PSM PROFESSIONAL SCIENCE MASTER'S

Professional Master's Degrees – Trends and Transitions

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CGS COUNCIL OF GRADUATE SCHOOLS

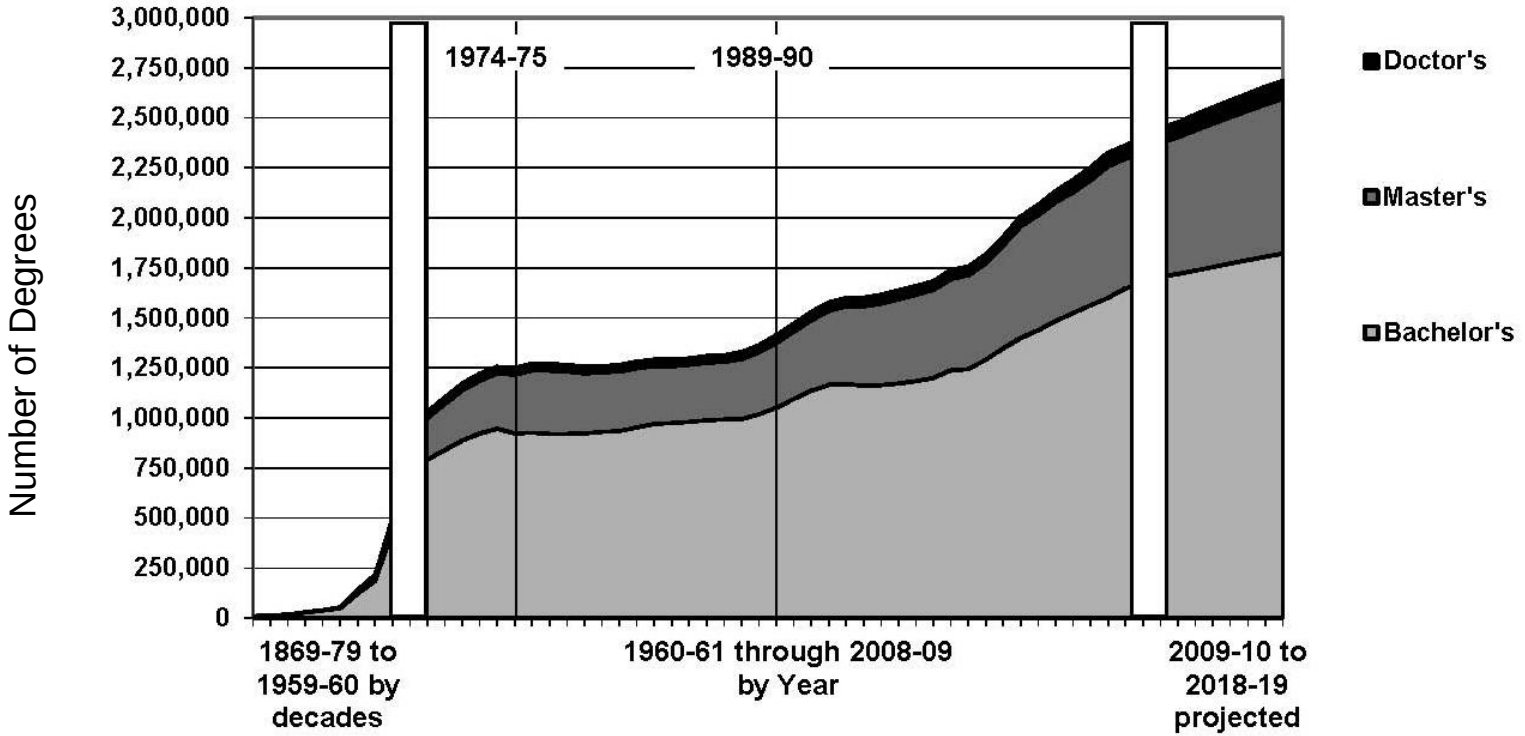
Overview

- Professional science master's degrees
  - US
  - Canada
- Future
  - Professionalization
  - PSM Affiliation–Transition Plans

Master's Education

- American "success story"
- Largest portion of graduate enterprise

Growth in U.S. Degrees



Source: U.S. Department of Education, National Center for Educational Statistics

Professional Science Master's (PSM) Degree

- Prepares graduates for science *careers* in industry, business, government, or non-profit sectors.
- Rigorous study in natural science, technology, engineering, mathematics/computational sciences *plus professional skills* development and *experiential* learning component.

PSM Rationale

Odd gap in U.S. science graduate education

- Strength at BS & PhDs levels
- But PhD too lengthy, with uncertain prospects
- But BA/BS insufficient for science *career*
- MS has been entry to (or exit from) the PhD
- And, attractiveness of PhD declining among domestic students
  - < 20% of majors continue in science/math graduate programs

PSM Rationale, Cont'd.

