

PIN - 12

Evidence Review

From Silos to Systems: Insights and Implications for Productivity Policy

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About PIN

The Productivity Insights Network was established in January 2018 and is funded by the Economic and Social Research Council. As a multi-disciplinary network of social science researchers engaged with public, private, and third sector partners, our aim is to change the tone of the productivity debate in theory and practice. It is led by the University of Sheffield, with co-investigators at Cambridge Econometrics, Cardiff University, Durham University, University of Sunderland, SQW, University of Cambridge, University of Essex, University of Glasgow, University of Leeds and University of Stirling. The support of the funder is acknowledged. The views expressed in this report are those of the authors and do not necessarily represent those of the funders.

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Introduction

The notion of the ‘productivity puzzle’ has come to dominate the productivity debate in the UK, where the persistently weak productivity growth since the 2007 financial crisis has confounded policy makers and academics. Explanations of the UK’s comparatively poor performance range variously between issues of measurement associated with intangibles, a lack of business investment, artificially low interest rates, labour market conditions, demand contractions, amongst other things. Research on these factors, and others, continues to contribute insights to the productivity debate, although there is a widespread consensus that there is no silver bullet for unlocking the productivity puzzle in the UK.

As previous evidence reviews by the Productivity Insights Network demonstrate, their first contribution is to survey the state of the art in order to develop a more granular understanding of productivity. Each of the evidence reviews unpacks and develops a more nuanced perspective on productivity, highlighting what we know and, significantly, what we do not know. This provides the basis for an important second contribution that is implicit to the discussion, namely the cross-referential nature of the productivity debate. When discussing productivity from the perspective of work and employment, for example, it is impossible to avoid the intersection with education and skills, health and wellbeing, and innovation and technology – yet these connections are often poorly developed and understood. While we know the productivity puzzle is better understood as a combination of factors which are often both interdependent and interrelated, achieving this both analytically and in practice is rare and difficult.

Academic debates on productivity have traditionally been dominated by economists using growth accounting frameworks. While they are not without criticism (Felipe and McCombie 2012), these approaches have allowed for deep insights into specific aspects of the productivity puzzle, and they also provide a strong body of research on productivity measurement issues. At the same time the experience of the dramatic productivity slowdown during the last decade in particular, has highlighted the limitations of these orthodox approaches and the extent to which they are not able to throw light on other aspects of the productivity puzzle. In particular, many of the drivers and inhibitors of productivity growth may be related to complex causal relationships which preclude examination by standard growth accounting frameworks, and many of the other potential explanatory factors, as detailed in PIN’s other evidence reviews, cannot be incorporated into these frameworks. As such, other more interdisciplinary approaches to understanding the interrelationship of these factors is a welcome contribution to the debate. Thinking which spans individual subject-specific and methodological silos can potentially greatly complement existing approaches and allow our productivity debates to move forward on a range of different fronts. In particular, while the focus of much research has remained on potential explanations of weak productivity growth, much less consideration has been given as to exactly what such insights mean in terms of the different dimensions of citizens’ lives and exactly how governments might be able to better address the productivity puzzle. More specifically, and focusing on productivity growth as opposed to the level of productivity, a pressing question remains as to what the growing body of academic analysis means for the future of productivity policy - especially since the objectives have remained the same for some time.

While previous evidence reviews have reflected on the different thematic aspects of the productivity puzzle in the UK this report assumes a broader conceptual approach. We argue that while in-depth academic insights may help unpack individual aspects of the productivity puzzle simply more research of this type is not the answer. Rather, if insights are to meaningfully help governments and institutions better respond to the current productivity challenges there is a compelling argument for thinking about productivity at a systems level. This report posits that while existing research is gradually coming to recognise the importance of the intersections to these debates, that more innovative and critical thinking is required if research is to impact policy.

The second section begins by reflecting on the nature and construction of productivity policy, as a more or less joined-up collection of policies intended to stimulate productivity growth. However, such policy narratives have limitations, and there remains a need to rethink the design and delivery of policy that meet the challenges of complex systems. The third section introduces the systems approach as a lens through which we can frame our thinking about productivity policy in a more holistic manner by looking for the intersections and interdependencies between policy and thematic silos. The fourth section explores the application of systems thinking and reflects on the implications for the productivity puzzle in practice in terms of reconceptualising and designing policies. The fifth section concludes by highlighting the need to move beyond siloed perspectives on productivity and the importance of trying to focus on the intersections and interdependencies between different aspects of our socio-economic system in order to afford new directions in productivity research and policy.

