EUROPEAN COMMISSION
European Research Area

SEVENTH FRAMEWORK PROGRAMME

Funded under Socio-economic Sciences & Humanities

FINNOV
Finance, Innovation & Growth

Finance, Innovation, and Growth

Mariana Mazzucato

Open University, FINNOV Co-ordinator

www.finnov-fp7.eu

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Finance, Innovation & Growth

	Title	Lead Institution
SELECTION	Co-Evolution of Industry Dynamics and Financial Dynamics	The Open University, UK
EXPERIMENTATION	Capital Markets and Innovation: Financing Business Experimentation in Europe	University of Cambridge, UK
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4 main points in short talk

- **Finance is about uncertainty**—and return.

- **Innovation is real uncertainty**: gotta be a little ‘crazy’.
  - most R&D fails
  - stock bubbles and innovation
  - problems for Lisbon target 3% R&D

- **Role of finance** in this uncertain innovative process.
  - does finance really play a *leading* role?
  - does finance *reward* or penalise innovation?

- **Lessons for policy makers**: beware!

Underlying the relationship between finance and innovation is: **Uncertainty**

“The starting point for any financial model is the **uncertainty** facing investors, and the substance of every financial model involves the impact of uncertainty on the behaviour of investors, and ultimately, on market prices.” (Campbell, Lo and MacKinlay, 1997)

Innovation = *real Knightian uncertainty*

"The practical difference between the two categories, risk and **uncertainty,** is that in the former the distribution of the outcome in a group of instances is known … While in the case of uncertainty that is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique…" (Knight, 1921)

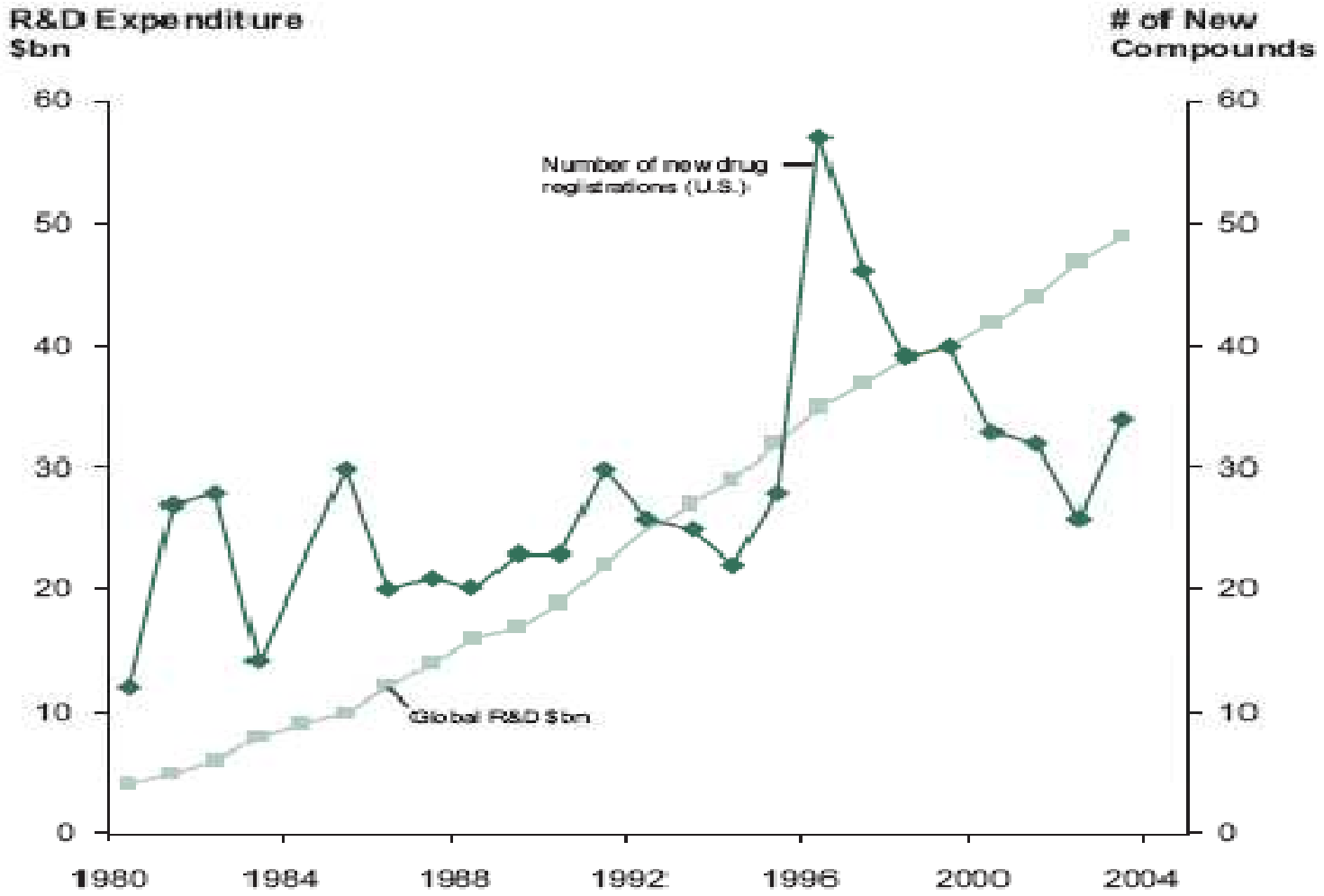
Without uncertainty there would be no innovation.