- New jobs will require graduate degree & will be in non-academic sector.
- PSM programs attract women & domestic students.
- Master's graduates more likely to be employed in the state where they earned degree.
- Graduates contribute to workforce development.

Multidisciplinary Programs

- Financial Mathematics
- Broadcast Meteorology
- Oceans and Human Health
- Health Care Informatics
- Ergonomics and Safety
- Quantitative Fisheries
- Biotechnology
- Forensic Science
- Biosecurity and Biodefense
- Agricultural Production
- Sustainability Science
- Imaging Science
- Physics for Entrepreneurship
- Bioinformatics

PSM Program Variation

- Designed for working professionals
- Cohort model
- Case studies
- Bundled program components (e.g. professional component) offered as a graduate certificate
- Focus on preparing entrepreneurs
- 3+2
- Online

PSM Recognition
Guidelines

1. Regional Accreditation
2. Program Goals & Student Learning Outcomes
3. Minimum credits
4. Curriculum
   - Disciplinary content
   - Professional Skills
   - Experiential Component
5. Quality Assurance Mechanism

Guidelines, Cont'd.

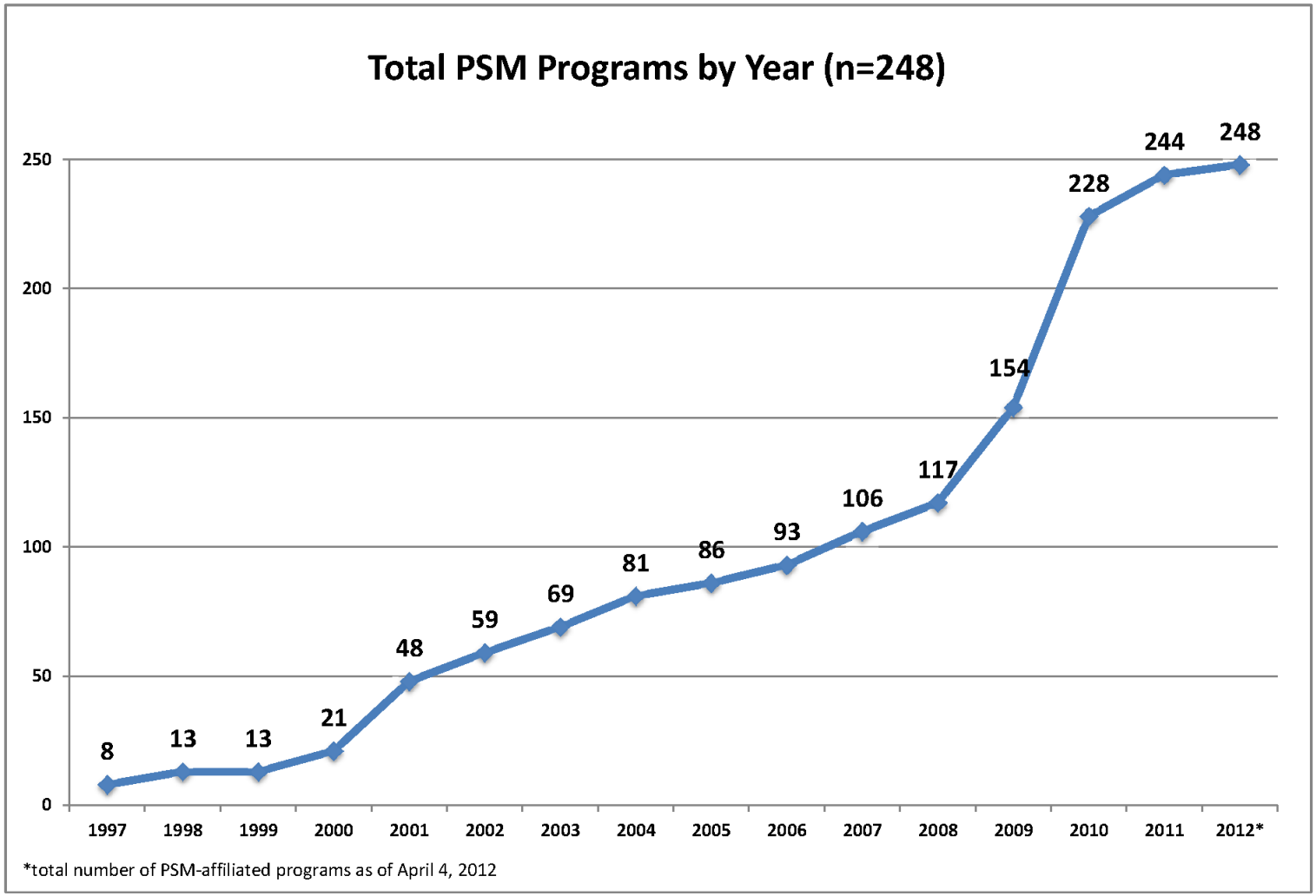
6. Advisory Board
7. Program Quality Assurance
   - Program Approval by University
   - Ongoing Program Review
8. Collection of Annual Data

