Response to call for evidence for
The Independent Review of Economic Statistics
Led by Prof Sir Charles Bean

Commissioned by
The Chancellor of the Exchequer
Rt Hon George Osborne MP
and
The Minister for the Cabinet Office &
Paymaster General
Rt Hon Matt Hancock MP

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For what purposes do you use economic statistics produced by ONS?	ONS outputs are used for three purposes: 1. As the UK official data & outputs measuring economic strength against international standards; 2. To SWOT (Strengths Weaknesses, Opportunities Threats) assess ONS, related bodies & underlying standards in terms of their fitness for measuring evolving economic powers; &, 3. Where gaps are evident research & develop better metrological instruments for the future.

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For what purposes do you use economic statistics produced by ONS?	ONS outputs are used as part of the services we supply to clients in both the public and private sectors, as well as inputs to academic and analysis used by corporates with which we are involved

Summary

1   The most significant challenges:

Productivity can no longer be measured in traditional ways. It will be more useful to approach it via its outcomes – successful trade growth, higher standards of living and more competitive businesses.

This means focusing on income measures, knowledge and capacities, trade and innovation, rather than traditional ways of thinking about productivity.

2   Features not well captured:

Non-traditional business outputs - from Airbnb to the cyber economy to management consulting. We should focus more on incomes and people and less on traditional output.

Trade, both internationally and between cities and regions is woefully covered. Instead of resourcing measuring ephemeral outputs we should concentrate on money flows between places

3   Top priorities

Better trade data, especially within the country

More focused business income and spending data

Evaluating combinations of capabilities and Knowledge Based Capital formation

4   ONS strengths and weaknesses

Knowledge of existing systems a strength but hard to respond to need for innovation or developing purpose

5   What ONS will need

Existing data collection and measurement improvements need to continue

A new unit will need to be established to bring together statisticians, network analysts and other skillsets to consider both how to measure new concepts and work out new methods of measurement.

6   Scope for using data science

Challenge of volume of data may overwhelm new methods

Data filtering techniques should be explored by a new innovation hub.

7/8   Governance changes

More clarity on what responsibilities are carried best by which groups; in particular, differentiating incremental innovation for efficiency gains from major innovations.

Governance for sustaining and advancing "world class" standing through innovation would need to be enhanced.

S1. Assessing the UKs future statistics needs

Q1. From your perspective, what are the most significant outstanding challenges in measuring the modern economy?

The foundations of national accounts were laid in the early 1930s, with the Nobel Laureate Simon Kuznets being the leading intellectual force. The focus was on the measurement of output at market prices.   It was clear that there had been a catastrophic fall in output, but policy makers lacked systematic information about its movements. Obtaining consistent and systematic information about output in the market sector of the economy was by far the most pressing policy problem.

Things have moved on.   Output is much less physical and employment is much less immediately linked to it. This was a consistent theme drawn from the Public Administration Select Committee's final inquiry into the production of the UK's economic statistics[1].

We take as our starting point the UK Government's Productivity Plan, with its twin pillars of long-term investment and a dynamic economy.   The policy issues which arise from this perspective define the significant outstanding challenges of measurement.   However, "[t]he significant problems we face cannot be solved by the same level of thinking that created them"[2].   Peoples' incomes and business growth are as much measures of productivity as attempts to measure output per person.

The most important challenge relates to the provision of information about growth and innovation.

A key aspect relates to the current mechanisms for categorising activities and occupations. Such categories fail to reflect innovation as it emerges and do not focus on capabilities which are at the heart of trading relationships.   Ricardo Hausman has looked at growth potential based on such capabilities[3].

The approach essentially attempts to measure the amount of productive knowledge which each country holds by applying network analysis techniques to the web of world trade.   The lack of information on productive knowledge is a major deficiency of the current system of national accounts.

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[1] Letter from the PASC Chair (Bernard Jenkin MP) to the Chief Statistician (John Pullinger) entitled "Statistics for the Economy and Public Finances Inquiry" (dated 25th Mar '15), available at http://www.parliament.uk/documents/commons-committees/public-administration/Letter-to-National-Statistician-18-March-2015.pdf last accessed 25th Sep '15.
[2] Philipsen, D (2015) The Little Big Number: How GDP Came to Rule the World and What to Do about It, citing Albert Einstein, Princeton University Press: Princeton NJ.
[3] See, for example, http://atlas.cid.harvard.edu/ and https://atlas.media.mit.edu/en/ .

