This can lead to a tendency for economic activity to cluster near complementary economic activity to benefit from this knowledge sharing. Some authors have termed this ‘knowledge spillovers’ although the exact processes through which it happens are controversial and not enough is known about this for evidence-based policies to be formulated easily in this area.

New economic geography

- New economic geography models show the processes which may lead to the spatial concentration or dispersal of economic activity. They show how the balance between processes which cause economic activity to disperse and those which cause it to concentrate can lead to different patterns of economic geography. This can help cities understand how their economies have emerged as they have, and how they might change over time.
- The forces which lead businesses to cluster in one place are called agglomeration economies. The three classic agglomeration economies are the benefits of a wide and deep pool of labour, the benefits of sharing specialised suppliers and the exchange of ‘knowledge’ locally. These factors make it profitable for businesses to locate near to each other. They offer a theoretical basis for the argument that cities matter, particularly in an economy where ‘knowledge’ is becoming more important.
- Where firms gain from proximity to other similar firms this may, if transport costs are low, lead them to cluster in one place. But because of the benefits of being in this group, other complementary firms will move nearby. As this may make the group even more attractive to other firms, this process can become self-

reinforcing and develop into a process of cumulative causation. New economic geography models can then be used to explain how historical accident can lead to modern industry mixes. New York is one such example, as the type of industry which is located there has evolved with time. While there are limits to the deterministic nature of these models, they can be powerful explanations of how urban economies evolve.

- One of the major implications of these models is what they tell us about uneven development.

The drivers of growth

- Lessons for cities can be drawn from endogenous growth theory, new economic geography and other literature investigating the determinants of growth in cities and regions. As discussed above, however, while much of this work is strong and yields consistent results, there are limitations to the empirical modelling of cities, highlighting the danger of just using available data to understand or assess city performance. Perhaps most importantly, they are limited to those variables which are regularly measured. Factors which may influence growth but which are not measured at a local level are not included.
- Some of the policies that cities should consider (and many are), but which are not easy to measure, are:
 - **Understand agglomeration.** An increased density, or a large market, has been shown to increase productivity through processes including the agglomeration economies discussed earlier. This has different implications for the composition of economies of different size cities.
 - **Encourage knowledge spillovers.** Knowledge spillovers occur through the localised exchange of knowledge from firm to firm. This might be through shared staff, through interpersonal contact or through other means. There is considerable evidence that knowledge is shared locally. This implies cities can benefit from focusing on complementary sectors to existing industries, although there are suggestions that the market may provide this service anyway.
 - **Invest in transport.** Transport and infrastructure improvements are important in increasing the size of the market and enabling firms to benefit from agglomeration economies. However, they may also lead to situations of uneven development and it is not always clear what the long run effect of transport improvements is for individual areas, although there is assumed to be an overall benefit.

- **Invest in public research and knowledge spillovers.** Research and development is crucial in the production of knowledge. This implies a key role for public and private research (which may be subject to spillovers to firms). There is strong evidence that regions and cities which have high levels of R&D are likely to grow faster.
- **Invest in higher education.** Universities have two key roles in regional development, through the production of knowledge and the production of human capital. There is some evidence that university research leads to innovation in nearby firms. This implies that universities are one of the key tools cities have to increase growth: more needs to be done to understand how cities can work with universities to mutual benefit.
- **Invest in human capital.** Human capital, in the form of a skilled and educated population, is consistently found to be a key driver of urban growth. In addition to its role in increasing productivity, it is argued to lead to a more adaptable economy. There is some evidence that human capital attracts further human capital, suggesting that investment in future skills (schools) and retaining skilled workers are vital, but not sufficient, for cities.
- **Build social capital.** Social capital is a vague concept generally used to refer to trust, social networks and other forms of social organisation. These can reduce the cost of doing business (as people are more likely to trust each other, there is less need for other contract enforcement). There is some evidence that social capital can lead to growth, but most of the evidence on this point remains inconclusive. Some of cities' community investment may help to build this but it is difficult to measure.
- Taken together, the evidence presented here highlights the usefulness of the *Ideopolis* framework as a way of linking and thinking about these factors together. In particular, it suggests that the importance placed on skills is justified, and that it is important for cities to recognise the importance of their existing assets and economic structure.

1. Growth and cities

A group of well-publicised ‘superstars’, such as Silicon Valley, Stockholm or even Bangalore dominate current discussions of economic growth and cities. These examples provide some important insights, and illustrate many of the processes which help cities to succeed. But these special cities are special cases; while they may be informative they are not necessarily generalisable and should not be the basis of one-size-fits all urban policies.

A narrow focus on the special cases may mean that cities miss the general principles which underpin good economic performance. But these mundane, day-to-day lessons about economic growth are vital. What are the specific drivers of growth for ‘normal’ cities? What general lessons are available for cities without a nascent semiconductor industry, without a ‘creative class’ or a world-class university? In short, what are the general lessons which lie behind good, if not spectacular, economic performance?

There is a thriving academic literature on the basic factors that underpin urban economic growth. This paper seeks to develop policy lessons from this literature. These are often obvious, but frequently neglected. And without this understanding, there is a genuine risk that cities will focus too much on replicating specifics from special cases and merely changing the name on the economic development strategy: a ‘cut and paste’ approach to economic development, rather than one which recognises the particular circumstances of place. The Sub National Review of Economic Development and Regeneration gave regions and cities more responsibilities for their economic futures, and makes it increasingly important for cities to both know and understand lessons from elsewhere – as well as knowing the limitations of the literature.

So the main aim of this paper is to provide a non-technical introduction to the theory and evidence behind urban economic growth and its implications for policy. In doing so, this paper addresses a subsidiary aim: to review The Work Foundation’s work on cities and the knowledge economy in light of existing theory and data. The paper is based on reviews of the relevant literature¹.

The paper begins with a brief background of urban and regional economics – giving some meaning to the jargon which litters academic work in this area. It then includes a brief discussion of the strengths and limitations of approaches to understanding cities which involve models. This is followed by the major purpose of the paper: a discussion of two

¹ Thanks in particular to Charles Levy and colleagues at The Work Foundation for comments and suggestions

classes of economic models which explain urban growth and the evidence behind it, and what they do – and do not – mean for policy.

First, it considers endogenous growth theory, a well publicised and occasionally mocked body of work. For our purposes, it provides an explanation of why localised concentrations of knowledge can lead to economic growth and how local actors, acting in their own interests, can improve the body of knowledge and stimulate growth. The theory supports The Work Foundation's emphasis on the importance of knowledge intensive industries, but also highlights the limitations of that work in devising practical policies for cities.

Second, this paper considers the new economic geography, a slightly more obscure body of work which emphasises the interplay between those factors which cause economic activity to agglomerate in one place and those which cause it to disperse. So while endogenous growth emphasises the importance of knowledge to growth, new economic geography shows how knowledge sharing might lead to creating cities and to uneven patterns of economic development. For policymakers, it provides a theory that supports the idea of an urban hierarchy – some cities are more economically successful than others for various reasons – but also suggests that there are potentially complementary relationships between cities on which places could capitalise.

Third, the main drivers of economic growth in cities – as included in the empirical literature on urban growth – are discussed. In addition to the theory, it is important to understand the evidence and alongside this the problems with how this evidence is produced. It shows that focusing only on data or targets won't help.

Finally, the paper considers the overall policy implications of this body of work.

***Ideopolis* Working Paper**

This is a working paper developed and published as part of the second phase of the *Ideopolis* programme. The primary aim is to provide policymakers with a non-technical guide to some of the theory and evidence on urban growth. An important secondary aim is to develop the evidence base which will contribute to developing the *Ideopolis* concept and to the next *Ideopolis* report, due to be published in July 2008. In particular the paper reviews the second *Ideopolis* driver of 'building on what's there'.

2. Some underlying urban economics

Public policy is starting to catch up with modern urban economics, much of which studies the impact of agglomeration – the clustering or concentration of economic activity across space – on productivity. This concept underlies the existence of cities, which depend on a balance of factors which cause economic activity to locate in separate areas and those which cause economic activity to concentrate in specific areas. Those factors causing dispersal are fairly obvious: they include congestion, high land prices in areas where other firms want to locate and pollution in built-up areas. But the fact that cities exist suggests that, in some sense at least, the forces which promote clustering are more powerful.

There are two underlying urban economic concepts that underpin policymakers' increasing interest in cities, and are particularly important for policymakers to understand in the context of the changes in the economy and the increase in employment in knowledge intensive industries. First, what 'agglomeration economies' are and why they matter and second, what 'external economies of scale' are and why they matter as well.

Agglomeration

There are many competing definitions for these agglomeration economies – the classic three are the Alfred Marshall's agglomeration economies from the late 1800s. He argued that there were three underlying processes driving industrial concentration.

The first is specialisation of supply and demand (in much of the literature this is referred to as 'input-output linkages'). The simple logic is that the larger the city or the increased concentration of firms of a particular type, the greater the potential for specialisation. As firms specialise, they may offer more appropriate or specific supply and demand for a good. A highly specialised financial services legal practice is more likely to find local markets if located in a large city with a financial services specialisation, such as London.