Affiliation Process

- **Apply to CGS through** www.sciencemasters.com

- **Review of Application**
  - Internal review
  - Contacts applicant for clarifications if needed
  - Internal conference on findings
  - External consultation sought if needed
  - Final determination made and communicated

Total PSM Programs by Year



CGS PSM Data Collection

(full reports at www.cgsnet.org)

- Two surveys:
  - PSM Enrollment and Degrees Survey
    - 2009-10 & 2010-11
  - PSM Student Outcomes Survey
    - 2011
- Project team:
  - Nathan Bell and Jeff Allum

Enrollment & Degrees - 2011

- Sample: 241 CGS-recognized PSM programs
- Limitations
  - Some data were necessarily suppressed
  - One institution has several large programs
  - Only CGS-recognized PSM programs were included
- Launched in Oct., 2011
- 95% response rate (n=230)

Total Enrollment

- 5,487 total PSM enrollment
  - 1,687 *first-time* enrollment
- 44% women
- 61% part-time
- Enrollees in U.S.-based programs
  - 14% international
  - 27% underrepresented minorities
  - 83% public institutions
  - 70% comp sci, biotech, envir sci

Applications and Degrees

- 6,309 applications; 2,771 accepted
- 1,573 degrees awarded (2010-11)
  - 81% from public institutions
  - 19% to underrepresented minorities
- Biology/biotechnology largest field of study

PSM Student Outcomes Survey

- 2010-11 PSM graduates
- Core data elements:
  - PSM program and institution
  - Graduation date
  - Employment status, sector of employment, job title, primary work activity
  - Salary range (and progression if possible)
  - Satisfaction with PSM degree
  - Relationship of PSM and internship to job

Operational Limitations

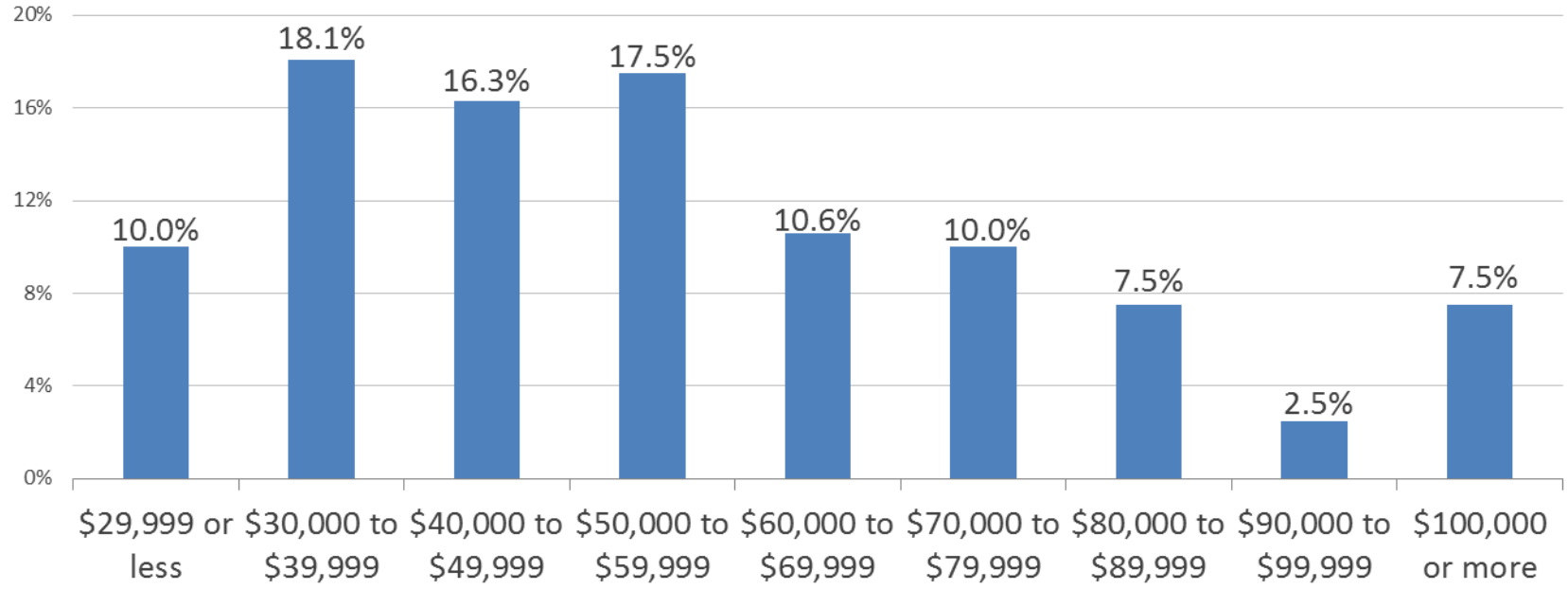
- Lack of contact information
- Lack of relationship with the graduates
- Some program directors unwilling to help
- One institution with very large programs
- Can’t estimate response rate because don’t know how many graduates were contacted (N=223 useable responses)

