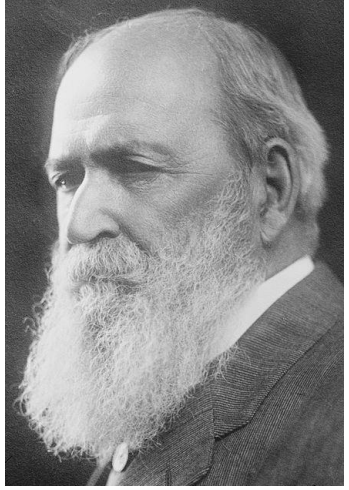
Cathedrals in the Desert?!

Universities as Instruments of Regional Development in Canada's Provinces

February 22, 2019 | Herb Emery, Vaughan Chair in Regional Economics



“The word useful should be banished from the university vocabulary.”

Basil Gildersleeve, Professor of Classics, Johns Hopkins University, 1877

DISSERTATION

“De Porphyrii studiis Homericis capitum trias” (Göttingen, 1853).

Do provinces experience higher GDP growth, labour productivity and innovative activity by investing in their own universities?

Don’t we know the answer to this question?

- Universities in Canada are recognized as important developers of human capital and knowledge for the national economy
    - graduates mobile across jobs, employers, industries, regions and nations.
    - Universities in Canada have also increased the research intensity of their missions over time, attracting internationally recognized researchers and producing commercializable discoveries.
  - little empirical evidence that universities drive growth of regional economy
    - (Goldstein and Drucker 2006, Drucker and Goldstein 2007, Kantor and Whalley 2014).

Fending off university-attacking zombies

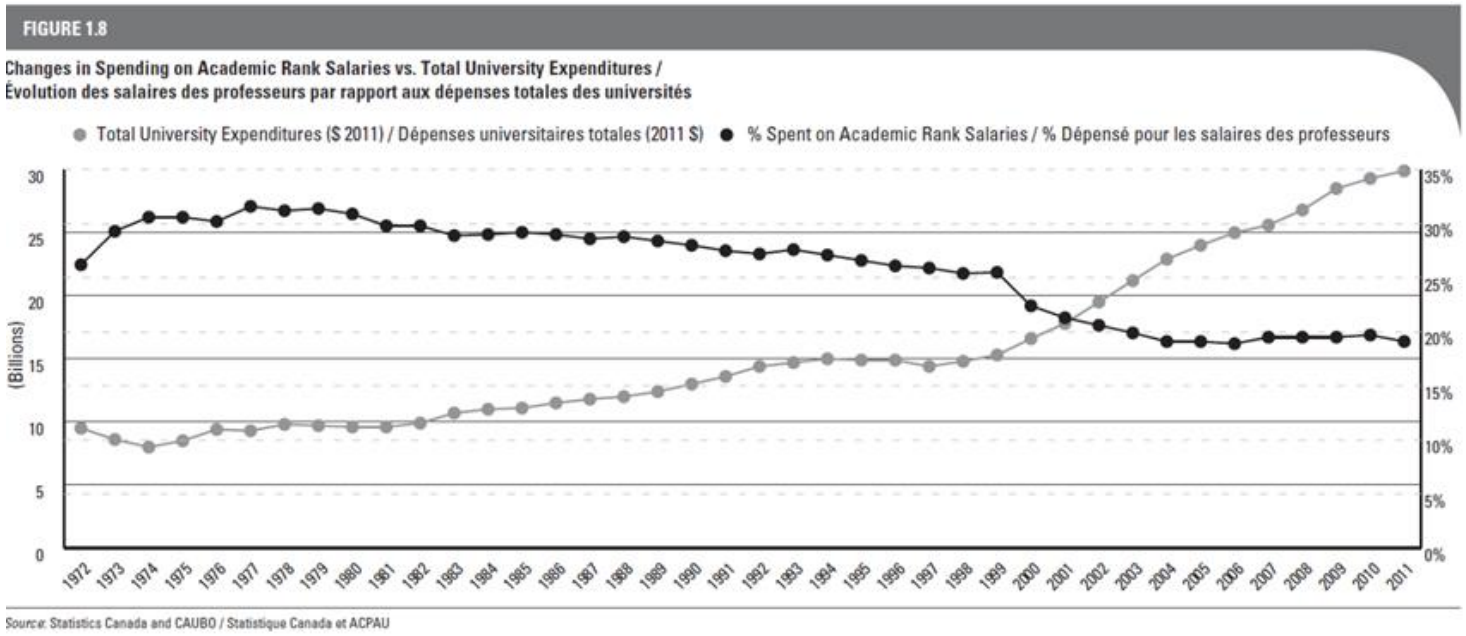
The University of Toronto's president definitively challenges the growing chorus of critics calling who have been calling for post-secondary education and research to be more closely aligned to job-market needs.

- "The decline (in world rankings of Canada's big universities) was a direct result of Canada's "highly egalitarian approach"… Canada refuses to focus its resources on a select number of top research universities strategically so that they could truly compete."
  - "Countries around the world are picking winners and investing heavily in them, so they are coming up the ranks while Canada is slipping."
  - "The risk… is that Canada could end up with many mid-ranked institutions, but lack the big flagship institutions that drive investment, research and development and the economy."
  - …and the asset that will be devalued the most if the Zombies win. I am referring, of course, to young talent."
    - https://business.financialpost.com/productive-conversations/fending-off-the-university-attacking-zombies
    - March 14, 2013

Regional impacts should matter for provincial taxpayers

- university operations funded provincially.
  - smaller population provinces have less fiscal capacity to fund universities
  - fiscal challenges for provinces and population aging
    - make sustaining the current scale of university operations and research more luxury rather than a necessity
    - provincial taxpayers have less appetite for subsidizing exports of the young population to other regions of the country.

Sizeable public expenditures on provincial universities: University expenditures have never been higher



Big commitment of public money to university faculty

By 2012, **highest paid professors** in publicly funded universities **in the world**!

Academic salaries

How professors' monthly salaries compare at publicly funded universities, adjusted for cost of living in each country:

	Average salary (PPP*-adjusted)
Canada	**$7,196**
Italy	6,955
South Africa	6,531
India	6,070
United States	6,054
Saudi Arabia	6,002
United Kingdom	5,943
Australia	5,713
Netherlands	5,313
Germany	5,141
Norway	4,940
Israel	4,747
Nigeria	4,629
Malaysia	4,628
Argentina	3,755
France	3,484
Japan	3,473
Brazil	3,179
Colombia	2,702
Turkey	2,597
Czech Republic	2,495
Mexico	1,941
Latvia	1,785
Kazakhstan	1,553
Ethiopia	1,207
China	720
Russia	617
Armenia	538

*purchasing power parity

SOURCE: Inside Higher Education

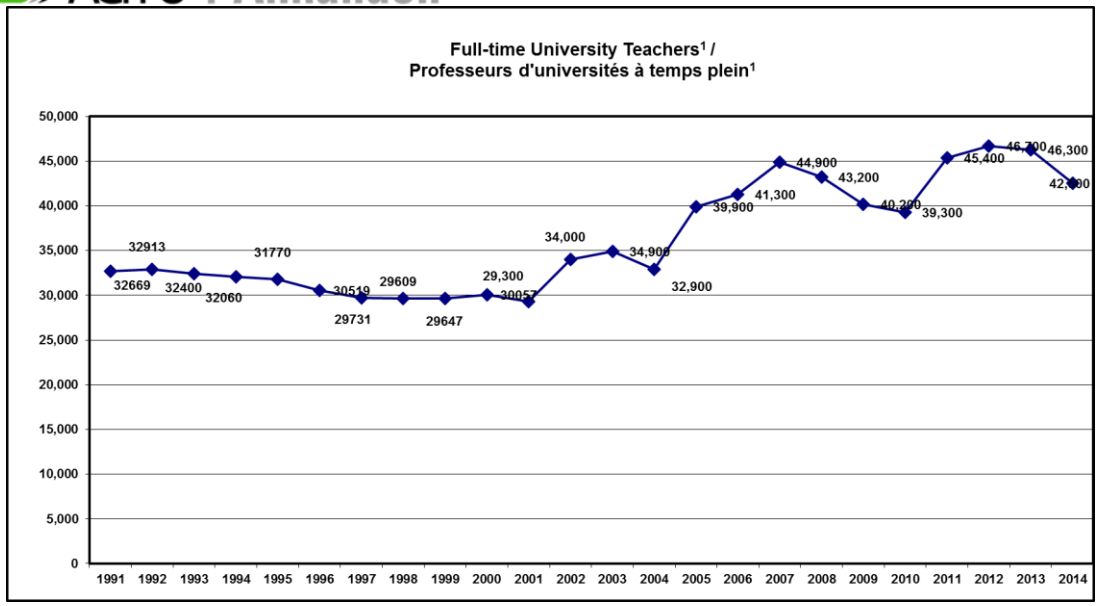
https://www.thestar.com/news/canada/2012/03/22/why_canadas_professors_are_the_best_bestpaid_that_is.html

"Why Canada's professors are the best (best-paid, that is)"

A desire to attract the best and brightest academics and the rise of Canada's dollar have helped make the country's professors the world's highest-paid at public universities.

