

Capitalizing on Science for Innovation: Policy Issues and Research Agenda

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Overview

- Science of Science Policy
- What has happened to the “Linear Model”
- The science production function and the science/innovation interface
- Spillovers in a globalized world
- Picking winners and science for economic growth



Science of Science Policy

“The Science of Science Policy (SoSP) is an emerging interdisciplinary and international field of research and community of practice that seeks to develop theoretical and empirical models of the scientific enterprise. The development of a strong science of science policy can enable policymakers and researchers to use an evidence-based platform to assess the impacts of the Nation’s scientific and engineering enterprise, to improve their understanding of its dynamics, and to evaluate potential future outcomes.”

U.S. Office of Science and Technology Policy, Executive Office of the President, <http://www.scienceofsciencepolicy.net/page/about-sosp>



Science of Science Policy (SoSP) (or Science of Science and Innovation Policy, SciSIP)

- Collection of data and development of metrics and proxies
- Modeling of research and innovation processes, particularly interactions between researchers and socio-economic system (Hall and Jaffe, 2012)
- Performance evaluation of specific policies and policy instruments



The “Linear Model”

- “Science”
 - Publicly funded
 - Inquiry-driven (may be outcome-motivated)

Feeds into:

- “Technology” or “Innovation”
 - Privately funded (at least in part)
 - Outcome-driven



The Non-linear Model

- Subtle and complex interactions (Lane, 2009)
- Science enterprise contributes through multiple pathways:
 - Inventions
 - Instruments/methods
 - Consulting
 - Human capital
- Technology feeds back to science



Pasteur's Quadrant

- Stokes (1997): Pasteur's Quadrant describes use-inspired basic research
- Orientation of researchers matters as much as source of questions
 - Individual attitudes and experiences
 - Organizational incentives
 - Organizational structures and links



Science Production Function

- Complementarity between good science and commercial applications
- Complementarity between research and teaching/training
- Teams and collaboration
- Competition versus cooperation
- Importance of stars



Public/commercial Interconnection

- Bayh-Dole Act and analogues: mechanism for development investment in publicly generated ideas
- Affects researcher orientation (previous slide)
- May be necessary for non-generic innovations
- Potential burden on use of generic technologies: “tragedy of the anti-commons” (Heller and Eisenberg, 1998)
- Need for focus on institutions that create most favourable tradeoff between incentives and monopoly burdens



Culture (cult?) of entrepreneurship

- Ambition, attitude toward failure, attitude toward success
- Are there any levers?
- IP rules
- Ubiquitous “shortage” of venture capital



Human Capital

- Joint production of research output and human capital
- Particularly critical when trying to grow a research area (Cockburn, Stern and Zausner, 2011)
- But growing supply of scientists can become dangerously separated from demand (Stephan, 2012)

