

ONS Renaissance Prize Essay

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Should measures of the nation’s capital stock be expanded to include types of assets that are currently excluded, and if so what measurement changes are needed?

“The measurement of capital is one of the nastiest jobs that economists have set to statisticians.”¹

1 Introduction

Attempts to define capital and decide how to measure it have caused great controversy within academic circles, even before the birth of neoclassical economic theory. Marx critiqued the role of capital in production as early as 1867 and, about a century later, questions about the role of capital goods sparked the ‘Cambridge Capital Controversy’ (Hulten, 1991). Capital is a crucial input into production so accurate measures of it are needed for national accounting and policy-relevant economic research. In particular, capital statistics are useful for research into firms’ use of technology, measuring productivity and inflation (Biorn, 2007).

A recent ONS publication points out the key features of a unit of capital: it is a durable, non-financial asset which is involved in production “without being completely used up or transformed in the process” (Dunn and Johannsson, 2021, p.8). Currently, the ONS measures the stock of such assets using the Perpetual Inventory Method (PIM), where, each year, new investments in capital (called Gross Fixed Capital Formation, GFCF) are added to the recorded stock and adjustments are made to account for capital which has expired (ONS, 2018*a*).

Here, we look at four aspects of the capital stock which have been the subject of considerable discussion. We consider social, human and organisational capital and then look at data science. Whilst investment in data is already included as part of the capital stock, measurement could be improved to ensure it is included more fully. Overall, there is room to improve the reported capital stock figure but sometimes, as we see with human capital, changes may be more detrimental than beneficial.

2 Social Capital

The capital stock measure could be improved by including social capital. The ONS focuses its understanding of this concept on an intangible representation of the UK’s social cohesiveness, with the understanding that a more “close-knit” society is better-functioning (ONS, 2020*a*, p.4). It also recognises the importance of this kind of capital and has developed indicators of it, like voter turnout (ONS, 2020*a*). Some economists, however, like Kenneth Arrow and Elenor Ostrom argue that social capital falls outside economists’ standard understanding of capital (Iisakka and Simpura, 2007). Despite this, social capital is a durable, non-financial asset which contributes to production so should be judged as capital, in line with the definitions above.

Some have suggested measuring social capital using transaction costs because, when trust is low, people take more measures to ensure honest and fair conduct and these types of costs

¹John R. Hicks (1981, p.204) in Hulten (1991)

rise (Bromiley and Cummings, 1995). However, social capital is not the only determinant of transaction costs and also affects other things, meaning that this method would give an incomplete picture.

A better way might be to look at how indicators of social capital translate into increased output. Dai et al. (2015) used regressions to determine how different indicators of social capital predicted the financial performance of Chinese hotels. Such studies could be carried out for UK firms of various sizes. Results of regular surveys measuring the same social capital indicators could then be used to estimate how changes in social capital are impacting output.

This method produces a valuation but is inconsistent with the standard way of measuring capital, namely the price it would cost to buy (ONS, 2018*a*). Perhaps some adjustments could be made to correct for this but it may have to be accepted as a limitation of the measure. Despite this, Dai et al. (2015) show empirically that (inter-firm) social capital is an important contributor to production, justifying the importance of this kind of capital when measuring the total capital stock.

3 Human Capital

Whilst human capital is currently excluded from the capital stock, it is reported in a separate measure as the total discounted future earnings of the working age population (ONS, 2020*b*). Each individual's lifetime earnings are calculated using the average earnings of people a year older than them and in the same category of age, gender and highest qualification (ONS, 2020*b*).

Whilst this measure does indirectly include every factor that affects a person's contribution to production, it does not offer much insight into their specific skills and characteristics. In contrast, directly measuring contributors to the human capital stock like non-formal education, training and health would allow the ONS to go beyond simple categorisations. These contributors could also be included as part of the ONS' reported capital stock.

The importance of these contributors has been underlined by the proliferation of internet access and the pandemic-driven expansion of remote learning and online learning resources (OFQUAL, 2021). Workers are creating human capital outside of formal education but the specific impact of this could remain unquantified under the current system of measurement. A higher resolution picture of the contributors to the human capital stock aid understanding of how its composition changes over time and, in turn, improve forecasting and policy.

Despite these benefits, it would be difficult to implement such a change. For example, the revenue from purchases of online courses could be added to the capital stock but this would cause double counting because that investment would also be captured implicitly by current wages-based measure of the human capital stock. To avoid this, the investment in online courses must then be removed from the current measure, making it incomplete.