More university teachers than ever

CAUT ACPPU | Almanac Almanach

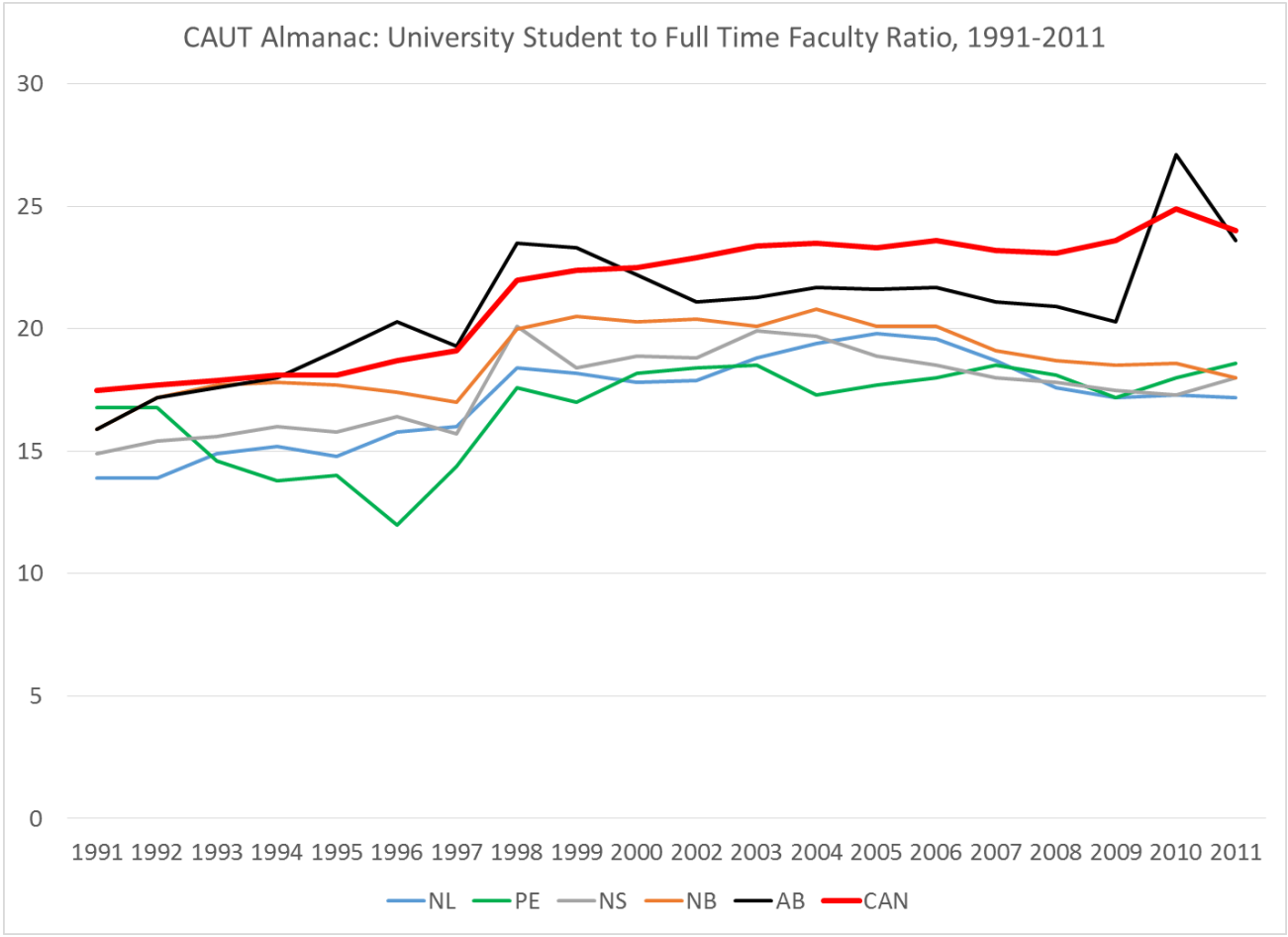


“The future will be much like the present. Only more expensive.”

- Student to faculty ratios returning to what we saw in the 1990s
  - Still higher than for the OECD

Faculty salaries have increased in real terms since 2000 for several reasons

- aging professoriate
- Real increases in salaries for all ranks
- Faculty research productivity falling over career…



Are local/provincial universities necessary for regional growth?

Do skills, knowledge and ideas produced by universities in the region have close substitutes that can be imported from universities outside the region?

- A province can invest in its own universities' or "free ride"
  - Cost effectiveness decision
    - Are provincial capacities for education, training and innovation more cost effective for addressing local needs than imports of people?
  - Market failures/positive externalities
    - research universities may have localized spillover benefits for the regional economy,
      - Generator of knowledge, entrepreneurs, businesses
      - Raise productivity of local non-university producers
      - ideas are costly to import and apply in the region,
        - university may provide the capacity to translate and apply imported knowledge to the regional economy

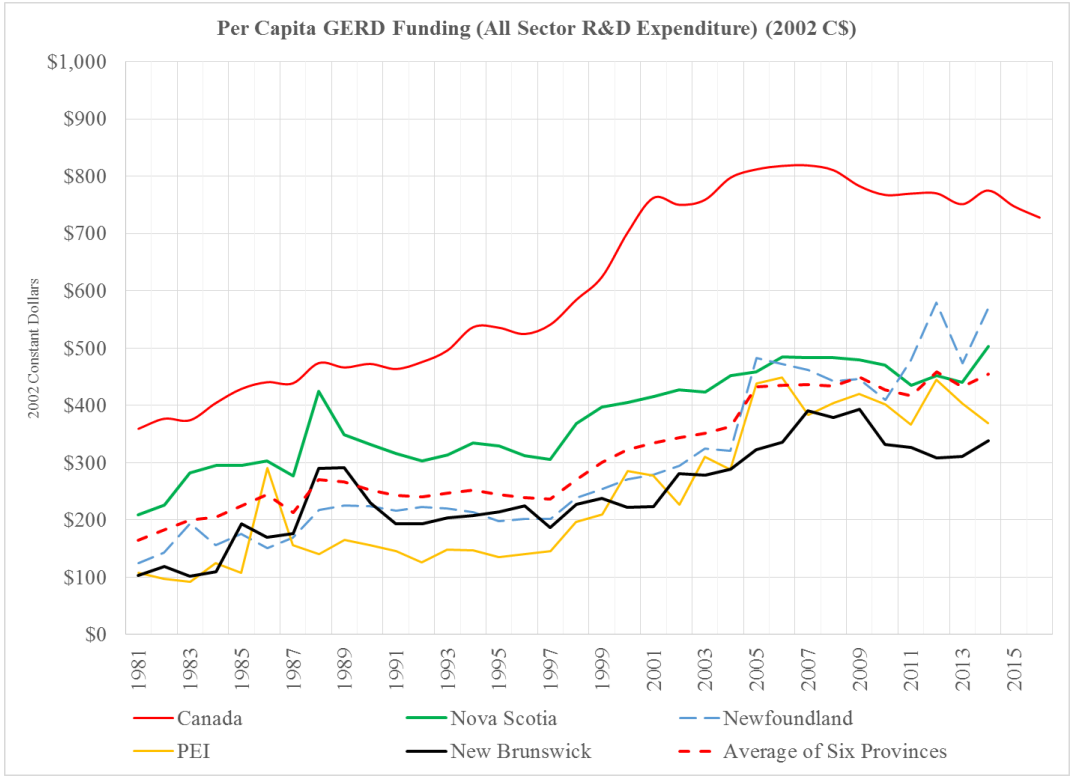
Are local/provincial universities sufficient for regional growth?