The second is very similar: the requirement for specialised labour markets. If workers live in a big city they have an incentive to invest in specialised skills and qualifications; the city is big enough to ensure that they will be able to find an employer who values this qualification, and so the investment will pay off. The corollary of this is for firms: if you locate in a large city, you are more likely to be able to attract specialised labour.

The third is more controversial, but refers to the importance of localised transmission of knowledge. Firms and workers that co-locate are likely to interact, and this interaction

allows the transmission of knowledge. This process remains disputed, with most work on the area silent on the actual mechanisms through which this transmission takes place. This is sometimes called knowledge spillovers.

These have been the three standard processes referred to in the urban economics literature. They help to explain why *'cities' contribution to the national economy (in terms of GDP or income) is greater than their share of the national population, and the contribution of larger urban centres is proportionately greater'* (HM Treasury 2006).

It is also important for policymakers to understand why businesses benefit from locating in cities, something explained by recent revision by Duranton and Puga² where they explain how firms benefit from the 'micro-processes' of agglomeration:

- **Sharing.** As firms can 'share' the benefits of having a large range of suppliers, the benefits of being able to specialise and the sharing of risks.
- **Matching.** As there are more firms and workers, there is a greater pool of actors against whom to match with appropriate opportunities.
- **Learning.** By which they mean the production, sharing and accumulation of knowledge, with learning assumed to be easier when a firm is close to firms from whom it is learning.

Against these forces are a set of forces of deagglomeration, processes which cause economic activity to spread out. These might include static factors such as natural resources, or processes such as congestion and high-costs for land and labour and can help policymakers understand why businesses might relocate from a large to a medium-sized city (and how they might demonstrate the benefits of businesses relocating to their city).

External economies of scale

In the changing economy it is also important to understand that many models of urban economics rely on the concept of externalities. An externality occurs when the action of one agent has a positive or negative impact on another agent, without this being traded in the market. The classic example is a factory producing smoke, which stains the washing hung out by a nearby resident, a negative externality.

² Duranton, Gilles and Diego Puga (2003) 'Micro-foundations of urban agglomeration economies', *Handbook of Regional and Urban Economics*, Volume 4, 2063-2117.

There are assumed to be many positive externalities in cities. But the positive externality most relevant to policymakers thinking about economic development is the knowledge spillover. This is the process by which information is assumed to flow from one economic actor (person or firm) to another. The actual process of these externalities is often poorly defined, but may include social and business networks, conferences, events or people moving jobs from one firm to another.

Knowledge spillovers remain something of a controversial subject, but they have two features here which are assumed to be particularly important. The first is that they are spatially limited – they are assumed to be more effective in very local areas, and decline in importance as two actors move further away. The second is that – because they can lead to the production of one actor allowing other to produce more, they may in some circumstances, lead to increasing returns.

Knowledge spillovers are one way of establishing external economies of scale for cities. Economies of scale occur when an increase in the size of a production run of a good leads to a decrease in the average cost of each subsequent unit produced. In short, they imply that production of a lot will be cheaper – on average – than producing a few. A company owning a bigger factory may benefit from internal economies of scale (internal, that is, to the firm, as might happen by having a larger factory and so being able to buy in bulk). A similar process applies to where firms locate: by locating in a bigger city, a company may benefit from these external economies of scale in terms of exchange of information. These processes are vital for the economics of cities and the more policymakers understand these, the more likely they are to be able to understand the particular circumstances of their city and how they might seek to develop its economy.

3. Economic models, their strengths and limitations

Economic models have something of a bad name, as they lead to a tendency to make bald but bold policy recommendations from relatively limited empirical work. For example, there has been a tendency to assume that the importance of knowledge intensive industries mean that all cities should have nanotechnology clusters: an idea that is clearly impractical. This does not mean that these studies are not useful, just misused. But it makes it important to begin by placing this sort of work in context.

Generalising from simple models

The models which are presented in this paper are powerful for their simplicity. But they are not without their problems. Economic models strip down the processes of growth to the bare basics, with these presumed to be the aspects of reality which really matter. These models lack nuance and the shades of meaning of social interactions, and this is partly the point. The assumption, of course, is that the processes which are modelled are the ones which really matter.

This leads to some important insights. One of the most important is that the processes which are modelled are assumed to be generalisable from one place to another. So the growth processes of a series of cities in America can – with certain caveats – be assumed to then apply to cities in other countries.

It also allows empirical work to be performed more rigorously³ through formal mathematical modelling of economic processes (allowing the implications of the economic model to be seen clearly using a range of mathematical techniques). This then allows a range of predictions to be derived which can be tested against a collection of data taken from the actual experiences of countries or cities, although this sort of data is not always of the highest quality.

What are the other problems with these techniques? Many of the assumptions of the formal models are quite abstract. A common assumption is that markets are perfectly competitive, with a large number of small firms in the market, none of which have real market power. But this condition rarely holds in real cities – meaning practical policies need to think about what their cities and their markets are really like⁴.

And there are other contextual problems in the data which can lead to the misapplication of these techniques. Using the modelling techniques alongside numerical data requires

³ Henry Overman (2004) 'Can we learn anything from economic geography proper?', *Journal of Economic Geography*, 4 (5), 501-516.

⁴ McCann, P. and Shefer, D. (2005) 'Agglomeration, economic geography and regional growth', *Papers in Regional Science*, 83 (1), 177-196.

the difficult assumption that all the variables of importance in real life are included in the model (so, for example, a model of national economic growth includes all the factors which are important determinants of the growth of that nation). But different models come to separate conclusions as to what these are. While the logic of the technique means that this can be accounted for, to a certain extent, it is no surprise that the use of such modelling techniques can lead to a series of separate, logically correct but entirely contradictory conclusions.

Loss of context can also result in errors of analysis. It would be foolish to suggest that the entire economic performance of a country can be explained in terms of a handful of explanatory variables, but this is what happens. And the flaws in some of the variables are often unaccounted for.

This means that the principal benefit of these models – the clarity of their logic – can also become their main flaw. These are simple models which illustrate processes, rather than contextual narratives which place individual economic actors in in-depth analysis. While they are valuable because they offer generalisations about processes, it is important not to use them to make widespread generalisations about places. In other words, policymakers need to ensure they do not just rely on one theory to create their policies but consider different theories and test the insights against their city's circumstances. The time that this takes is one of the reasons we have written this paper.

Problems with the empirical modelling of cities

The third literature this paper addresses is the empirical work on growth which looks at levels of analysis smaller than the nation state – principally cities and regions. There are considerable practical difficulties of this sort of work. The empirics of economic growth on a national scale are controversial, with academics developing something of an industry in producing cross country regressions. This has led to considerable scepticism, with three respected economists, Baumol, Litan and Schramm, arguing that:

*'To broadly generalize, a wide range of results has been obtained from the statistical tests that have been reported in the leading studies. Essentially, one can pretty much find whatever results one is looking for, depending on what variables, countries, and time periods one wants to include in the regressions. This state of affairs is hardly comforting to policy makers and others outside the profession. But it is the reality, and, to some extent, it should be expected.'*⁵

⁵ Baumol, William, Robert Litan and Carl Schramm (2007) *Good Capitalism, Bad Capitalism and the Economics of Growth and Prosperity*, Yale: YUP, pp 53.

The complications of modelling spatial data makes it even more difficult, with a number of problems with the empirical modelling of cities. It is useful for policymakers looking for city metrics to know about these challenges and the limitations of quantitative targets. First, there are problems with the spatial units used in modelling. Work in the US generally deals with cities, as data at this level is available through the Standard Metropolitan Statistical Area (SMSA). This is standardised across the US, and is a good approximation for cities. For studies of the European Union, data at this level is harder to get. European Union attempts to establish common databases at the urban scale have been poor⁶. However, regional indicators are available at comparable levels (NUTS1, NUTS2 and NUTS3) through the Regio database. This is commonly used and has become seen as acceptable, but NUTS regions largely approximate local government structures rather than natural economic units. A few European level studies have used aggregated data for spatially proximate NUTS regions to approximate Functional Urban Areas⁷. Studies at the national level depend on national data sets. This paucity of data means that many apparently 'urban' studies are actually based on regional data.

There are also statistical difficulties about the modelling of growth. Cheshire and Magrini⁸ argue that growth is such a complex process that detailed conclusions (of the form an increase in x of y leads to a growth payoff of z) appears ludicrous. A wide range of potential explanatory variables are omitted, meaning the results are always 'best cases'. For example, the wide range of factors included in this review are rarely included all together in a single model. Moreover, studies tend only to be able to measure those variables which are available in governmental statistical databases, limiting the extent to which new concepts (such as knowledge) can be included or accounted for.

This reflects the problem of including all the potentially important variables in a single model. With quite simple models, multicollinearity (where the explanatory variables correlate with each other) can be a problem, making it hard to see which variable is actually having the effect on growth. Many studies have difficulty establishing cause and effect because they lack reliable time series data, or because political shocks have influenced some of the sample.

Moreover, **cities are not closed economies**, but the models often assume they are. This means interrelations between the areas in question also cause substantial problems, as

⁶ GLA Economics (2005) 'Towards a Common Standard: Comparing European and American Cities', *GLA Economics Working Paper* 13.

