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Indicators of the Capacity for Invention in the United States

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Introduction

The economic growth and well-being of the United States depends on the competitiveness of U.S.-based business establishments in international markets. These establishments' competitiveness, in turn, depends on their capacity to invent and innovate. Taken as a whole, the nation's capacity to invent and innovate is a function of a wide variety of factors such as workforce skills, entrepreneurship, and investment in research and development.[2]

In light of these relationships, a look at indicators of U.S. invention and innovation outcomes and capacity relative to other nations can be instructive for U.S. public policy. The purpose of this paper is to offer a set of such indicators. It does so in the following categories:

- Invention and Innovation Outcomes
- Research and Development
- Human Capital
- Patent Policies
- Free Trade
- Presence of Young Firms
- Rate of Worker Hires and Quits
- Societal Values and Attitudes
- National Innovation Agency and Strategy

With the recent increased access to large volumes of country statistics, numerous public and private organizations have initiated publication of global indices on competitiveness, innovation, and market economies. These indices provide long lists of often sophisticated statistical indicators for as many as 152 countries. Most often, these indicators are drawn from

[1] The author is research professor at the George Washington Institute of Public Policy. This paper is the public version of one delivered under contract to the Lemelson Foundation of Portland, Oregon for its internal use. The foundation's mission is to support inventors and invention-based enterprises in the U.S. and developing nations. The content of the paper is entirely the author's responsibility.

[2] Andrew Reamer, "The Impacts of Technological Invention on Economic Growth – A Review of the Literature," February 28, 2014. The earlier paper defines the terms "invention," "innovation," and "technology."

data published by major multinational organizations, including the United Nations, the Organisation for Economic Co-operation and Development (OECD), the World Bank, the World Trade Organization (WTO), the International Monetary Fund (IMF), and the World Intellectual Property Organization. In several instances, these secondary data sources are complemented by an extensive global opinion survey of executives.

In light of the ready availability of worldwide sets of sophisticated indicators, for the purposes of this paper it made more sense to use existing indicators rather than create new ones "from scratch." Each of the sections that follow looks at patterns among U.S. indicators in one of the above categories, beginning with invention and innovation outcomes. In most, but not all, sections, the analysis focuses on the U.S. rank compared to other nations. The indicators provided are the latest available, most often from an annual report.[3] Each section's table of indicators is organized by publication.[4]

This analysis uses indicators provided by the following reports:

- *World Competitiveness Yearbook 2013*, published by IMD (Swiss management school).
- *Global Competitiveness Report 2013-2014*, published by the World Economic Forum (based in Switzerland).
- *The Global Innovation Index 2013: The Local Dynamics of Innovation*, published by Cornell University, INSEAD (French business school), and the World Intellectual Property Organization (based in Switzerland).
- *OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth*, Organisation for Economic Co-operation and Development (based in France).
- *Science and Engineering Indicators 2014*, National Science Foundation (U.S.).
- *The Global Talent Competitiveness Index 2013*, published by INSEAD (France), Human Capital Leadership Institute (Singapore), and the Adecco Group (Switzerland).
- *Economic Freedom of the World: 2013 Annual Report*, published by the Fraser Institute (Canada).
- *Global Intellectual Property Index: The 4th Report*, published by Taylor Wessing (United Kingdom).
- *OECD Skills Outlook 2013: First Results from the Survey of Adult Skills*.
- "Crisis squeezes income and puts pressure on inequality and poverty," OECD, 2013.

[3] In the future, it would be desirable to look at changes in absolute and relative indicators of U.S. invention capacity over time.

[4] Often, several publications will include the same indicator. However, the ranking may differ from one publication to another because of differences in data sources, year of the data, or number of countries covered.

Comparable national indicators are not available for the presence of young firms and hire/quit rates. In these instances, U.S.-only time series data were obtained from federal sources.

Invention and Innovation Outcomes

Inarguably, the U.S. has been the most inventive nation in human history. Its standing can be seen in terms of the extraordinarily high percentage of radical and incremental inventions developed in the U.S. over the last 250 years and the remarkable increase in per capita income over time generated on the basis of these inventions.[5]

Table 1 provides a list of invention and innovation indicators for the U.S. The data make clear that the U.S. continues to be one of the world's leading nations in these realms. Key findings include:

- The World Competitiveness Center (WCC) and World Economic Forum (WEF) executive opinion surveys place the U.S. in the top tier among nations in terms of capacity for innovation.
- The U.S. has
  - more firms active in biotechnology and nanotechnology than any other nation and
  - the largest national share of pharmaceutical patent applications and second largest share of environmental technology applications.
- As measured by rate of citations, the quality of U.S. scientific research is the highest in the world.
- Relative to the size of its economy and population, the U.S. ranks quite high, but not at the very top, in terms of the:
  - number of patent applications,
  - number of journal articles, and
  - percent of early-stage entrepreneurs with a new product or service.