Are universities a large, or at least influential, contributor to the region's overall knowledge infrastructure?

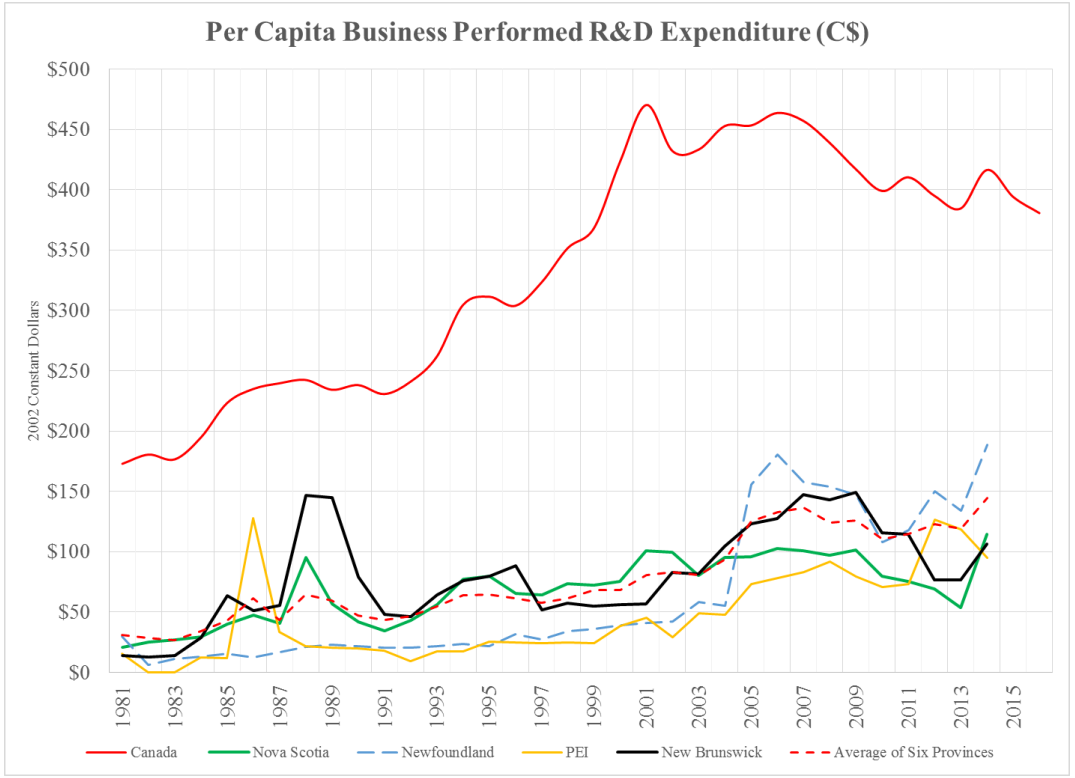
- regional knowledge infrastructure
  - includes public and private institutions of knowledge production; the capacities of firms, workers and institutions for innovation and learning; and the network of connections among them.
    - Goldstein and Drucker (2006)
- Atlantic provinces particularly reliant on universities for R&D
  - research funding largely comes from federal government granting agencies
    - Even though federal research funding is concentrated in the large population provinces.
- Are universities complements or substitutes for other forms of regional knowledge infrastructure?

Substitutes or complements? In Atlantic provinces, high dependence on universities for R&D given low GERD and low BERD