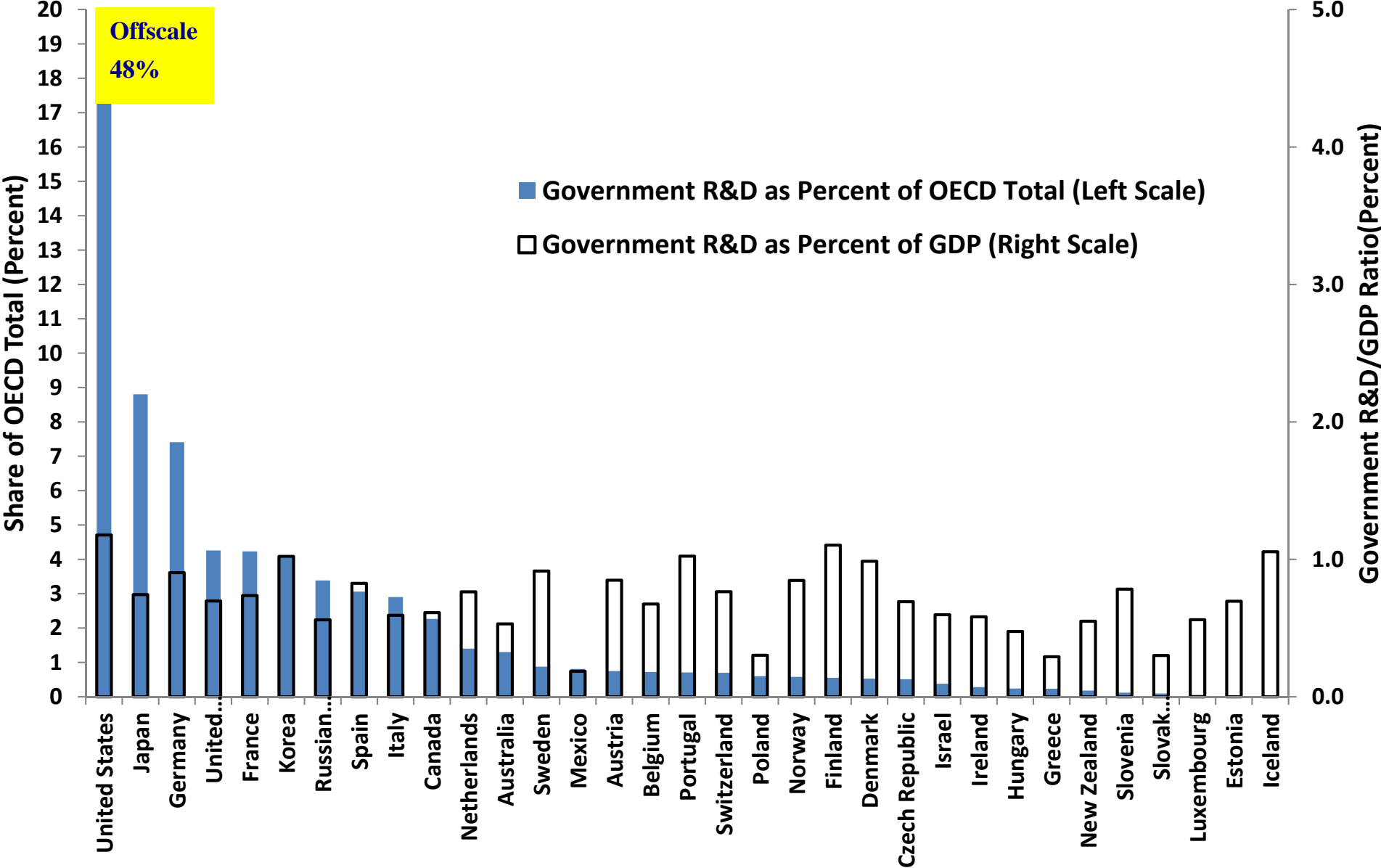


Spillovers in a Global Context

- Everyone is a drop in the global research bucket



Government Expenditure on R&D (2010)



Spillovers in a Global Context

- Everyone is a drop in the global research bucket
 - Capability building a la Cohen and Levinthal (1989)
 - Unique/distinctive needs
 - Adaptation
 - International reputation/diplomacy
- Why don't we all see the growth of the science enterprise in China as a good thing?
- Geographic localization of knowledge—Is the world really “flat” (Freidman, 2005)?