The narratives of productivity policy

Poor productivity growth has been a characteristic of many advanced economies since the 2008 Financial Crisis. While it is widely accepted that productivity is the biggest long-run determinant of wages and living standards, addressing the issue is very complex. The notion of 'productivity policy' is at best an oversimplification, and in some contexts an inaccurate portrayal, of how productivity issues are both understood and responded to by governments around the world. In different situations and contexts productivity policy has been ostensibly framed in different ways, although 'productivity policy' is arguably better understood in terms of the prevailing 'policy mix', or the combination of policies on offer to improve productivity.

While there is understandably a focus on current productivity performance and policy debates, the reality is that previous governments and their policy choices typically have considerable influence over present productivity trajectories. Decisions to invest, or not, in areas such as education and infrastructure have long term implications for the productivity of countries, and so any change in policy imperatives need to be understood in this context. It is important, therefore, to appreciate that a broad-spectrum of policy choices may affect productivity growth, irrespective of whether they are considered as part of the productivity policy mix or not. As such, productivity policy and the policy mix never emerges de novo and it is as much a historical construct as a contemporary one.

The approach of governments towards productivity policy is varied. In previous decades productivity or productivity-related policies were typically the remit of either a treasury or a finance ministry or a ministry for industry, whereas related arenas such as education, science policy, infrastructure and land use, would often be addressed by entirely separate ministries. As such, siloed policy formulation was not uncommon. Yet, as long as productivity growth appeared to be fairly robust, as in the decades prior to the global financial crisis, there was no deemed reason for altering these institutional arrangements. However, the experience of the last decade in particular, has shifted policy-related thinking, and a markedly greater sense of urgency has emerged in many countries for fostering cross-thematic and cross-institutional approaches to productivity thinking and productivity policy delivery. Nowhere was this more apparent than in the cases of Australia and New Zealand where national Productivity Commissions were established in 1998 and 2011, respectively, by central government and provided with wide-ranging and independent powers of enquiry and investigation. Increasingly, for many national governments the productivity puzzle is understandably becoming much more of an interdepartmental challenge, with each arm of government having primary responsibility for a specific portfolio (i.e. business, employment, education, transport, infrastructure etc) although increasingly in a manner which connects with other areas of government. Within the UK, developing and delivering cross departmental policy proposals represents a major institutional challenge. As noted in the House of Commons Business, Innovation and Skills Committee report on The Government's Productivity Plan, the danger is what prevails is simply a 'collection of existing policies [rather] than a new blueprint for the future' (BISC, 2016, p. 7).

In order to overcome the potential challenges of fragmented policy agenda across governments, it has become fairly typical for a sponsoring department to coordinate cross-departmentally. For productivity it is often the Treasury or Department for Business that assumes the lead. However, unless there is strong and accountable political leadership, it is often difficult to get traction for the types of cross departmental, if not whole-of-government, actions required to address complex challenges and deliver better outcomes. The Industrial Strategy in the UK, which is essentially a productivity strategy, attempts to achieve this system-wide perspective, although actually how to deliver and achieve this remains a major institutional challenge for government. New cross-departmental analytical and policy-delivery teams have been established, so these represent potentially very positive steps. This is especially important in relation to the Industrial Strategy where as well as transcending what are established silos of government, there is increasingly a need to engage with local government and a spectrum of external organisations.

More joined-up government represents an attempt to succeed where previous policy responses have proved inadequate, although there still remains a need for more creative alternatives. This is particularly true in relation to the productivity puzzle, which is an example of what Head (2008) describes as a 'wicked problem' in public policy. That is to say it is complex, open-ended and intractable. While academics and commentators have, and continue to, discuss the nature of the productivity puzzle, its causes and potential solutions remain contested. In Australia and New Zealand, the creation of independent 'Productivity Commissions' serve as advisory bodies with more of a system-wide view. While the Commissions have no executive power, they do undertake very detailed public inquiries and

productivity-related research across all issues with a view to improving national productivity by making small steps towards progress across a broad range of fronts. As a mechanism these commissions may seek to challenge and propose new ideas, although they can only make recommendations, of which the outcomes are still contingent on their effective implementation and delivery by government.