The point extends below the level of the economy as a whole, in two ways. First, cities are a major focus of innovation and of agglomeration. They exist within hinterlands of commuters and related businesses. The UK has no agreed definitions for cities and does not collect good information about the networks which support them. This point has been made in the current Future of Cities Programme by Coyle and Rosewell[4]

Second, the regional discrepancies within the UK economy exhibit very strong persistence. There is no real sign of the gap between, to generalise, the North and the South narrowing, despite decades of policies designed to do something about the problem. This is a major constraint on the growth and innovation potential of the UK economy.

Regional statistics remain wholly inadequate. An important perspective on the regional issue is provided by Rowthorn (2010)[5], who argues that the basic problem is one of balance of payments imbalances between the North and the South. Yet no official data exist for trade of this kind.

Q2. Are there features of the modern economy that you think are not well captured in the present range of UK economic statistics?

We have noted above in the response to Q1 the current weakness in terms of providing informative data to policy makers on growth and innovation, and in particular to the stock of productive knowledge, in a number of dimensions. Innovation can no longer be treated as the residual output after more easily measurable inputs and outputs are counted. Innovation has been a core element in new firm creation and this was true even when national accounts were being invented. If "we are what we measure"[6], then continuing to measure quantities of output rather than the outcomes of innovation grounded more in Knowledge Based Capital (KBC), will stunt the growth of productivity on the terms we now need it.

The rapid growth of the cyber economy poses further challenges. The difficulties of valuing innovative products and services, especially in terms of their contribution to real output, are well known[7]. (The value of a specific innovative product or service is of course a separate issue to the assessment of the stock of productive knowledge and the capacity of the economy to innovate).

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[4] D Coyle and B Rosewell, (2014) Investing in city regions: How does London interact with the UK system of cities and what are the implications of this relationship? Foresight Future of Cities Project, Government Office of Science. https://www.gov.uk/government/publications/future-of-cities-investing-in-city-regions-london-and-the-uk-system-of-cities

[5] R Rowthorn, 'Combined and Uneven Development: Reflections on the North–South Divide', Spatial Economic Analysis, 5, 363-388.

[6] Hauser, JR & Katz, GM (1998) Metrics: You Are What You Measure! Available at http://www.mit.edu/~hauser/Papers/Hauser-Katz%20Measure%2004-98.pdf last accessed 25th Sep '15.

[7] See for example J Hausman, 'Sources of Bias and Solutions to Bias in the CPI', *Journal of Economic Perspectives*, 2003, 17, 1, 23-44

A challenge is the valuation of what are essentially public goods created in cyber society. How is value to be assigned in the rapidly growing, so-called *prosumer* sector (i.e. production and development by consumers)[8] of the economy? The activity of much of this sector corresponds closely to the classic definition of public goods, in that the output is both non-excludable and non-rivalrous.

The issue can perhaps be illustrated with a concrete example. In recent years, the statistical package R has become the package of choice for young scientists in a wide range of disciplines around the world (https://www.r-project.org/). A huge range of routines can be downloaded.   It is, in the everyday sense of the word, a very valuable tool for conducting almost any conceivable kind of statistical analysis. Its graphics features are illuminating. But R, and all the routines associated with it, can be downloaded for free. True, R has now become so widely used that a Foundation has been set up to support developments. The foundation, however, is a 'not for profit organization working in the public interest'. It does attract a certain amount of funding, and so its output could be measured using conventional national accounting techniques. The value of R, intuitively, seems to be rather considerably greater than this.

The national accounting techniques developed in the 1930s are, as is well known, much more suited to a manufacturing oriented economy than to a service one. The growth of the service sector, and in particular that associated with the cyber economy, increases the uncertainty around estimates of many particular instances of data.   National accounts statisticians are already tackling these issues[9].

However, a quite separate issue is the extent to which any particular series contains genuine information rather than 'noise'. This may seem connected to the issue of measurement uncertainty, but it is quite distinct. By way of illustration, suppose we were able to measure a random series with complete accuracy (the digits of π, say). The series would still be random and hence contain only noise.

This has important implications for the *inherent* accuracy of economic prediction of any given series such as GDP, and therefore for the conduct of economic policy. Modern signal processing techniques can readily show that the macro series in particular are dominated by noise rather than by signal[10].