The large size of the nation's invention and innovation ecosystem very much compensates for this slightly lower relative output.

[5] Philippe Aghion and Steven N. Durlauf, editors, *Handbook of Economic Growth*, Oxford: Elsevier, 2014.

Table 1: Invention and Innovation

Indicators, by Report	Rank	Year	Data Source
World Competitiveness Yearbook 2013 (n=60)			
Innovative capacity of firms (to generate new products, processes, and/or services) is high in your economy	2	2013	WCC Executive Opinion Survey
Global Competitiveness Report 2013-2014 (n=148)			
Capacity for innovation	5	2013	WEF Executive Opinion Survey
Corporate capacity to innovate	5	2013	WEF Executive Opinion Survey
Applications filed under Patent Cooperation Treaty per million population	12	2009-2010	OECD Patent Database
Global Innovation Index 2013 (n=142)			
Citations index -- number of citations received in subsequent years by articles published in a given year, divided by the number of articles published that year.	1	1996-2011	SCImago
Domestic resident patent applications per billion GDP	7	2011	World Intellectual Property Organization
International patent applications filed by residents at Patent Cooperation Treaty per billion GDP 2012	15	2012	World Intellectual Property Organization
Scientific and technical journal articles per billion GDP	45	2012	Thomson Reuters Web of Science
OECD STI Scoreboard 2013			
Number of firms active in biotechnology (n=28)	1	2011	OECD
Number of firms active in nanotechnology (n=16)	1	2011	OECD
Share of global PCT patent applications in pharmaceuticals (n=22)	1	2009-2011	OECD Patent Database
Share of global PCT patent applications in environmental technologies (n=22)	2	2008-2010	OECD Patent Database
Global Talent Competitiveness Index 2013 (n=103)			
Innovation output	16	2012	Innovation output subindex, Global Innovation Index
Percent of early-stage entrepreneurs with a new product or service	29	2012	Global Entrepreneurship Monitor

Research and Development

The level and quality of R&D are essential aspects of a nation's capacity to invent. Table 2 provides a list of R&D indicators for the U.S. Consistent with Table 1, the data show that the U.S. remains a world leader in R&D efforts. Of 24 identified R&D indicators, the U.S. ranked 10th or greater for 22 indicators, and 11th and 20th, respectively, for the other two. Key findings:

- The U.S. spends more on R&D than any other nation, in total and by business.
- The U.S. has a balance between public and private R&D that is in the vicinity of the ideal.
- Normalized by the size of the economy and population, U.S. R&D expenditures ranks very high, though not at the top. As with invention and innovation outcomes, the sheer size of the nation ensures the total is greater than other nations. The one R&D in which the U.S. lags on a per capita basis is in academic institutions.
- According to the WCC and WEF executive opinion surveys, the quality of U.S. scientific research is among the best in the world.
- These two surveys also say that:
    - the U.S. is a world leader in university-industry R&D collaborations,
    - knowledge transfer between business and academia is well developed,
    - there is significant interfirm cooperation in technology,
    - both public and private sector ventures support technology development, and
    - U.S. industry clusters promote knowledge transfer and innovation.

Table 2: Research & Development

Indicators, by Report	Rank	Year	Data Source
World Competitiveness Yearbook 2013 (n=60)			
Total expenditures on R&D	1	2011	OECD
Business expenditure on R&D	1	2011	OECD
Knowledge transfer is highly developed between companies and universities	3	2013	WCC Executive Opinion Survey
Scientific research (public and private) is high by international standards	4	2013	WCC Executive Opinion Survey
Public and private sector ventures are supporting technological development	6	2013	WCC Executive Opinion Survey
Total expenditures on R&D as % of GDP	10	2011	OECD
Total expenditure on R&D per capita	10	2011	OECD
Business expenditure on R&D as % of GDP	10	2011	OECD
Technological cooperation between companies is developed	11	2013	WCC Executive Opinion Survey
World Economic Forum Global Competitiveness Report 2013-2014 (n=148)			
University-industry collaboration in R&D	3	2013	WEF Executive Opinion Survey
Company spending on R&D	5	2013	WEF Executive Opinion Survey
Quality of scientific research institutions	5	2013	WEF Executive Opinion Survey
State of cluster development	6	2013	WEF Executive Opinion Survey
Global Innovation Index 2013 (n=142)			
University/Industry research collaboration	3	2011-12	WEF Executive Opinion Survey
State of cluster development (including extensiveness of interfirm collaboration to promote knowledge flows and innovation)	9	2011-12	WEF Executive Opinion Survey
R&D performed by business as % of GDP	9	2011	UNESCO Institute for Statistics
Gross R&D expenditure as % of GDP	10	2009	UNESCO Institute for Statistics
OECD STI Scoreboard 2013			
Business R&D as percent of value added, adjusted for industry structure (n=24)	4	2011	OECD
Business R&D as percent of GDP (n=36)	9	2011	OECD
Higher education R&D as percent of GDP (n=36)	20	2011	OECD