Student Outcomes Results

- Most frequent reason for enrolling:
  - Impart scientific/technical skills/training
  - Fulfill personal interest
  - Increase opportunity for advancement/pay
- 82% working, 5% students, 1% not looking
  - Of those working, 88% in preferred field
- Program satisfaction ratings are high (3.12-2.92); value ratings are higher (3.00-3.24)

Student Outcomes Survey

Salary Distribution Among PSM Graduates Working Full-Time, 2011



Source: Council of Graduate Schools, 2011
Represents only respondents who were working during the week of June 20, 2011

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CGS PSM Team
Through June, 2012

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www.sciencemasters.com and www.cgsnet.org

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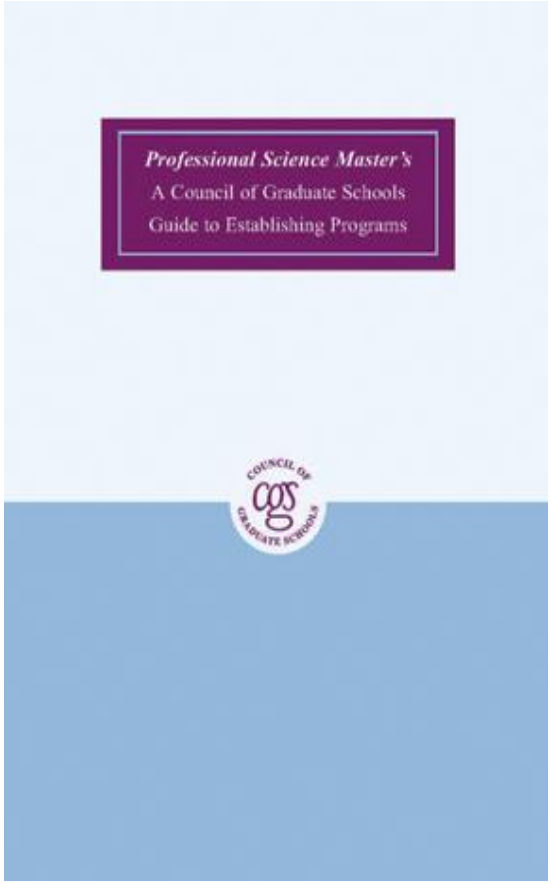
Professional Science Master's