⁷ Paul Cheshire and Stefano Magrini (2000) 'Endogenous Processes in European Regional Growth: Convergence and Policy', *Growth and Change*, 31 (4), 455-479.

⁸ Cheshire and Magrini (2000) *ibid.*

– for example – London and Birmingham are open economies which are relatively close to each other (an exception may be Canadian studies, due to the low population density, large distances and relatively small number of cities in the country⁹).

Finally, there are issues about the ways in which these studies have been related to the theory. With endogenous growth studies at least, the papers here rarely test endogenous growth models specifically at a sub-regional level, and when they do the links between the theory and the empirics tends to be quite loose¹⁰. This means city policymakers should not rely too heavily on theories only testable at a national or regional level.

Unsurprisingly, growth studies more generally have a long history of failure, with many of the experiences of the 1990s missing from growth studies in that period¹¹. Studies of urban growth are only part of the evidence, but an important part. The consistency of results across several papers, despite significantly different methodologies, suggests they should carry some weight with policymakers however – even if they should not be the only basis on which decisions are made.

The following sections will review evidence from these empirical studies and relate it back to our review of endogenous growth theory and new economic geography, concluding what these mean for policymakers.

⁹ Mark M. Partridge, Rose Olfert and Alessandro Alasia (2007) 'Canadian Cities as Regional Engines of Growth: Agglomeration and Amenities', *Canadian Journal of Economics*, 40 (1), 39-68.

¹⁰ Mark Roberts and Mark Setterfield (2007) 'Endogenous Regional Growth: A critical survey', *Cambridge Centre for Economic and Public Policy Working Papers*, WP0107.

¹¹ World Bank (2005) *Economic Growth in the 1990s: Learning from a Decade of Reform*, Washington: World Bank.

4. Endogenous growth theory and cities

What is 'endogenous growth theory' and why should cities worry about it? It matters because it's an explanation of the how economic growth happens and how cities can use their economic development strategies to help stimulate it. There is no single 'endogenous growth' model for economic growth. Endogenous growth theories are a diverse school of models sharing some analytical basis in that they emphasise the internal processes within an economy which lead to the production of knowledge, which in turn leads to long-run economic growth. The idea is well established, and has been well-covered¹². Rather than repeat this work, the focus here is to explain briefly what endogenous growth is and then why it should apply to regions and cities.

Economics and endogenous growth theory

Before setting out what 'endogenous growth' is, it's important to outline the 'old' models of economic growth. These were based on various mixes of three factors of production: capital, labour and – sometimes – land. These three factors were assumed to be mixed in various ways in a variety of contexts, with particular patterns of trade and with different market structures. The mix and the context led to a different output growth in different places. But in these theories, knowledge was imported from abroad rather than being created by local agents; technology was assumed rather than explained.

But technological progress (along with the rate of increase of the supply of labour) was in reality what predicted long run growth. But the old models assumes that investment in capital lead to diminishing returns, with the return from an investment in machinery or infrastructure declining with time and scale. So while the old models predicted growth in the short term, they failed to explain that technological progress would predict growth in the long term¹³.

For a growth model to be unable to explain economic growth in the long term was clearly unsatisfactory. But the important work putting a longer perspective on these issues was surprisingly late in coming. It took until the mid-1980s for Paul Romer to introduce the theory of endogenous growth in a series of seminal papers based on his PhD thesis¹⁴. He worked with the simple premise that technological change came from the actions of economic agents within the economy. This technological change led to growth, hence 'endogenous' growth.

¹² For a critical typology see: Ron Martin and Peter Sunley (1998) 'Slow Convergence? The New Endogenous Growth Theory and Regional Development', *Economic Geography*, 74 (3), 201-227. For a textbook treatment see: Robert Barro and Xavier Sala-i-Martin, (2003) *Economic Growth*, Boston: MIT Press.

¹³ Martin, Ron and Peter Sunley (1998) 'Slow Convergence? The New Endogenous Growth Theory and Regional Development', *Economic Geography*, 74 (3), 201-227. Darren Acemoglu (2007) *An Introduction to Modern Economic Growth*, Available from www.mit.edu

¹⁴ David Warsh (2006) *Knowledge and the Growth of Nations: A Story of Economic Discovery*, London: Norton.

Early endogenous growth models saw improvements in technology as inevitable consequences of production¹⁵. The models have become more complex, with a spectrum of internal processes and resource allocation choices occurring in the internal workings of the model and leading to different growth outcomes¹⁶. Most models see technological change as resulting from the internal choices of resource allocation inside the model, with these allocations (how much to invest in R&D, for example) having important impacts on economic growth.

In an early formulation, Romer¹⁷ set out three propositions for growth: First, he asserted the importance of technological change to economic growth (it cannot just be accounted for by 'outside' factors), second, economic actors create technological change through conscious decisions about allocation of resources – and market incentives are important in ensuring public knowledge is commercialised into profitable uses, third, knowledge is subject to a fixed cost when it is converted into useful knowledge – firms have an incentive to spread this cost over a larger market.

Box A: A simple model of endogenous growth

A helpful illustrative model of endogenous growth is provided by Crafts (1996), who develops the Grossman-Helper endogenous growth model. His model of the economy has output being produced as a function of three inputs – capital, labour and 'design', where 'design' is an intermediate good (for the purposes of this paper, it might be considered 'knowledge').

Labour can be put to work either in production or design. If it goes into production, it suffers from diminishing returns. If it produces design it will have constant returns; as you increase the stock of designs for other people when you add to the total stock (there are spillovers). Growth is determined by the state of D – the stock of design in the economy.

But for there to be any incentive for firms to invest in design, they must make some rents (simply, by this we mean profits above what they would normally expect from putting the same amount of work in another form of economic activity). If firms did not make these rents, there would be no incentive to produce design. They therefore need some form of protection for their intellectual property, so they have an incentive to produce more. Importantly, in this case there may be gains on aggregate despite the private property rights of value: with property rights, there would be no point in investing in design so none would be produced, but having more design is beneficial for the economy as a whole (and 'design' might equally be called 'knowledge').

Cont..

¹⁵ Mark Roberts and Mark Setterfield (2007) 'Endogenous Regional Growth: A critical survey', *Cambridge Centre for Economic and Public Policy Working Papers*, WP0107.

¹⁶ Romer, Paul M. (1994) 'The Origins of Endogenous Growth', *Journal of Economic Perspectives*, 8 (1), 3-22.

¹⁷ Romer, Paul M. (1990) 'Endogenous Technical Change', *Journal of Political Economy*, 98 (5), s71-s102.

Cont..

There are two notable features of this simple model. First, as Crafts recognizes, it implies that larger markets will lead to more innovation (as design costs can be spread out over a larger market share). Second, it shows that the government can influence innovation. The social benefits of design and its potential under provision may justify subsidies for design, or can ensure a market structure exists which allows firms to invest in design. This provides a logic for policies including copyright and other intellectual property protection.

Endogenous growth, the knowledge economy and cities

How does the knowledge economy link with endogenous growth theory? Most obviously, they share a focus on 'knowledge' in various forms. For endogenous growth theory, the production of knowledge is the crucial ingredient of economic growth, with its importance due to the assumption of constant or increasing returns (it can be used by more than one person). As Romer¹⁸ puts it in the original paper: 'as results of trial and error, experimentation, refinement and scientific investigation, the instructions that we follow for combining raw materials have become vastly more sophisticated'. The production and sharing of knowledge creates more sophisticated recipes, and these recipes spur growth. In other words, the theory supports the idea that cities should increase employment in knowledge intensive sectors as this will improve their economy.

Romer's concept of 'instructions' also relates to the use and production of intangibles. The classic example is R&D spending, used in much empirical work on endogenous growth in part because it can be measured accurately. But there is no reason that a similar logic should not apply to a broader category of intangible investments, such as design, research into business practices and other knowledge or ideas¹⁹. Increasing the proportion of R&D in an economy is likely to generate economic returns on this basis.

How does this link to cities? In many studies, knowledge is originally assumed to be distributed evenly across space. But empirical evidence (discussed later) shows that knowledge is geographically limited, subject to diminishing returns from distance. This provides the evidence for knowledge spillovers, locally bounded exchanges of knowledge which make it profitable for firms to cluster together. Models can show that, if knowledge spillovers are locally bounded, they are likely to lead to clustering in one area. Martin and Ottaviano²⁰ present a technical model which shows that this can happen in some

¹⁸ Romer, Paul M. (1994) 'The Origins of Endogenous Growth', *Journal of Economic Perspectives*, 8 (1), 3-22, S72.

¹⁹ See: Michelle Mahdon, Katerina Rudiger, Ian Brinkley and David Coats (2007) 'What you get is not what you see: Intangible assets and the Knowledge Economy', *The Work Foundation*, London.

²⁰ Philippe Martin and Giovanni Ottaviano (1999) 'Growing Locations: Industry location in a model of Endogenous Growth', *European Economic Review*, 43 (2), 281-302.

industries, where spillovers are high enough to compensate for transport costs, ie it will apply to certain industries which rely on agglomeration but have relatively low transport costs. Moreover, the increasing returns which operate as part of the endogenous growth models can be interpreted in an urban context as traditional agglomeration economies, such as the need to be near to a large pool of specialised labour²¹.