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[8] The term is derived from Toffler, A (1980) The third wave: The classic study of tomorrow. New York, NY: Bantam, developing it from first use in terms of electrical goods consumption. With the advent of smart manufacture, 3D printing and open source design the concept and use of the word now resonates more with Drucker, P (1993) Post-Capitalist Society, Routledge: Abingdon.

[9] See for example, both the 'backcasting' ranges which now feature in the Bank of England fan charts, and Charles F Manski, *Journal of Economic Literature,* 2015, 53(3), 631–653

[10] See, for example, Ormerod, P. and C. Mounfield, (2000). Random matrix theory and the failure of macroeconomic forecasting , *Physica A* 280: 497-504

The ONS might usefully produce a series of bands for the various data series, indicating their inherent degree of predictability. This may help policy makers to obtain a different perspective on policy and targets.

Q3. What do you think should be the two or three top statistical priorities for measuring the modern economy?

The main priorities should relate to the provision of better information to decision-takers and policymakers in the context of the UK Government's Productivity Plan:

- categorising activities and occupations in ways which both reflect innovation as it emerges and focus on capabilities which are at the heart of trading relationships
- valuing the amount of productive knowledge which the country holds
- Drilling down these two points to the geographic levels of cities and regions
- Enhancing in general the provision of information on cities, regions, and the internal trade flows of the UK

Development in these areas would create new measurement standards. Not only would the UK have to demonstrate proficient uptake of the innovations measurement these would entail but also be able to enable innovation diffusion internationally. Unless new standards are taken up by developed and developing nations, their effectiveness is rendered inadequate. Enabling the diffusion of measurement innovations would be a mark of "world-class" standing.

The importance of such standing comes back to the overriding issue of purpose. Improving measures for productivity is a strategic issue of major concern. For example, the UK meets the Sustainable Development Goals that commits us to spending 0.7% of GDP. Changes to how that figure is calculated not only matters for donor countries but also for recipients. If their GDP calculations are using dated weights or failing to take up good innovation, money will be misspent. This has security implications as Syrian and related migration makes evident.

S2: *Effectiveness of ONS in delivering those statistics*

Q4. What are the strengths and weaknesses in ONS's current ability to deliver the existing range of economic statistics?

A major strength of the bodies regulated by the UK Statistics Authority (UKSA) which is not to be discounted is the history upon which they and we build[11]. Understanding how measures evolve is vital to challenging what may otherwise become buried assumptions. It is not evident that the MSc in Official Statistics ONS uses to build capacity, links history to strategic purpose and the science necessary to challenge assumptions in depth and breadth.

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[11] See, Vanoli, A (2005) A History of National Accounting, IOS Press: Oxford, for a comprehensive non-British appreciation of the UK's historic contribution.

Statisticians need to understand the purpose of measurement as well as techniques for providing it. Diane Coyle puts these into perspective in a matter of a few pages[12]. Ultimately, the Productivity Plan and its measurement challenges has to contribute to a purpose, much as the original national accounts statisticians were contributing first to winning the war and then the peace.

However, The ONS already has a significant challenge maintaining the excellence of its current services. For example, the RPI is required until 2068 to underpin Gilt contracts, while bedding down changes under ESA will require more adaptations and constrain the capacity of ONS to develop new sources of measurement and techniques. Efficiency gains through the uptake of incremental innovation notwithstanding, UKSA, ONS and GSS must streamline its work to focus more on its core business.

Q5. What steps do you think are needed for ONS to have the capability to collect, analyse and disseminate the relevant data to meet future statistics needs?

If the ONS needs to focus on sustaining its core business through efficiency gains that enhance high quality effectiveness, while complying with international standards, then they remain well placed to contributing towards the capacity building for such standards elsewhere in the world. Helping others with the incremental challenges will sustain world class standing but not necessarily advance it. Nonetheless, contributing to capacity building abroad is a necessary contribution to the world class status for economic statistics the UK aspires to, albeit sufficient for the future.

The OECD's recent "Future of Productivity" report produces some ideas for aggregating micro data in new ways. However, it still rests on standard ways of thinking about firms and activities, rather than the capability and supply chain approaches that are necessary to understand the networks of globalised supply. Such networks are of course dynamic and research is necessary into how we might categorise the dynamics of many evolving combinations of capabilities[13]. This requires research skills missing from existing statistical approaches and which need to be explored. Infrequent input/output tables are insufficient.