A Council of Graduate Schools Guide to Establishing Programs



PSM PROFESSIONAL SCIENCE MASTER'S

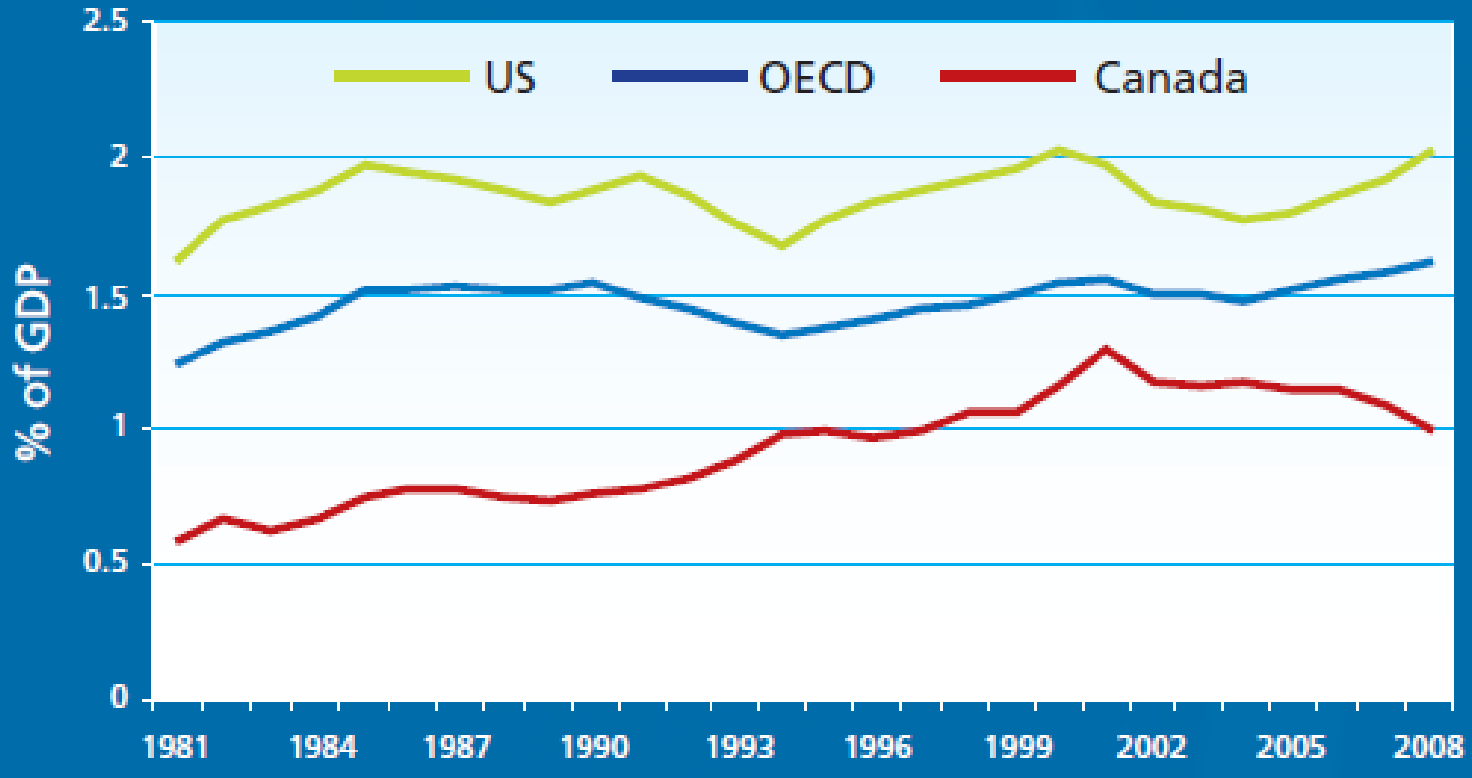
Overview: Canada

- Are professional programs in science needed in Canada?
- What Professional Science Masters and related programs currently exist in Canada?
- What supports exist for these programs outside universities?
- Future?

Rationale for PSM in Canada

- Canada faces same imperative as US to increase R&D in science and technology
- Concerns that Canada lags behind the US in productivity growth
- Lower levels of graduate training relative to US seen as an important cause of GDP/capita gap (Institute for Competitiveness and Prosperity)

BERD Intensity Trends, 1981–2008



Source: OECD (2011).

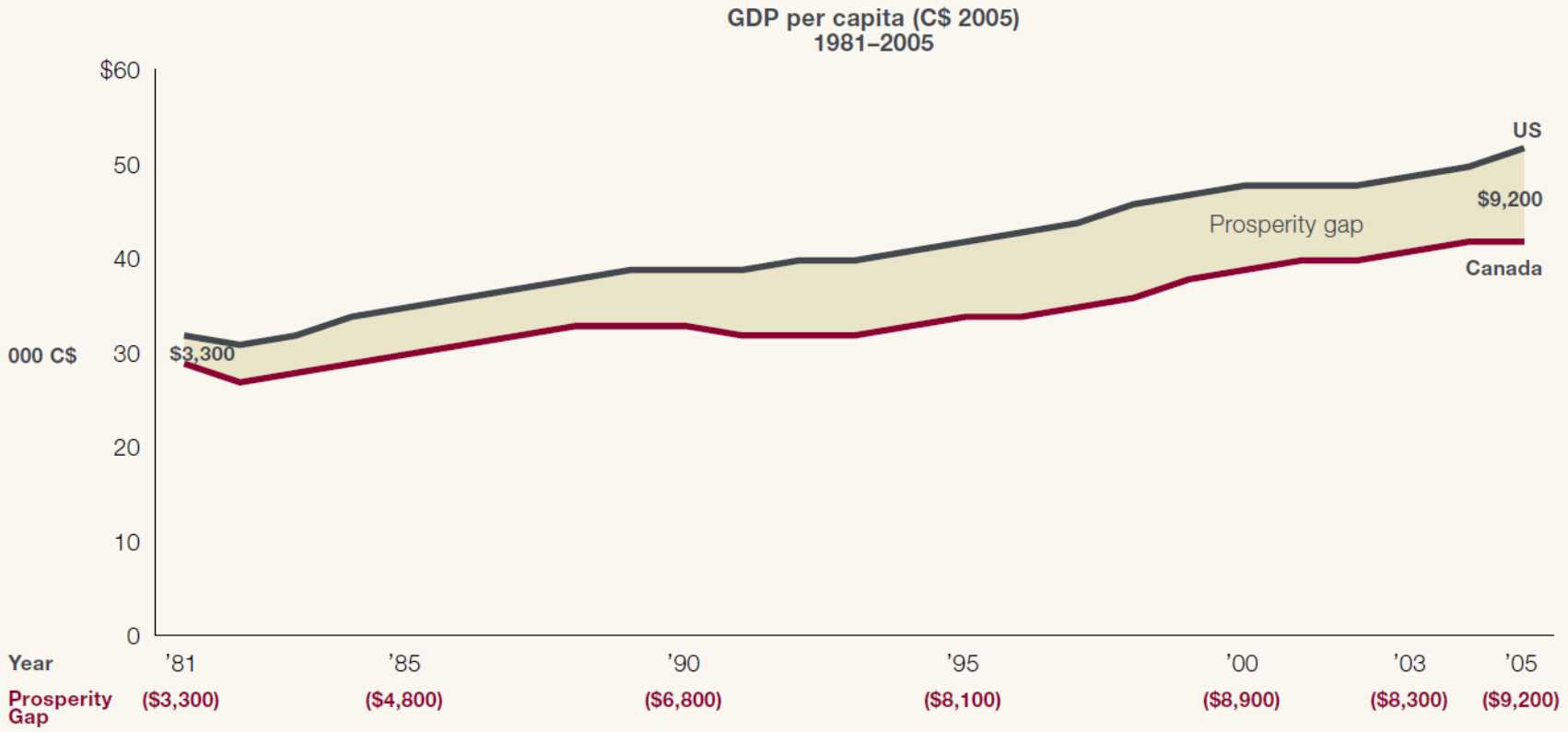
Figure 2.2 Sources of Canada–US Gap in Average Annual Labour Productivity Growth
(differences in percentage growth rates: Canada minus the US)[a]