NSF S&E Indicators 2014			
Spread between business R&D performance as percent of total R&D performance and 66.7% ideal (n=7)	2	2011	NSF and OECD
Spread between business R&D expenditures as percent of total R&D expenditures and 66.7% ideal (n=7)	4	2011	NSF and OECD
R&D as percent of GDP (n=55)	9	2011	OECD
Global Talent Competitiveness Index 2013 (n=103)			
Gross R&D expenditure as % of GDP	8	2010	UNESCO Institute for Statistics

Human Capital

The U.S. capacity to invent depends on the skills, abilities, knowledge, and creativity of its scientific researchers, knowledge-based workers, and of the public at large. Table 3 provides an extensive set of indicators on U.S. human capital related to invention and innovation. There are a number of positive findings:

- The U.S. ranks very highly regarding its base of scientific researchers.
  - The U.S. has one of the highest ranked university systems in the world and is a leader in the number of new doctorates in science and engineering.
  - The nation is a magnet for researchers from other countries and loses few to brain drain elsewhere.
  - Its availability of scientists and engineers is high, according to executive opinion.
  - However, its percentage of first university degrees in science and engineering is relatively low.
- In general, the U.S. has an excellent base of knowledge workers.
  - It is among the world leaders in the
    - percent of workers who are knowledge-based and
    - percent of workers in science and technology.
  - The U.S. ranks third in the percent of adults with postsecondary education.
  - Executives believe that:
    - information technology skills are readily available,
    - skilled workers in general are readily available, but
    - the U.S. does not do as well in the availability of qualified engineers.
  - The U.S. is among leaders in worker participation in high proficiency job-related education and training. Executives believe that:
    - the U.S. has a very good system for specialized worker training,
    - firms adequately invest in worker development, and
    - that university education meets the needs of a competitive economy.
- More broadly, the U.S. leads the world in adult literacy.

However, comparative data also indicate that the U.S. lead in human capital, and ultimately invention and innovation, is in peril because of the relatively poor skills base of its broader adult population, particularly younger adults, and the middling performance of its education systems compared to other developed nations.

- While the U.S. ranks third in the percent of people aged 55-65 with postsecondary education, its standing for people aged 25-34 is well below many other nations.
- Among the 23 nations participating in the OECD Adult Skills Survey, the U.S. ranks
  - 16th in literacy proficiency,
  - 21st in numeracy proficiency, and

    - 14th in proficiency in problem solving in technology-rich environments.
- Executives see U.S. workers as well below average in language skills.
- In reading, math, and science, U.S. 15 year-olds rank 14th among 37 nations.
- Executives give the U.S. less than stellar marks regarding the quality of math and science education in schools and the extent to which science is sufficiently emphasized in schools.

A correlate of these disturbing findings is the relatively high income inequality in the U.S. Among 34 developed nations, the U.S. ranks 32nd in income equality. Many U.S. communities do not have the incomes to fund school systems of a quality required to sustain high capacity for invention and innovation. Further, a recent study indicates, the U.S. has low economic mobility compared to other nations.[6]

[6] Raj Chetty, Nathaniel Hendren, Patrick Kline, Emmanuel Saez, and Nicholas Turner, "Is the United States Still a Land of Opportunity? Recent Trends in Intergenerational Mobility," National Bureau of Economic Research, Working Paper 19844, January 2014. From the authors' Equality of Opportunity Project website: "Contrary to popular perception, economic mobility has not changed significantly over time; however, it is consistently lower in the U.S. than in most developed countries."

Table 3: Human Capital

Indicators, by Report	Rank	Year	Data Source
World Competitiveness Yearbook 2013 (n=60)			
Adult (over 15 years) literacy rate as a % of population	1	2010	UNESCO or national sources
Researchers and scientists are attracted to your country	2	2013	WCC Executive Opinion Survey
Foreign high-skilled people are attracted to your country's business environment	3	2013	WCC Executive Opinion Survey
Brain drain (well-educated and skilled people) does not hinder competitiveness in your economy	5	2013	WCC Executive Opinion Survey
Information technology skills are readily available	5	2013	WCC Executive Opinion Survey
University education meets the needs of a competitive economy	10	2013	WCC Executive Opinion Survey
Attracting and retaining talents is a priority in companies	12	2013	WCC Executive Opinion Survey
Flexibility and adaptability of people are high when faced with new challenges	12	2013	WCC Executive Opinion Survey
Skilled labor is readily available	14	2013	WCC Executive Opinion Survey
Percentage of persons 25-34 with tertiary education	18	2010	OECD Education at a Glance 2012
The education system meetings the needs of a competitive economy	21	2013	WCC Executive Opinion Survey
Corporate values take into account the values of employees	21	2013	WCC Executive Opinion Survey
Qualified engineers are available in your labor market	22	2013	WCC Executive Opinion Survey
Science in schools is sufficiently emphasized	32	2013	WCC Executive Opinion Survey
Gender Inequality Index	36	2012	UN Human Development Report
Percentage of total first university degrees in science and engineering	38	2008	NSF Science & Engineering Indicators
Gini Index (equal distribution of income)	40	2000-11	UN Human Development Report
Language skills are meeting the needs of enterprises	42	2013	WCC Executive Opinion Survey
World Economic Forum Global Competitiveness Report 2013-2014 (n=148)			
Corporate capacity to innovate	5	2013	WEF Executive Opinion Survey
Availability of scientists and engineers	6	2013	WEF Executive Opinion Survey
Availability of high-quality, specialized training services	9	2013	WEF Executive Opinion Survey
Company investment in training and employee development	12	2013	WEF Executive Opinion Survey
Quality of education system	25	2013	WEF Executive Opinion Survey
Quality of math and science education in schools	49	2013	WEF Executive Opinion Survey

