State investments in innovation: fixing vs. creating markets

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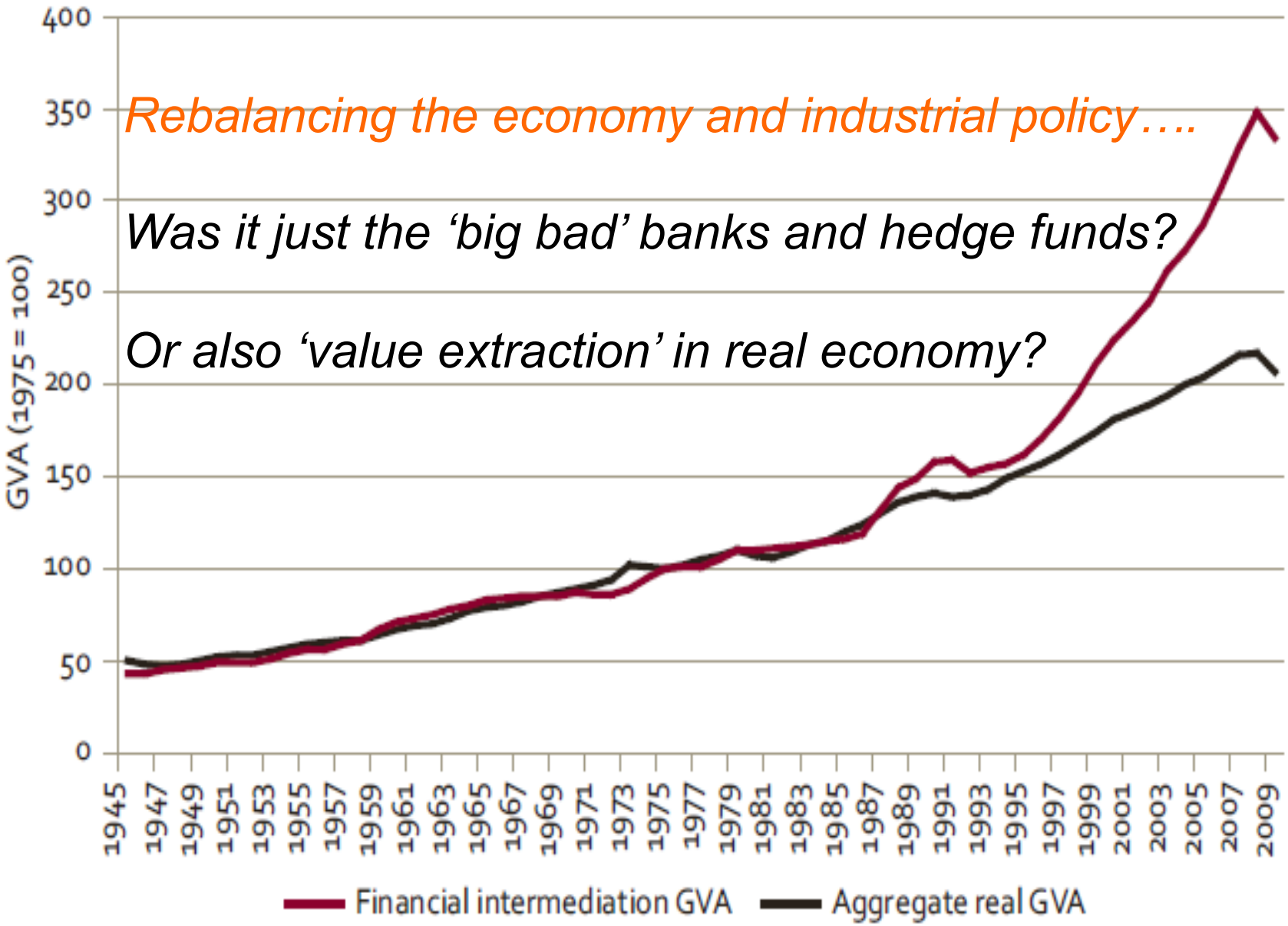
1. The context: financial crisis and industrial policy
2. State's role: market fixing or market making
3. Myths & policies: wrong policies for wrong diagnosis
4. Risks and rewards: parasitic vs. symbiotic eco-systems

Financial intermediation and aggregate gross value added compared



Source: Bank of England (2011)

What is the State's role in the economy?

Correcting:

1. Market failure (even 'free marketeers')
2. Output failure (Keynesians)
3. System failure (Schumpeterians)

Creating/shaping:

4. Something more interesting …

1) Market failure

Markets fail to allocate investment, goods & services, due to:

- Externalities
- Public goods
- Information asymmetries
- Non competitive markets
- Principal agent problems

e.g. **basic research** is a public good (positive externality), hard to appropriate, so firms tend to under-invest. (vs. mission oriented)

e.g. pollution is a negative **externality** not incorporated into company costs, making marginal social cost greater than the marginal social benefit.

Market failure policies

- Fund what is not funded: motorways, basic research.
- Change **incentive structures** (e.g. R&D subsidies, environmental taxes, feed-in tariffs).
- **Nudge** private sector in the right direction (e.g. Green Investment Bank).

2) Output failure (Keynes)

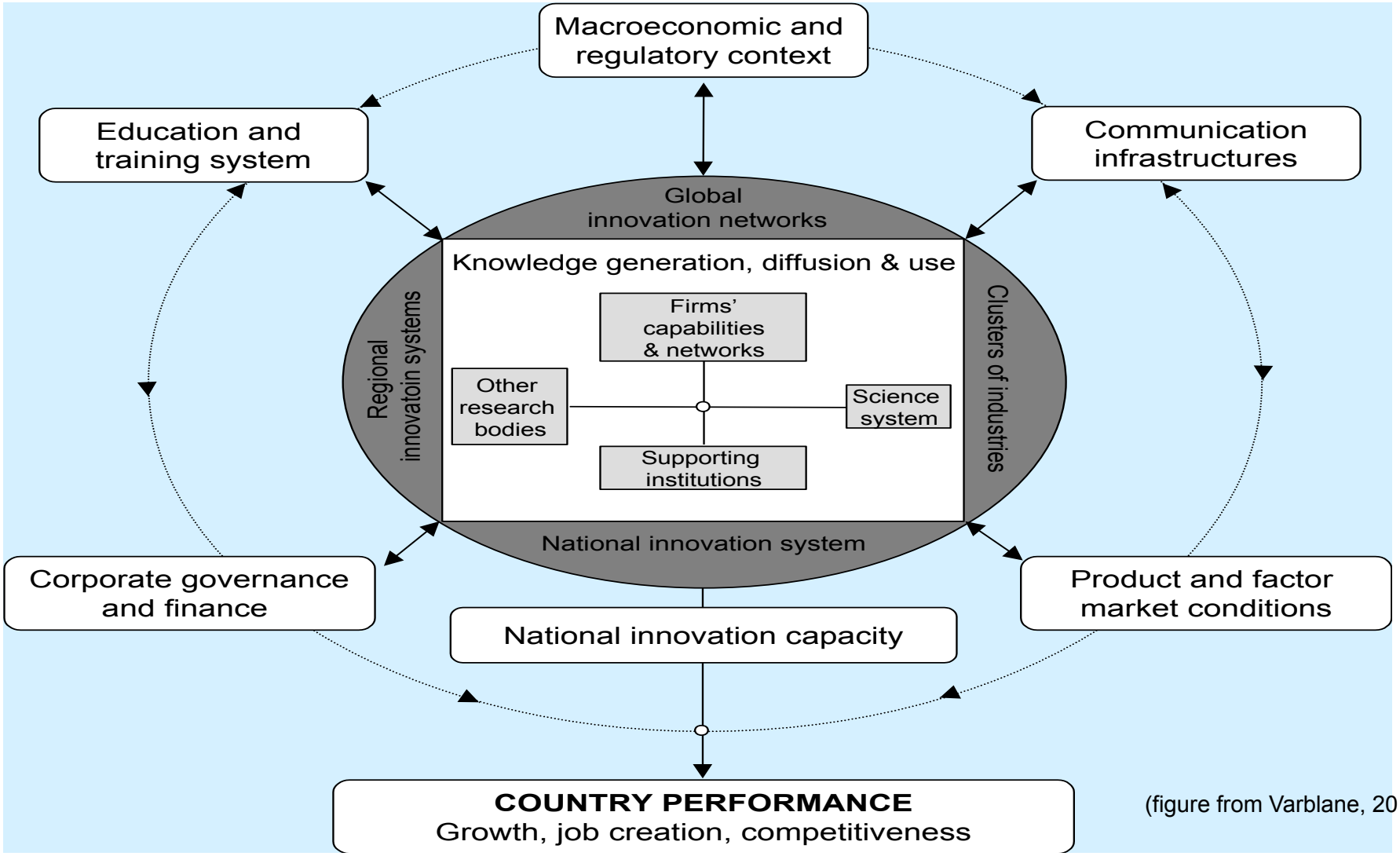
"The important thing for Government is not to do things which individuals are doing already, and to do them a little better or a little worse; but to do those things which at present are not done at all." *J.M.Keynes, The End of Laissez Faire, 1926*

$$GDP=C+I+G+(X-M)$$

Private investment (I) is too pro-cyclical, and volatile (driven by animal spirits), so government investment (G) must be counter-cyclical and more stable.