Many factors influence productivity and it is apparent that there is no single action or solution that will unlock greater productivity growth. Indeed, the often multidimensional and interdependent nature of *policies* affecting productivity, and the varied contexts in which the productivity puzzles persist, mean that it is not possible to prescribe what policies or policy mix should be pursued. Indeed, even if such a prescription were possible it would be likely vary from context to context. As such, there is a need to maintain a broad perspective on both the implications and impact of discrete policy areas as well as their contribution as part of any specific policy mix. Productivity policy is, therefore, about more than the coordination of policy areas, in that it is about *the capacity to respond to dynamic economic challenges that change over time and in relation to the actions of other individuals, industries and economies*.

Macroeconomists have sought to explain aggregate productivity growth in terms of its various contributory production factors, although it may well be the case that in some aspects the influence of specific individual factors are likely to be more transient. This is particularly pertinent when viewing economies as complex adaptive systems, and this also means that policy instruments cannot be viewed as either uniform or stable in terms of their impact. The complexity of economies as economic and social systems, and the productivity puzzles therein, demands dynamic and reflexive government interventions. Testament to this, and as previous evidence reviews highlight, while once productivity research was almost entirely within the field of economics, the social sciences as a whole are increasingly offering new and different interdisciplinary perspectives on the productivity puzzle.

Arguably the social sciences have tended to be more reflective than forward looking, in that they offer potential insights around what Elliott and Kiel (1996) refer to as ‘gentle policy action’. Elsewhere this has come to be articulated as experimentation, a concept that resonates with the productivity puzzle since there is no agreed solution. This is important where the outcome is to open the debate as to the politics of productivity policy choices, thereby highlighting how the productivity puzzle is both perceived and interpreted as well as articulating the approach as to how it might be resolved.

Indeed, this is about more than recasting the narrative of productivity policy. As we highlight here, the productivity puzzle is both multi-faceted and multi-scalar. However, resolving the productivity puzzle does not require new (meta)narratives, but rather a better understanding of how existing narratives relate to each other. In other words, how do the pieces of the puzzle fit together? The literature on ‘systems’ offers some promising insights to both understand and explain alternative approaches about the working of complex policy environments, although further work is still required to see these whether conceptual insights can influence and inform practice. As such, it is important to recognise that despite the extant literature on productivity, we still do not have a system-level understanding about productivity - either within or beyond government.

A Systems Lens on Policy

Given the generally complex and fragmented policy approach to productivity growth there is a compelling argument to be made for reframing our perception of the policy space. This section suggests that we need to adapt approaches that consider the productivity puzzle holistically and that look for the intersections and interdependencies between productivity policies and outcomes. It explores parallels between our critiques of policy and thematic silos and those marshalled by systems-approaches to broader trends of reductionism (Astill & Cairney, 2015) and dominance of mechanical models in the social sciences (Eppel & Rhodes, 2018).

Both public policy and social science are susceptible to charges of reductionism (Astill & Cairney, 2015). In order to grapple with a range of complicated puzzles researchers and decision-makers often rely on heuristics that adopt and operate under assumptions associated with Newtonian approaches. Eppel and Rhodes (2018, p. 949) summarize these assumptions as follows:

- (1) relationships between individual components of any system can be understood by isolating the interacting parts;
- (2) there is a predictability in the relationship among the parts, and;
- (3) the result of interactions and the working whole might eventually be understood by simply summing the parts.

The neat mechanical nature of this approach certainly applies in selected contexts. Eppel and Rhodes (2018) go on to evoke a watchmaker who can disassemble a clock into its component parts in order to understand how it works in order to replicate or mend it. Figure 1a shows a simplified representation of a system based on these assumptions. A series of inputs affect outputs, or, in the language of social science methods, independent variables influence the dependent variable.

Yet problems in the social sciences rarely conform to these assumptions. Policy spaces are messy, complex, and, sometimes even chaotic. Social phenomena cannot be studied in perfect isolation as they are embedded in, and affected by, their wider environment. There can be relationships between phenomena that appear stable but are subject to sudden shifts, or relationships that seem like they should function a certain way but do not. In fact, the ‘working whole’ is not reducible and cannot be described by the attributes of its parts alone (Astill & Cairney, 2015; Furtado, Sakowski, & Tovoli, 2015). Rather, “the whole becomes not only more than but very different from the sum of its parts” (Anderson, 1972, p. 395).

