**UCGSA Brief on Target vs Base, Human Capital, and Graduate Student Productivity**

November 19th, 2024

*Base vs Targeted Funding:*

* Research contains “indirect costs” (legal counsel, utilities for laboratories, administrative support for field work, etc) that are only partially covered by research grants.
* Targeted funding, especially if it’s targeted enrollment funding, can miss the administrative support elements necessary for successful research.
* Targeted funding also restricts level of interdisciplinary/transdisciplinary research, as inequitably funded departments (especially if administrative costs are inequitably covered) will find it difficult to efficiently collaborate.
* Targeted funding can also lead to economic stagnation if it becomes an overused policy tool:
  + Entrepreneurship is supposed to be disruptive, meaning that entrepreneurs are changing the labour market, not keeping the status quo;
  + Base funding increases allow university departments to freely collaborate and produce research that’s entrepreneurial (adaptive and disruptive);
  + Adaptive and disruptive economies are the only kind that compete in the open, global marketplace;
  + Targeted funding is a bet by the government that today’s labour market needs will persist indefinitely, which is true for some fields (medicine) but not for the majority of jobs;
  + Therefore, a post-secondary system that supports a globally competitive economy will prioritize base funding increases over targeted funding.

*Human Capital Studies:*

There’s growing evidence that labour markets are rewarding so-called “soft skills” or “higher order skills”—personality traits, motivations, critical thinking skills, and teamwork—at an increasing rate.

A sampling of the academic literature:

* Heckman, J.J and Kautz, T. 2012. “Hard Evidence on Soft Skills,” *Labour Economics* 19(4): 451-464.
  + Soft skills predict life achievement to a greater extent than traditional “cognitive skills” like IQ, though the importance of cognitive ability increases with the complexity of tasks.
  + Authors focus on benefits of early childhood interventions for building soft skills, but implication is that individuals who are better cooperators, more intrinsically motivated, and are more curious have higher lifetime earnings.
* Denning, D.J. 2022. “Four Facts about Human Capital,” *Journal of Economic Perspectives* 36(3): 75-102.
  + **“Fact #4: Higher-Order Skills Such as Problem-solving and Teamwork Are Increasingly Economically Valuable, and the Technology for Producing Them Is Not Well Understood.”**
  + “Higher order skills” involve applying existing knowledge to new situations, evaluating multiple sources of evidence, and collaborating with others in turning knowledge into concrete action. “Lower order” cognitive skills involve memory and recall.
  + *Lists experimental studies that directly tie social and teamwork skills to higher productivity levels*.
  + On-the-job experience in areas like communication and time management, as well as social skill training sessions for entrepreneurs, also show increasing productivity levels. One interpretation (not explicitly laid out in the paper) is that there’s some suggestive evidence that adults can still learn and improve these skills.
  + Good economic decision-making requires counterfactual thinking (i.e., the consideration of alternatives).
  + Cognitive empathy predicts strategic sophistication, allowing participants to solve complex problems quicker (ex: reaching Nash Equilibrium in a game theoretic environment more quickly).
* Deming, D.J. and Silliman, M.I. 2024. “Skills and Human Capital in the Labour Market,” *NBER Working Paper* (pre-print).
  + Builds a multi-dimensional model of human capital formation that takes into account the importance of “non-cognitive” skills and their development over a person’s educational lifecycle.
  + Model helps distinguish wages and productivity of workers who are able to better make collaborative decisions with those who can’t.
  + Model helps explain why teamwork, social skills, and good “economic decision-making” all predict higher lifetime earnings.

The main implication of these studies is that degree streams which rely heaviest on “soft” or “higher order” skills will start seeing increasing lifetime returns, and one of the most consistent mechanisms explaining these increasing returns is the connection between soft/higher order skills and productivity. These degree streams may teach in unconventional ways (ex: reading from works of fiction) and may not produce physical technology in the way engineering program might. However, the skills these students acquire create productivity gains and, thus, increase the economic returns for themselves and their firms, community, or local economy.

The return to lower-order cognitive skills might actually be *declining* due to the rapid progress of artificial intelligence (A.I.), which has automated many tasks that predominantly rely on memory and recall. Meanwhile, generative A.I. programs like Chat-GPT seems to act more as a *compliment* to human soft skills rather than a substitute. Thus, enhancing the level of soft skills will likely allow us to make increasing productivity gains by partnering with A.I.

If a government wants to grow the economy, it will want a post-secondary system that supports these degree streams. Importantly, it won’t defund or delegitimize degree streams that engage in counterfactual reasoning or learn through measures that enhance cognitive empathy, such as reading works of fiction. We believe that the more theoretically-oriented natural sciences, social sciences, and humanities all fit the description of degree streams that prioritize soft or higher order skill sets. As such, Alberta’s post-secondary system should celebrate the education that students in these degrees, and recognize that in the age of A.I., these skills are only going to get more important.

*Approximate Contribution of Students to Canadian Productivity*

The following is a back-of-the-envelope calculation based on the following article:

* Martin, F. 1998. “The Economic Impact of Canadian University R&D,” *Research Policy* 27(1) 677-687.

*Dynamic economic impact of university R&D = Total Factor Productivity (TFP) increases resulting from R&D spending*

*Student contribution to dynamic impact = increases to TFP resulting from human capital accumulation*

*Total graduate student contribution (plus spending from student tuition and fees):*

* **$6,254,812,500**

*Total undergraduate student contribution (plus spending from student tuition and fees):*

* **$4,955,546,875**

*Total aggregate student contribution:*

* **$11,210,359,375**

*Canadian GDP in 1997[[1]](#footnote-1):*

* **$655,990,000,000**

*Percentage of Canadian GDP from student TFP enhancements:*

* **(11,210,359,374/655,990,000,000) x 100 = 1.71%**

*Canadian GDP in 2023:*

* **$2,140,000,000,000**

*Student Contribution to 2023 GDP if % holds constant:*

* **$36,594,000,000**

In other words, if approximately 1.7% of Canada’s GDP is attributable to productivity enhancements from the human capital of students, then in 2023 this would equal **$36.6 billion**. Note that this doesn’t include contributions to Canada’s GDP through day-to-day consumption. Note, too, that it’s entirely possible the percentage contribution from students has *increased*, due to declining private sector investment in R&D and Canada’s unique reliance on higher education contributions to R&D. This number likely substantially underestimates the total contribution of students to Canada’s economy.

1. The year the article was submitted. [↑](#footnote-ref-1)