Global Innovation Index 2013 (n=142)			
QS university ranking	2	2012	QS World University Ranking
Knowledge-intensive employment %	14	2010	International Labor Organization
PISA reading, math, science scores (15 year-olds)	23	2009	OECD
OECD STI Scoreboard 2013			
Knowledge-based capital related workers % (n=25)	1	2012	national data
Participation in high proficiency job-related education and training (n=17)	2	2012	OECD PIAAC
New doctorates in science and engineering (n=20)	2	2007-11	OECD and national sources
Human resources in science and technology as % of all workers (n=37)	5	2012	OECD, ILO, national sources
PISA reading, math, science scores (15 year-olds) (n=37)	14	2009	OECD
Global Talent Competitiveness Index 2013 (n=103)			
QS university ranking	2	2012	QS World University Ranking
Tertiary-educated workforce	3	2010	UNESCO Global Education Digest
Investment in staff training	15	2012	WEF Executive Opinion Survey
PISA reading, math, science scores (15 year-olds)	22	2009	OECD
Researchers per million population	31	2009	UNESCO Institute for Statistics
OECD Skills Outlook 2013 (n=23)			
Population 55-65 with tertiary education	3	2012	OECD PIAAC
Population 25-34 with tertiary education	14	2012	OECD PIAAC
Proficiency in problem solving in technology-rich environments among adults	14	2012	OECD PIAAC
Literacy proficiency among adults	16	2012	OECD PIAAC
Numeracy proficiency among adults	21	2012	OECD PIAAC
OECD Income Inequality (n=34)			
Ratio of share of income between richest and poorest 10 percent	32	2010	OECD analysis

Patent Policies

A high national capacity for invention requires a patent system that provides sufficient incentives to invent, encourages the transformation of that invention to innovation, and facilitates the diffusion and adoption of these innovations. Table 4 provides indicators on perceptions about the U.S. patent system, drawn largely from the Taylor Wessing Global Intellectual Property Index (GIPI). The table suggests that perceptions about the U.S. patent system are mixed:

- The U.S. ranks first in terms of ability to deal in and take advantage of patents.
- Capacity to enforce patents, challenge the validity of patents, and obtain and maintain patents is seen as good, but not quite as high.
- The U.S. ranks poorly in the cost effectiveness of patent enforcement.

Regarding enforcement and protection of intellectual property rights in the U.S. more broadly, the WCC and WEF surveys provide somewhat differing results—the U.S. ranks in the top 10 percent in the former and the top 20 percent in the latter.

Table 4: Patent Policies

Indicators, by Report	Rank	Year	Data Source
Taylor Wessing Global Intellectual Property Index 2013 (n=36)			
Patent system -- overall score	11	2013	GIPI Survey
Ability to deal in and exploit patents	1		
Ability to enforce patents	6		
Ability to challenge the validity of or revoke/cancel patents	8		
Ability to obtain and maintain patents	11		
Cost effectiveness of patent enforcement	25		
World Competitiveness Yearbook 2013 (n=60)			
Intellectual property rights are adequately enforced.	5	2013	WCC Executive Opinion Survey
World Economic Forum Global Competitiveness Index 2013-2014 (n=148)			
In your country, how strong is the protection of intellectual property, including anti-counterfeiting measures?	25	2013	WEF Executive Opinion Survey

Taylor Wessing GIPI Criteria

- Ability to deal in and exploit patents
  - Adequate body of clear patent law
  - Cost-effective and efficient means to enforce breached agreements
  - Availability of competent professionals to assist
  - Clear and fair tax regime, possibly with patent-related tax breaks/incentives
  - Ready availability of finance/venture capital
  - Complexity of formalities associated with patent transactions/licences
- Ability to enforce patents
  - Adequacy of court procedures and extent claimant controls/influences timetable
  - Competence, reputation and specialisation of judges
  - Whether courts/tribunals are viewed as generally pro or anti patentee
  - Availability of competent professionals to assist
  - Speed of obtaining judgment on merits