Despite these observations about how things actually *are* these Newtonian-like mechanical models typically continue to dominate approaches to research and practice. Even so, a recognition of the limits and inadequacies of mechanical explanations has more recently prompted the emergence of more sophisticated models that have been developed and applied in physical, biological, ecological, and social research. Systems approaches are often described as a new approach to science and focus on mapping and explaining systems or processes characterised by complexity – in other words systems that lack order and stability and universal laws. A system is complex if it is difficult to “describe, explain, engineer, evolve,

or predict” (Bednar & Page, 2016, p. 450). Systems-based approaches, of which complexity theory is one, aim to explain how and why system-wide behaviour emerges from the interaction between large numbers of smaller, often interdependent, components (Mitchell, 2009). Figure 1b attempts to provide a visual contrast to the mechanical model in 1a.

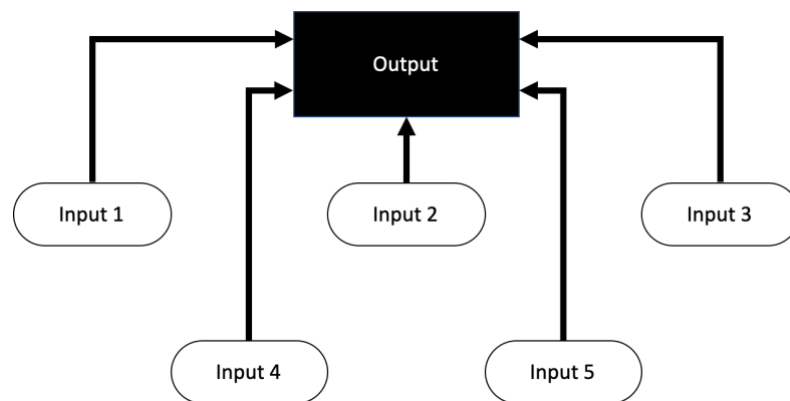


Fig 1a: Mechanical Model

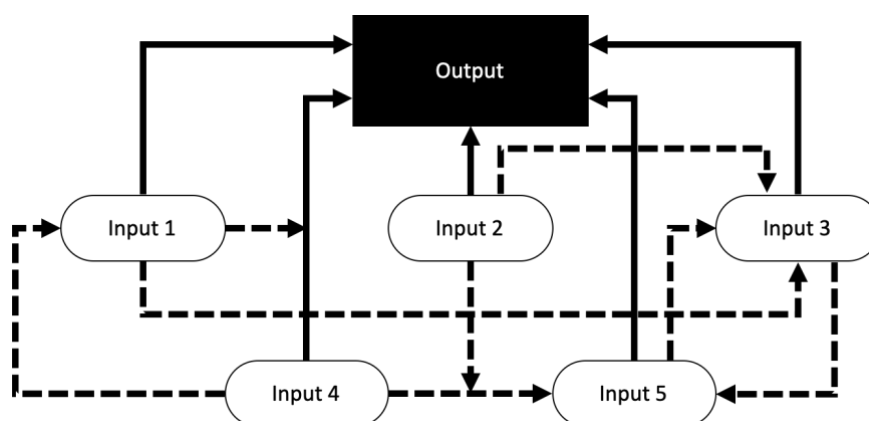


Fig 1b: A (simple) complex system

Cairney (2012) identifies six broad themes of complex system behaviour and implications for the application of systems approaches, summarised in Table 1. For the most part, these conclusions are intuitive. Many people, for instance, grasp the idea of the ‘butterfly’, or ripple, effect where small changes in a (deterministic, non-linear) system can have large impacts. Many will also concede that while we know a lot about how social and political systems function, at the same time their outcomes are often difficult to anticipate and may be predicated on connections and interactions that are presently unknown. Thinking in terms of systems - engaging with complexity theory - provides a conceptual frame through which scholars and practitioners can begin to more holistically map the problems that they are grappling with into their respective systems and, from there, to develop a deeper understanding of their interdependencies, and to potentially devise better policy interventions.