But endogenous growth models also provide a curious explanation for **regional inequalities** important for policymakers to understand. Neo-classical models often predicted that the economy would move towards a rate of growth which was constant, with a steady state rate of growth dependent on technological progress and the size of the population, rather than technology. Endogenous growth models tend to predict 'conditional convergence' with the long term growth rates depending on factors such as national institutional structure, preferences and economic structure²².

Policy conclusions

Economic growth is a complex phenomenon, while endogenous growth models are simplifications of this complex reality. As such, it would be dangerous to draw policy conclusions from a single model, particularly given the well recognised limitations: 'some aspects of the models are less than convincing and it would be unfortunate if these were taken too seriously by policy-makers.'²³

The first general policy lesson from endogenous growth is that government, and so cities, can – with appropriate (or inappropriate) policies – affect the long run rate of growth by investing in knowledge and providing incentives to create knowledge. By adjusting the rate at which knowledge is produced, government can stimulate economic growth in the future.

The second lesson concerns how this is done, both at a national and local level. One way is to ensure that the producers of knowledge receive some benefits from its production, and have an incentive to produce more. This is achieved through a variety of intellectual property regulations, including copyright frameworks and patents. Another is to subsidise the production of knowledge, meaning that it becomes worthwhile for private actors to create additional knowledge, up to the point where the knowledge produced is equal to the social, rather than private, benefits of using it. The R&D tax credit is one example

²¹ Luisa Corrado, Ron Martin and Melvyn Weeks (2005) 'Identifying and Interpreting Regional Convergence Clusters across Europe', *The Economic Journal*, 115 (502), C133-C160.

²² Corrado, Martina and Weeks (2005) *ibid*

²³ Crafts, Nicholas (1996) 'Post-Neoclassical Endogenous Growth Theory: What are its policy implications', *Oxford Review of Economic Policy*, 12 (2), 30-47

of this type of policy. Alternatively, government may produce certain types of knowledge themselves, particularly basic research which may not be immediately turned into marketable projects and so produced by firms, or research on areas with social benefits which may otherwise not be profitable, such as in areas of pharmaceuticals or social science. This suggests that cities can benefit from their universities' research in the short and longer term.

The third is to create the social institutions and human capital which allow the creation and use of new knowledge. This might be through specific programmes which reduce the cost of the application of knowledge and failing to exploit technology transfer, for example investing in knowledge transfer programmes²⁴. The creation of human capital has been flagged as important since the early endogenous growth models, and remains an important function of growth models. In other words, cities need to invest in schools, FE colleges and universities to ensure their population are equipped with the skills the economy needs.

But finally, endogenous growth theory suggests that investments need to be made with a long timescale²⁵. In the financial markets in particular, this implies looking below short-term investment returns and towards the longer-term benefits of capital and knowledge accumulation. Where financial markets value only very quick returns on investment in knowledge, this can lead to a rate of economic growth which is lower than it should be. For cities that means having long term investment programmes in the institutions that help to create knowledge, in 'knowledge transfer' programmes and in the partnerships between universities, businesses and local areas to ensure that they all benefit from the creation and development of knowledge.

²⁴ Crafts (1996) *ibid.*

²⁵ Crafts (1996) *ibid.*

5. The new economic geography

The second theory of relevance to policymakers thinking about economic development and cities is the new economic geography. The theory of new economic geography is set out here, as well as its implications for cities.

Why places matter to the Treasury

One of the reasons that places may not have necessarily featured highly in Treasury policies in the past are that traditional economic models tend to ignore places. In trade models, for example, countries are envisaged as two abstract wholes, and ignore disparities and the production of differential growth. The two classic trade models, Heckscher-Ohlin and Ricardian, focus on factor endowments (natural resources or disparities in the amount of labour they have) and technology to explain disparities between cities, regions and countries. They tend to ignore the preferences of firms and the pressures pushing companies to co-locate.

New economic geography models show the processes which may lead to the spatial concentration or dispersal of economic activity. While some of these processes were well understood already, the main contribution of new economic geography has been to formally model them and explain how location patterns arise from the decisions of individual economic actors²⁶. The genre's figurehead is Paul Krugman, but other significant contributors include the economists Masahito Fujita and Tony Venables.

The central tenet of these models is the tension between centripetal forces, which will tend to cause economic activity to agglomerate (or cluster), and centrifugal forces which will tend to make it disperse²⁷. The centripetal forces tend to be backward and forward linkages between firms and suppliers or firms and the market (and are so similar to the Marshall's external economies of scale), but apply in some cases to knowledge spillovers where companies want to be close together to exchange knowledge. The centrifugal forces may include the location of fixed resources such as minerals or the cost of land.

Box B on the next page shows a stylised set of these factors. Centripetal forces, which draw economic activity to locate in the same area include access to a large market for finished products and specialised suppliers (linkages), a wide and deep labour market (particularly important for specialised industries) and knowledge spillovers. The centrifugal forces, which cause economic activity to disperse, include the fact that some

²⁶ Ottaviano, Giovanni and Diego Puga (1999) 'Agglomeration in the Global Economy: A survey of the "New Economic Geography"', *The World Economy*, 21 (6), 707-731.

²⁷ Paul Krugman (1998) 'What's New about the New Economic Geography', *Oxford Review of Economic Policy*, 14, 7-17

Box B: Factors affecting geographical concentration

Centripetal Forces (Leading to agglomeration)

- Market size effects (linkages)
- Thick labour markets
- Pure external economies (knowledge spillovers)

Centrifugal Forces (Leading to dispersion)

- Immobile factors (eg minerals)
- Land rents
- Pure external diseconomies

Transport Costs (Altering the balance)

- Distance
- Trade barriers
- Nature of good
- Mobility of factors of production
- Transport technology

Sources: Adapted from Krugman, 1998 and Brakman et al 2004

factors such as natural resources cannot be moved (such as coal, which has to be mined in a particular location) the greater cost of land where density and so demand is higher.

New economic geography models provide a reasonable explanation for situations like the so-called 'North/South divide': the historical persistence of spatial patterns of economic activity, meaning that places that have always been successful tend to attract more firms. New economic geography sometimes provides a clever way of explaining why cities continue on the same path – path dependence – through cumulative events that continue to reinforce them on this path. While these factors were all reasonably well known and (often) obvious, they weren't considered before for obscure technical reasons²⁸.

²⁸ In short, they are a) Dixit Stiglitz monopolistic models: where firms have a monopoly on their own product, but other partial substitutes can be produced freely by other firms who can enter the market at will. This ensures there are no monopoly profits, but allows an economy in which increasing returns operate.) Iceberg Transport Costs: Rather than including a 'transport industry' which would be onerous to model, the iceberg technique assumes part of the good in question is lost as distance is travelled. These assumptions simplify the models but do not force the modeller to resort to anything approaching realism.

**Why London
is doing
well and
Sunderland
still struggles**

Krugman²⁹ presents a simple, non-mathematical model which illustrates the new economic geography and helps to explain what is happening to different cities in the UK. He starts with two locations – core and periphery – in a situation with no movement of factors of production, so people or physical capital cannot move from one place to another. First, he deals with the ‘home market’ effect. That is, if core and periphery were identical in all other respects, and the good in question becomes cheaper as you produce more (has increasing returns to scale). With trade between the two areas, production may be concentrated in one region, as with certain levels of transport costs it will be cheaper to ship goods from the big home market to the peripheral regions. Goods will, of course, be slightly cheaper in the home market, as there will be no need to pay transport costs; meanwhile, workers will want jobs.

Then he makes the assumption that the workers are mobile – they can choose to move from one place to another. This changes the effect of the home market because workers are also consumers – as workers move so does the size of the market. With this case there is a possibility that all workers will move to get the cheaper goods – in doing so they will tend to cluster in one location. While this story is simple and generalisable (and there are circumstances which may not hold), it has the virtue of demonstrating how: ‘a small asymmetry between locations, perhaps arising from some small chance event, will prove self-reinforcing’³⁰. Importantly, however, this model only works with a few caveats – in particular that there is no congestion and that production is not reliant on immobile resource, such as land or minerals.

Of course, whether the concentration of production actually occurs depends on the centripetal and centrifugal force and how they shape up against each other (transport costs are important in mitigating the migration decision: this explains why Leeds City Region and others are campaigning so hard for a tram). In Krugman’s demonstration model this is the firms and the workers – what matters is how much workers benefit from being near production, and how much firms gain from being near the worker-consumers. In the real world, this is about city regions and the inter-relationships between different local authorities in a functional economy. It supports the idea that there are urban hierarchies but also that there are complementary relationships of different types that can happen between cities.

²⁹ Paul Krugman (2000) ‘Where in the World is the New Economic Geography?’ in Gordon Clark, Maryann P Feldman and Meric S. Gertler (eds.) *The Oxford Handbook of Economic Geography*, Oxford: Oxford University Press, 40-60.

³⁰ Krugman (2000) *ibid*, 53

Explaining the New York success story

To illustrate what the model means further, it is worth looking at the classic example of urban success explained through new economic geography processes: New York City. The question being why New York's economic success was sustained where alternative cities proved less successful?

Glaeser³¹ provides a detailed case for why the city retained its advantages. The city was founded with an island location which made the site fortifiable and gave access to the sea trade. The port, which was to be the catalyst for future success, was established. The geography of the port (deep and sheltered by an island location), was beneficial as it was further south (and so nearer to the middle of the US) than others.