    - Overall costs (including challenges to validity and assessing compensation)
    - Availability of adequate remedies (including interim remedies)
    - Possibility of enforcement through public bodies and criminal sanctions
- Ability to challenge the validity of or revoke/cancel patents
    - Publicly accessible register to identify ownership of patents
    - Adequacy of court/registry procedures pre- and post- registration
    - Competence, reputation and specialisation of judges/tribunal
    - Availability of competent professionals to assist
    - Whether courts/tribunals are viewed as generally pro or anti patentee
    - Speed and cost of obtaining judgment on merits
- Ability to obtain and maintain patents
    - Speed and cost of securing protection
    - Availability of competent professionals to assist
    - Complexity of formalities associated with patent filing and prosecution
    - Potential for independent judicial oversight of administrative procedures
    - Level of respect for patent rights in general
    - Signatory to relevant international treaties
    - Renewal costs and ease of renewal
- Cost effectiveness of patent enforcement
    - Overall costs allowing for reimbursement from losing opponent
    - Amount of compensation awards
    - Robustness of decisions (too easily overturned on appeal or unpredictable)
    - Options for low cost forum for smaller cases

Free Trade

According to the economic literature, invention is stimulated by free trade. Table 5 provides a series of indicators regarding the extent to which the U.S. participates in free trade. Key findings:

- The U.S. ranks highly in terms of simple tariff averages, but less so for weighted measures.
- Executives do not see protectionism as a major issue.
- The costs of complying with trade regulations in the U.S. is among the lowest.
- Executives believe that the efficiency of U.S. customs authorities is somewhat above the average.
- Executives express some concern about non-tariff barriers, capital controls, and impediments to foreign investment.
- The U.S. ranks below average in terms of the freedom of foreigners to visit as tourists and for short-term business purposes (likely due to post-9/11 restrictions).

Table 5: Free Trade

Indicators, by Report	Rank	Year	Source
World Competitiveness Yearbook 2013 (n=60)			
Tariffs on imports -- most favored nation simple average rate	5	2012	World Trade Organization
Protectionism does not impair the conduct of your business	10	2013	WCC Executive Opinion Survey
Capital markets (foreign and domestic) are easily accessible	10	2013	WCC Executive Opinion Survey
Customs' authorities facilitate the efficient transit of goods	18	2013	WCC Executive Opinion Survey
Foreign investors are free to acquire control of domestic companies	22	2013	WCC Executive Opinion Survey
World Economic Forum Global Competitiveness Index 2013 (n=148)			
Trade-weighted average tariff rate	33	2012	International Trade Centre
In your country, how efficient are the customs procedures (related to the entry and exit of merchandise)?	35	2013	WEF Executive Opinion Survey
In your country, to what extent do non-tariff barriers (e.g., health and product standards, technical and labeling requirements, etc.) limit the ability of imported goods to compete in domestic markets?	53	2013	WEF Executive Opinion Survey
In your country, to what extent do rules and regulations encourage or discourage FDI?	55	2013	WEF Executive Opinion Survey
Global Innovation Index (n=142)			
Applied tariff rate, weighted mean	41	2010	World Bank
Market access for non-agricultural exports, weighted tariff	78	2010	WTO, ITC, and UNCTAD
Economic Freedom of the World 2013			
Freedom to trade internationally -- index score (n=152)	43	2011	
Compliance costs of importing and exporting (n=151)	5		World Bank Doing Business
Mean tariff rate (n=152)	10		World Trade Organization
Trade taxes as % of total trade (n=134)	47		International Monetary Fund
Non-tariff trade barriers (n=142)	48		WEF Executive Opinion Survey
Foreign ownership/investment restrictions (n=142)	57		WEF Executive Opinion Survey
Standard deviation of tariff rates (n=152)	61		World Trade Organization
Capital controls (n=151)	65		International Monetary Fund
Freedom of foreigners to visit for tourism and short-term business purposes (n=151)	89		Lawson and Lemke