Table 1: Six themes about complex system behaviour and study

<ol style="list-style-type: none"> 1. A complex system cannot be explained merely by breaking it down into its component parts because those parts are <i>interdependent</i>: elements interact with each other, share information and combine to produce systematic behaviour. 2. The behaviour of complex systems is difficult (or impossible) to predict. They exhibit '<i>non-linear</i>' dynamics produced by feedback loops in which some forms of energy or action are dampened (negative feedback) while others are amplified (positive feedback). <i>Small actions can have large effects and large actions can have small effects</i>. 3. Complex systems are particularly sensitive to initial conditions which produce a long-term momentum or '<i>path dependence</i>'. 4. They exhibit emergence, or behaviour that evolves from the interaction between elements at the local level rather than central direction. <i>This makes the system difficult to control</i> (and focuses our attention on the rules of interaction and the extent to which they are adhered to). 5. They may contain 'strange attractors' or demonstrate extended regularities of behaviour which are 'liable to change radically' (Geyer and Rihani, 2010, p. 39; Bovaird, 2008, p. 320). They may therefore <i>exhibit periods of 'punctuated equilibria'</i> - in which long periods of stability are interrupted by short bursts of change. 6. The various problems that complexity theory seeks to address - such as predicting climate change, earthquakes, the spread of disease among populations, the processing of DNA within the body, how the brain works, the growth of computer technology and artificial intelligence, and the behaviour of social and political systems - <i>can only be served by interdisciplinary scientific groups</i> (Mitchell, 2009, p. x).
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Source: (Cairney, 2012, p. 384). Emphasis added.

As such, systems thinking has a number of important implications for the way that we think about and deliver policy. Castelnovo and Sorrentino (2018) argue that public managers (1) think holistically rather than linearly to grasp the big picture; (2) break with the logic of best practices that dominates the policy-design mindset; and (3) supersede the traditional dichotomy between evaluation and implementation so as to focus on the feedback process and how performance is constructed.

Their first point about the need to think 'holistically' and grasp the 'big picture' may seem obvious but it is one of the most important implications of systems thinking. While discrete, targeted, and controlled policy initiatives are not doomed to failure they can potentially benefit enormously from being first subjected to the test of systems-thinking. A key implication of perceiving systems instead of silos is that all systems and subsystems are inherently contextual, whereas the language of 'best' and 'good' practices in public policy largely ignores this. Castelnovo and Sorrentino (2018, p. 1027) eloquently describe 'best answers' and 'golden rules' as, at best, wishful thinking. This is not to say that policy-learning, the sharing of experiences, and in some cases even policy-transfer, serve no purpose, but rather that the adoption of others' policy models carries important risks. Calling on policymakers to "supersede the traditional dichotomy between evaluation and implementation" and focus on feedback processes they highlight the need to change mindsets towards policy expectations and towards the policy design, implementation, and refinement cycle. Engaging with systems means a break with governance and accountability models based on "assumptions of predictability, the elimination of uncertainty by planning and analysis methodologies and control by compliance" (Rhodes, Murphy, Muir, & Murray, 2015, p. 206). Instead, benchmarks and performance reviews must give way to a culture of frequent adaptation and policy responsiveness. Managers must learn "the art of managing and changing contexts, promoting

self-organizing processes, and learn how to use small changes to create large effects” (Burnes, 2005, p. 82).

Inherent in this call for agility and policy creativity with respect to public managers and bureaucratic cultures is the development of mechanisms to effectively process policy-feedback. While they do not address it explicitly, here Castelnovo and Sorrentino (2018) point towards notions of experimental governance, a core tenet of which is to be reflexive and to foster iterative adaptation to policy feedback. A key point here is to distinguish between two very different types of governance cultures. On the one hand there are governance cultures that prioritise the evaluation of *success* in the pursuit of ever more targeted laws and rules and regulations. On the other hand there are governance cultures which prioritise evaluation for the purposes of *learning*, and these governance cultures would appear to be often better suited to underpinning processes of policy innovation and adaptation in complex contexts. Systems thinking, therefore, demands more trial and error in policymaking and the adoption of experimental approaches. As Eppel and Rhodes state:

Complexity acts as a challenge to the quest for certainty in policymaking and also prompts discussion about the role of pragmatism in policymaking [...] Experimenting with new forms would appear to be an important complexity-friendly policymaking practice that would lead to more sustainable public systems (Eppel & Rhodes, 2018, p. 956).

As such, the following section discusses the practical application of systems thinking and explores the potential of experimental policy design.