GERD

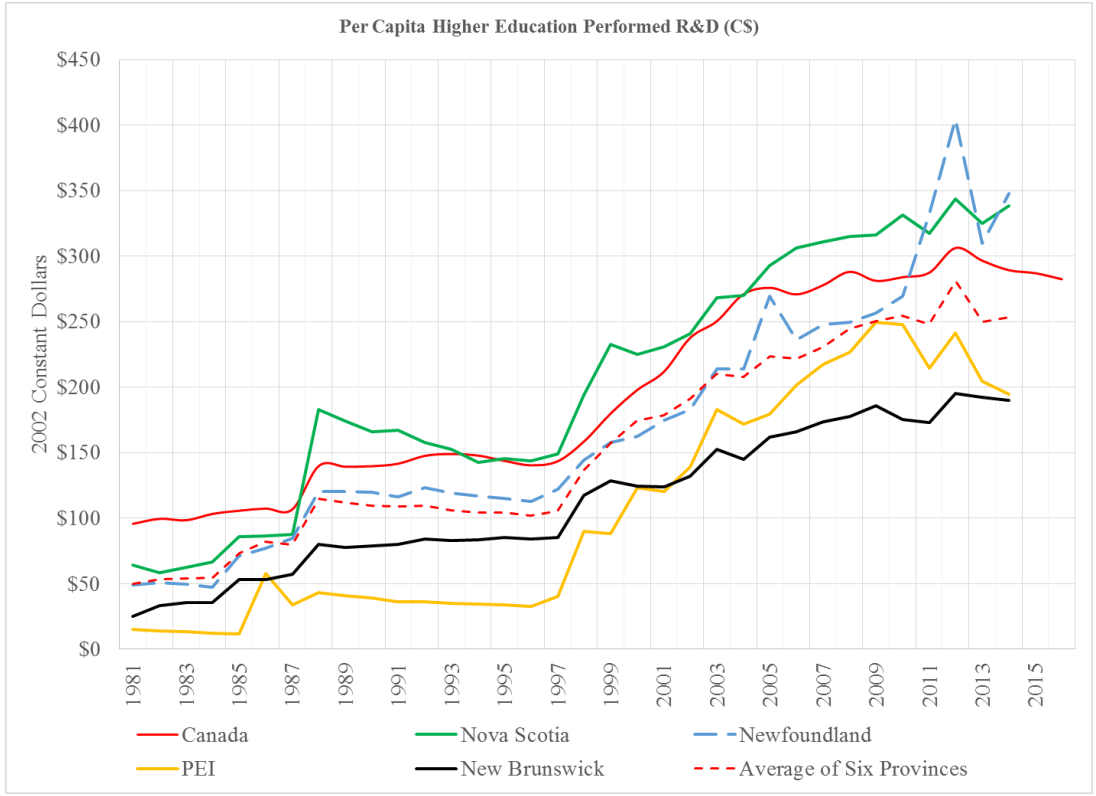


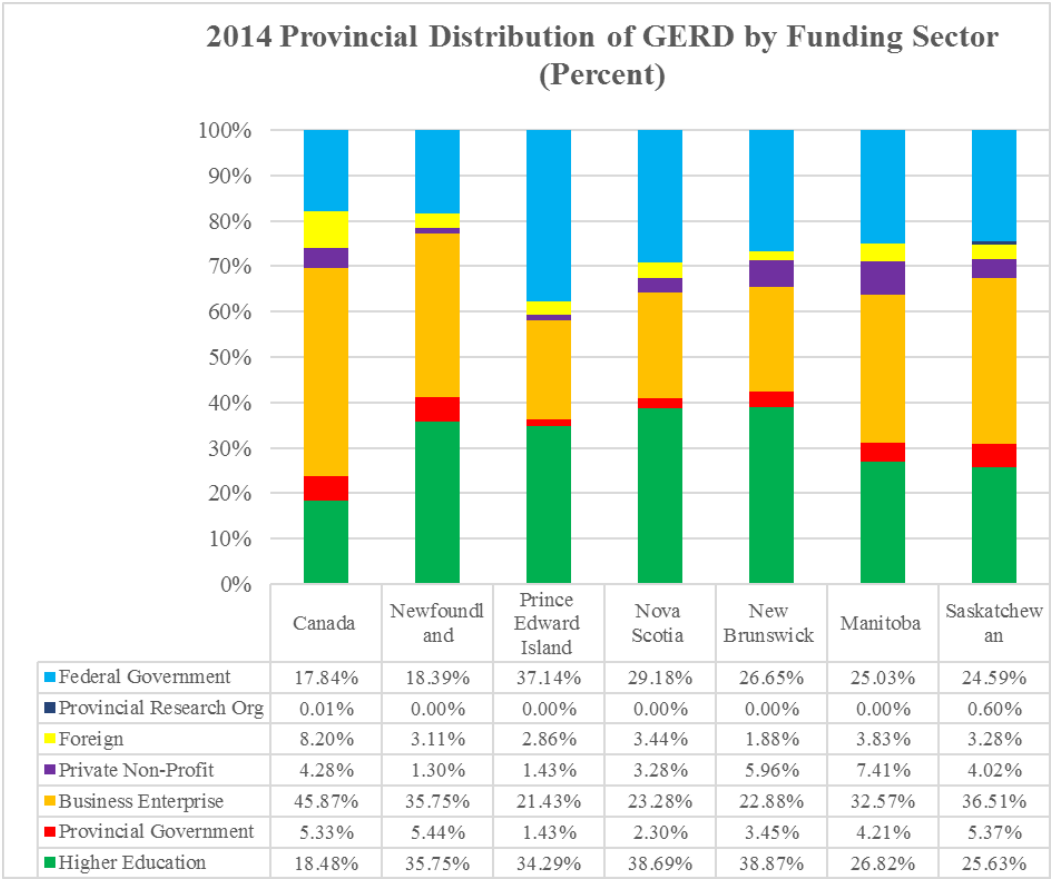
BERD



Do we need even higher HERD in Atlantic Canada to substitute for low BERD, or higher BERD to complement HERD?

HERD – Performing Sector





	Canada	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Manitoba	Saskatchewan
Federal Government	17.84%	18.39%	37.14%	29.18%	26.65%	25.03%	24.59%
Provincial Research Org	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.60%
Foreign	8.20%	3.11%	2.86%	3.44%	1.88%	3.83%	3.28%
Private Non-Profit	4.28%	1.30%	1.43%	3.28%	5.96%	7.41%	4.02%
Business Enterprise	45.87%	35.75%	21.43%	23.28%	22.88%	32.57%	36.51%
Provincial Government	5.33%	5.44%	1.43%	2.30%	3.45%	4.21%	5.37%
Higher Education	18.48%	35.75%	34.29%	38.69%	38.87%	26.82%	25.63%

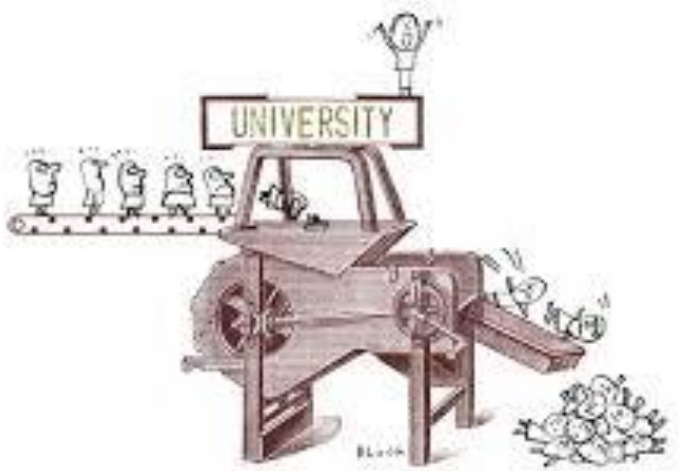
Fig. 1. 2014 provincial distribution of GERD by funding sectors (percent)

Are local university missions and activities oriented to the needs of the regional economy?

- If they are, is it by accident or design?
  - Are teaching programs aligned with labour market needs?
    - Which decade? Which labour market? Curriculum development, refresh?
  - faculties, departments and individual faculty members within any university may have activities aligned with regional interests.
    - Impacts on the regional economy may not be sustained beyond the exit or retirement of key faculty members, nor replicable with new hires.

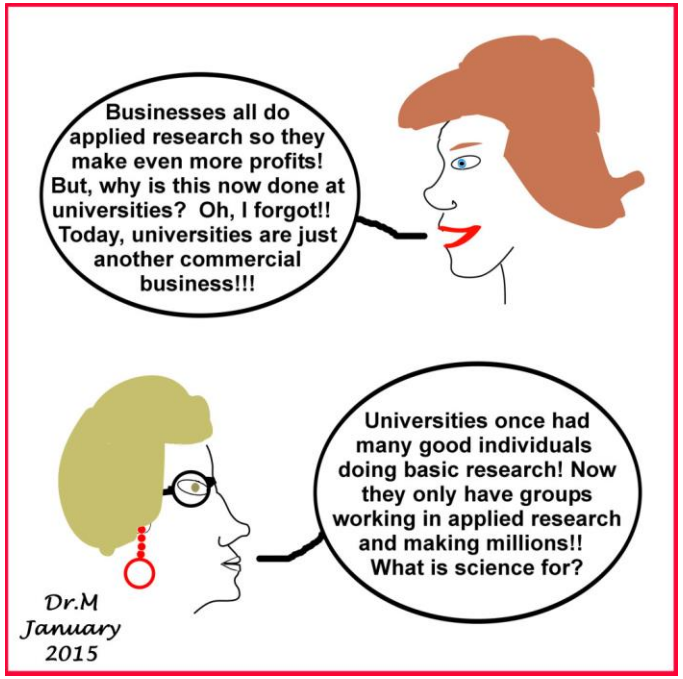
Universities as detached and conventional "knowledge factory"

- university research is expected to passively translate into innovation outputs
    - assumes that basic research (or at least the research that academics unilaterally choose to pursue) will ultimately yield discoveries of "eventual value" to industry, the economy and the public.
        - the presence of research-intensive universities passively, but positively, influences innovation activity of local firms and the location of knowledge-intensive activities, like hi-tech startups.



“Engaged university” -- mission shifts from knowledge transfer of existing university research to aligning functions with regional development needs

- Economic and fiscal conditions and flagging public support for academic research result in:
  - universities seeking to contribute to regional economic competitiveness through greater collaboration with industry.
    - In some cases driven by changes in budgets/public revenues
      - Eg. Student enrolment drives budgets, industry funding/partnership required for public funds
  - Profit centres on campus/University Entrepreneurship
    - prospect of supplementary earnings from patents, licensing, and industrial collaborations has acted as an additional lure in a period of tight public education budgets
      - administrative offices, technology transfer offices and business incubators actively and strategically push university research into industrial application and/or commercialization.



http://dr-monsrs.net/2015/01/14/basic-versus-applied-research-are-there-alternatives-to-funding-by-research-grants/

Public sources of funding encourage universities to pursue the knowledge factory mission