To resolve this, the entire human capital stock must be included in the main capital stock measure but this creates another issue. The UK's human capital stock was estimated to be £21.4 trillion in 2018 (ONS, 2019*a*), but the physical capital estimate was £4.6 trillion that same year (ONS, 2018*b*). This massive difference means that efforts to merge the two are likely to be fraught (Valero and Brown, 2021). This, combined with increased measurement costs, means that leaving human capital as a separate figure may be optimal.

4 Organisational Capital

Intangible assets like organisational capital are uncapitalised and currently in experimental publications (ONS, 2019*b*). Much of the literature is increasingly showing that intangible assets and organisational capital at the heart are growing in importance (Black and Lynch, 2005; Enache and Srivastava, 2017). Lev et al. refer to organisational capital as being the prime intangible asset of businesses and the enabler of “patents, brands, and human capital to be productive” (Lev et al., 2016, p.5). Notably though, its notoriety for being difficult to measure is underpinned by how organisational capital is unique to each firm, making it a challenge to ascertain the level of organisational capital en masse.

Albert Einstein’s famous comment that “Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted” (Einstein, n.d.) is especially pertinent with regards to organisational capital, although some academics argue that its role in terms of contributing to a company’s – and therefore society’s – investments is becoming difficult to ignore. Intangible investments appear as an expense in the selling, general, and administrative (SG&A) section of a public company’s income statement. (Mauboussin and Callahan, 2022) suggest measurement changes (for accountants) which the ONS could potentially leverage. These entail intangible investments (currently in this ‘expense’ section) being compartmentalised into main SG&A and maintenance. The example they use which encapsulates the argument refers to how £1000 spent to obtain a customer that is expected to provide revenues for the next 5 years would, as it stands, be treated as an expense (and not attributed to an investment portion pertaining to a capital stock) as opposed to £1000 spent on equipment that is expected to provide the same cash flows.

Enache and Srivastava (2017), deviating from the perpetual inventory method, estimate that on average, across firms, 54% of SG&A is attributable to an investment portion, i.e., not maintenance and is spending towards growth. This is different to more mainstream methods (Peters and Taylor, 2017) of capitalising intangible assets which uses 100% of R&D and 30% non-R&D (main) SG&A. This process arguably better captures investment that might otherwise be classed as an expense towards maintenance. However, it should also be noted that all these suggestions apply to publicly traded companies, so any measurement changes must also be expanded, albeit less accurately, to firms that do not fall into this category. Further, intangible assets are usually gauged post-firm acquisition, where usually goodwill is the proxy for intangible assets, perhaps using transactional value (Ewens et al., 2020); the above provides a methodology for assaying intangible assets for firms that have not undergone any acquisition. Clearly, the debate continues about whether organisational capital, which underlies much of what glues uncapitalised assets together, should be added to the official measure. Enache and Srivastava’s recommendations could be used to include organisational capital within the ONS figures and improve the measurement of the capital stock.

5 Data

Investment in Data is an important part of the capital stock, with investment in big data having grown in the last 3 decades to reach £5.7bn in 2010 (Goodridge and Haskel, 2015*a,b*). Academics and the ONS have been studying this development and there have been improvements to knowledge about and measurement of these technologies (McCrae and Roberts, 2019).

The ONS currently includes investments in databases and computer software as contributions to the capital stock (ONS, 2021). The inclusion of investment in data science in these figures is easily justifiable because knowledge derived from data can make production more efficient (Goodridge and Haskel, 2015*a*; Corrado et al., 2021).

Research by Goodridge and Haskel (2015*a,b*), however, showed that the ONS figures were likely underestimates of actual investment in data science. The ONS measures investment in data and knowledge by looking at how many people are employed in occupations likely to be involved in creating this form of capital. However, some of the occupations were missing. By accounting for these, the authors were able to estimate how much investment was being missed.