Systems Thinking and Policy Design: From Theory to Practice

Having established this conceptual frame we can now reflect on what lessons systems-thinking holds for the specific issue of the productivity puzzle. Productivity policy to date tends to adopt siloed and weakly coordinated approaches to the policy process. In short, while it is perhaps not blind to the systemic nature of the policy problem it has, to the eyes of many observers, so far been largely unsuccessful at adapting to these realities. Systems-thinking offers a way of reconceptualising policy. In a setting which allows for our bounded knowledge of interactions and interdependencies within the system itself. These principles can, in turn, be applied to the policy design and policy evaluation processes in order to help develop policies that recognise and adapt to the limitations of doing policy with a systemic environment.

Systems thinking from theory to practice: modelling and experimentation

Systems thinking brings critical attention to the construction and function of models in policy and the social sciences. Models are representations of the world that allow for “the description of a situation, the exploration of future scenarios, the valuation of different outcomes, and the establishment of possible explanations for what is observed” (Edmonds & Gershenson, 2015, p. 205). But there is something of a paradox inherent here, in that while models are meant to be simplified representations of complex systems they are, by that definition, also often prone

to the very reductionism that systems approaches critique. However, far from considering this an indictment of the approach systems theorists embrace this tension as an opportunity to reflexively adapt methodologies. Specifically, models and modelling, play a useful exploratory role in the project of complexity-informed social science, provided that one does not minimize their limitations (Byrne & Callaghan, 2014). In short, they function as touchstones for research and policy and act as crucial steps in the process of building a more holistic understanding through experimentation.

It is worth noting that the tension between comprehensiveness and pragmatic parsimony in models is not new, nor is it exclusive to systems thinking. For example, Britton Harris, himself building on decades of debates on economic and social modelling, adopted a critical approach to theory, simulation, modelling, and the policy process in the 1960s (Harris, 1966, 1968, 1985). Without explicitly engaging with complexity theory, Harris focused on the limits of holistic versus partial models. The former were obviously preferable in terms of providing a foundation for understanding but he recognised it as essentially an unattainable ideal. Researchers and policymakers, then, have very little choice but to rely on partial models - models that examine sub-systems in isolation - and are mainly the province of partial equilibrium economic analysis. For Harris, it was possible to aspire to holistic models - more complete understandings of a complex system - through the combination of partial models. Crucially, this involves not simply the *aggregation* of partial models but establishing an accurate relationship by recognising that they should be “communicating with each other and interacting with one another in a computer, much as the subsystems of the metropolitan area interact in the real world” (Harris, 1968, p. 371) and that this should function as a *system of models*.

However, Harris draws some important distinctions between the appropriateness of this integrative approach in research and policy. He warns against policymakers adopting “piecemeal and problem-oriented attacks” (Harris, 1968, p. 365) and notes that “the decision-maker is ultimately forced to consider not only the total environment, but the totality of ultimate effects, both direct and indirect, of given policies” (371). But what then can policymakers do if partial approaches are not likely to be successful and holistic ones practically unattainable? The answer, for him, lay in the way he defined models: a model is an experimental design based on theory - it is an experimental means of putting the theory in contact with the real world (Harris, 1966, 1968). Experimentation, then, is the mechanism through which partial models gain coherence. Models exist to test theories, predict phenomena, and to extrapolate the effects of causes beyond the ranges in which causes were originally observed. Experiments allow the investigator to hone models by interpreting results and feedback. While we typically think about models, simulations, and tests of this variety as “paper experiments” that is certainly not the only realm of experimentalism. This approach can also be incorporated into policy design as part of a programme of model testing and tweaking that aspires to a more holistic understanding and increasing precision in interventions and outcomes.

For systems theorists, then, models have two functions - an exploratory one and an experimental one. In policy, models represent cognitive approaches and help anchor decision-making frameworks and can be implicit or explicit. As Edmonds and Gershenson (2015) summarise:

A model is appropriate for establishing and understanding candidate explanations of what is happening, which will inform policy making in a less exact manner than prediction, being part of the mix of factors that a policy maker will take into account when deciding action (Edmonds & Gershenson, 2015, p. 211).

This is a fundamental first step to engaging in policy experimentation and experimental policy design, discussed in more detail in the following section. One final point on the significance of models (and their experimental refinement) is that they can function as an interface between research and practice. The role of academic analysis is to critically develop and devise tests for sub-system models and to theorise intersections and interdependencies. The role of policy is to adapt and synthesise, to assemble as much as is feasible the system of models, and then design creative and reflexive policy approaches. Ideally, both branches participate in the interpretation of feedback and iterative experimental design.