New ship technology lowered transport costs. Ships on the cross-Atlantic trade became larger, benefiting from economies of scale (fewer staff being needed). They docked only at a single, central and deep port in the US, New York vying with New Orleans. New York became the centre for a hub-and-spoke system of transport with the resulting increase in density. In addition, New York became a centre of immigration, with a relatively open culture and processes of chain-migration directed at it.

But the port also had subsidiary benefits. Nascent finance and banking industries developed to facilitate trade, while the advantages of being the centre for new information from Europe spawned other industries (Glaeser uses the example of the publishing industry, initially copying British books as they arrived on boats). These benefits have continued with New York, 'now sustained by the advantages conveyed by an existing agglomeration to certain industries, notably finance and communication'³²

New York's present success can then be seen as an accident of history, due to these historical advantages. New Economic Geography models show this as an accident of history, one of several possible outcomes: 'if somehow Philadelphia rather than New York had become established as the centre of the financial industry in 1860, that leadership would be just as self-sustaining today as the one we actually see. It may seem obvious that this means that history determines which of many possible structures actually emerges.'³³

³¹ Edward Glaeser (2005) 'Urban Colossus: Why is New York America's largest city?' *Harvard Economics Working Papers*

³² Paul Krugman (2000) 'Where in the World is the New Economic Geography?' in Gordon Clark, Maryann P Feldman and Meric S. Gertler (eds.) *The Oxford Handbook of Economic Geography*, Oxford: Oxford University Press: 50.

³³ Krugman (2000) *ibid*: 52.

**Lessons for
policymakers
from new
economic
geography**

Some lessons for policymakers can be taken from these models.

First, and in common with endogenous growth, the models use the concept of constant or increasing returns to scale. In other words, cities that have existing or emerging clusters of firms can be attractive places for similar firms to locate, and there is an argument for cities 'building on what's there' in order to develop these economically beneficial clusters.

Examples of this might include London's focus on financial services or the way it has developed creative industries where firms are small but more productive if they locate near other firms. These industries may operate in a cluster at the scale of the city (financial services in Norwich being one example).

Second, chance historical circumstances have longer term impacts through the process of cumulative events: agglomeration economies or home-market effects are self-reinforcing. Once the critical mass is achieved in one place, it becomes harder for other places to catch up. This process has occurred in New York but also in other cities such as London's financial services, which saw the development of: 'specialised functions developed around London's role as a hub of an empire and a worldwide shipping network'³⁴, from which the City developed. Similar examples might include the silting up of the River Dee shifting trade to Liverpool from Chester. What this suggests is that there is an urban hierarchy: areas that are accessible to a lot of people because of good transport links or agglomeration will be attractive to labour and to firms, and this is one reason why large cities may be able to contribute more to the economy. Nonetheless nearby cities may be able to benefit from these 'agglomerations' and should seek to understand what their role in the functional economy is and how they can make the most of their history and of their existing assets.

Third, the models generally predict stability of the economic geography, but they can also predict sudden shifts in economic geography (an outcome which rarely occurs). Gradual or rapid changes in transport costs or technology can shift economic geography. A gradual reduction in transport costs may lead to initially nothing, but then relatively rapid changes in the distribution of economic activity. In short, there are tipping points and this supports some of the arguments being made by places like Leeds, Birmingham and Manchester for greater investment in transport. However, new economic geography

³⁴ Thompson, P. (1997) 'The Pyrrhic victory of Gentlemanly Capitalism: The Financial Elite of the City of London, 1945-90', *Journal of Contemporary History*, 32 (3), 283-304.

does not predict one specific outcome, it suggests that the resulting outcome may be self-sustaining.

Fourth, with decreases in trade costs there will be a tendency to agglomerate³⁵. As transport costs are lower, the balance between the forces of agglomeration (such as access to pools of highly skilled labour) will tip, leading to a greater tendency for firms to cluster (as they will no longer have to locate near markets). This is somewhat paradoxical and contradicts much of the current thinking which suggests that economic activity will disperse to take advantage of the cheapest locations. New economic geography suggests that – for certain industries – the benefits from locating in the same place may outweigh the costs. This agglomeration will be shown up in economic activity through increased functional specialisation of cities and regional economies – and this could have both good (it will be more efficient) and bad (as it may lead to disparities) consequences. If this is the reality, policymakers need to consider how to encourage cities to build on their assets but also how to reduce trade costs or make other shifts necessary to make themselves more attractive locations in which firms can cluster.

The limitations of the new economic geography

New economic geography is important because it demonstrates clearly how ‘historical accident can shape economic geography’³⁶ and this matters to policymakers because it helps to explain why some cities are doing better than others. The brief analysis here is, however, a sketchy simplification. And new economic geography itself is a gross simplification of a multifaceted reality, filled – in Krugman’s own words – with: ‘strategic simplifications, which only an economist could love’³⁷.

There is also a growing fuzziness between the boundary of these theories and other economics, with papers being conducted linking new economic geography models with, for example, endogenous growth models³⁸. The theories are sketchy about spatial scale, although some suggest that they are most relevant for areas of around 100km across, or the area of NUTS2 regions³⁹. These models are notably quiet on issues of geographical

³⁵ Keith Head and Thierry Mayer (2003) ‘The Empirics of Agglomeration and Trade’, in Paul Vernon Henderson and J. F. Thisse (eds.) *Handbook of Urban and Regional Economics*, 4, Amsterdam: North Holland.

³⁶ Paul Krugman (1988) ‘What’s new about the new economic geography’, *Oxford Review of Economic Policy*, 14 (2), 7-17, 7.

³⁷ Paul Krugman, cited in Masahita Fujita and Paul Krugman (2004) ‘The New Economic Geography: Past, present and the future’, *Papers in Regional Science*, 83, 139-164.

³⁸ Ron Martin and Gianmarco Ottaviano (1999) ‘Growing Locations: Industry location in a model of Endogenous Growth’, *European Economic Review*, 43 (2), 281-302.

³⁹ Steve Brakam, Harry Garretsen, Joeri Gorter, Albert van der Horst and Marc Schramm (2004) ‘The New Economic Geography, Empirics and Regional Policy’, *University of Groningen Working Paper*.

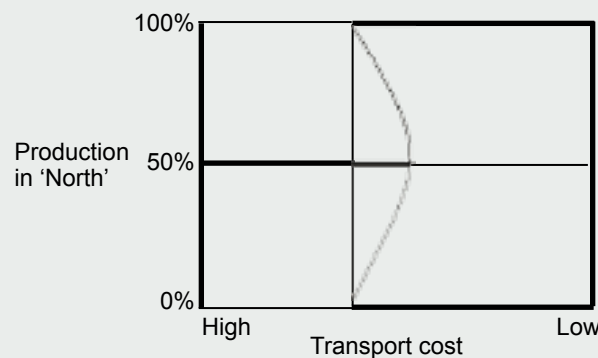
Box C – Transport costs and industrial location – why economic activity may cluster

Krugman (1991) demonstrates a model of industrial location which can be used to explain economic concentration.

The model begins with one industry and two regions – ‘North’ and ‘South’ – which are identical in any region. The industry is happy to locate anywhere and only wants to minimise transport costs. It is – crucially – subject to agglomeration economies, which will cause the industry to locate in a single place.

A simple diagram plots this position. On the upward axis is the proportion of industry which is located in the ‘North’. On the horizontal are transport costs. These might be political and trade costs or the price of shipping a good from one place to another.

Start with high transport costs. To minimise transport costs, production is split between the regions – 50% is located in ‘North’. As the price of transport falls, this situation initially stays the same until the point where transport costs are equal to the agglomeration benefits. At this point, industry could locate quite happily in either region. At first, it does not however – the situation is in balance, but it is not stable as the movement of a single firm would tip the balance; the agglomeration economies in either region would be enough to cause a shift of all firms to that region. When transport costs fall slightly more, industry will locate in either region – it doesn’t matter which one.



One way this might happen is falling transport costs. As these continue to fall, there become a point where for a firm will locate in either region.

Once industries are located in either region, they will continue to be located there unless transport costs rise again – the agglomeration economies will set them in place.

What does this tell us about cities? First, it illustrates path dependence, as firms will not move to another region an initial advantage of some sort can have long term implications. Second, it illustrates the changing pattern of trade with resulting falls in transport costs (this has implications for European integration as well as new infrastructure projects). Finally, it shows that in some circumstances a limited change can lead to a profound change.

clustering or agglomeration within a region – it happens within cities, but also across cities⁴⁰

Some critics have taken issue at the abstractness of many of the models, which are more reliant on abstract models of place than real world observations. Meanwhile others have disagreed with the prominence and – perceived – arrogance of Krugman himself (he left himself open to criticism with a chapter entitled ‘History of the World: Part I’). The lack of clear, accessible real world examples sometimes leads to problems. Meanwhile, as a relatively young field, new economic geography is still relatively undeveloped empirically. It should probably be seen more as an aid to understanding general changes than as a cut-and-dried recipe for success. The policy lessons remain valid but should not constitute the basis for policies at a city level on their own.