	1961–2008	1961–1980	1980–2000	2000–2008
Gap in labour productivity growth	-0.3	0.4	-0.4	-1.9
(i) Capital deepening	0.4	0.8	0.2	0.1
(ii) Workforce composition	0.2	0.4	0.1	0.1
(iii) Multifactor productivity	-0.9	-0.9	-0.6	-2.1

[a] The numbers in the first line of the table — the difference between Canada and the US in average annual labour productivity growth — are equal to the sum of lines (i) through (iii), which decompose the productivity growth gap into components related to capital intensity, workforce composition and MFP (subject to rounding).

Source: Baldwin and Gu (2009).

Exhibit 2 **Canada's prosperity gap has widened**



Source: Institute for Competitiveness & Prosperity analysis based on data from Statistics Canada; US Department of Commerce – Bureau of Economic Analysis; and OECD.

[1] We convert US dollars to Canadian dollars at the PPP rate of 1.23. See Task Force On Competitiveness, Productivity and Economic Progress, Fourth Annual Report, *Rebalancing priorities for prosperity*, November, 2005, p. 27 for an explanation of our methodology.

Education trends

- Ontario and Quebec are major manufacturing provinces
- Manufacturing has to adjust with freer trade
- Ontario has invested heavily in education and innovation to restructure economy
- Has encouraged a major graduate expansion

Professional degrees

- One aim of graduate expansion in Ontario, has been to increase employment of graduates in private sector
- Professional programs in Business, Education, Law, Architecture, Health, Public Admin, Social Sector are not new, and constitute about 70% of Masters

Professional programs

- Liberal arts and science Masters have typically been 30% of Masters
- Professional programs in traditional liberal areas of science and arts are newer
- Examine some examples of science programs
- Others have EITHER internship or mix mgt/science but not necessarily both

Examples of PSM-type programs in Canada

Program	University
MSc Bioinformatics	University of British Columbia
MFS Food Science	University of British Columbia
MBiotech	University of Toronto Mississauga
Master of Appl Sci in Biotechnology	McGill University
Master of Quantitative Finance	University of Waterloo
Maîtrise en Mathématiques, finances et computionelle	Université de Montréal
Master of Medical Biotechnology	U of Windsor (not yet approved)
MSc Environmental Sustainability.	UTM (not yet approved)
Master of Land and Water Resources	UBC (coming in 2012)

Requirements of PSM-type programs in Canada

Program	Internship	Course requirements
MSc App Biotech McGill	1x4mth possible	5 science, 1 management, 1 ethics, 2 electives (either science/business/ethics), plus research project in university, public or private sector
MQF, UW	1x4 mth	16 mths ; 4 math, 3 accounting, 1 eco, 1 elective courses plus Research Paper
MBiotech, UTM	8-12 mths	24 mths; 7 science, 4 business courses, 1 elective
MSc BioInform-Atics, UBC	3x4mth Lab exper	24 mths; 8 science, thesis (1 term); 2 required professional devt courses
M Math, U de Montréal	1 term possible	12 months; 11 math, 1 econ course, research report OR internship
MFS UBC	1X4mth	12 mths; 2 management, 4 science, 2 elective (mgt/science) courses; summer practicum