We suggest that a separate unit or hub needs to be created with a mix of both statistical and research skills to consider how to deal with disruptive change and new measures. While many talk about Knowledge Based Capital, the measurement challenges are very poorly understood even for a point in time, let alone how it might depreciate. Firm specific skills and organisation know-how are very vague concepts.

Q6. What scope is there for ONS to exploit emerging data-science techniques in meeting future statistics needs?

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[12] Coyle, D (2014) GDP: A brief but affectionate history, Princeton University Press: Oxford.
[13] See, MacIntosh, JP; Mahrra, JK & Tyler, LR (2012) Transformation: DIG for Realism, ISRS available at https://www.ucl.ac.uk/isrs/publications/TransformationDIG4R last accessed 25th Sep '15.

There is scope for exploiting what we might term in this context 'late 20th century' techniques. For example, a vast amount of electronic point of sale data has been captured for at least twenty years and exploited for commercial purposes. This provides contemporaneous, high frequency, highly reliable data on consumer activity. It is not clear that the ONS is taking full advantage of this.

With the growth of cyber activity, a great deal more data is now routinely captured by companies.

Access to this sort of data would be a fruitful way for the ONS to improve the accuracy and timeliness of its estimates, quite separately from the issue of emerging data-science techniques. There will be a challenge to relate such data to standard concepts but it has the advantage of never requiring revision.

Specifically on the issue of emerging data-science techniques, our view is that there is a great deal of hype, and the question needs to be approached with constructive skepticism.

The explosion in the amount of data which has taken place in the past few years is often not fully appreciated. The complexity scientist Dirk Helbing, at ETH in Zurich, estimates that all content collected in the history of humanity until the early 21st century was around 5 billion gigabytes. This is a data volume which is now produced approximately every single day. Storage costs will start to rise and Kryder's law may not generalize. It is unclear whether privacy concerns will abate or worsen as such vast amounts of data is mismanaged within largely unexpected storage constraints.

It is, therefore, unsurprising that deeper links between energy, economics and data are coalescing. Advanced computer science is re-engaging with the Landauer principle; the energy to delete data relates to changes in entropy that are reviving keen interest in its significance. This may seem to matter only at the smallest scales (e.g. micro or nano and perhaps bordering on quantum) but the implications reach to macroscales too and are of enduring consequence. The consumption of electricity (which China already uses as an economic measure) to run Smart Cities and Big Science in global networks is already in danger of hitting capacity constraints that have to be addressed now[14]. Those energy, economic and data constraints are also registered in how economic measurements have to improve if we're to meet the strategic policy challenges ahead for the public good[15].

So although Big Data and associated techniques certainly give scope for improving economic statistics, it is clear that there is a serious risk of, for example, over-fitting or of obtaining spurious correlations, even using techniques such as Lasso regression, which essentially

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[14] See, for example, Prof Andrew Ellis and the EPSRC funded work he is leading entitled "Petabit Energy Aware Capacity Enhancement (PEACE)j" programme, details available at
gow.epsrc.ac.uk/NGBOViewGrant.aspx?GrantRef=EP/L000091/1 last accessed 25th Sep '15
[15] See, for example, Hall, CAS & KIitgaard, KA (2011) Energy and the Wealth of Nations: Understanding the Biophysical Economy, Springer: London.

enable very large numbers of candidate explanatory factors to be examined and which, until very recently, were unfamiliar to economists.

A further problem is that information derived from, say, web based queries can have quite different meanings depending on the motivation of the individuals carrying out the search activity. Google Trends was acclaimed, for example, for being able to predict a flu outbreak, but the next year this approach gave very poor predictions. Ormerod et al. (http://arxiv.org/abs/1408.0699) examine four episodes in which Google Flu Trends data gave accurate predictions of actual flu cases, and four in which the search data over-predicted considerably. They find that social influence, the fact that people may search for a phrase simply because many others are, was much stronger in the inaccurate compared to the accurate cases. Search engine data may therefore be an unreliable predictor of contemporaneous indicators when social influence on the decision to search is strong.

The fundamental issue in eliciting genuine information from Big Data is that of knowing which data to ignore – which could easily be over 99 per cent of the total available in any particular context. Filtering data through the lens of economic theory is often a valuable step to take.

S3. The governance framework

Q7. Do you think the current governance arrangements for economic statistics support their effective production?