The *opposite* of what is happening today.

3) System failure



(figure from Varblane, 2011)

National System of Innovation

system failure policies

e.g. Europe's *Innovation Union*

Strengthening the knowledge base & reducing fragmentation

- Education and skills
- European Research Area
- EU financing instruments

Getting good ideas to market

- Access to finance
- Single innovation market
- Openness and creative potential

Social and territorial cohesion

European Innovation Partnerships

International cooperation

Source: Innovation Union
Flagship Initiative presentation, Oct, 2010

failure failure failure…

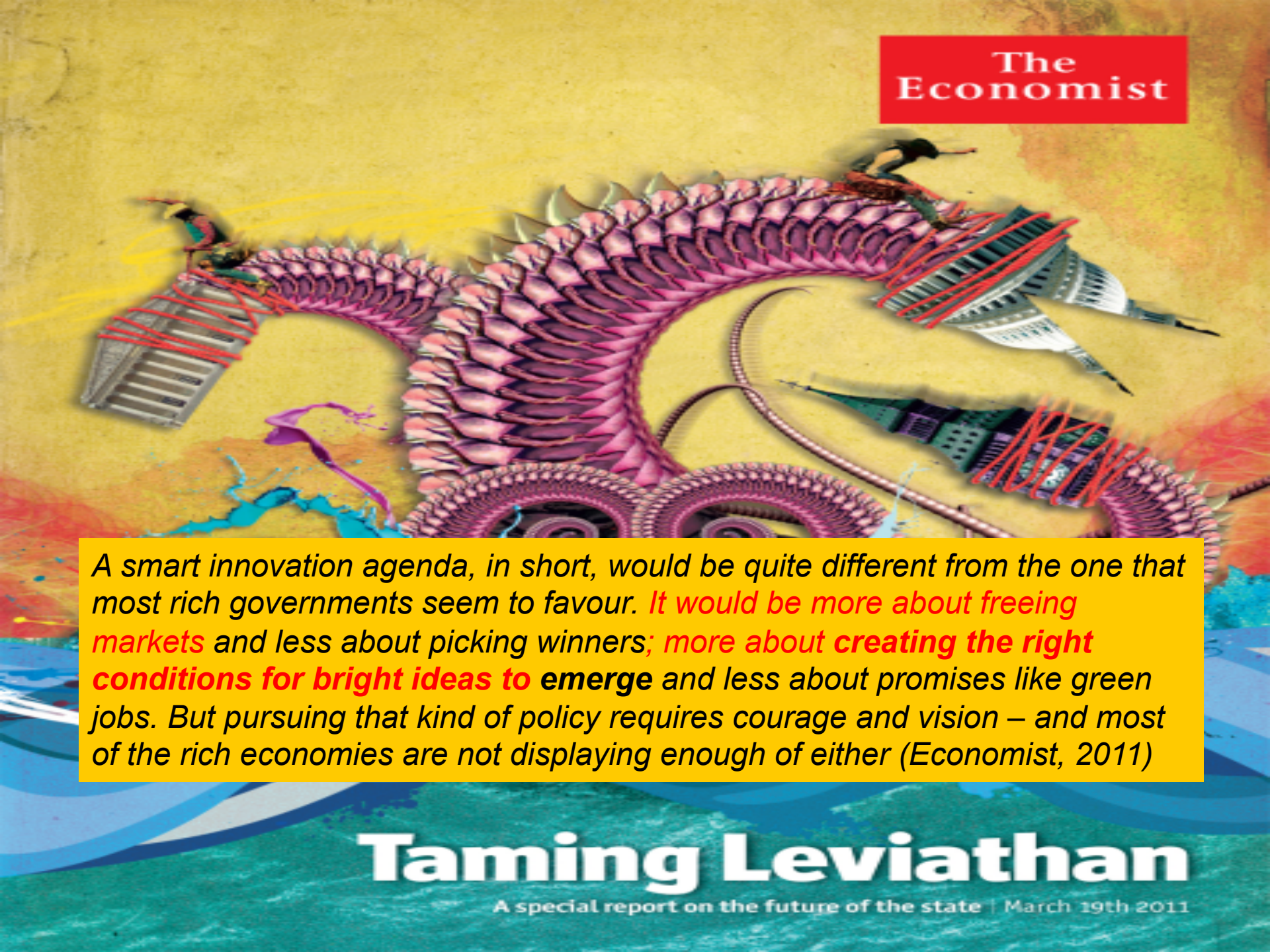
If there are so many failures….why don't we change the diagnosis, rather than constantly just picking up the pieces, and wasting so many band-aids?

all based on false contrast…

Private sector = fast, innovative, dynamic, entrepreneurial...

Public sector = slow, bureaucratic, inertial...or even worse:

'enemies of enterprise' (David Cameron, 2011)



A smart innovation agenda, in short, would be quite different from the one that most rich governments seem to favour. It would be more about freeing markets and less about picking winners; more about ***creating the right conditions for bright ideas to emerge*** *and less about promises like green jobs. But pursuing that kind of policy requires courage and vision – and most of the rich economies are not displaying enough of either (Economist, 2011)*

Governments have always been lousy at picking winners, and they are likely to become more so, as legions of entrepreneurs and tinkerers swap designs online, turn them into products at home and market them globally from a garage. As the revolution rages, governments should stick to the basics: better schools for a skilled workforce, clear rules and a level playing field for enterprises of all kinds. *Leave the rest to the revolutionaries.*

The Third Industrial Revolution, *The Economist,* April 21, 2012


BUSINESS
IS
GREAT
BRITAIN
WITH LOW CORPORATION TAX AND LESS
REGULATION, THE UK IS EUROPE'S BEST
DESTINATION FOR INVESTMENT

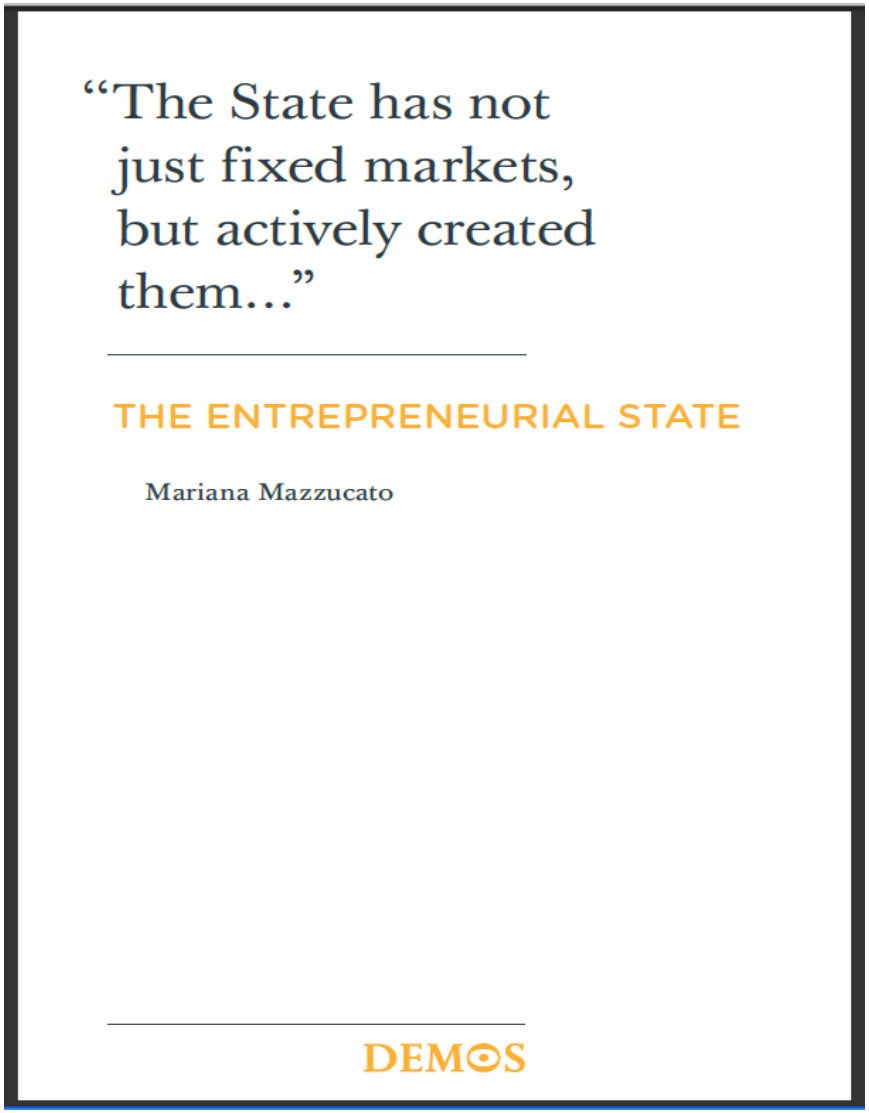
Animal spirits
or
pussy cat?