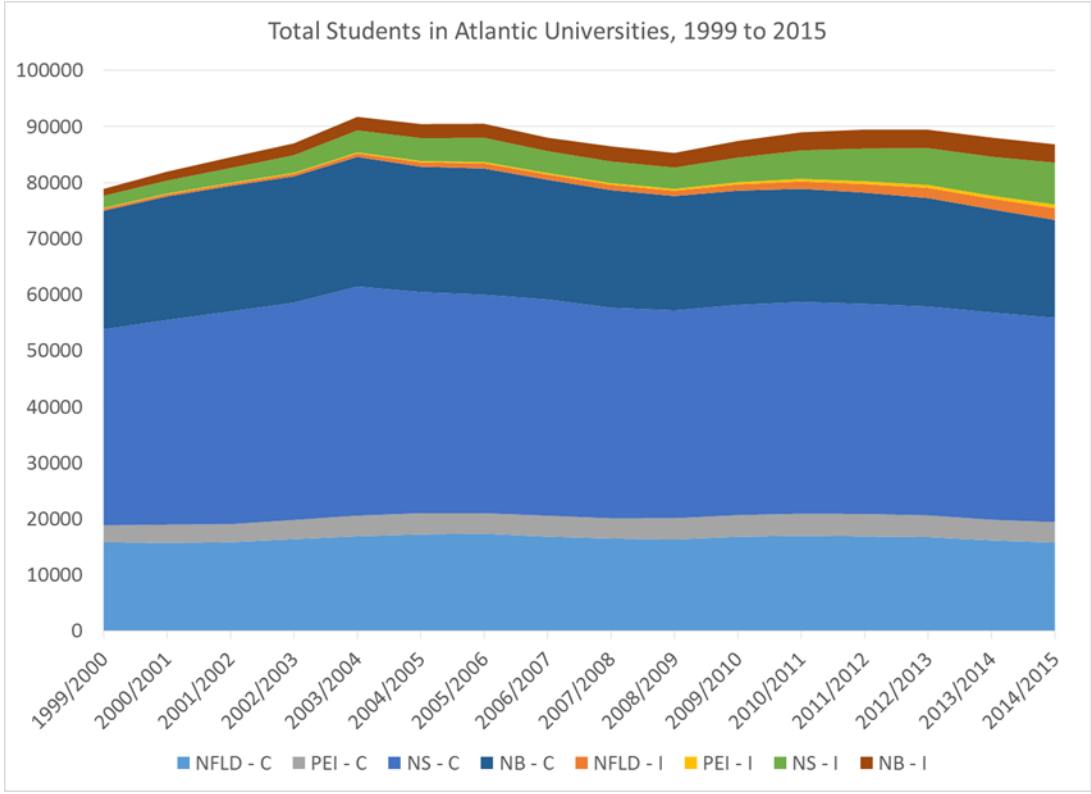
- The prestige, pay and autonomy of academic professions increased with the rise of government support for universities and research after World War II
    - Academic research institutions evolved to be less focused on the practical and applied research and development needs of private industry
        - more oriented toward the basic and long-term applied science agendas of federal funding agencies,
        - as well as helping academics build their academic reputations.
    - universities defined their mission to be to produce “well trained graduates, published research results and faculty consultants.”
- Canada’s Advisory Panel on Federal Support for Fundamental Science recommended
        - “that the federal government should rapidly increase its investment in independent investigator-led research to redress the imbalance caused by differential investments favouring priority-driven targeted research over the past decade.”

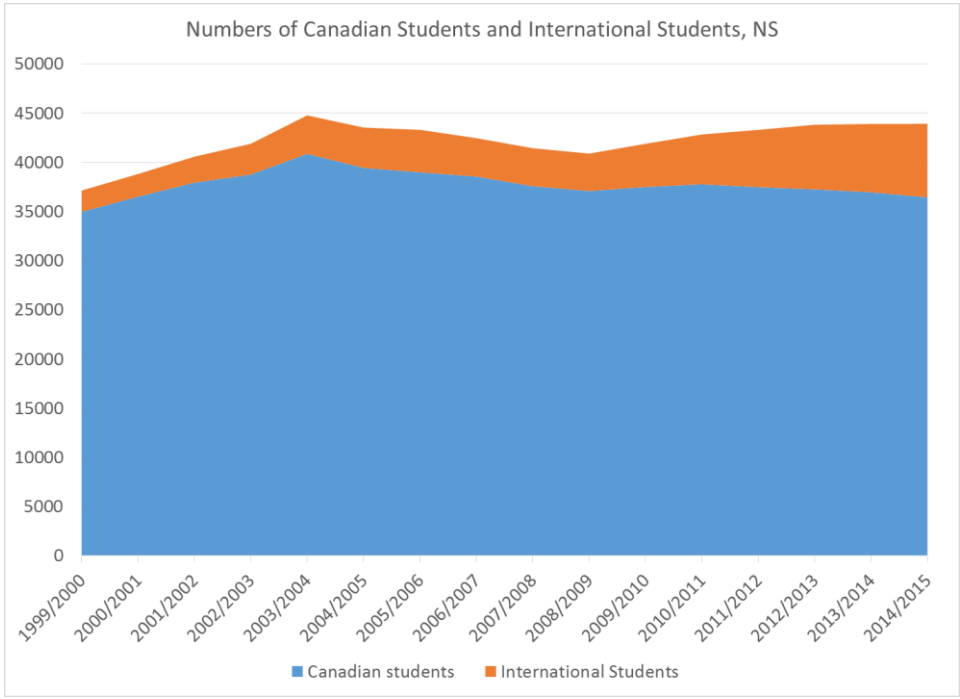
Knowledge Factory mission may be for regional adjustment rather than growth

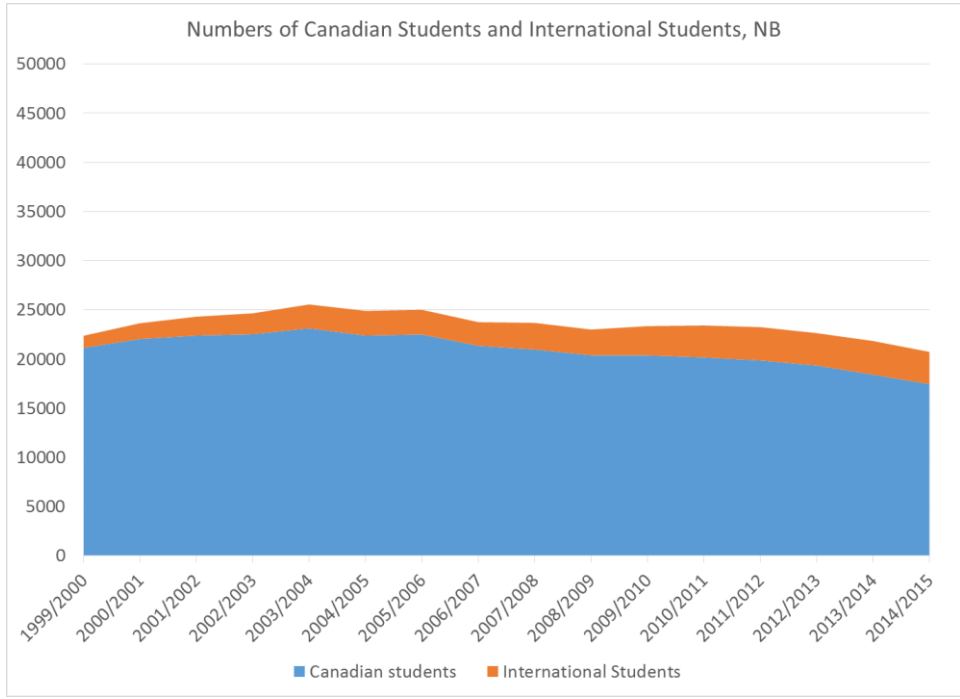
- Universities in Canada have been important instruments of economic adjustment,
  - degree programs oriented toward producing exportable human capital,
    - education and skills training that enables graduates to be mobile across jobs, employers, industries, regions and nations
  - Teaching mission oriented toward national labour market