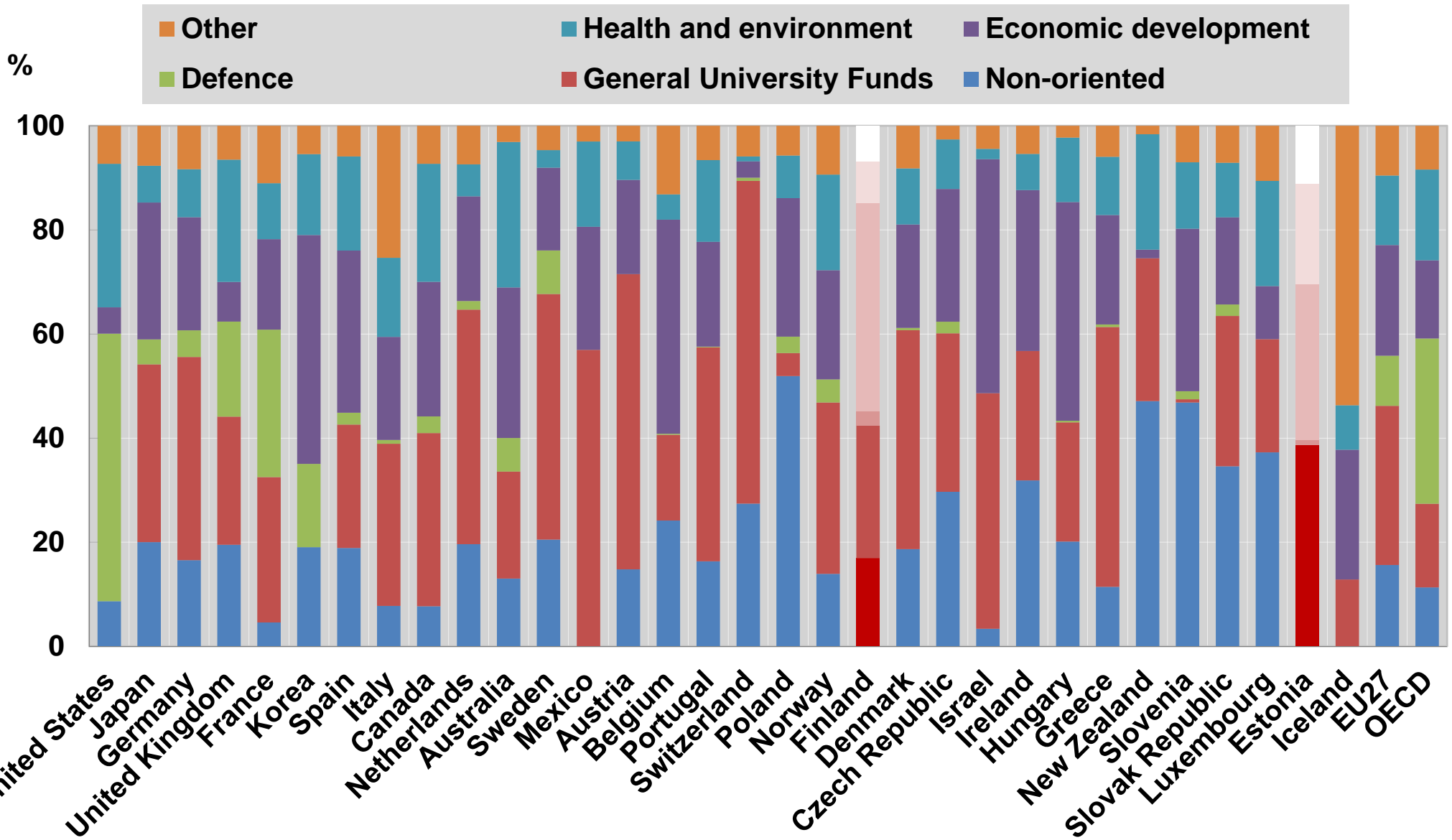


Picking winners?

- Everyone makes choices...



Public Research Focus Across the OECD



Picking winners?

- Everyone makes choices...
- U.S. is outlier
- Very long lags (Adams, 1990) make choosing based on economic benefit dubious
- Serendipity means it doesn't really matter?



The Dark Side of Spillovers—The “Stickiness” Problem

- Success or failure?
 - Publicly funded patent licensed overseas
 - Domestic startup acquired overseas
 - Native born who emigrate and get rich
 - Immigrants who get rich
- Normative
 - Spillovers versus short-run jobs
 - who’s in the objective function
- Distinguish means/ends, short-run/long run



Parting Shots

- Thinking about innovation does not cheapen science
- Theory alone essentially useless
- Innovation systems concept casts doubt on transferability of lessons
- No substitute for country-specific empirical micro research
- Huge ancillary issues:
 - Climate change
 - Inequality



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