Businessmen have a different set of delusions from politicians, and need, therefore, different handling. They are, however, much milder than politicians, at the same time allured and terrified by the glare of publicity, easily persuaded to be ‘patriots’, perplexed, bemused, indeed terrified, yet only too anxious to take a cheerful view, vain perhaps but very unsure of themselves, pathetically responsive to a kind word. You could do anything you liked with them, if you would treat them (even the big ones), not as wolves or tigers, but as domestic animals by nature, even though they have been badly brought up and not trained as you would wish….

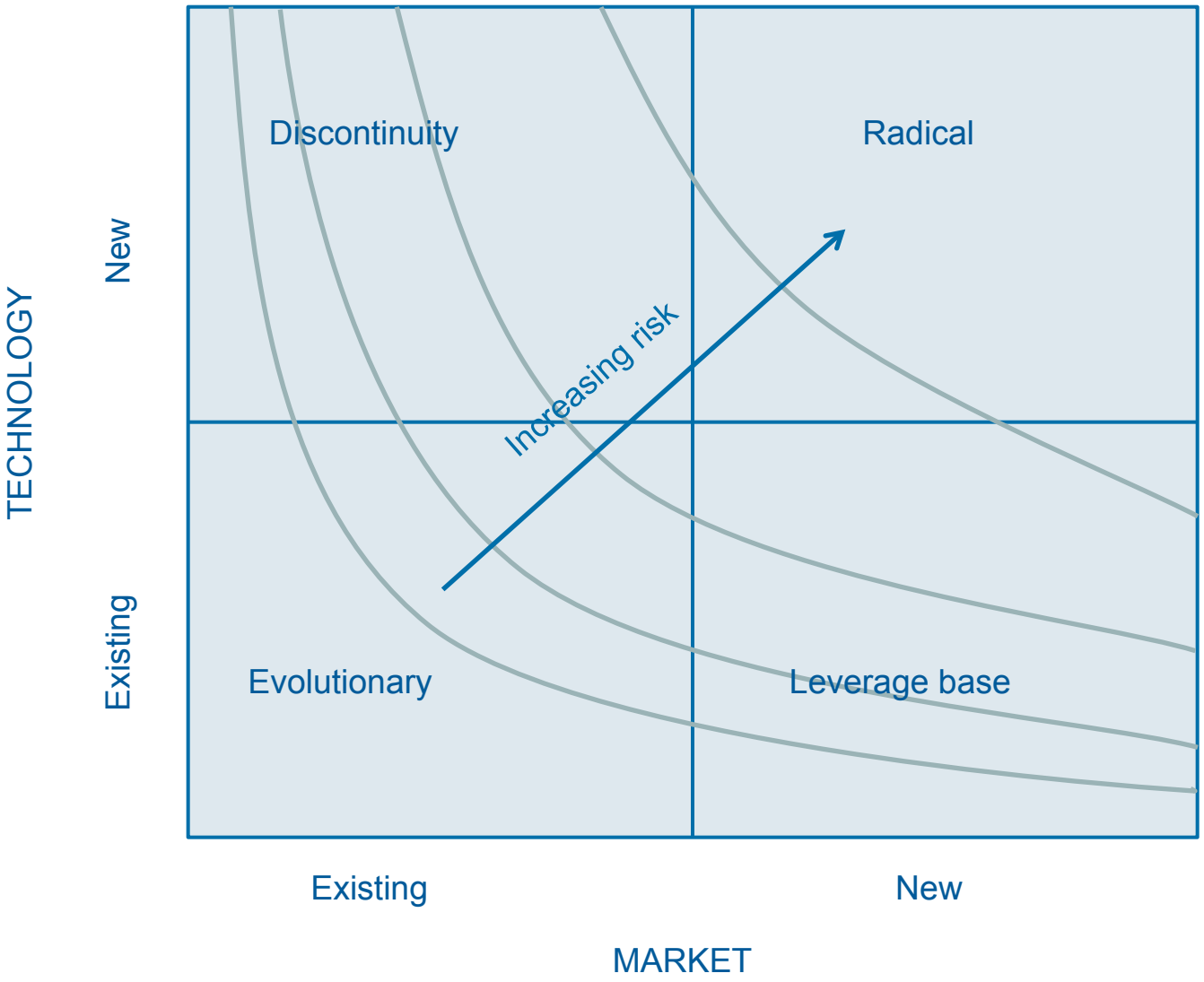
John M. Keynes’s private letter to Franklin D. Roosevelt, Feb 1, 1938

4) The Entrepreneurial State

- Government doesn't only 'fix' markets but does what private sector not willing to do.
- Catalyst, and lead investor, sparking the initial reaction in a network. *Creator* not facilitator of knowledge economy (Block and Keller, 2011).
- Engaging with very high risk, uncertainty, radical change.
- Courageous…but a bit naïve on the returns….



market and technology risk



technology risk in clean tech

(GIB will nudge, VC will ride the wave, who will kick/push?)