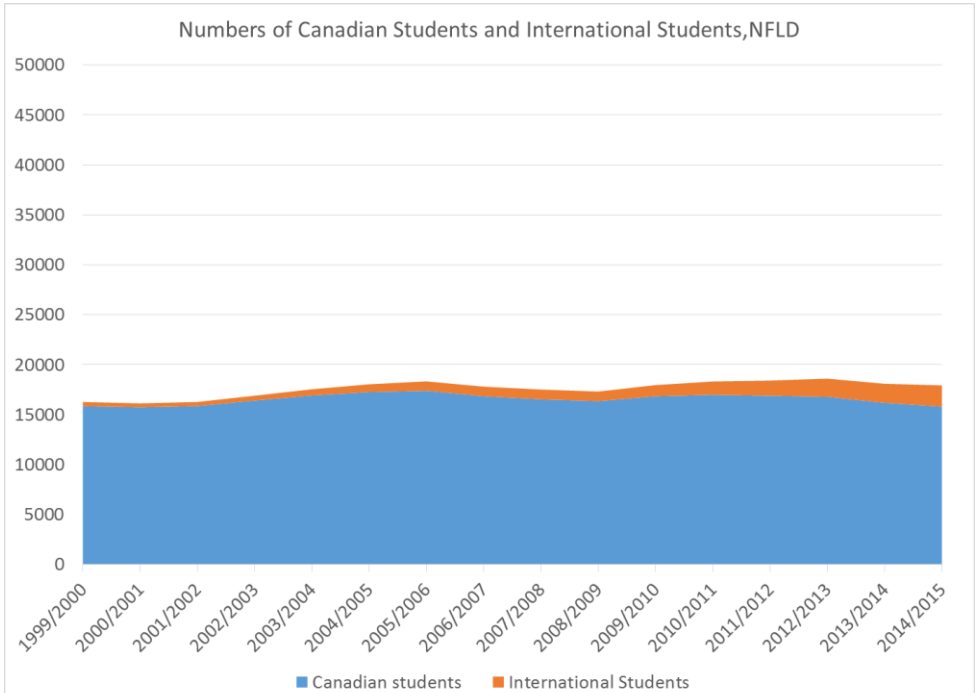
Knowledge Factories and Education as an Export

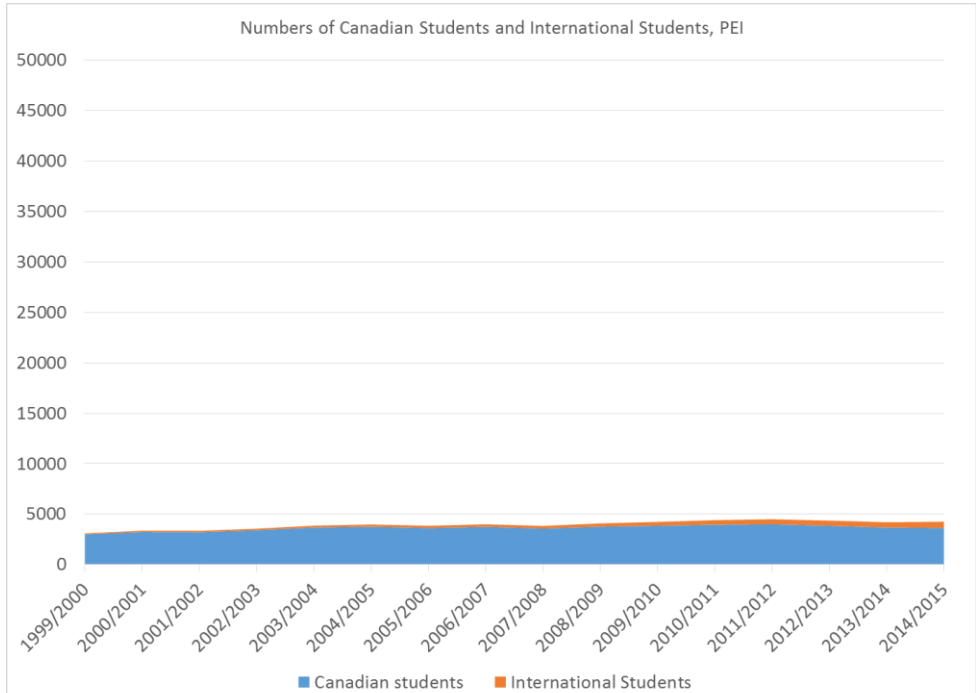
- increased recruitment and enrolment of international students
  - response to decline in the number or provincial residents of university attending ages.
- University human capital exports differ from export of other goods and services
  - Revenues are from tuition and other mandatory
  - graduates capture the returns to the investment through their income after graduation.
    - human capital, knowledge produced impact the economies in which they employed or commercialized.
- university human capital exports a subsidized industry
  - jointly financed by the student and by provincial taxpayers.
    - students may not pay for the full cost of their degrees
  - emigrating graduates will not pay taxes in the province
    - One could argue, of course, that exports still impact the local economy through alumni donations; however, because these are voluntary remittances, they are not considered economic return




Numbers of Canadian Students and International Students, NS
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999/2000
2000/2001
2001/2002
2002/2003
2003/2004
2004/2005
2005/2006
2006/2007
2007/2008
2008/2009
2009/2010
2010/2011
2011/2012
2012/2013
2013/2014
2014/2015
Canadian students
International Students


Numbers of Canadian Students and International Students, NB
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999/2000
2000/2001
2001/2002
2002/2003
2003/2004
2004/2005
2005/2006
2006/2007
2007/2008
2008/2009
2009/2010
2010/2011
2011/2012
2012/2013
2013/2014
2014/2015
Canadian students
International Students


Numbers of Canadian Students and International Students,NFLD
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999/2000
2000/2001
2001/2002
2002/2003
2003/2004
2004/2005
2005/2006
2006/2007
2007/2008
2008/2009
2009/2010
2010/2011
2011/2012
2012/2013
2013/2014
2014/2015
Canadian students
International Students


Numbers of Canadian Students and International Students, PEI
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999/2000
2000/2001
2001/2002
2002/2003
2003/2004
2004/2005
2005/2006
2006/2007
2007/2008
2008/2009
2009/2010
2010/2011
2011/2012
2012/2013
2013/2014
2014/2015
Canadian students
International Students

Finally, what about the spending multiplier?

- expectation that universities expenditures increase GDP
  - Is it different from any other form of spending?
    - consumption expenditure in competition with other uses of funds such as the relief of poverty, aid to less-developed countries, or increased consumption by taxpayers
- Wilson and Raymond (1973) -- local multiplier effects of university related expenditures are smaller than for other spending
  - higher propensity for university related expenditures (the school proper, faculty, staff, and students) to leak out of the local economy,
    - high proportion of local expenditures on items with low local value added.
- Kantor and Whalley (2014) – local multiplier effects larger than for other spending
  - research universities have modest, but persistent, productivity spillovers to local industries expenditures

Are provincial universities associated with provincial economic performance?

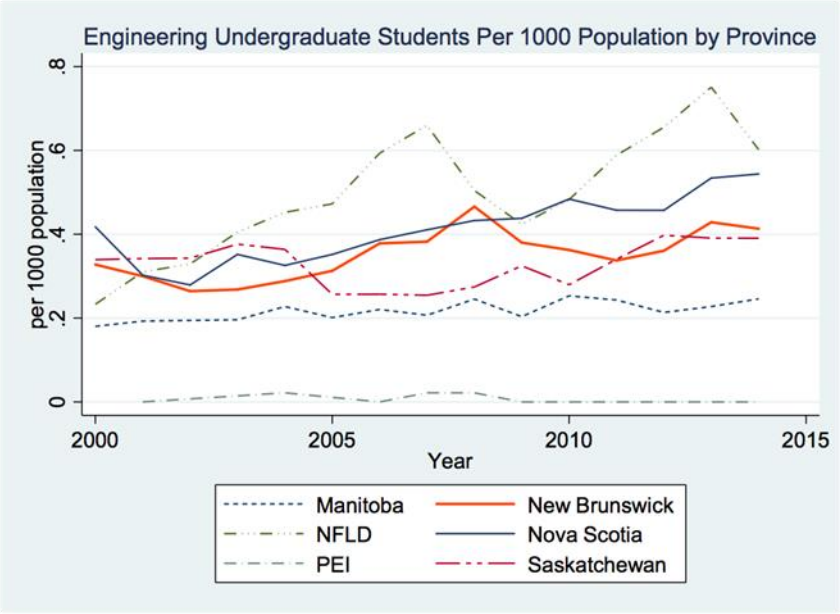
We also did local universities and CMA level outcomes…

