

Quantifying Australia's returns to innovation

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The desire to quantify the relationship between innovation and Australia's economic growth is ever present. This working paper quantifies the relationship between domestic gross expenditure on research and development (R&D) and GDP per capita growth to estimate the return on investment (ROI) to innovation for Australia. It is intended to inform discussions regarding the role and value of innovation investment in the Australian economy, and to guide policy and investment decisions.

In September 2020, Benjamin F. Jones and Lawrence H. Summers at the National Bureau of Economic Research (NBER) released a working paper, 'A calculation of the social returns to innovation', which provides a novel methodology for estimating the economy-wide returns to investments in innovation and applies this to the United States.

Motivated by public and private sector leaders' interest in quantifying the Australian return to innovation investment, CSIRO Futures has replicated this approach for the Australian context in this working paper. Using Australia input data, this paper adopts the Jones and Summers approach to calculate quantitative estimates of the economy-wide return on investment (ROI) of R&D spending for the Australian economy.

This is a novel yet simple macroeconomic approach that complements other methodologies for estimating the economic returns to innovation. It encompasses both successful and unsuccessful R&D investments and quantifies only economic benefits, excluding non-monetary societal and environmental benefits.

Although economic growth is entirely attributable to technological innovation in our model, two adjustments have been identified that better reflect the timing and way in which R&D is incorporated into the economy. These adjustments involve a delay between R&D and payoffs and the costs of building R&D into new capital inputs (known as embodied capital deepening).

The most conservative estimates incorporate these adjustments and state that \$1 of R&D investment creates an average of \$3.5 in economy-wide benefits for Australia in today's dollars, and a 10% average annual return.

Removing these two adjustments yields the upper-bound for this paper's returns to innovation estimates. This unadjusted result, which does not account for the additional time and costs associated with integrating R&D into the economy, is estimated as creating \$20.8 in economy-wide benefits and a 104% average annual return for every dollar spent on R&D in Australia.

Even with the conservative estimates (combined adjustment), the returns to innovation remain high compared to private investment returns. Historically in Australia, 10-year government bond returns have averaged under 7% per year and private equity market returns have averaged around 10% per year. Likewise, the conservative benefit-cost ratio estimate of \$1 to \$3.5 is notable since benefit-cost ratios greater than \$1 to \$1 typically indicate that a project or program has economic merit.

These findings imply that innovation investment made to-date has been well worthwhile and increasing future investment could capture substantial economy-wide returns. This is notable since Australia's R&D expenditure share of GDP lags behind the OECD average and has been decreasing over the past decade.

Further research may investigate how much economy-wide returns rise if Australia was to increase its R&D expenditure share of GDP, such as up to the OECD average. Future studies may also quantify how international R&D expenditure and activity affects Australian productivity and growth, irrespective of domestic innovation investments which are the focus of this paper.

Key Words

Returns to innovation, innovation investment, R&D expenditure, economic growth