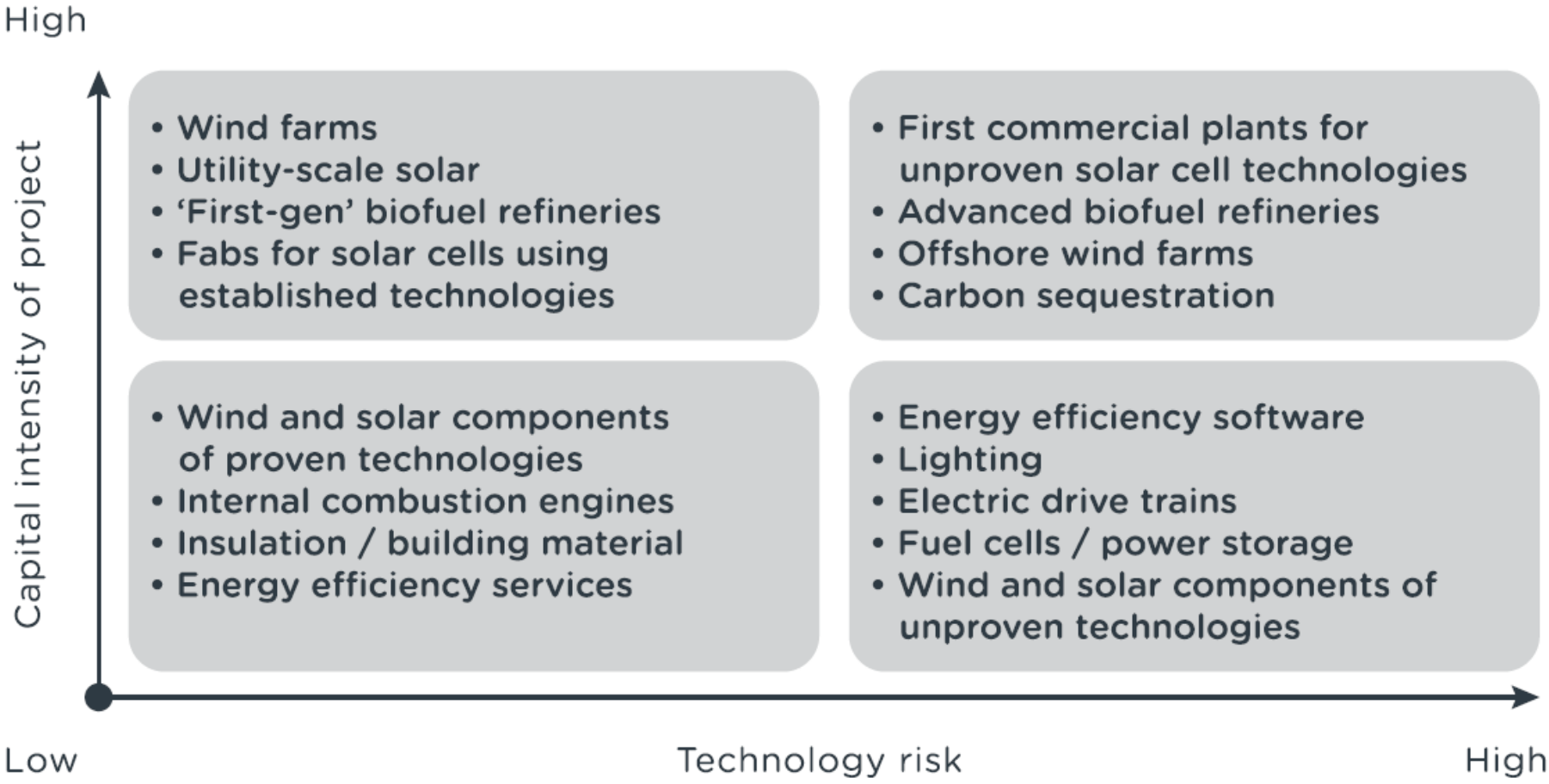
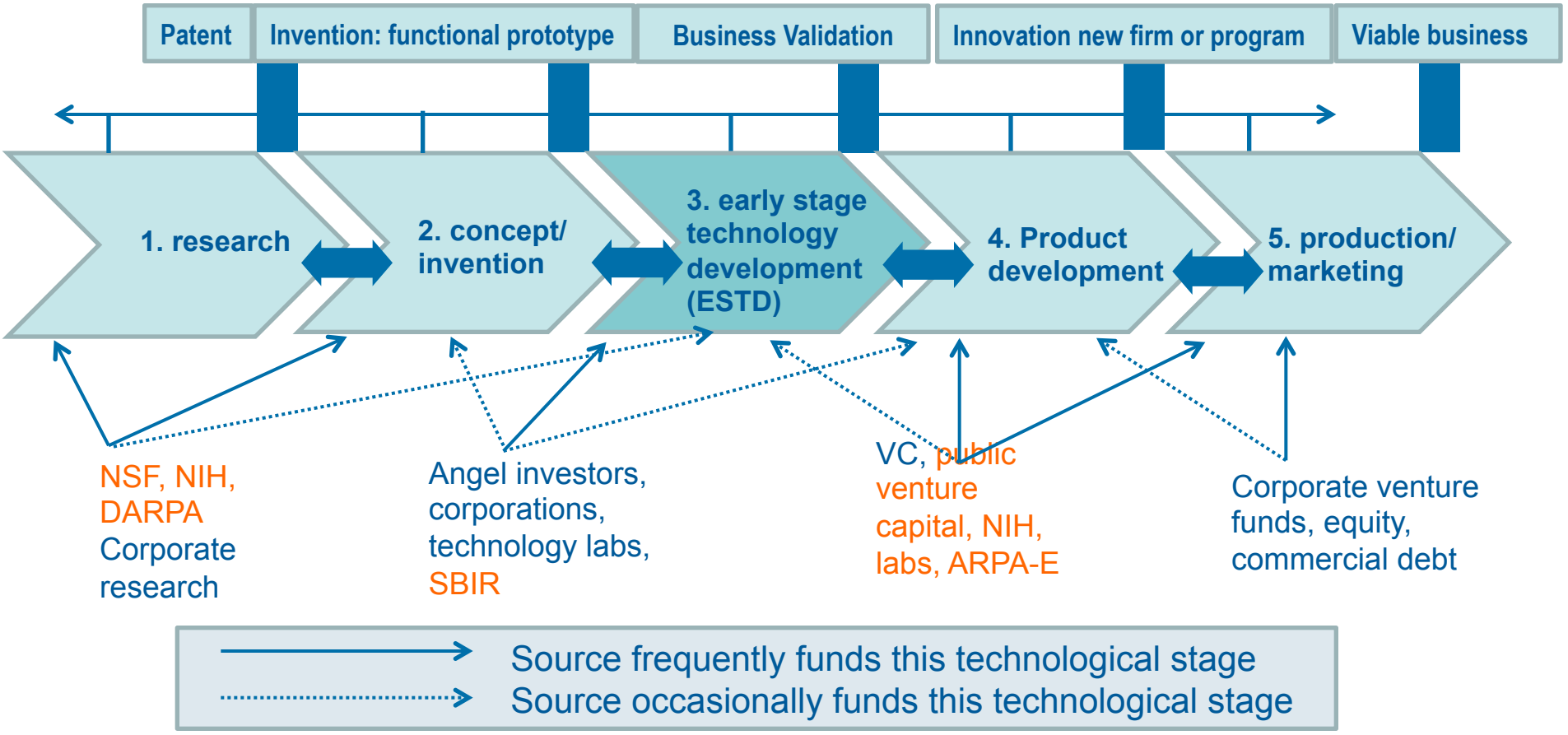


Figure source: Ghosh and Nanda, 2011

Valleys of death and Darwinian seas

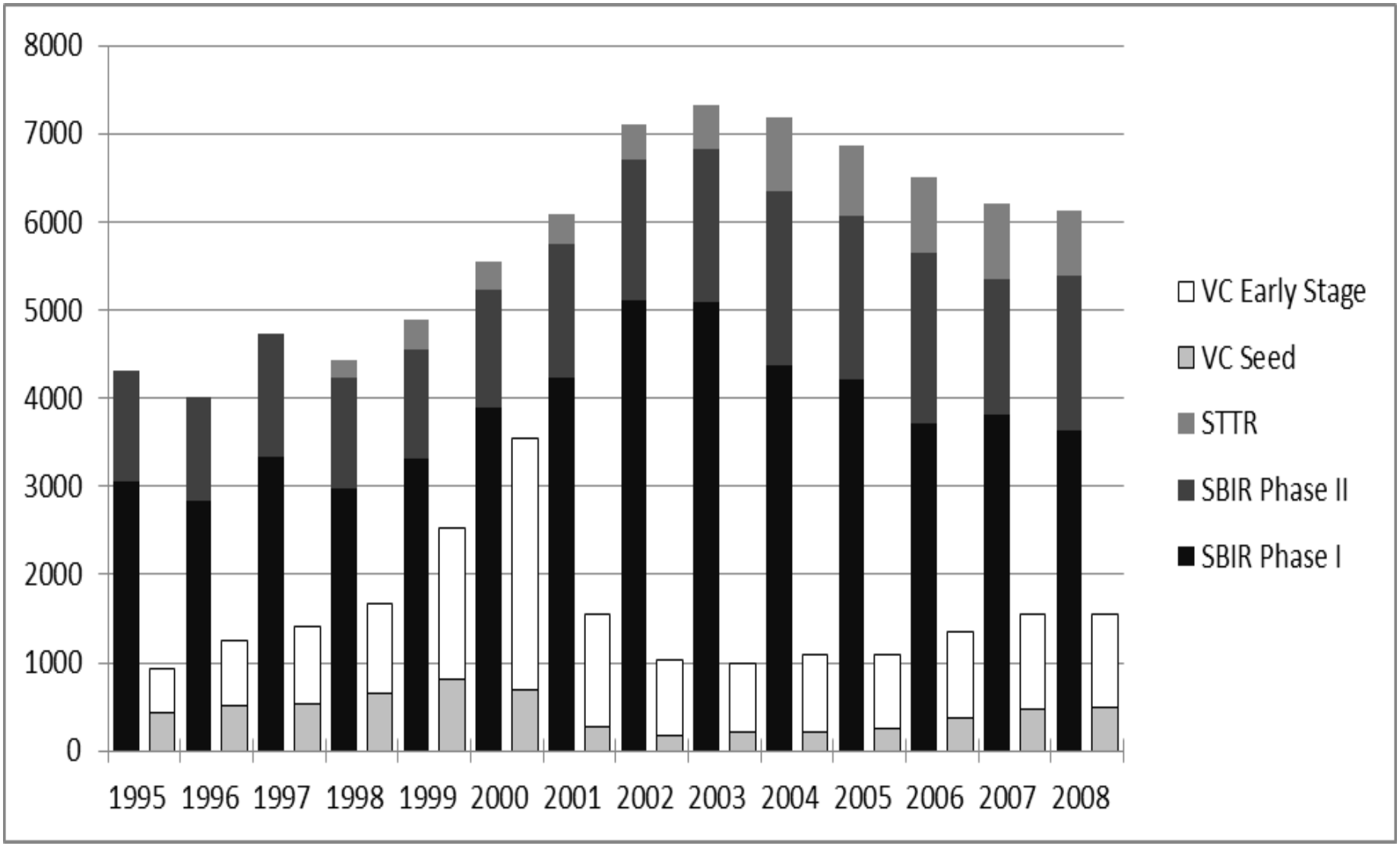


Source: Auerswald/Branscomb , 2003

bumpy investment landscape

Point at which investment made	Risk of loss
Seed stage	66.2%
Start-up stage	53.0%
Second stage	33.7%
Third stage	20.1%
Bridge or pre-public stage	20.9%

Number of Early Stage and Seed Funding Awards, SBIR and Venture Capital (Block and Keller, 2012)




9:41 AM
7
Phone
Mail
Safari
iPod

iPhone

Microchips powering the iPhone owe their emergence to the U.S. military and space programs, which made up almost the entire early market for the breakthrough technology. In the 1960s, the government bought enough of the initially costly chips to drive down their price 50x in a few short years, enabling numerous new applications.