Experimentation as the Foundation for Practice

To this point, the concepts of experimentation, experimentalism, and trial and error have employed to suggest as a pathway forward, a bridge, and a solution for some of the gaps in research and practice that we have identified in the course of this report. This section elaborates what that means in theory and in practice.

To recap, a core tenet of systems thinking is that outcomes are driven by intersections and interdependencies between elements within a system and that these relationships are (a) imperfectly recognised in the state of the art of research and policy and that (b) these relationships are not easily knowable. When the search for axioms and universal laws for systems characterised by complexity - as social and political systems are - is misguided the only remaining recourse is to intervene and interpret and respond to feedbacks. In short, to apply experimental methods to practice.

Fortunately, an entire branch of scholarship is dedicated to the role of experimentation in policy design and implementation. Experimental governance has conceptual origins stretching back to Dewey's work on democratic experimentalism in the 1920s and was popularised by Charles Sabel through a series of seminal publications in the 1990s and 2000s (Morgan, 2018). As its name suggests, experimental governance is centred on the idea of trial and error in policymaking and, above all, the concept of *learning*. Broadly, it conceives of the policy cycle as having four steps linked in an iterative process:

- (1) Decision-makers establish framework goals and metrics;
- (2) Implementing units are given autonomy and discretion to pursue goals in their own ways;
- (3) As a condition of this autonomy, the units must report regularly on their performance and participate in peer review;

- (4) Goals, metrics, and decision-making procedures are revised by an ever-widening circle of actors in response to the problems and possibilities revealed by peer review (adapted from Morgan 2018).

Sabel and Zeitlin (2012, p. 169) characterise this as “a recursive process of provisional goal-setting based on learning from the comparison of alternative approaches to advancing them in different contexts”. Eppel, Turner, and Wolf (Eppel, Turner, & Wolf, 2011) identify four practices central to this policy strategy: it is explicitly *experimental* in design from the development of hypotheses (models) to action; it is *learning-oriented* resulting from an ongoing process of searching for what works and what does not followed by adapting models and actions; it is *procedurally accountable* to the extent that decision-makers are accountable for experimentation, learning, and for outcomes determined not by preordained metrics but as a function of interaction between policy objectives, actors involved in implementation, and context; and *collegial* as policy interventions, effective learning, and interpreting feedback relies on building connections across disciplines, departments, and other divides.

Complete experimental governance is an ideal as a model for systemic policymaking but, like many ideals, is unrealistic in practice. However, the adoption of the general tenants that emerge from systems thinking are practicable and, indeed, in practice (with varying levels of success) in various forms all over the world, as reflected in widespread movements away from rigid hierarchies and top-down policymaking and government and towards governance approaches adopting more trial-and-error strategies. Indeed, these principles are all core elements in the *smart specialisation* principles embedded in EU regional and urban policies (McCann 2015; McCann and Ortega-Argilés 2015). But nowhere have these approaches been adopted across entire governments or even completely within a specific policy area. As a result, when considering how to apply systems thinking to policy, practitioners have turned to policy experimentation and evidence-based policy.

Policy experimentation applies scientific and systems-based thinking to specific policy programmes (Huitema, Jordan, Munaretto, & Hildén, 2018). This involves, broadly, beginning a policy programme with a set of hypotheses, designing interventions to test those hypotheses, and evaluating the evidence that arises. In practice, these often take the form of very targeted interventions or pilot programmes. Importantly, the experimentation is an explicit element of policy design a feature that is not appropriate for every kind of policy initiative. Greenberg et al. (2003) argue that experimentation works best for a situation in which there is a single decision maker with clear goals, a limited set of well-known policy alternatives, and sufficient time to await the outcomes of research.

Systems-thinking is manifest also in practice through the related concept of evidence-based (or evidence-informed) policy making. This policy approach involves applying a scientific mindset to policy - basing the interpretation of policy problems and their solutions on rationally evaluated data rather than intuition or politics - and incorporating processes these into more detailed policy rationalisation and justification. This policy approach incorporates the trial and error dimension of policy experimentation, if less rigidly, into the design process. Central to the concept of evidence-based policy is that it should result in doing more of what works rather

than more of what *should* work (as viewed through ideological lenses) and maintains a focus on achieving the best possible solutions for all.