Characteristics of PSM-type programs in Canada

- These 6 example programs are all fairly new – oldest one is 10 years old
- Some offer an alternate traditional research degree (another Masters, or a route to a PhD instead of an internship)
- Some involve higher fees (MBiotech UTM; MQF UWaterloo)

Characteristics (cont)

- Some involve a higher proportion of international students (MQF – UWaterloo; M Medical Biotech – UWindsor proposed – aimed at India and China)
- Programs aimed at recent graduates often involve internship; those aimed at working professionals often purely coursework (professionals don’t need experience)

Supports: MITACS programs for graduate students & PDFs

Mitacs

Inspiring innovation
Inspirer l'innovation

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NSERC support for PSM

- NSERC industrial research & development fellowships
- NSERC industrial postgraduate scholarships
- Both support young scientists undertaking projects/research in industry

People. Discovery. Innovation.

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Professional Skills programs at Universities (non-credit)

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Professional Skills programs (another variant)

- University of Ottawa diploma, can be completed along with MSc or PhD in 4 science disciplines and Math: 6 short courses (equivalent to 3 courses/9 credits) in management skills

uOttawa

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Future Directions

- PMA
- PSM transition to KGI in US
- External supports in Canada

Professional Indicators

- Skills based courses
- Writing course for non-academics
- Final project with research experience
- Advisory board
- Internship
- Faculty background
- Activities to enhance professional skills
- Tracking of graduates
- Assessment

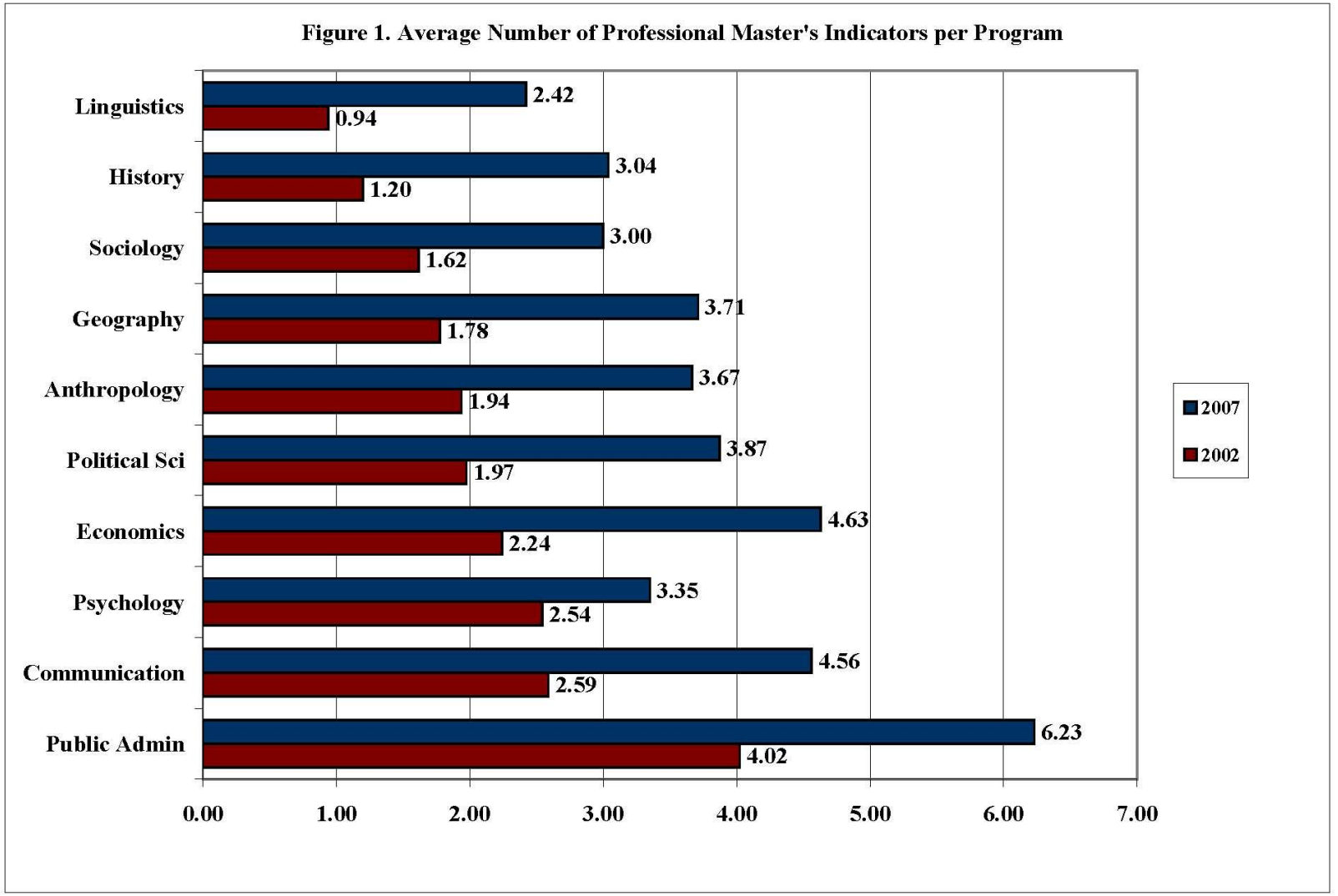
Figure 1. Average Number of Professional Master's Indicators per Program
Linguistics
2.42
0.94
History
3.04
1.20
Sociology
3.00
1.62
Geography
3.71
1.78
Anthropology
3.67
1.94
Political Sci
3.87
1.97
Economics
4.63
2.24
Psychology
3.35
2.54
Communication
4.56
2.59
Public Admin
6.23
4.02
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
2007
2002