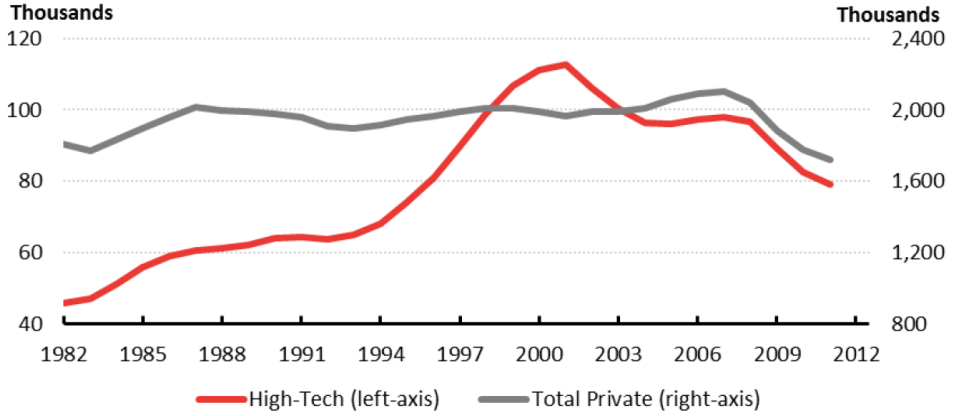
Presence of Young Firms

According to the economic literature, a nation's capacity to invent depends on the relative presence of young firms in the economy. Chart Set 1 is worrisome in that it shows a substantial decline in the presence of young firms as a share of all firms over the last three decades. This trend is even more pronounced for young high-tech firms.

Chart Set 1: Presence of Young Firms

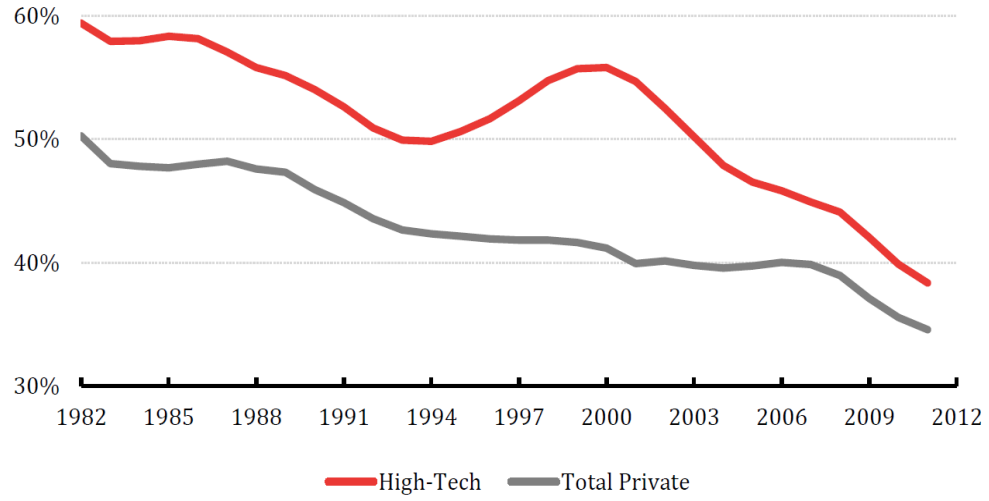
Source: John Haltiwanger, Ian Hathaway, and Javier Miranda, "Declining Business Dynamism in the U.S. High-Technology Sector," Ewing Marion Kauffman Foundation, February 2014

Fig. 3: Young Firms (aged five years or younger) by Sector (1982–2011)



Source: U.S. Census Bureau, BDS and Special Tabulation; authors' calculations

Fig. 4: Young Firms (aged five years or younger) as a Share of Total Firms by Sector (1982–2011)



Source: U.S. Census Bureau, BDS and Special Tabulation; authors' calculations

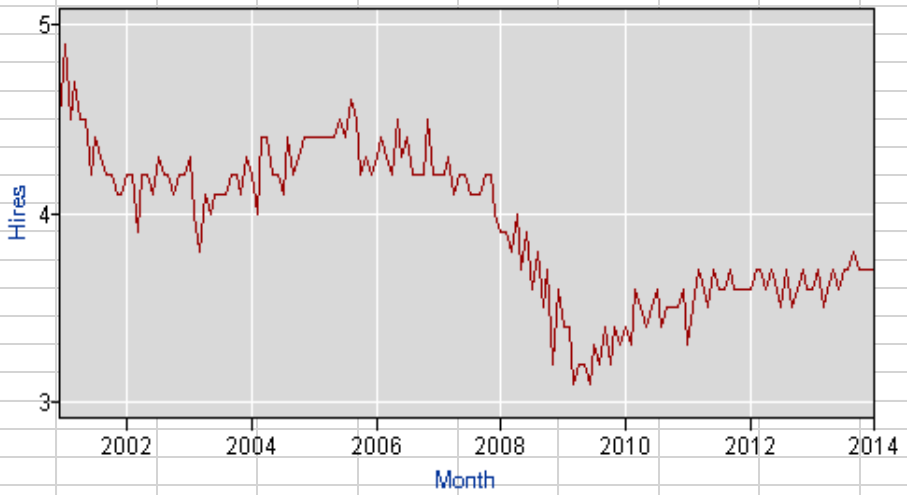
Private Sector Hire and Quit Rates

The frequency of invention is a function of the extent to which workers are willing to voluntarily leave a current job and take on a new one. Chart Set 2 below shows hires and quits as a percent of all employment. The trend is troubling in that it shows the rate of voluntary quits, though rising, is still well below the rate of a decade ago.