It is important to recognise that while both of these practical approaches incorporate key elements of systems thinking they do not necessarily, in and of themselves, imply that a systemic perspective has been adopted. Experimentation can happen in silos just as easily as in systems. It is therefore crucial for policy makers to be self-conscious in policy design and to genuinely try to embrace systems thinking - and not just buzzwords - into their models, into their approaches to problem solving, and in their negotiating of the political landscape. The challenge of effectively incorporating systems-thinking into the policy process is indeed a thorny one, albeit a critical one.

Conclusion - Implications for UK Productivity Policy

The value of social science research in providing insights and evidence to inform the development of policy is widely accepted. Previous evidence reviews highlight questions and explore trends in productivity research in their respective thematic areas, as well as identifying gaps in our understanding. Developing these productivity perspectives is important in mapping the current debate and identifying the prevailing intellectual boundaries of the evidence base. However, the evidence reviews do not focus on the intersections and interdependencies of the debate, and it can be difficult to recognise this when assuming a primarily thematic focus. The aim of this report is to reflect on the wider implications of the current trajectories of research and practice for productivity policy.

In keeping with the Modernising Government White Paper (Cabinet Office, 1999), addressing the productivity puzzle in the UK requires that policy should be forward looking as opposed to responding to short-term pressures and the symptoms of poor productivity. Given that productivity policy is better understood as a policy mix, Cartwright and Hardie (2012) highlight the need to understand how factors combine and relate across themes. This is critical to our argument for adopting a systems lens, whereby a greater granularity of evidence is not in itself the key to better productivity policy. The central challenge, therefore, is in the design of productivity policy that utilizes evidence from research to develop policy that delivers better outcomes.

Research on productivity has traditionally been dominated by economists, advancing economic models with ever more detailed conclusions within relatively narrow fields of inquiry. As Harris (1968) argues, academic analysis constructing and testing partial models must still be sensitive to the ultimate goal. Therefore, if academic research on productivity is to be relevant to policy, there is a need to overcome the siloed approach and associated conceptual isolation. It is not meaningful, in a policy context, to segment the productivity puzzle into individual slices, as productivity is not the outcome of discrete variables. However, the prospect of researching productivity entirely at the system level is arguably implausible unless assumptions are made, and the model is itself simplified - steps that potentially negate the usefulness of the model.

Where academics are researching partial models, the systems lens highlights the need for such research to be undertaken with an appreciation of how it relates to the wider system as part of a collection of models. This is critical if future research is to meaningfully build on the intersections and interdependencies of the various themes and factors that shape productivity, and ultimately bridge the divide that has come to exist between productivity research and the practice of productivity policy. Where research and policy can better take account of the various factors and how they relate to the outcomes is also likely to strengthen evidence-based policy. Moreover, and in contrast to other critiques of evidence-based policy, a systems-inspired approach premised on (multiple) models also has the potential to better predict whether policies will be effective.

More than advocating a systems lens for researching productivity and productivity policy, this report contends that considerable effort needs to be made by academics and policymakers to bridge the divide between research and policy. The central challenge is to ensure that evidence from the research base better informs the design and development of policy. Arguably a systems perspective differs from the dominant mindset of both academics and policymakers, with neither group accustomed to working in this way. If the systems perspective is to become an effective approach it will demand new ways of working and thinking about the productivity puzzle. To achieve this, and put system thinking into practice through models, demands policy experimentation and adaptation based on the evidence. It also suggests that a broader range of issues and arenas need to be incorporated into productivity research, than has traditionally been the case. As previous evidence reviews have detailed, many issues which in earlier eras were not perceived as being particularly relevant for productivity research are nowadays increasingly understood as being crucial. These include issues such as governance, trust in institutions, social engagement, distributional issues of many different kinds, power relationships, and new forms technological change involving intangible assets.

When considering each of these issues, adopting systems thinking offers the potential to change the tone of the productivity debate. By focusing on the intersections and interdependencies of the productivity puzzle, as opposed to pursuing ever more granular analysis of thematic questions, such approaches offer the possibility of providing a basis for next-generation policy design. Realising the promise of new multidisciplinary horizons in productivity research by asking new questions and advancing new perspectives is about much more than the research itself. It demands a new openness, which if achieved will enable the modelling and exploration of new frontiers of productivity policy by drawing on research and evidence in new and creative ways.

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