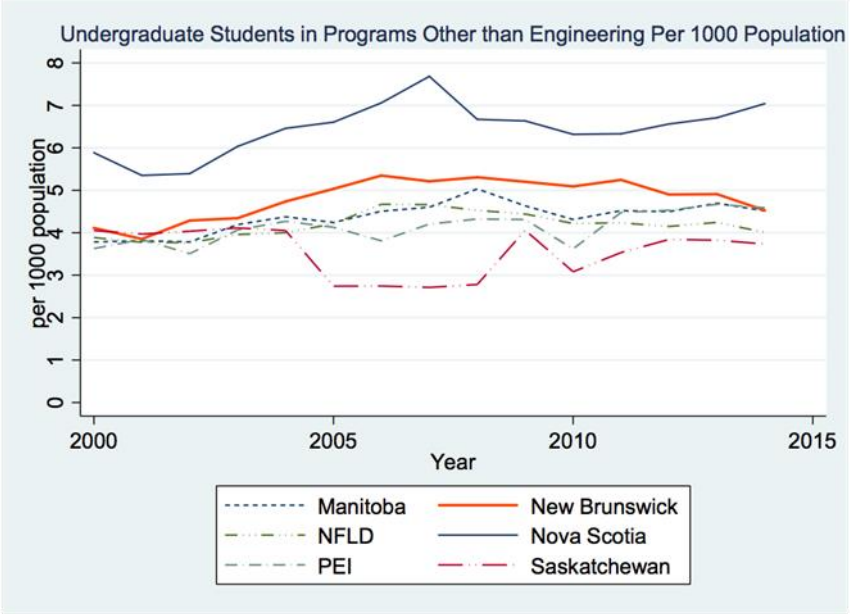
Annual Data 2000-2014 by province

- Economic outcomes
    - GDP, labour force, employment, investment, population
        - Statistics Canada's CANSIM database.
- University enrolment by province
        - CANSIM.
    - Undergraduate versus graduate
    - we distinguish between enrolment in engineering programs and enrolment in all other programs
        - CANSIM's "Architecture, engineering and related technologies" category
- university research funding (by source) and total size of university budgets by province
        - CAUBO's FIUC database.
- Four samples: all provinces, 6 smaller population provinces, and 4 larger population provinces; CMAs and CAs
    - Goldstein and Drucker (2006) found universities impact regional outcomes in Metropolitan Statistical Areas (MSAs) in the United States with less than 200,000 non-farm employees,
        - 6 provinces with around 1 million population or less which would have universities located small to medium sized Canadian Census Metropolitan Areas (CMAs).

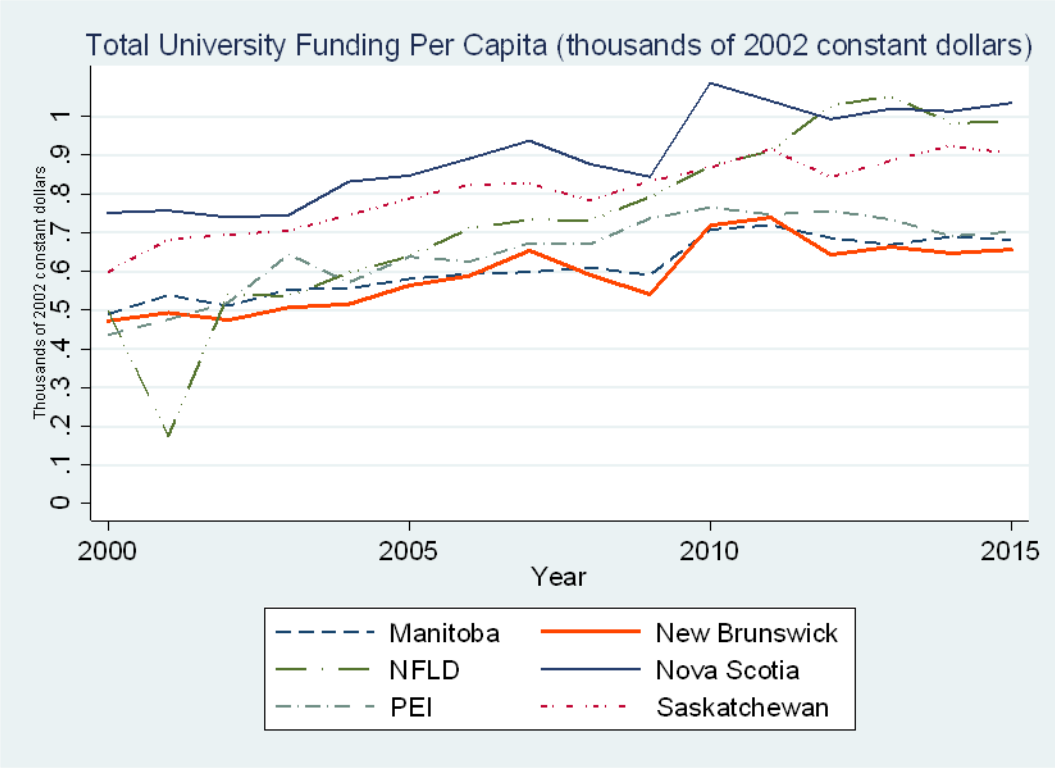
Enrollment trends differ between Engineering and non-Engineering programs

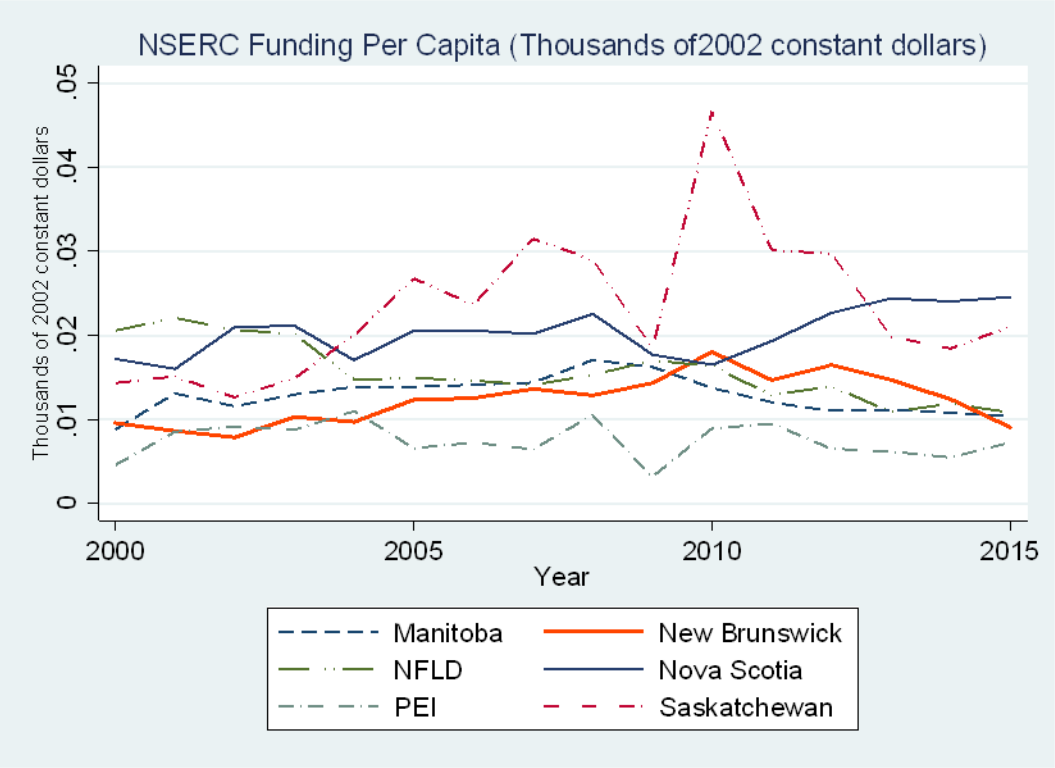
Engineering programs believed more oriented to local industry





Examples of funding measures





We estimated a lot of specifications…

- First differences of logarithms of outcome measures represent the annual growth rates of the dependent variable y_{it} in province *i* in year *t*.
  - account for provincial fixed effects
  - y_{it}, ={GDP (in constant 2007 dollars), labour productivity (GDP in constant 2007 dollars divided by the size of the labour force), population size, labour force size, employment, investment and total factor productivity (TFP)}
- For independent variables,
  - enrolment per thousand population in engineering undergraduate and graduate programs, total enrolment in university programs other than in engineering;
  - per capita NSERC and CIHR research funds, research funding from donations, government contracts, private sector contracts, and per capita total revenues of universities in the province.
    - All funding variables are in constant 2002 dollars in per capita terms.
    - To allow for lagged effects of research funding, we estimate models which include the three year total research funding by category or the three year moving average of research funding by category.

