Digital concrete: productivity in construction

Abstract submitted to NBER/CRIW Conference on Technology, Productivity, and Economic Growth 2022
Authors: Diane Coyle (Bennett Institute, University of Cambridge, ESCoE, and The Productivity Institute), Rehema Msulwa (Bennett Institute, University of Cambridge)

The construction sector accounts for 6-7% of nominal annual GDP in the UK (as in the US), and its measured labour productivity growth has been close to zero (negative in the US). This is consistent with the popular image of construction sites as low-tech environments. Yet Griliches (1994) designated construction as a hard-to-measure sector, and indeed the disappointing aggregate performance is puzzling to industry observers, who note there have been increases in the productivity of specific activities (e.g. Goodrum, Haas & Glover 2010), and in particular a significant increase in the use of digital tools from the design stage all the way through to maintenance. Work by the BLS to improve deflators for some parts of the sector has gone some way to resolve the puzzle in US data (Sveikauskas et al 2016), but this project did not consider the activity shifts within the sector or the implications for deflators of the ongoing digitalisation of construction.

In this paper we will explore the impact of digitalisation on the structure of the construction sector, and on the measurement of its output and labour productivity. The use of computer-aided design (CAD) tools has commoditised the design stage, leading to considerable outsourcing to countries such as Brazil and Poland. At the other end of the value chain, much construction activity is now contracted out to specialist sub-contractors. In between, both consultants and major contracting firms seek to capture value through digitally-enabled project and programme management using integrated 3D software models that capture data through time from design through construction to operation (known as 'digital twins' or BIM). For example, sensors embedded in concrete or steel can be monitored in real time allowing reduced maintenance costs or averting structural failures. Thus operational costs for clients are reduced over time. In addition, parts of structures are increasingly built offsite for onsite assembly, a process enabled by CAD, whose major benefit is reduced construction time. Some major firms are building factories to produce these parts for their construction projects.

While well-appreciated in the industry, these changes are not reflected in aggregate output, price and productivity statistics. We have begun a series of semi-structured interviews with industry experts. This will feed into a joint Bennett Institute-Economics Department workshop in Cambridge in June 2021 for industry practitioners, engineers and economists, to map these industry shifts and consider implications for the measurement and understanding of their productivity impacts. These implications might also relate to other sectors upstream or downstream from construction. We would then work with colleagues at the Office for National Statistics (Coyle is an ONS Fellow and ESCoE lead researcher) to develop improved productivity metrics, using micro-data. This process is the same as we used in improving measurement of prices and real output in the UK telecommunications sector (Abdirahman et al 2020), which is now being implemented in UK national statistics (ONS 2020).

References

Abdirahman, M., Coyle, D., Heys, R. & Stewart, W. (2020). A Comparison of Deflators for Telecommunications Services Output. Economie et Statistique / Economics and Statistics, 517-518-519, 103–122. https://doi.org/10.24187/ecostat.2020.517t.2017

Paul M. Goodrum, Carl T. Haas & Robert W. Glover (2002) The divergence in aggregate and activity estimates of US construction productivity, Construction Management and Economics, 20:5, 415-423, DOI: 10.1080/01446190210145868

Griliches, Z. (1994). "Productivity, R&D, and the Data Constraint," The American Economic Review, Vol. 84 (1), (Mar., 1994), pp. 1-23.

ONS 2020
https://www.ons.gov.uk/economy/nationalaccounts/uksectoraccounts/articles/producinganalternativeapproachtogdpusingexperimentaldoubledeflationestimates/2020-11-02

Leo Sveikauskas, Samuel Rowe, James Mildenberger, Jennifer Price, &Arthur Young, Productivity Growth in Construction, J. Constr. Eng. Manage., 2016, 142(10): 04016045, https://ascelibrary.org/doi/pdf/10.1061/%28ASCE%29CO.1943-7862.0001138