⁴⁰ Fujita, Masahita and Paul Krugman (2004) ‘The New Economic Geography: Past, present and the future’, *Papers in Regional Science*, 83, 139-164

6. Drivers of urban growth

A more accessible way of understanding the lessons for policymakers from the academic literature is pulling together the range of drivers of economic growth derived from both endogenous growth theory and new economic geography, which apply at the level of the city. These drivers differ, to some extent at least, from those highlighted in work which looks at a national scale – they tend to focus on the influence of factors which can be measured at a local scale. This section focuses on the lessons for cities – and the limits of these lessons based on the current literature.

**Understand
Agglomeration:
Large and
medium-sized
cities**

Numerous studies have tested the hypothesis that agglomeration (or density) is good for growth. Fingleton and McCombie⁴¹ find increasing returns to scale in manufacturing plants located near other manufacturing plants for EU regions. One Canadian study showed that proximity of one city to another is a key predictor of growth, although it was not clear whether this was due to population density or the absolute size of the city⁴². In the US, population growth over the 1990s was greatest in those cities which were most dense to begin with⁴³. What this means is that large cities can often be more successful, but that making the most of proximity to other places is a real opportunity for cities of all sizes.

Agglomeration also suggests that different size cities may be more or less attractive for different firms or people. Some studies have used information about the existing location of many industries to review this in the US. Manufacturing prefers to be in 'medium density' cities as they will require workers (and so some density) but will have no need for the densest locations, which offer access to customers but are expensive⁴⁴. Work by Vernon Henderson⁴⁵ makes similar predictions, suggesting that large cities tend to be specialised in service industries (such as finance, banking and insurance and real estate), but have less employment in manufacturing (which presumably benefits least from agglomeration economies). Meanwhile, medium sized cities tend to specialise in mature industries (such as Textiles, food and pulp) but less in newer industries such as electronics, which presumably gain benefits from scale and agglomeration.

Agglomeration does not always explain economic success but this theory does provide important insights for policymakers looking at the potential complementary roles

⁴¹ Ben Fingleton and John McCombie (1999) 'Increasing returns and economic growth: some evidence for manufacturing from the European Unions regions', *Oxford Economic Papers*, 51 (3), 574-75

⁴² Partridge, Mark M. Rose Olfert and Alessandro Alasia (2007) 'Canadian Cities as Regional Engines of Growth: Agglomeration and Amenities', *Canadian Journal of Economics*, 40 (1), 39-68

⁴³ Glaeser, Edward L. and Janet E. Kohlhase (2003) 'Cities, Regions and the Decline of Transport Costs', *HIER Discussion Paper No. 2014*

⁴⁴ Glaeser and Kohlhase (2003) *ibid*

⁴⁵ Vernon Henderson (1997) 'Medium sized cities', *Regional Science and Urban Economics*, 27 (6), 583-612

of different size cities to consider. It may also help to explain some of the regional inequalities: in Europe, there is evidence that, for example, income inequality in Norway is increasingly due to differences in the level of agglomeration rather than local workforce skills⁴⁶.

Encourage 'Knowledge spillovers'

There is growing evidence about 'knowledge spillovers' happening in local areas, that suggests that places should seek to understand more about these processes in order to benefit economically from there. These theories are based on the fact that there were substantial flaws with traditional models of business innovation. While industry-level explanations for innovation were seen as successful, those which tried to predict innovation at the level of the firm were considerably less successful. This hinted at the need to put the firms into context, viewing some of the processes behind innovation as external to the firm but internal to the place where the firm was located⁴⁷. This led to some highly successful modelling of territorial innovation.

While knowledge spillovers are a useful concept, and few deny their existence absolutely, they remain somewhat controversial. They are a relatively amorphous object of study for economists, who are normally preoccupied with formal modelling of 'concrete' subjects which can be measured discretely (money, or – as in the previous model – R&D spending). It is unsurprising that the introduction of knowledge spillovers into models has caused some disquiet⁴⁸.

However, studies have found considerable evidence for spillovers over local areas. Jaffe, Trajtenberg and Henderson's study⁴⁹ showed that patent applications which cite a University patent tend to be clustered around the academic institution which issued them. More recently work has challenged some of these ideas for the principal reason that they use older data which fails to reflect the impact of the internet. Griffiths, Lee and Van Reenen⁵⁰ show that the localisation effect for patent citations (on a national scale) fell between 1975 and 1999. This implies that scientific collaboration may be happening increasingly on an international scale, as the effect of the internet feeds through into the data.

⁴⁶ Karen Helene Midelfart (2004) 'Does Agglomeration Explain Regional Income Inequalities?' *BORA Working Paper*, 40

⁴⁷ David B. Audretsch and Maryann P. Feldman (2003) 'Knowledge Spillovers and the Geography of Innovation', in *Handbook of Urban and Regional Economics*, Volume 4

⁴⁸ Stefano Breschi and Francesco Lissoni (2001) 'Knowledge spillovers and local innovation systems: A critical survey', *Industrial and Corporate Change*, 10 (4), 975-1005

⁴⁹ Jaffe, Adam B. Manuel Trajtenberg and Rebecca Henderson (1993) 'Geographic Localisation of Knowledge Spillovers as Evidenced by Patent Citations', *The Quarterly Journal of Economics*, 108 (3), 577-598

⁵⁰ Rachel Griffiths, Sokbae Lee and John Van Reenen (2007) "Is distance dying at last? Falling home bias in fixed effects models of patent citations", NBER Working Paper W13338

Innovation is the product of a function of dependent variables. These dependent variables normally include skilled labour, research and development spending and high-tech industries. A recent study with a US/EU comparative perspective estimated that innovative regions tend to have a R&D investment, economic density (a measure of GDP and population density), specialisation and human capital. There is also the possibility of spillover effects between regions⁵¹, although more work needs to be done on this.

This is not just a science-based phenomenon. While patent knowledge spillovers will tend to be relevant for manufacturing or technology employment, there is some evidence of a 'positive association between business service employment and local academic knowledge spillovers as well'⁵². In other words, cities should not assume that science and technology are the only forms of knowledge that matter – all knowledge intensive industries can make a contribution to their economy.

There is evidence that knowledge spillovers need to reach a tipping point, or critical mass, before having a substantial impact on innovation. For cities without this critical mass, knowledge spillovers may not have a particularly important impact. Instead they may need a strategy which links academia with high technology businesses, business services and small firms⁵³.

Policy levers: Agglomeration and knowledge spillovers are processes; they are not direct policy levers. They can be encouraged but there is no easy way to make them happen. However, a cluster of policy interventions map onto these processes, with one aim of helping them to function.

Transport, R&D, universities and industrial mix

Transport and Infrastructure

The evidence on transport costs is mixed, with the common point about transport infrastructure being that roads run both ways and so transport improvements can, in the short run at least, have both positive and negative impacts.

Most papers take the long run view, assuming that transport costs are bad for growth and so transport improvements are unambiguously good. The magnitude of improvements

⁵¹ Ricardo Crescenzi, Andres Rodríguez-Pose and Michael Storper (2007) 'The territorial dynamics of innovation: a Europe – United States comparative analysis', *Journal of Economic Geography*, 7 (6), 673-709.

⁵² Attila Varga (1998) 'Local Academic Knowledge Spillovers and the Concentration of Economic Activity', *Journal of Regional Science*, 40.2, 289-309.

⁵³ Varga (1998) *ibid*

can sometimes be surprisingly large. In a study of Brazilian cities, Da Mata et al.⁵⁴ find that a reduction of one standard deviation in the cost of transport between two cities is associated with an increase in income per worker of over 3%. The fall in transport costs leads to an effective increase in the number of people in an area, effectively increasing agglomeration.

The decline in transport costs has also been shown to be responsible for increases in the growth performance of cities during the industrial revolution: one study finds that commuting patterns, facilitated by railways and trams, and was responsible in the early 20th century for raising wages in urban areas by 14% alongside an increase in GDP of 8% in England and Wales. However, a more recent study focusing on transport investment in Leeds showed that much current transport policy fails to account for the full benefits of transport investment⁵⁵. This suggests that local policymakers campaigning for improved transport can draw on this academic theory as well as more localised arguments to support their case.

R&D and Innovation

Endogenous growth theory emphasises the role of the creation of new knowledge in economic growth. This leads directly to policies which address perceived under provision of research and development (R&D) through market failures. The standard argument for R&D is relatively linear, with R&D investment leading to innovation either through the creation of new products or services (horizontal innovation) or the improvement of existing ones (vertical innovation).

Most models of the impact of research and development on economic growth tend to use 'R&D investment' as an input. But other studies have shown that R&D is not the only important input in the innovation process, that the organisational context alters significantly the success of these investments, and that in some highly innovative and creative sectors R&D may not be an appropriate measure at all. Some academics have gone so far as to argue that the importance of R&D in policymaking and academia is due in large part to the easy availability of statistics⁵⁶.

⁵⁴ Daniel Da Mata, Uwe Deichmann, J. Vernon Henderson, Somik V. Lall and Hyoung G Wang (2007) 'Determinants of City Growth in Brazil', *Journal of Urban Economics*, 62 (2), 252-272.