We have already suggested that governance needs to deal separately with existing production and new developments. We should:

Currently, there are then two major areas for existing governance to work on:

a) Swift definition of the current core business, including:

- Deciding what no longer needs to be done and stopping it;

- Considering decisive (possibly statutory) action on Point of Sales data;

- Brokering access to administrative data led by ministers on behalf of UKSA;

- Achieving efficiency gains through the uptake of incremental innovation;

- Minimising the creation of further legacy dependencies (cf. RPI); and,

- De-conflicting incremental innovation from major innovations to come.

b) Create the headroom at ONS and GSS for the smooth uptake of major innovations, including:

- Developing the investment in education beyond the MSc in Official Statistics;

- Protecting the time of ONS and GSS staff to engage with basic R&D programmes;

- Awarding fellowships or PhD scholarships for those with the greatest potential to lead disruptive innovation;

- Creating channels for lessons identified by incremental innovation on current business to be learned within research and innovation programmes; and,

- Creating space for innovative pilot capabilities to be experimented with at ONS, GSS and in partnership abroad.

Getting the governance arrangements for incremental efficiency gains to work well and using amplifying those gains by creating the headroom for smoother uptake of major innovation will be no mean achievement. Moreover, getting it right will also permit UKSA, ONS & GSS to foster developments abroad that contribute both to maintaining and advancing the UK's world class standing in measuring economies for the public good at home and abroad. Giving ONS etc breathing space does mean greater challenges are tackled elsewhere, albeit in partnership with UKSA and the bodies it regulates.

Q8. Are there changes to those arrangements that you would advocate?

Sir Charles Bean's commission for the Economic Statistics Review stems from the Command Paper placed before Parliament by the Chancellor in July 2015[16]. It cites the Bank of England's hypothesis that the fifth factor – albeit small – in the UK's "Productivity Puzzle" is the measurement challenge that productivity presents in the current and future economy. In particular: "capturing fully the increasing quality of new goods and services for example, along with financial services measurement, forms a distinct part of the puzzle" [17]. Measuring such a dynamic system is a challenge to statistical offices globally[18] not just in the UK.

There is a need for another body linking basic R&D through rapid and realistic innovation pathways, which enable less disruptive uptake of major innovations. This could form a hub for Learning Innovation, involving partners ranging from:

- Official users (ONS, GSS etc perhaps on fellowships, cf. Q7);

- Open Source Prosumers (making innovative use of data and developing apps);

- Regulators (UKSA, BoE, RCUK etc);

- Private sector firms willing to contribute to the public good; and,

- Basic research coupled with accelerated approaches to advanced learning.

For example, the Hub for Learning Innovation would work from advanced research at the Turing Institute and the EU's Metrology Programme[19], through to creating and supporting the fielding of real capability options. It would experiment with the best combinations of

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[16] Command Paper (2015)Fixing the foundations: Creating a more prosperous nation, Cm9098, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443898/Productivity_Plan_web.pdf last accessed 25th Sep '15

[17] ibid, p. 79

[18] ibid, p. 7

[19] See, the European Metrology Research Programme, available at http://www.emrponline.eu/downloads.html last accessed 25th Sep '15.

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these capabilities in order to sustain and advance the UK's world-class standing in instruments for measuring economic power. In sum, it would mesh Continuous Professional Development (CPD) with basic research to advance the smoother uptake by organisations of major innovations in measuring economies.

This would not shy from involving the most senior users, not least elected officials. Inasmuch as such arrangements would honour the Haldane Principle akin to that which vouchsafes UKSA and the National Statistician, it is not clear that UKSA has the leadership and governance competencies defined or individuals selected to fulfil such roles as a Hub for Learning Innovation requires.

Whilst the Hub could readily draw on relevant RCUK funded programmes across the board, experimentation and piloting of economic measures might involve regulatory changes. It would certainly require political leadership able to broker access to administrative data and confidence that the Hub for Learning Innovation could uphold the highest standards of Information Assurance (i.e. confidentiality, integrity and privacy even with well anonymised data). There are no easy solutions to the challenge of measuring future productivity.

What is advocated here would make far better use of existing resources but could not claim to involve no new money. If, as the call for evidence claims, world class measurements are the goal, then adding a body – a Hub for Learning Innovation – linking advanced research with the smoothest uptake of major innovations otherwise too disruptive to handle, is a good investment. It will not only prevent skills mismatch plaguing ONS and GSS but enable them to achieve productivity growth and diffuse the capabilities to other Statistical Bodies abroad. All of which is for the public good. Of course, if this can be accommodated under UKSA all the better. If not, other governance arrangements may be needed.