The early foundation of **cellular communication** lies in radiotelephony capabilities advanced throughout the 20th century with support from the U.S. military.

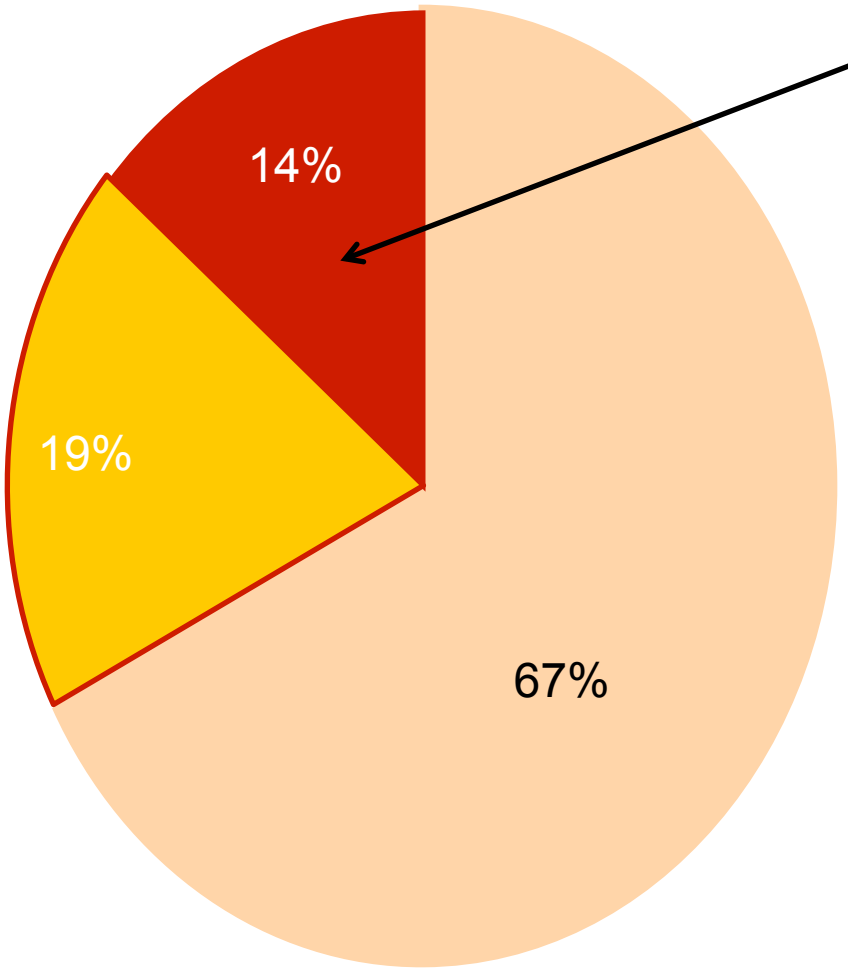
The technologies underpinning the **Internet**, which gives the "smart phone" its smarts, were developed and funded by the Defense Department's Advanced Research Projects Agency in the 1960s and 70s.

GPS was created/deployed in 1980s/90s by the military's NAVSTAR satellite program

The **multi-touch display** that makes using an iPhone so intuitive has the government's fingerprints all over it. The revolutionary interface was first developed by a brilliant pair of University of Delaware researchers supported by NSF and CIA grants Source: **The Breakthrough Institute**, *Where Good Technologies Come From?*, 2011

SIRI, iPhone 5's *personal assistant*, developed initially in DARPA.

new vs. ‘me too’ in pharma (1993-94)



Radical innovation funded almost entirely by public sector labs

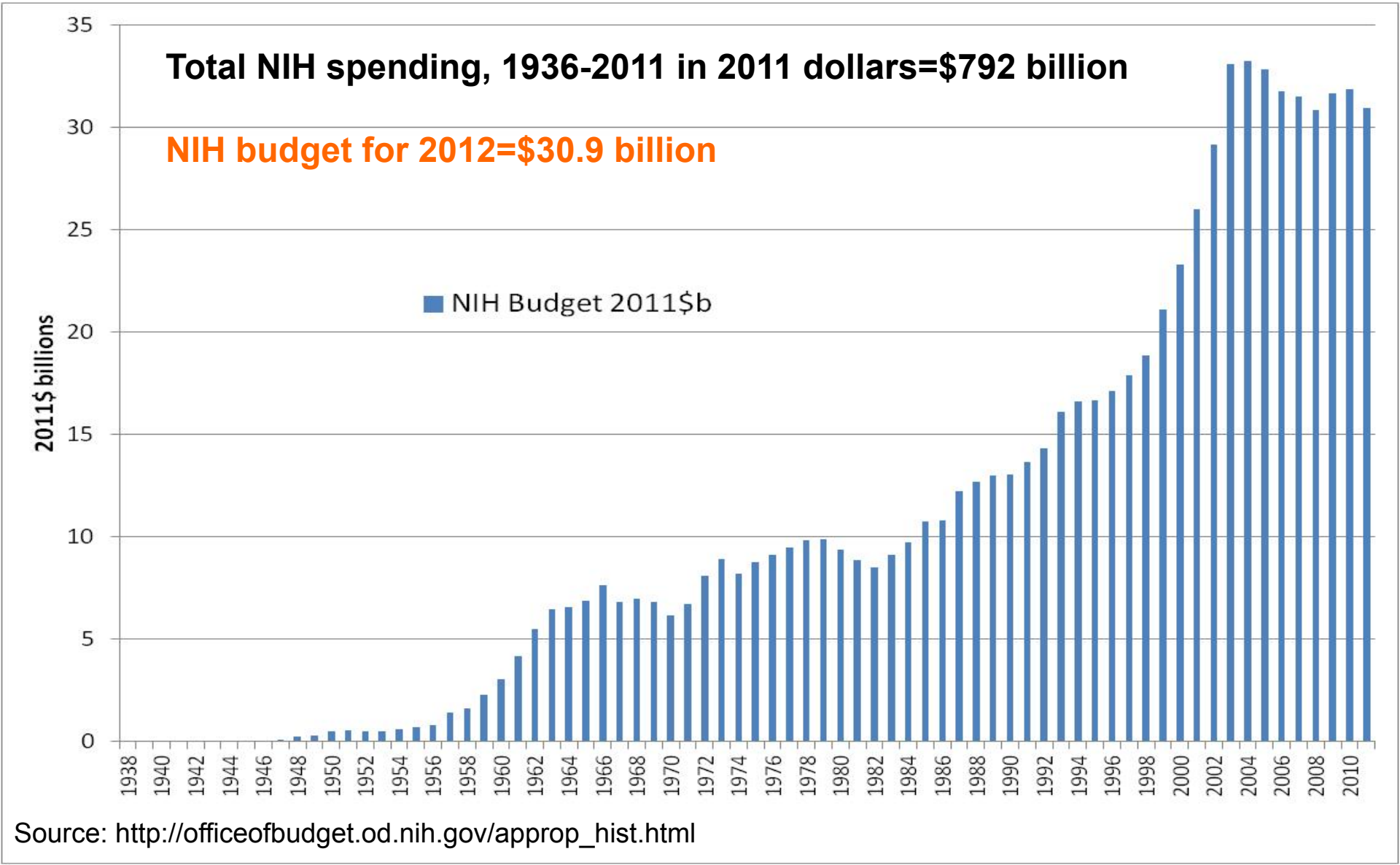
Variations of existing drugs

Priority NMEs

Standard NMEs

Angell (1984)

National Institutes of Health budgets 1938-2011



Source: http://officeofbudget.od.nih.gov/approp_hist.html

General Purpose Technologies

Government investments have been key in bringing about GPTs:

- ‘mass production’ system
- aviation technologies
- space technologies
- IT
- internet
- nuclear power
- nanotechnology
- Internet

Ruttan (2006)

Irony: USA = very interventionist

- Myth of US market approach vs. EU State led approach.
- Visible hand of US government present in computer revolution, biotech, nanotech, and green-tech today.
- Active though *decentralised* State agencies (NSF, NNI, SBIR, DARPA..). 'Hidden' industrial policy (Block and Keller, 2011)
- Willingness to fail, and expertise within Govt.