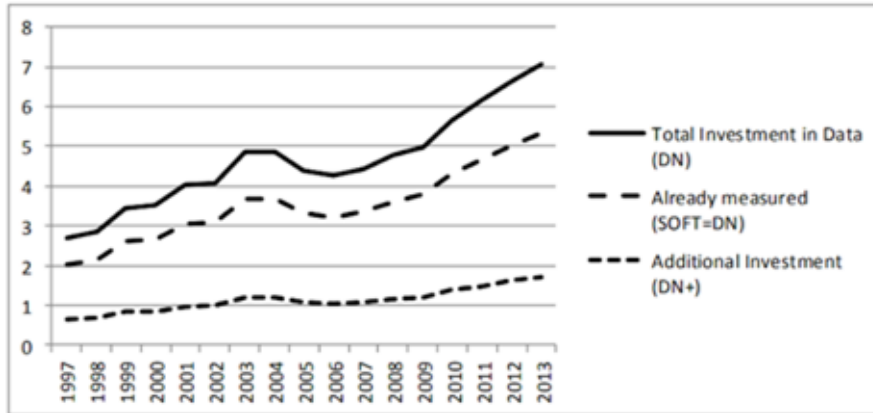


Figure 1: Total, measured and missed investment in data (Goodridge and Haskel, 2015*a,b*)

For example, they estimated that £1.6bn of investment was missed from the capital stock in 2012. In light of these- and other- issues, the ONS has made some improvements, as McCrae and Roberts (2019) reported. Alongside replacing forecasted estimates of investment within companies with collected data, the ONS also used interviews with industry experts and microdata from the Annual Survey of Hours and Earnings (ASHE) to improve measurement of time invested by companies in software development.

Despite these improvements, Goodridge et al. (2021) discuss continuing issues. Specifically, ONS surveys can cause confusion about how respondents categorise investment. This, combined with attempts to avoid double counting, can mean that some investment in databases and data science are missed. Asking specific questions in ONS surveys about investment in databases and data science would remove ambiguity surrounding whether firms report these types of investment as part of software development or R&D (Goodridge et al., 2021). If they report them as part of software development, they will not be included in R&D GFCF figures. As such, some investment in data science will be missed from the published capital stock figures.

Whilst the capital stock already includes investment in data, clearly changes could be made to measurement to ensure that this type of asset is fully included within the reported figures. These changes include improving ONS surveys to ask more specific questions about firm’s investments.

6 Conclusion

In this essay we have seen the importance of social, human and organisational capital and how they could be measured. Inclusion of anything extra in the capital stock would cause the figure to rise and there are judgements to be made about the proportionality of including things like human capital. That said, in cases where there would not be unreasonably large relative changes, inclusion of other types of capital would allow for a more cohesive breakdown of the contributors to the UK's capital stock- and thereby its production. Finally, we have seen that measurement changes could help incorporate relatively contemporary types of assets more fully.

References

- Biorn, E. (2007). Measuring and Decomposing Capital Stock and Service Values: Should Capital Quality be given a Place?, Discussion Papers 518, Statistics Norway, Research Department.
- Black, S. and Lynch, L. (2005). Measuring organizational capital in the new economy. Measuring capital in the new economy, 65, 205-234.
- Bromiley, P. and Cummings, L. (1995). Transaction Costs in Organizations with Trust. In Bies, R., Lewicki, R. and Sheppard, B. (editors) Research in Negotiation in Organizations, Volume 5. JAI Press. 219-247.
- Corrado, C., Haskel, J. and Jona-Lasinio, C. (2021). Artificial intelligence and productivity: An intangible assets approach. Oxford Review of Economic Policy, 37(3), 435-458.
- Dai, W., Mao, Z., Zhao, X. and Mattila, A. (2015). How does social capital influence the hospitality firm's financial performance? The moderating role of entrepreneurial activities. International Journal of Hospitality Management, 51, 42-55.
- Dunn, M. and Johannsson, K. (2021). 'Capital stocks and fixed capital consumption, UK: 2021'. <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/bulletins/capitalstocksconsumptionoffixedcapital/2021>. Accessed 23/04/2022.
- Einstein, A. (n.d.). Origin unknown.
- Enache, L. and Srivastava, A. (2017). Should Intangible Investments Be Reported Separately or Commingled with Operating Expenses? New Evidence. Management Science, Forthcoming, Tuck School of Business Working Paper No. 2715722. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2715722. Accessed 24/04/2022.
- Ewens, M., Peters, R. H. and Wang, S. (2020). Measuring Intangible Capital with Market Prices (No. w25960). National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w25960/w25960.pdf. Accessed 24/04/2022.
- Goodridge, P. and Haskel, J. (2015*a*). How does big data affect GDP? Theory and evidence for the UK, Working Papers 25156, Imperial College, London, Imperial College Business School.
- Goodridge, P. and Haskel, J. (2015*b*). How much is UK business investing in big data?, Working Papers 25159, Imperial College, London, Imperial College Business School.