⁵⁵ Adam Marshall and Chris Webber (2007) The Case for Better Transport Investment: Agglomeration and growth in the Leeds City Region, Centre for Cities, www.centreforcities.org

⁵⁶ Benoit Godin (2006) 'The Knowledge-Based Economy: Conceptual Framework or Buzzword', *Journal of Technology Transfer*, 31, 17-30

What cities should be aware of is first, that where evidence exists, it shows that cities with higher proportions of R&D tend to grow faster. Magrini⁵⁷ studies Functional Urban Regions – approximations of city-regions – across the EU over the period 1979-1990. Significantly for endogenous growth, he finds that R&D has a vital role in economic growth in his FURs. Cities with R&D employment use human capital better, and produce more innovative economic outputs. Wages are therefore higher as the returns to human capital are better (you can make more of your skills). This suggests that it is still important for national policymakers to enable cities to invest in research and development.

Second, there is evidence of knowledge spillovers: FURS located within two hours of travel time to other research intensive activities are more likely to grow faster. These are an externality, with firms gaining from proximity to similar R&D activity. This suggests that cities should be thinking about potential complementary relationships to both grow their knowledge intensive sectors and their economies.

Third, in the context of European integration, with the increased specialisation of European industries, city policymakers should be aware that these processes could lead to inequality: if the highly productive sectors specialise over space, research and development may lead to growth in some areas but not others.

Invest in Higher education

The university has become almost as much part of policy discussion around growth as R&D. And many of the 'classic' examples of urban economic growth have a university prominent in their story. Silicon Valley and Stanford is one example, as is the Cambridge phenomenon in the UK. Universities have both direct and indirect impacts on knowledge creation⁵⁸: direct, through R&D and the creation of knowledge, and indirect through the creation of human capital in the form of graduates and post-graduates.

It is reassuring, given the emphasis put on university research that evidence suggests it is important. Spatial econometric studies reveal a significant association between university research and high-tech innovation in cities⁵⁹. However, there are many examples of university cities which have been less successful in driving growth, and the extent of any 'knowledge spillovers' is dependent on a range of other factors including the existence

⁵⁷ Stefano Magrini (1998) 'The Determinants of Regional Growth: An Empirical Analysis', Paper Presented to the 38th Congress of the European Regional Science Association. Available from www.ersa.org

⁵⁸ Magrini (1998) *ibid*

⁵⁹ Luc Anselin, Attila Varga and Zoltan Acs (1997) 'Local Geographical Spillovers between University Research and High Technology Innovations', *Journal of Urban Economics*, 42 (3), 422-448

or extent of an entrepreneurial university culture and the availability of venture capital⁶⁰. This implies that the growth effect of a university is about more than just the having one: a host of other factors relating to the activities of the university are important⁶¹. For cities, working in partnership with universities to identify mutually beneficial projects is likely to be vital, as is seeking to create opportunities for knowledge transfer between businesses and universities. National policy should also consider how it could create more incentives for universities to think about places as well as place-free research.

Specialisation and diversity

One question that cities developing economic strategies need to consider is whether specialised or diverse industrial structures are more likely to stimulate this sort of innovation flow: do firms gain spillovers from similar firms, or firms which are very different? There are two common ways of looking at this⁶².

1. **Jacobs Externalities.** Jane Jacobs famously argued that complementary exchange required diversity, with different sectors exchanging information and the most beneficial exchanges being those from other sectors. Cities with diverse economic structures would be expected to innovate more quickly and grow faster.
2. **Marshall-Arrow-Romer Externalities (MAR).** The second argument is for the localisation effect of the concentration of a particular industry. This is closely related to theory around monopoly – with monopolistic organisations being likely to accrue all the gains from these localised spillovers, and so being more likely to invest in innovation. This theory predicts that specialised or similar economic structures will be more likely to be innovative.

There has been a flourishing empirical literature testing these theories for a range of circumstances. Feldman and Audretsch⁶³ find that specialisation is associated with lower rates of innovation; a relatively more diverse industrial base is more innovative. Glaeser⁶⁴ supports this, using a study of employment growth in 170 US cities between

⁶⁰ Attila Varga (1998) 'Local Academic Knowledge Spillovers and the Concentration of Economic Activity', *Journal of Regional Science*, 40.2, 289-309

⁶¹ See Laura Williams and Natalie Turner (2008 forthcoming) *HE and FE in the Knowledge Economy*, from www.theworkfoundation.com

⁶² Edward Glaeser, Hedi Kallal, Jose Sheinkman and Andrei Shieifer (1992) 'Growth in Cities', *Journal of Political Economy*, 109 (62), 1126-1152. Maryann Feldman David Audretsch (1999) 'Innovation in cities: Science based diversity, specialisation and localized competition', *European Economic Review*, 43 (2), 409-429.

⁶³ Feldman and Audretsch (1999) *ibid.*

⁶⁴ Edward Glaeser, Hedi Kallal, Jose Sheinkman and Andrei Shieifer (1992) 'Growth in Cities', *Journal of Political Economy*, 109 (62), 1126-1152.

1956 and 1987 to find that a diverse industrial structure, rather than one specialised in a few sectors, is important for employment growth. European evidence is more ambiguous, however. For example, one study of Italian labour market areas suggests that neither diversity nor specialisation has any significant impact on productivity⁶⁵. So while there is some tentative evidence for the economic impact of diversity, the evidence is far from clear – not helpful for cities but suggesting that it will vary according to the distinctive characteristics of that city's economy.

**Social factors
and economic
growth**

The third area of research is the social. This has proved a popular if relatively new form of study often linked strongly to theory around endogenous growth theory, if rarely explicitly testing an endogenous growth model. Again, it has implications for city policymakers when they make decisions about areas in which to invest for economic development.

Invest in human capital

There is clear evidence that investing in 'human capital' benefits cities – and that cities do not need to be large to benefit. Capital is normally included as the average level of human capital in a population⁶⁶. It is not normally seen in itself as being necessary to have a population of a certain size and of a similar level of capital, a finding with good implications for small cities with highly educated populations such as Cambridge⁶⁷.

The first effect of human capital is on increasing productivity and growth. This may extend beyond the effect of the individual doing their job. Early work looking at US cities found that levels of productivity were higher in cities with higher levels of human capital, and that this remained so even when accounting for the human capital of the population, indicating spillovers⁶⁸. In more recent work on European cities, Cheshire and Magrini⁶⁹ showed that populations with high levels of human capital grew faster.

The second effect of human capital is to allow cities to adapt to economic change⁷⁰. This process of adaptability hints at a new economic geography explanation, in that cities

⁶⁵ Federico Cingano and Fabiano Schivardi (2004) 'Identifying the Sources of Local Productivity Growth', *Journal of the European Economic Association*, 2 (4), 720-742.

⁶⁶ Robert Lucas (1988) 'On the Mechanisms of Economic Development', *Journal of Monetary Economics*, 22 (1), 3-42

⁶⁷ Mark Roberts and Mark Setterfield (2007) 'Endogenous Regional Growth: A critical survey', *Cambridge Centre for Economic and Public Policy Working Papers*, WP0107

⁶⁸ James E. Rauch (1993) 'Productivity gains from the geographic concentration of human capital: Evidence from the cities', *Journal of Urban Economics*, 34, 380-400

⁶⁹ Paul Cheshire and Stefano Magrini (2000) 'Endogenous Processes in European Regional Growth: Convergence and Policy', *Growth and Change*, 31 (4), 455-479

⁷⁰ Ed Glaeser and Albert Saiz (2003) 'The rise of the skilled city', *NBER Working Paper No. 10191*.

with relatively high levels of education are better at adapting to external shocks. It may also reflect an endogenous growth explanation, in that cities are more able to make use of technology if their population is highly educated. Glaeser and Saiz⁷¹ in a study of US cities, find that cities with a more educated population have grown faster than other cities.

Third, there is evidence that human capital attracts further human capital (a cumulative causation, or new economic geography explanation). There is also significant evidence of clustering of human capital. Lucas⁷² argued that populations with high levels of human capital tended to move to be with other people with high levels of human capital. Berry and Glaeser⁷³ show that US cities that were well-educated in 1970 tended to extend their lead, with an even greater proportion of their population being well educated in 2000 than would be expected. They explain this through entrepreneurship, as the well educated are likely to develop firms which employed the well educated. In other words, cities can create a self reinforcing effect if they can retain highly skilled workers.

Fourth, there is some evidence that the labour market effects predicted by Marshall – which suggests that the highly skilled prefer to live in cities – can be seen. Glaeser and Mare⁷⁴ show US evidence that the existence of cities allows people to invest in specialised human capital, in the belief that there is a sizeable enough market for it.

Build social capital

The gradual re-introduction of social factors into economic growth has been synonymous with the amorphous concept of social capital. This is not directly related to either new economic geography or endogenous growth theory, but is included here as it has been integrated into some models of growth and is a key issue of concern for city policymakers.

The concept was pushed by Putnam as part of a neat but controversial series of papers in which he argued that the advent of television had been responsible for the decline in membership of associations in the United States⁷⁵ and in arguments about the economic success of Italian regions. Putnam defines social capital as: 'features of social organization, such as networks, norms and trust that facilitate action and cooperation

⁷¹ Glaeser and Saiz (2003) *ibid*

⁷² Robert Lucas (1988) 'On the Mechanisms of Economic Development', *Journal of Monetary Economics*, 22 (1), 3-42.