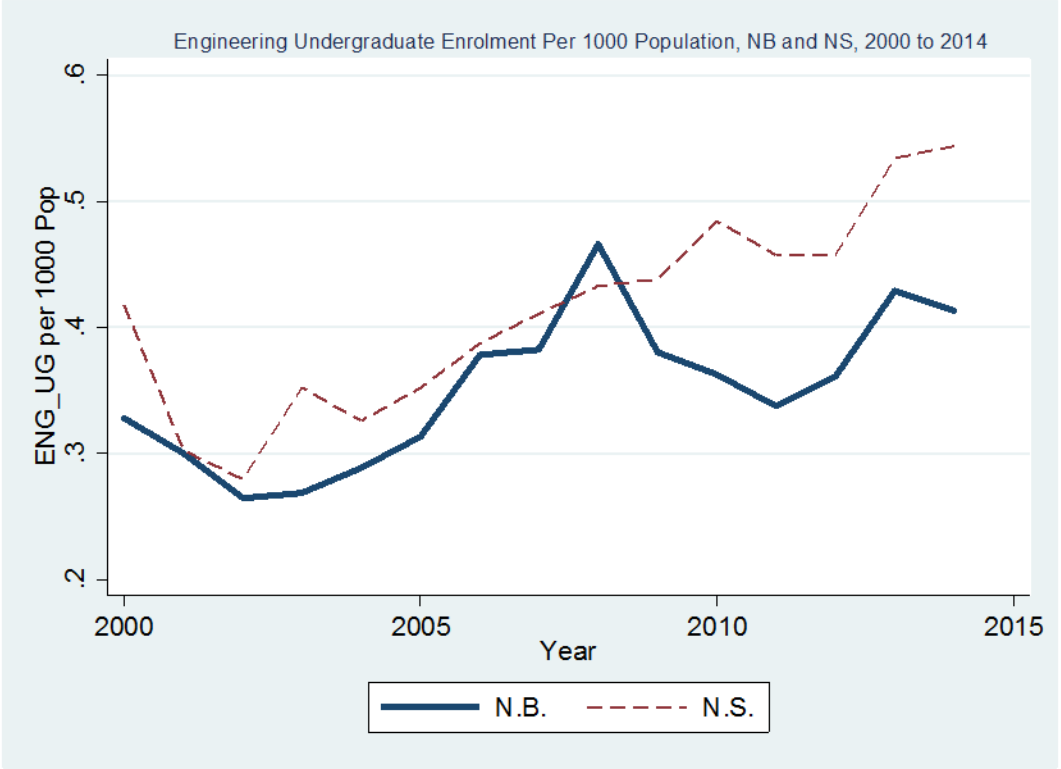
Sign and significance of association between university activity and growth outcomes, small province sample

	GDP	Labour Productivity	Total Factor Productivity	Labour Force	Investment	Employment
Research Activity						
NSERC	-	-	-	+	+	+
CIHR	-	-	+	-	-	-
Donations	+	+	+	+	+	+
Government Grant Contract	+	+	+	-	-	-
Private Grant Contract	+	+	+	+	+	+
Total University Funds	-	-	-	-	+	-
Teaching programs						
Engineering Undergraduate	+	+	+	+	+	+
Engineering Graduate	+	+	+	+	+	-
Undergraduate, not engineering	-	-	-	+	-	+

- Note, the engineering enrolment effect could be a proxy measure for overall activity in an engineering faculty.
  - Growing undergraduate enrolment may be associated with increases of full time faculty and an invigoration of teaching and research in the Faculty of Engineering.
  - May be greater variation in undergraduate engineering enrolment making it appear most sensitive to outcomes of interest.

EFFECT SIZES: If New Brunswick enrolled 45 more engineering undergraduates per year

- restores engineering enrolment per 1000 population to the level in Nova Scotia generating
  - $370 million more GDP,
  - $865 higher GDP per worker and
  - 1400 more persons employed in the province



Discussion: Universities are “cathedrals in the desert”

Uyarra (2010)

In smaller provinces, universities present a potential policy lever for stimulating the provincial economy.

- Apart from faculties of engineering, universities do not have much measurable impact on the regional economy
  - engineering enrolment at the undergraduate level associated with improvements in regional economic outcomes.
    - Additional analysis of economic outcomes at the level of cities shows that the presence of an engineering school or faculty within a city is associated with the faster economic growth of the city.
  - Overall university budgets, research funding and the bulk of degree programs have no significant direct impact on the regional economy.

Is the lack of a measurable correlation of university research and teaching activities and regional economic performance a problem?

- **No** -- university outputs have long gestation periods before they have economic and social impacts missed by short term measures
- **No** -- the lack of correlation of university activities and economic outcomes shows that universities are doing what they are supposed to do, advancing knowledge rather than addressing local societal needs.
  - Stanley Fish (2008, 55-57) -- "inutility" of academic work for economic and societal outcomes as "a fact about it, and a defining, not a limiting, fact". .. it is not the job of liberal arts education to bring about particular effects in the world and the value of that education should not be defined by extra-curricular payoffs.
  - "universities argue from weakness when they say … 'see, what we do does fact contribute to the state's prosperity, or to the community's cultural life, or to the production of a skilled workforce" (page 104).
- **No** -- Canada's Advisory Panel on Federal Support for Fundamental Science (2017, 17) –
  - "for Canada, … , research is ultimately about harnessing the power of human ingenuity and creativity to advance objectives cherished by our citizenry. A vibrant research ecosystem is essential to a wide range of objectives."
    - these include: living longer and healthier lives in a cleaner and safer environment; protecting and enriching Canada's diverse cultures and heritage; developing innovative technologies, goods, and services that contribute to our economic prosperity and create fulfilling jobs; sustaining our economic sovereignty, standard of living, and valued social programs; fostering a creative, vibrant, and inclusive society; stimulating informed public debate; and supporting evidence-based policy-making in a period of accelerating change and complex domestic and global challenges.

“Most of the contemporary “scientific culture” argument for government support of basic science research is to put it … in the class of economically functionless activity. The argument that individuals with a talent for such research should be supported by society… differs little from arguments formerly advanced in support of the rights of owners of landed property to a leisured existence, and is accompanied by a similar assumption of superior social worth of the privileged individuals over common men. Again, insistence on the obligation of society to support the pursuit of scientific knowledge for its own sake differs little from the historically earlier insistence on the obligation of society to support pursuit of religious truth, an obligation accompanied by a similarly unspecific and problematical payoff in the distant future. “

Harry Johnson 1964

Could universities do more to address provincial economic growth?

- Professors may not like this question but
  - the majority of university funds comes from provincial taxpayers and students—stakeholders who often do not have an active role in defining university missions.
    - provincial governments and taxpayers may recognize the value of university education and research but they have a choice to free ride on the investments in universities elsewhere.
- If university impacts are observed locally then that would signal a return to provincial residents from investing in their own universities over a strategy of importing/attracting human capital and relying on innovations produced outside the province.

LIMITATIONS: Lots of them…

- We are unable to assess if there are causal interpretations of the reported associations.
- Small sample sizes have low statistical power for identifying effects of interest with respect to university activities and provincial economic outcomes.
- The lack of a near term correlation of universities and local economic outcomes should not come as a surprise if the knowledge and discoveries coming from universities have long gestation periods in terms of generating downstream economic impacts.
- This perspective would hold that the economic benefits we seek to measure will be present but on a time scale of decades rather than years. If this is the case then caution should be exercised in shifting university resources toward activities with nearer term expected economic benefits (e.g from basic research to commercializable applied research). Doing so could undermine the longer term benefits associated with the current allocation of university resources.