Chart Set 2: Elective Job Flows: Private Sector Hires and Quits as % of Total Employment

Source: Job Openings and Turnover Survey, Bureau of Labor Statistics

Hires as % of Total Employment -- Private Sector



Quits as % of Total Employment -- Private Sector

Societal Value and Attitudes

A nation's capacity to invent is broadly determined by its general values and attitudes. Table 6 shows several indicators of executive opinion about U.S. values and attitudes. Executives perceive that the U.S. value system supports competitiveness and that firms are quite adaptable to market changes. However, they believe the U.S. does not fully embrace globalization in general and foreign ideas in particular.

Table 6: Societal Values and Attitudes

Indicators, by Report	Rank	Year	Data Source
World Competitiveness Yearbook 2013 (n=60)			
The value system in your society supports competitiveness	1	2013	WCC Executive Opinion Survey
Adaptability of companies to market changes is high	9	2013	WCC Executive Opinion Survey
The national culture is open to foreign ideas	26	2013	WCC Executive Opinion Survey
The need for economic and social reforms is generally well understood	30	2013	WCC Executive Opinion Survey
Attitudes towards globalization are generally positive in your society	31	2013	WCC Executive Opinion Survey

National Innovation Agency and Strategy

Experience indicates that growth of a nation's capacity to invent is facilitated by the presence of a national innovation agency capable of seeing to the effective implementation of a thoughtful national innovation strategy. As Chart Set 3 shows, the U.S. does not have such an agency, unlike other nations. The U.S. model is one in which the federal government's focus is primarily on funding basic research through the National Science Foundation and the National Institutes of Health. While the Obama Administration has published two national innovation strategy documents, both are at a broad level and there is no evidence to suggest either has provided a meaningful framework for federal policy.[7] Without an effective innovation agency and strategy, the U.S. is at a competitive disadvantage with other nations.

[7] "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs," September 2009, and "A Strategy for American Innovation: Securing Our Economic Growth and Prosperity," February 2011.

Chart Set 3: National Innovation Agencies

Country	National Innovation Agency/Foundation	Year Agency Introduced
China	Ministry of Science and Technology	1998
Denmark	Agency for Science, Tech, and Innovation	2006
Finland	Tekes	1983
India	National Innovation Foundation	2000
Ireland	Forfas	1994
Japan	NEDO	1980
Korea	Korea Industrial Technology Foundation	2001
The Netherlands	SenterNovem	2004
Norway	Innovasjon Norge	2004
Portugal	Agência de Inovação	2003
South Africa	National Advisory Council on Innovation	2006
Sweden	VINNOVA	2001
Taiwan	Industrial Technology Research Institute	1973
Thailand	National Innovation Agency	2003
United Kingdom	Department of Business, Innovation, and Skills	2009
United States	N/A	N/A
Uruguay	National Research and Innovation Agency (ANII)	2008

THE INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

Source: Rob Atkinson, "Innovation & Economic Growth: Rationales for a National Innovation Strategy," presentation at Tecnomanagement 2013, sponsored by the Mexican Institute of Finance Executives and the Mexican Association of Computer Professionals, October 17, 2013.

Conclusion

From this review of indicators, one can draw both substantive and methodological conclusions on the U.S. capacity for invention.

The U.S. is the world's leading nation in terms of invention and innovation. However, for it to sustain this place, it must:

- Sustain a high level of federal investment in research and development;
- Ensure the continued preeminence of its scientific R&D establishment, particularly in its universities;
- Catalyze a significant increase in postsecondary educational attainment and basic and advanced skills development across the wider population;
- Facilitate a higher rate of new business development;
- Do these last two steps in part by addressing severe income inequality and lack of economic mobility; and
- Commit to achieving full employment so that workers will be more willing to leave a job for new opportunities.

While participants and observers are generally positive about the U.S. patent and customs systems, they think that both systems would benefit from greater efficiencies and strategic redesigns.

The U.S. is more likely to achieve these objectives if it were to have one agency with central, proactive management of U.S. innovation policy.

Regarding methodology, the plethora of regularly updated global innovation-related indices makes possible a broad, deep, and current assessment of the U.S. capacity for invention. That said, the one notable hole in the available data is the absence of a U.S. equivalent to the Community Innovation Survey (CIS) periodically conducted by European Commission.[8] As a result, the U.S. is not represented in OECD science, technology, and industry indicators regarding topics such as:

- External sources of knowledge for innovation;
- Externally developed goods and services innovation;
- Firms collaborating on innovation activities, by size;
- Firms collaborating on innovation with higher education or public research institutions;
- Firms collaborating on innovation with suppliers and clients;
- Firms engaged in international collaboration on innovation;
- Type of firm innovation (product, process, organizational);
- Product innovation by firm R&D intensity; and

[8] See http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/cis.