Big bird syndrome

The green revolution....

Will never take off with a weak state.

Not about nudging ... need to push.

Incremental vs. radical innovation; high risk vs. low risk areas

Lead public investors: China, Korea, Germany, Finland, Denmark, Brazil. ARPA-E.

And private sector is reacting with their feet…..GE, Vestas: “no green vision in the UK”

2. Why getting this wrong leads to myths & bad policies

Mistake 1: wrong actors in wrong *places/times*

let's copy Silicon Valley...venture capital!!

Venture capital model inappropriate for pharma and biotech

From 1976 VC was applied to biotechnology. VC wants return in 3-5 yrs. Yet it takes at least a decade and $1 billion to develop and commercialize a biopharma drug with high risks of failure.

Not surprising that in biopharma there is a prevalence of PLIPOs (productless IPOs).

Danger: speculation permits financial interests to gain even when no product is produced.

"During a recent visit to the United States, French President Francois Mitterrand stopped to tour California's Silicon Valley, where he hoped to learn more about the ingenuity and entrepreneurial drive that gave birth to so many companies there.

Over lunch, Mitterrand listened as Thomas Perkins, a partner in the venture capital fund that started Genentech Inc., extolled the virtues of the risk-taking investors who finance the entrepreneurs.

Perkins was cut off by Stanford University Professor Paul Berg, who won a Nobel Prize for work in genetic engineering. He asked, "Where were you guys in the '50s and '60s when all the funding had to be done in the basic science? Most of the discoveries that have fueled [the industry] were created back then."

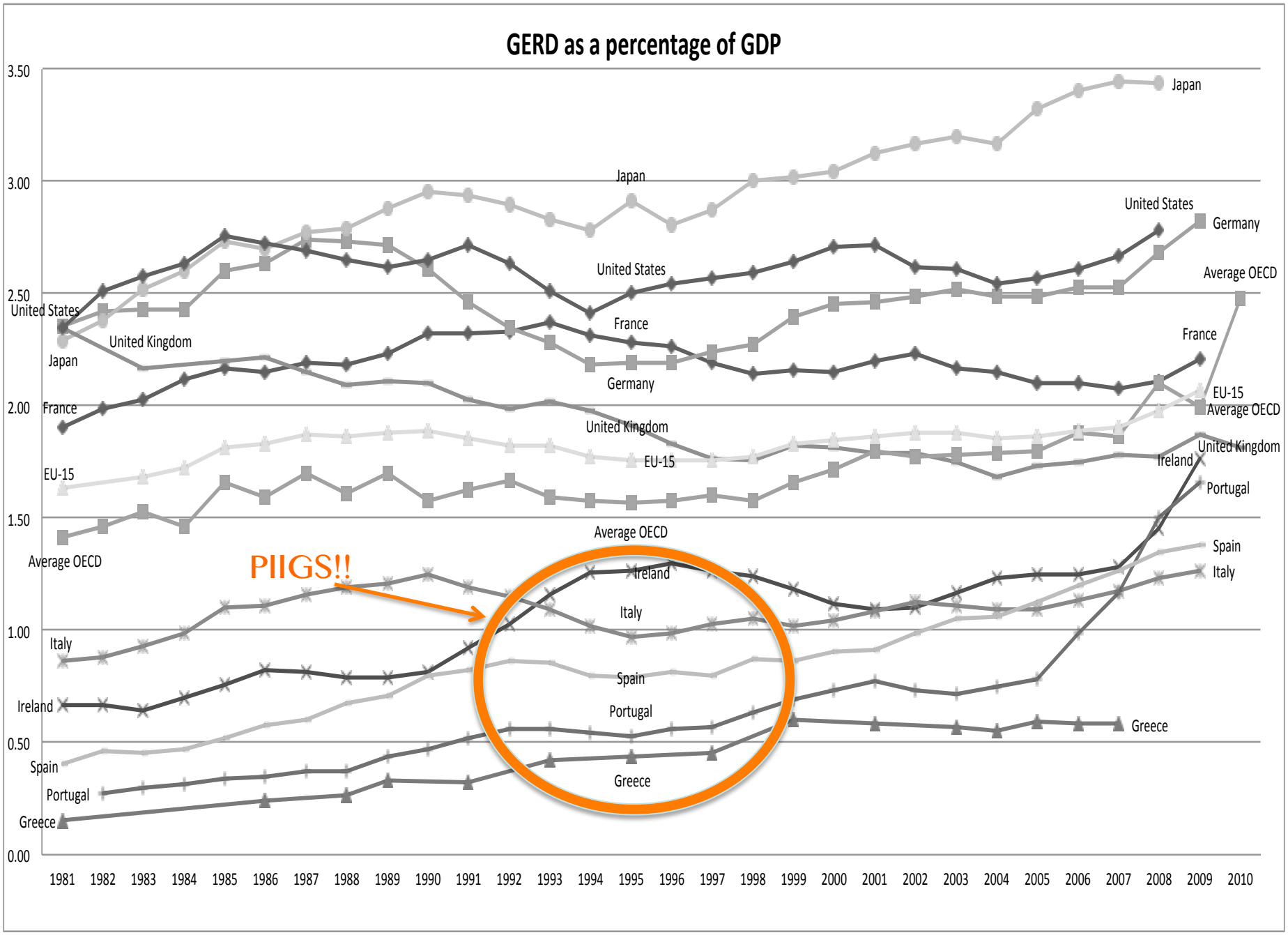
Source: Nell Henderson and Michael Schrage, 1984, "The roots of biotechnology: Government R&D spawns a new industry," Washington Post, December 16, 1984

Mistake 2: obsession with some actors, e.g. SMEs

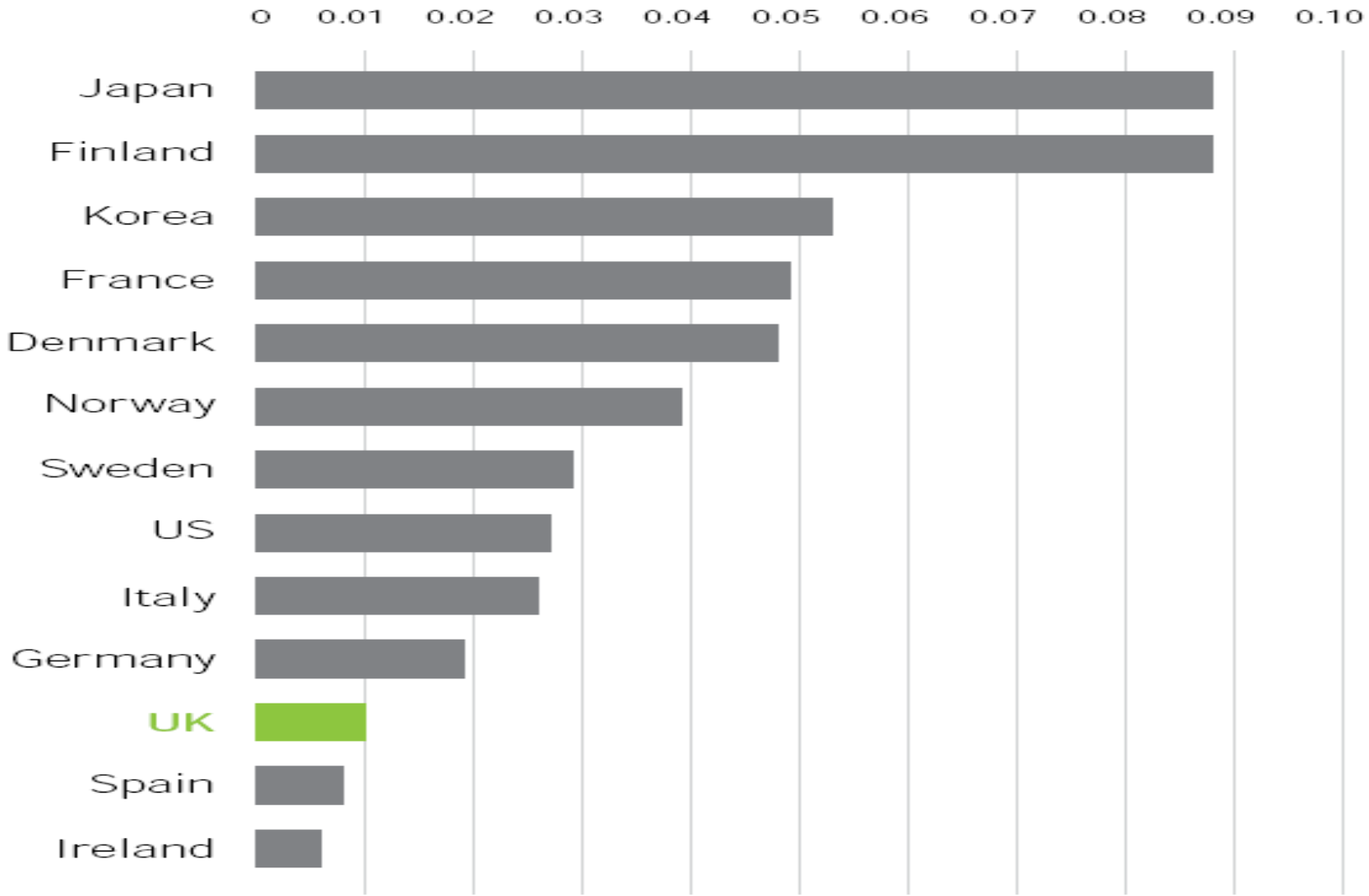
- Less than 10% of all new firms produce 50% and 75% of all new jobs by new firms. Yet SMEs get £8 billion in direct/indirect support in the UK (more than the police force!).
- Evidence: Storey (1994): 4% of new firms born in any given year accounted for 50% of all the jobs created by the surviving firms within that cohort after ten years. Kirchhoff (1994): 10% of fastest-growing firms contributed to three quarters of new jobs during an eight-year observation period within a cohort of firms started in the US in 1978. Birch et al. (1997): 'gazelles' accounted for more than 70% of the employment growth in the U.S. between 1992 and 1996, while representing only about three per cent of the firm population. NESTA (2009): 6% of UK businesses with the highest growth rates generated half of the new jobs created by existing businesses between 2002 and 2008.
- Need more nuanced approach to uncover the job-generation power of high-growth innovative firms.