PMA Programs: US

- American University–Certificate in Public Sociology
- University at Albany–Certificate in Economic Forecasting
- Sarah Lawrence College–Health Advocacy
- University of Maryland, Baltimore County–Public History

PMA Programs: Canada

- Master of International Public Policy, Master of Applied Business Economics: Wilfrid Laurier University
- MA in Cultural Studies – Curatorial Practice Studies: U of Winnipeg
- MA Child and Youth Care, Community Development, Dispute Resolution, Leisure Services Admin (others): U of Victoria

Transition: US

- Keck Graduate Institute selected
  - Affiliation process
  - Maintain www.sciencemasters.com

- July, 2012

Future directions: Canada?

- Canada doesn't have a PSM network
- But clearly programs are evolving in this direction in Science (internships, management skills), in response to need
- External supports e.g. TriCouncils, MITACS
- Some similar trends also in Arts

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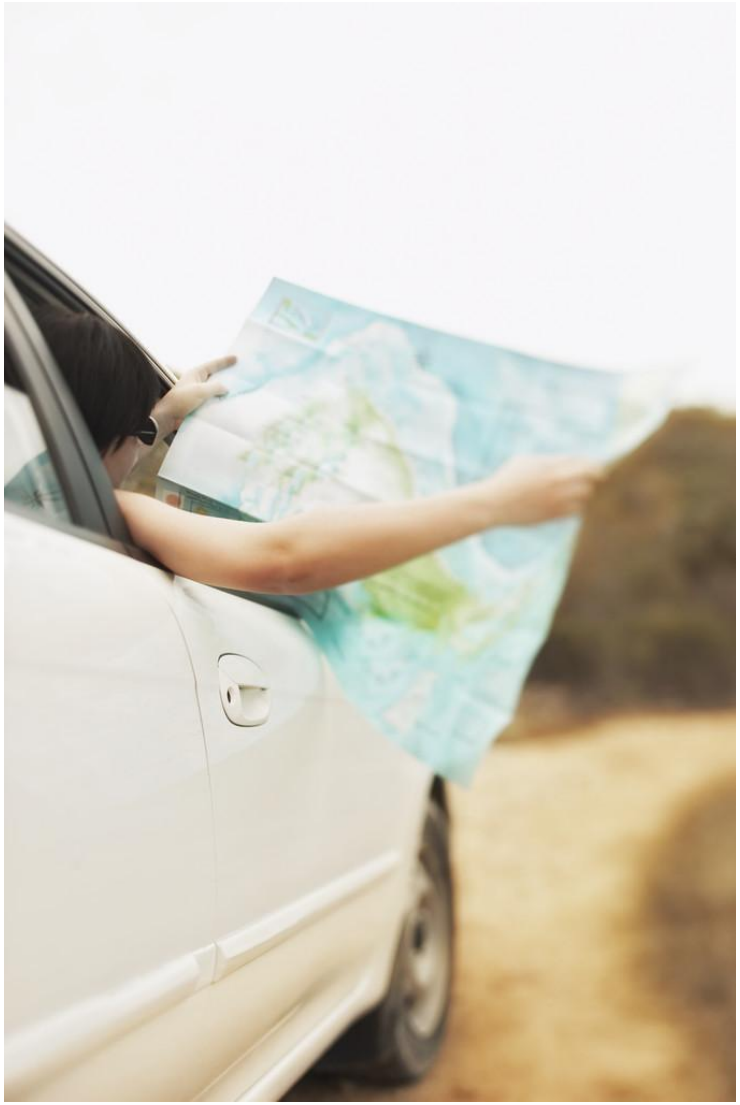
"The first step towards getting somewhere is to decide that you are not going to stay where you are."

Chauncey Depew



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