- Firms receiving public support for innovation.[9]

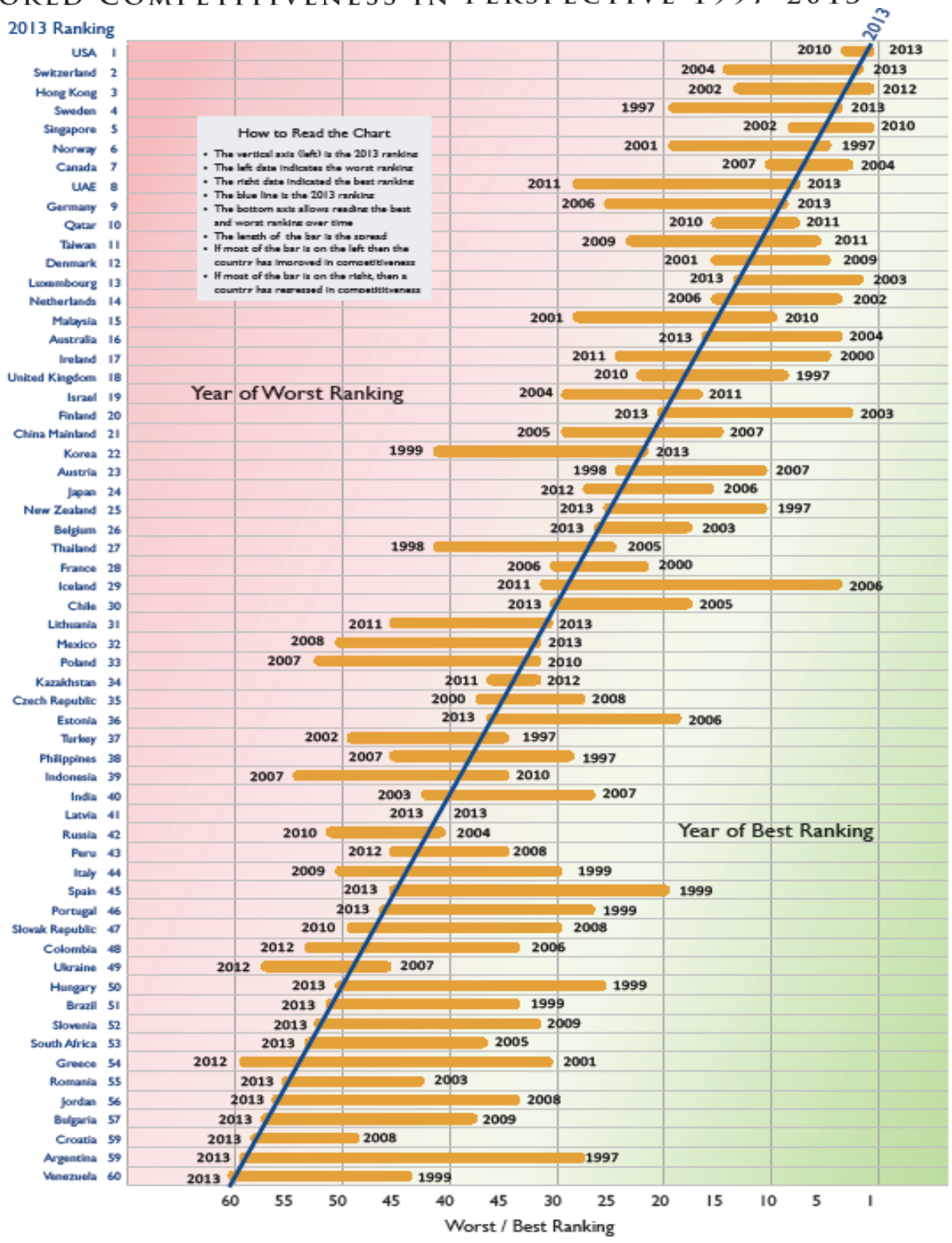
At present, the U.S. Department of Agriculture's Economic Research Service (ERS) has a one-time Rural Establishment Innovation Survey in the field at present which has adapted a number of questions from the CIS. It would be worthwhile to determine the feasibility of regularly asking such questions in the U.S.

Indicator analysis of U.S. capacity for invention could be enhanced through a review of U.S. rankings over time in various categories. While a number of the global index reports are relatively new, a meaningful assessment of the change in U.S. positions regarding individual indicators over time certainly is feasible. However, care would need to be taken to ensure that any particular indicator is comparable over time. An indicator may not be present every year, it could be redefined from one year to the next, the source or nature of its data might have changed, and the number of countries ranked might have increased or decreased.

The World Competitiveness Center does provide the following chart that shows variation in each nation's competitiveness index rank (which encompasses more than the dimensions of invention and innovation) from 1997 to 2013. As can be seen, the U.S. has been in or close to the lead every year. However, as noted throughout this paper, the underlying indicators suggest that the U.S. position cannot be taken for granted.

[9] Organisation for Economic Co-operation and Development, "OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth," 2013.

World Competitiveness in Perspective 1997-2013



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