Mistake 3: obsession with knowledge transfer, *like pushing on a string*

1. EU problems don't come from poor flow of knowledge from research but from EU firms' smaller stock of knowledge. US: 2.6% of GDP on R&D. Germany 2.5%. UK 1.3%.
2. If the US is better at innovation, this isn't because university-industry links are better—they aren't—or US universities produce more spinouts—they don't. It simply reflects more research being done in more institutions, (more pluralistic).
3. And more mission oriented research.
4. US funding is split between research in universities and early-stage technology development in firms. Getting EU universities to do both runs the risk of generating technologies unfit for the market.


GERD as a percentage of GDP
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Japan
United States
Germany
Average OECD
France
EU-15
United Kingdom
Ireland
Portugal
Spain
Italy
Greece
PIIGS!!

Government energy R&D spend as % GDP (2007)



(Source: Committee on Climate Change, 2010)

while ‘emerging countries’ leaping ahead

Chinese 5 year plan: 1.5 trillion dollars in 7 new emerging areas, including new engines, new materials, new generation IT, environmentally friendly technologies…

Brazilian State Investment Bank (BNDES) investing in clean-tech and biotech; ‘death valley’ bond, 21% return on equity.

Mistake 4: focus on tax and ‘red tape’

Netherlands has low R&D/GDP (similar to UK).

Will tax and cutting red tape change this?

R&D tax credits: little evidence of ‘additionality’, ie making R&D happen that would not have otherwise.

Capital gains tax reductions have often made private equity and VC even more short-termist (Labour, 2002).
No evidence they drive innovation investment.

Corporate tax reductions have increased inequality.
No relationship to innovation (only to time spent golfing)

Companies, like Pfizer, ask for less regulation.

But Pfizer did not leave Sandwich, UK to go to Boston, USA due to lower regulation and tax --but the greater 'animal spirits' that $31 billion of NIH spending/year creates in the pharma business sector.

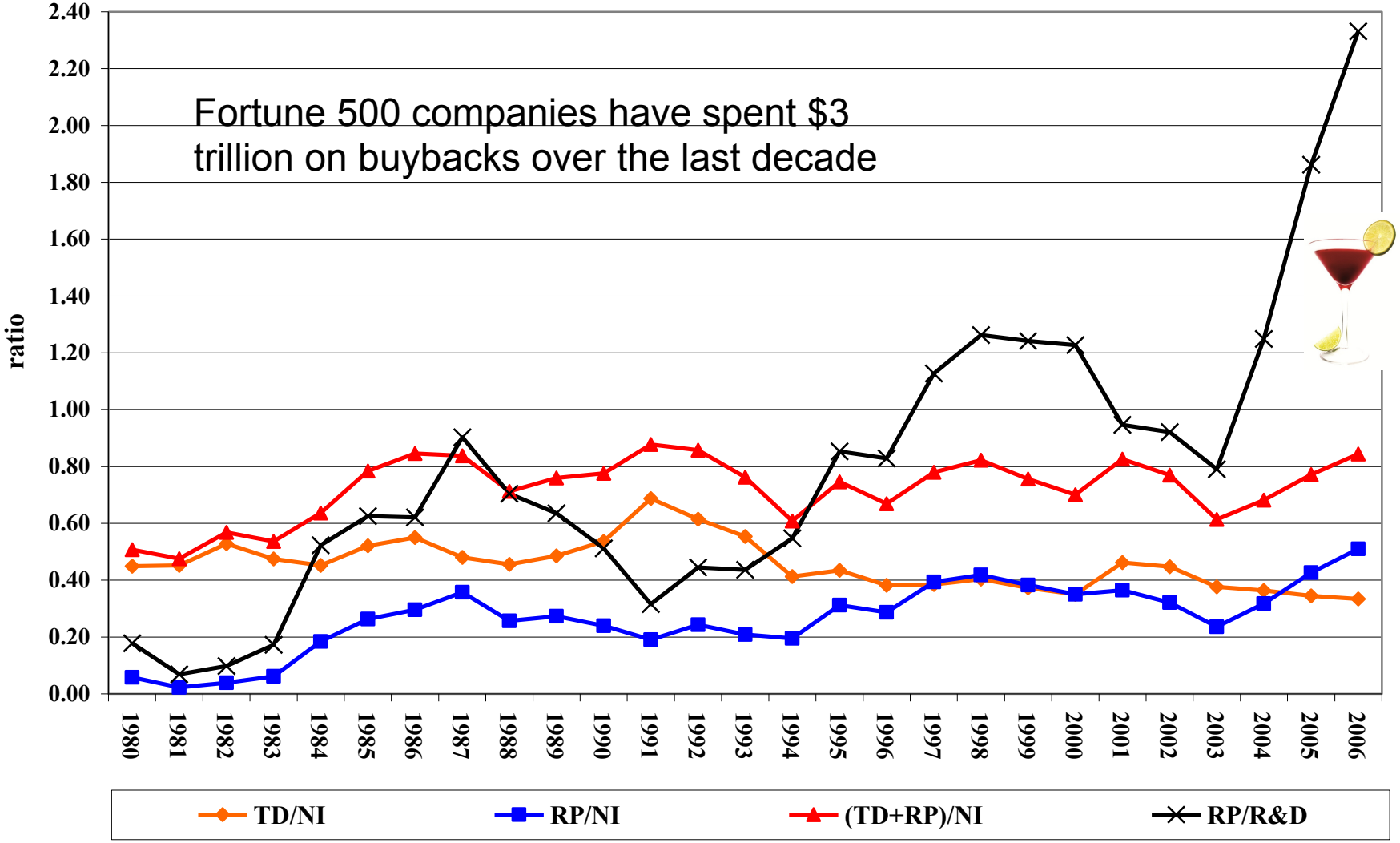
What type of direct investments in NL can increase business animal spirits?

Problem is not 'picking winners' but losers picking (capturing) government (with talk about tax and regulation). Evidence of impact?