⁷³ Christopher R. Berry and Ed Glaeser (2005) 'The divergence of human capital levels across cities', *Papers in Regional Science*, 84 (3), 407-444

⁷⁴ Ed Glaeser and David Mare (2001) 'Cities and Skills', *NBER Working Paper 4728*

⁷⁵ Robert Putnam (1995) 'Tuning In, Tuning Out: The Strange Disappearance of Social Capital in America', *PS: Political Science and Politics*, 28 (4), 664-683

for mutual benefit'⁷⁶. This definition contains three general ideas, the feeling of trust, social norms for cooperation and the civic network⁷⁷. This controversial work created as close to academic excitement as is possible, and opened 'Pandora's box of research'⁷⁸. Economists saw the introduction of a social element to their papers as an answer to the void in their models marked 'society'; sociologists saw the introduction of a blunt quantitative variable labelled 'society' even more offensive than when it was simply ignored.

A variety of papers looked at the role of social capital in economic growth⁷⁹. But despite the excitement, the results of these studies are mixed. Most studies looked at countries. One with some definite conclusions is Whiteley⁸⁰ who uses a neo-classical (rather than endogenous) growth model for 34 developed countries. He finds an important impact, with: 'the influence of social capital on growth appears to be at least as strong as the influence of human capital or education, which is the focus of much of the recent research on endogenous growth theory'. In one of the earliest empirical studies Knack and Keefer⁸¹ found no relationship between voluntary activity and economic performance, but they did conclude that trust is correlated with economic performance – presumably because it reduces the need for formal arbitration in transactions, and so reduces the cost of doing business.

For cities it is worth being aware of the work that has also taken place at sub-national levels. Casey⁸² looks for correlations between economic growth and social capital in UK regions. He uses measures of civic engagement including electoral turnout participation in voluntary and community groups, and – more curiously – newspaper readership. Civic organisations and trust in regions are associated with growth but newspaper readership is not. A study of 54 European regions by Beugelsdijk and Van Schaik⁸³ shows evidence that growth is associated with membership or associational activity, but no link between trust and growth. Other studies have argued that social capital, while relevant, is not as

⁷⁶ Robert Putnam (1993) 'The Prosperous Community: Social Capital and Public Life', *American Prospect*, 167

⁷⁷ Philip Whiteley (2004) 'Economic Growth and Social Capital', *Political Studies*, 48, 443-446.

⁷⁸ Casey, T. (2004) 'Social Capital and Regional Economies in Britain', *Political Studies*, 52, 96-117

⁷⁹ Typically they used the European Values Survey, only asking part of what Putnam referred to: Generally speaking, would you say that most people can be trusted, or that you cannot be too careful in dealing with people?

⁸⁰ Whiteley, P. F. (2004) "Economic Growth and Social Capital", *Political Studies*, 48, 443-446

⁸¹ Stephen Knack and Philip Keefer (1997) 'Does social capital have an economic payoff? A cross-country investigation', *Quarterly Journal of Economics*, 112 (4), 1251-1288

⁸² Terrence Casey (2004) 'Social Capital and Regional Economies in Britain', *Political Studies*, 52, 96-117

⁸³ Sjoerd Beugeldijk and Ton van Schaik (2005) 'Social Capital and Growth in European Regions: An empirical test', *European Journal of Political Economy*, 21, 301-324

important as other factors in determining growth – but for most cities this is unlikely to be a reason to ignore the issue, given the disparities between certain communities and its importance for reasons other than simply economic growth⁸⁴.

⁸⁴ Gerald Schneider, Thomas Plumper and Steffen Baumann (2000) 'Bringing Putnam to the European Regions', *European Urban and Regional Studies*, 7 (4) 307-317

7. Conclusions

So what are the drivers of growth apparent in this literature and most useful for policymakers?

First, agglomeration – proximity to other economic agents can lead to growth. Importantly, this only applies to certain sectors. The impact of proximity only applies in some helpful circumstances, and different types of city are helpful for different types of firms. For cities, this suggests they need to understand their particular circumstances and to ‘build on what’s there’ in order to make the most of their assets.

Second, human capital, which makes cities more likely to grow, is more robust against change and more likely to attract other highly skilled people. This should make it a priority area for investment from a national, regional and local perspective, both in terms of raising the skills of the future workforce and, building on the Leitch Review, increasing the skill levels of those already in work.

Third, some universities have proven important, but there has been little empirical work to assess their importance at an aggregate level, except through university R&D and their role in the creation of human capital. This suggests this is a vital area for further work: something The Work Foundation is pursuing.

But most importantly, the ‘knowledge spillovers’ are apparently vital for urban success, although the literature on this point remains abstract and with little regard for the actual methods of transmission. More needs to be done to understand how knowledge transfers actually happen.

The new economic geography emphasises the importance of geography in two senses. First, it suggests the importance of geographical factors (such as the depth of the port in New York) in current patterns of economic location. These ‘old economy’ events include the proximity to transport links for the movement of manufactured or physical goods. They remain important, in part, because of the cumulative causation processes which new economic geography explains. The second sense in which geography matters is that – for some economic activities – their performance is enhanced when they are located close to complementary activities. The ‘chance’ location of the first sense of activity provides the seed for economic activity, while the second sense makes the location of economic activity constant afterwards.

However, there are limits to the explanatory power of new economic geography, and it should not imply a deterministic approach. Other factors, particularly physical infrastructure, are also important. There are many examples where scale and accessibility are not important. Iceland, for example, is a small isolated country, has higher per capita income than Hungary, which is more accessible. New economic geography makes some implications about transport improvements, opening up some important questions for cities.

Endogenous growth theory has its own limitations. It is a supply side approach and so fails to illuminate the argument about demand or innovation. It fails to illuminate the internal spatial organisation of production within regions, focusing on a narrow spectrum between 'dense' and 'un-dense'⁸⁵. Neither theory offers a full understanding of these processes (how, exactly, is knowledge spilt-over?). The World Bank has suggested that a major deficiency of most growth theory is the crude assumption that the same model can apply for Korea as well as Bolivia⁸⁶. A similar argument might apply for the differences between Stoke and Canterbury, for example.

But the policy implications of the theory appear valid, with investment in education, universities and research uncontroversial and important for other reasons. Some of these (education, universities) are nominally under the control of cities, and this gives cities a potential role in managing future growth.

A subsidiary aim of this paper has been to provide evidence to support or refute aspects of the original '*Ideopolis*' report. What does it tell us about the original report? In the original report, we identified a series of drivers. Two were particularly 'economic': diverse specialisation and building on what's there. **Diverse specialisation** refers to the theory that firms should have multiple niches, rather than a focus on a single industry. It implied that cities which indulge in 'monoculture' are less likely to succeed. At the most basic level, there is strong evidence suggesting that a diverse industrial base will tend to mitigate against the effects of economic change⁸⁷. Having a wider range of industries will leave a city less exposed if any one industry faces harsh market conditions. But at a more theoretical level, there is evidence that economic diversity can have a real impact

⁸⁵ Mark Roberts and Mark Setterfield (2007) 'Endogenous Regional Growth: A critical survey', *Cambridge Centre for Economic and Public Policy Working Papers, WP0107*

⁸⁶ World Bank (2005) *Economic Growth in the 1990s: Learning from a Decade of Reform*, Washington: World Bank

⁸⁷ Koen Frenken, Frank van Oort and Thijs Verburg (2007) 'Related Variety, Unrelated Variety and Regional Economic Growth', *Regional Studies*, 41 (5), 685-697

on growth: by stimulating knowledge sharing between very different sectors, cities can be more innovative and experience faster rates of growth than before.

The second driver was about **building on what's there**. We meant this to imply that cities should not try and conjure an economic sector from nothing (for example, there is little point trying to attract a biotechnology hub in a mountain village). There is also considerable support for this driver – agglomeration economies show why it might be difficult to gain an advantage in a previously unseen sector. This driver also receives considerable backing from the ideas of new economic geography. This suggests that building a critical mass of an industry, when subject to these external economies of scale, will create considerable advantages. Attempts to subsidise firms to move in response to this should be resisted. Not all industries, however, are subject to these agglomeration effects, and in many cases they will be weak.

Finally, there is considerable evidence that the skills of the population are a consistent factor in economic growth, for a number of reasons. This suggests that the driver which relates to the skills of the population (and the extent to which they can use those skills) – **High Skill Organisations** – is extremely important.

What doesn't it tell us? While there is some good evidence for the role of the knowledge economy in urban economic growth, the evidence base is still forming – most studies suggests it is important, but there has been relatively little work conducted on this topic. Particularly in light of some of the quantitative modelling in the first *Ideopolis* report, this seems to be something of an evidence gap. Moreover, there is relatively little empirical evidence on many of the other drivers – such as distinctiveness, investing in communities or the physical knowledge city. This is due in part to the problems of modelling these intangible factors. But it also suggests that there is a considerable amount of work remaining to be done in this area and that perhaps cities could be doing more not only to learn the lessons, but to call for work that has practical and theoretical application to be done to inform national, regional and local policies.

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Registered as a charity no: 290003

First published: March 2008

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