- Goodridge, P., Haskel, J. and Edquist, H. (2021). We See Data Everywhere Except in the Productivity Statistics. *The Review of Income and Wealth*, *The Review of income and wealth*, 2021.
- Hulten, C. R. (1991). The measurement of capital. In *Fifty years of economic measurement: The jubilee of the conference on research in income and wealth* (pp. 119-158). University of Chicago Press.
- Iisakka, L. and Simpura, J. (2007). Social capital – ways ahead and ways blocked in national assessment and international comparisons. [Paper presentation] 2007 Conference of European Statisticians, Geneva, Switzerland, 11-13 June 2007. Available at: https://unece.org/DAM/stats/publications/Measuring_capital.pdf. Accessed 23/04/2022.
- Lev, B., Radhakrishnan, S. and Evans, P. C. (2016). ‘Organizational Capital: A CEO’s Guide to Measuring and Managing Enterprise Intangibles’. *Measuring and Managing Organizational Capital Series No. 1*. The Center for Global Enterprise. <https://www.thecge.net/app/uploads/2016/02/WEB-Capital-Investment-Feb22.pdf>. Accessed 24/04/2022.
- Mauboussin, M. J. and Callahan, D. (2022). ‘Intangibles and Earnings: Improving the Usefulness of Financial Statements’. *Consilient Observer*. Morgan Stanley. <https://www.morganstanley.com/im/en-us/financial-advisor/insights/articles/intangibles-and-earnings.html>. Accessed 24/04/2022.
- McCrae, A. and Roberts, D. (2019). ‘Impact of Blue Book 2019 Changes on Gross Fixed Capital Formation and Business Investment’, *National Accounts articles*, London, Office for National Statistics.
- OFQUAL (2021). ‘Learning during the pandemic: review of research from England’. <https://www.gov.uk/government/publications/learning-during-the-pandemic/learning-during-the-pandemic-review-of-research-from-england>. Accessed 23/04/2022.
- ONS (2018a). ‘Capital stocks and fixed capital consumption QMI’. <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/methodologies/capitalstocksandcapitalconsumptionqmi>. Accessed 23/04/2022.
- ONS (2018b). ‘Capital stocks and fixed capital consumption, UK: 2018’. <https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/bulletins/capitalstocksconsumptionoffixedcapital/2018>. Accessed 23/04/2022.
- ONS (2019a). ‘Human capital estimates in the UK: 2004 to 2018’. <https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/humancapitalestimates/2004to2018>. Accessed 23/04/2022.
- ONS (2019b). ‘Developing experimental estimates of investment in intangible assets in the UK: 2016’. <https://www.ons.gov.uk/economy/economicoutputandproductivity/productivitymeasures/articles/experimentalestimatesofinvestmentinintangibleassetsintheuk2015/2016>. Accessed 24/04/2022.
- ONS (2020a). ‘Social capital in the UK: 2020’. <https://www.ons.gov.uk/economy/grossdomesticproductgdp/compendium/unitedkingdomnationalaccountsthebluebook/2021>. Accessed 23/04/2022.

- ONS (2020*b*). 'Indicator Based approach to measuring Human Capital'. <https://consultations.ons.gov.uk/well-being-inequalities-sustainability-and-environment/indicator-based-approach-to-measuring-human-capita/>. Accessed 24/04/2022.
- ONS (2021). 'UK national accounts, the blue book: 2021'. <https://www.ons.gov.uk/economy/grossdomesticproductgdp/compendium/unitedkingdomnationalaccountsthebluebook/2021>. Accessed 23/04/2022.
- Peters, R. H. and Taylor, L. A. (2017). Intangible Capital and the Investment-q Relation. *Journal of Financial Economics*, Vol. 123, No. 2, February 2017, 251-272. <https://www.aeaweb.org/conference/2017/preliminary/paper/23tF46eZ>. Accessed 24/04/2022.
- Valero, A. and Brown, P. (2021). 'Which investments in human capital will boost productivity growth?'. *Economics Observatory*. <https://www.economicsobservatory.com/which-investments-in-human-capital-will-boost-productivity-growth>. Accessed 24/04/2022.