3. Why it matters for inequality and financial market reform: socialised risk, privatised rewards.

Repurchases, dividends, net income, R&D 1980-2006

(293 corporations in the S&P500 in October 2007 in operation in 1980)



FINNOV WP 5 (Bordeaux)

The biggest pharma repurchasers

Pharmaceutical companies argue to Congress that they need high drug prices in US to fund R&D. Many spend a large proportion of their profits on stock repurchases (RP) (NI=net income; TD=total dividends)

	2008		1997-2008			
Source: Compustat	Rev. $b.	F500 rank	RP/ NI	(TD+RP)/ NI	RP/ R&D	(TD+RP)/ R&D
J&J	63.7	29	**0.40**	**0.79**	**0.60**	**1.17**
Pfizer	48.3	46	**0.73**	**1.41**	**0.73**	**1.42**
Abbott	29.5	80	**0.18**	**0.71**	**0.27**	**1.04**
Merck	23.9	103	**0.41**	**0.93**	**0.72**	**1.63**
Wyeth	22.8	110	**0.15**	**0.67**	**0.16**	**0.71**
BMS	20.6	120	**0.23**	**0.91**	**0.26**	**1.03**
Eli Lilly	20.4	122	**0.29**	**1.03**	**0.22**	**0.77**
Schering-Plough	18.5	138	**0.13**	**0.75**	**0.08**	**0.45**
Allergan	4.4	517	**0.68**	**0.93**	**0.32**	**0.43**

Lazonick and Tulum (2011)

Innovation requires patient finance

Leading pharmaceutical companies keep US drug prices at least double the prices in other advanced countries – they argue in Congress that high US drug prices are needed to fund drug research – yet many such as Merck, Pfizer, J&J, and Amgen did buybacks equal to 28-105% of R&D expenditures, 2001-2010

In 2011, along with $6.2 billion in dividends, Pfizer repurchased $9.0 billion in stock, equivalent to 90 percent of its net income and 99 percent of its R&D expenditures. While Americans pay inflated price for drugs, big pharma allocates billions to buybacks, and then finds that it does not have new blockbusters in the pipeline to replace those whose patents are now expiring.

Amgen, the largest dedicated biopharma company, has repurchased stock in every year since 1992, for a total of $42.2 billion through 2011, including $8.3 billion in 2011. Since 2002 the cost of Amgen's stock repurchases has surpassed the company's R&D expenditures in every year except 2004, and for the period 1992-2011 was equal to fully 115 percent of R&D outlays and 113 percent of net income.

(source: Lazonick and Mazzucato, 2012)

Look out Green!…..

2010: US American Energy Innovation Council (AEIC) asked for 3x spending on clean technology to $16 billion annually, with an additional $1 billion given to the Advanced Research Projects Agency for Energy (ARPA-E)

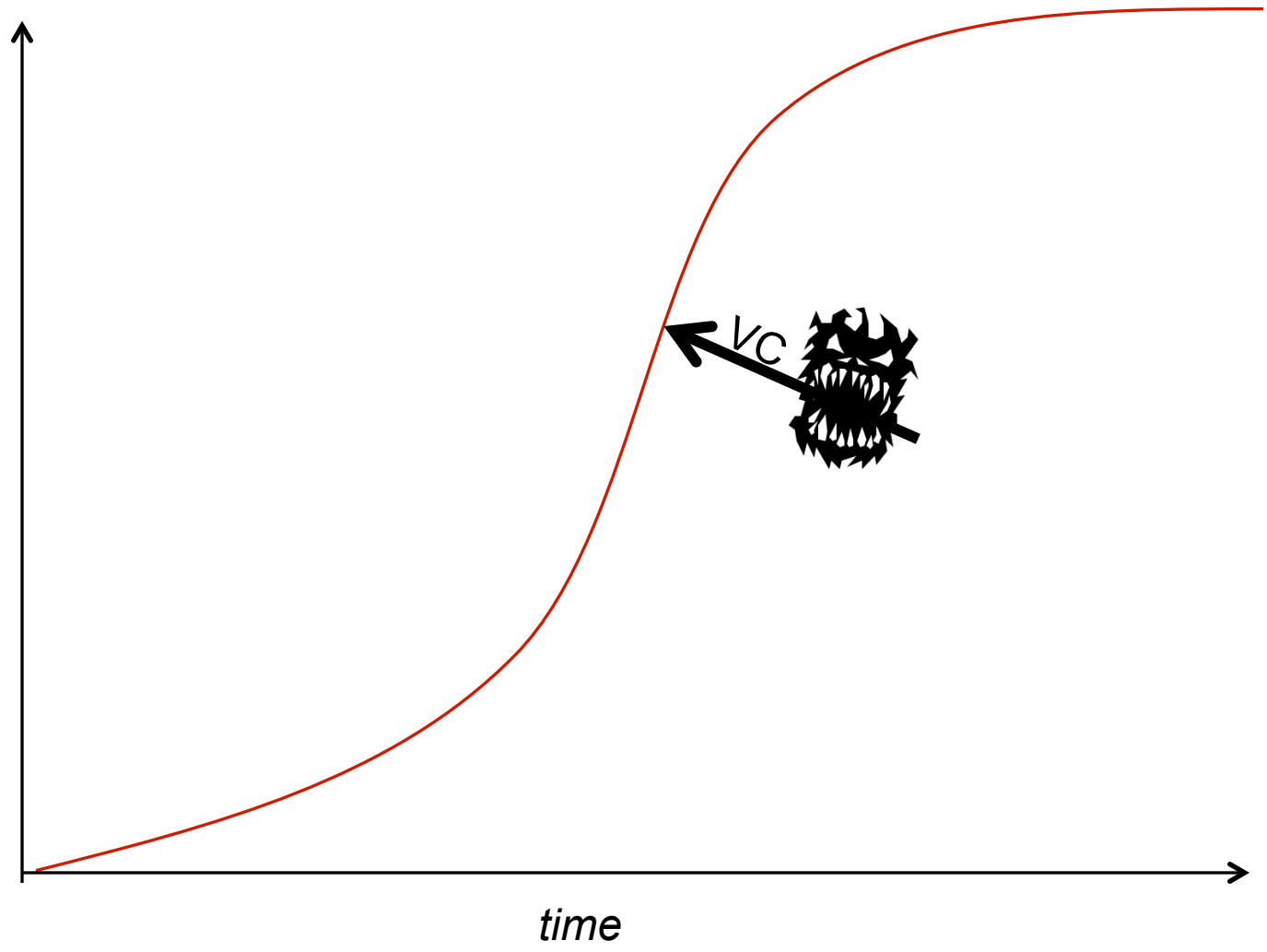
Yet AEIC have together spent $237 billion on stock repurchases between 2001-2010.

The major directors of the AEIC hail from companies with collective 2011 net incomes of $37 billion and R&D expenditures of approximately $16 billion. That they believe their own companies enormous resources are inadequate to foster greater clean technology innovation is indicative of the state's true role as the first driver of innovation. (Mazzucato, 2013 forthcoming)

Risks and return in innovation (and finance)

- Uncertain (Knight, 1921)
- Collective (*Systems* of Innovation)
- Cumulative (dynamic returns and path-dependency)

Cumulative innovation curve



Risks and Rewards

Moving beyond eco-system hype (old wine in new bottles) to a division of innovative labour, and getting something back.

Can ‘tight’ EU budgets afford to invest in risky innovation? How to reconcile investment (in expensive and risky R&D) with ‘golden rule’ of deficit reduction?

A new pharmaceutical that brings in more than $1 billion per year in revenue is a drug marketed by Genzyme. It is a drug for a rare disease that was initially developed by scientists at the National Institutes of Health. The firm set the price for a year's dosage at upward of $350,000. While legislation gives the government the right to sell such government-developed drugs at 'reasonable' prices, policymakers have not exercised this right.

The result is an extreme instance where the costs of developing this drug were socialized, while the profits were privatized. Moreover, some of the taxpayers who financed the development of the drug cannot obtain it for their family members because they cannot afford it. (Vallas et al. 2011).

Nokia vs. Google

When **SITRA**, the Finnish government's public innovation fund, provided the early stage funding for Nokia, it later reaped a significant return on this investment – a fact accepted by the Finnish business community and politicians.

The reason why the US government has not reaped a return from its early stage investments in companies like Google (which benefitted from a state-funded grant for its early algorithm) and other such success stories including Apple, Intel and Compaq (which received public SBIR funding) is due to the lack of understanding in the USA, and many other economies, of state-led growth-inducing investments, which allow conservative forces to portray the state as only a menace in the economy.

Creative thinking on tools to claim back return

- Innovation ‘fund’ that firms pay into
- IPR golden share
- Income contingent loans
- Public VC (reinvested back), e.g. SITRA
- Shares
- National Investment Bank (e.g. Brazil’s BNDES 20% return on equity!)

Lazonick and Mazzucato (2012), Risks and rewards in the innovation-inequality relationship, forthcoming.