Gotta be a little '**crazy**' to engage in R&D

e.g. PHARMA:

- R&D very costly: $403 million per drug
- R&D takes a long time: 17 years
- Failure rate is very high: only 1 in 10,000 compounds reach market approval phase, i.e. .01% succeed

R&D → Dry hole in pharma



Innovation led growth? (Lisbon agenda)

Effect of R&D on firm growth

(Mazzucato and Demirel 2010)

$$gr_{i,t} = \beta_0 + \beta_1 \, log(S_{i,t-1}) + \beta_2 RDin_{i,t-1} + \beta_3 \, log(PubAge_{i,t}) + \varepsilon_{i,t}$$

Firm growth for firm i in year t: $(gr)_{i,t}$: $(\log(\text{revenues})_{i,t} - \log(\text{revenues})_{i,t-1})$

R&D intensity ($RDin_{i,t}$): $RDin_{i,t} = \frac{R\&D_{i,t}}{S_{i,t-1}}$

Firm size: log (revenues ($S_{i,t}$))

Public **Age** ($PubAge_{i,t}$) for firm i in year t: The number of years a firm is quoted on the stock exchange

(Panel regressions using fixed effects and instruments)

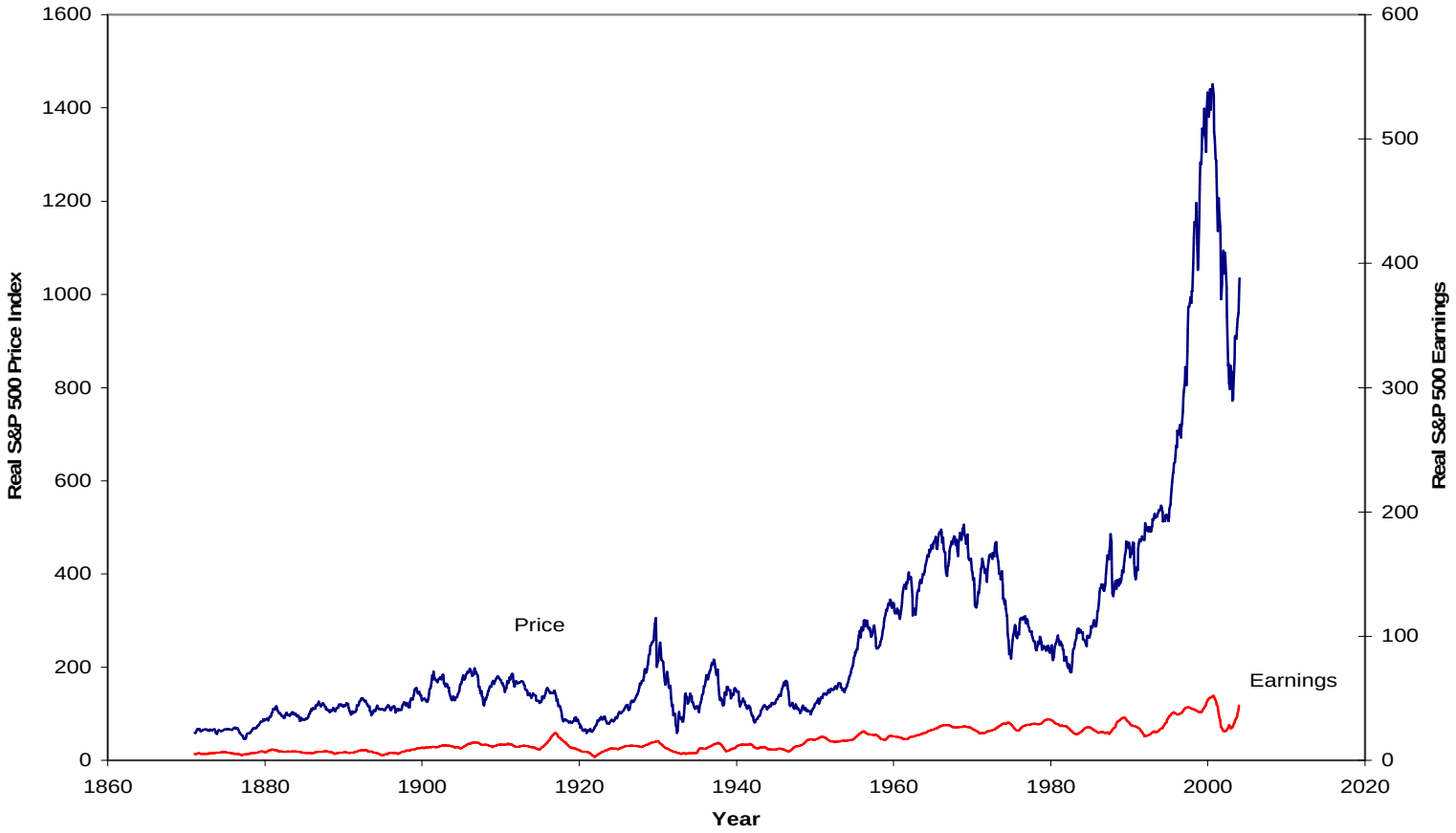
Problem for **Lisbon Agenda**

- For most firms, *R&D leads to no growth*

Mazzucato and Demirel (2010) find that in order for R&D to lead to growth, certain firm-specific characteristics must be present, e.g. persistent patenting.

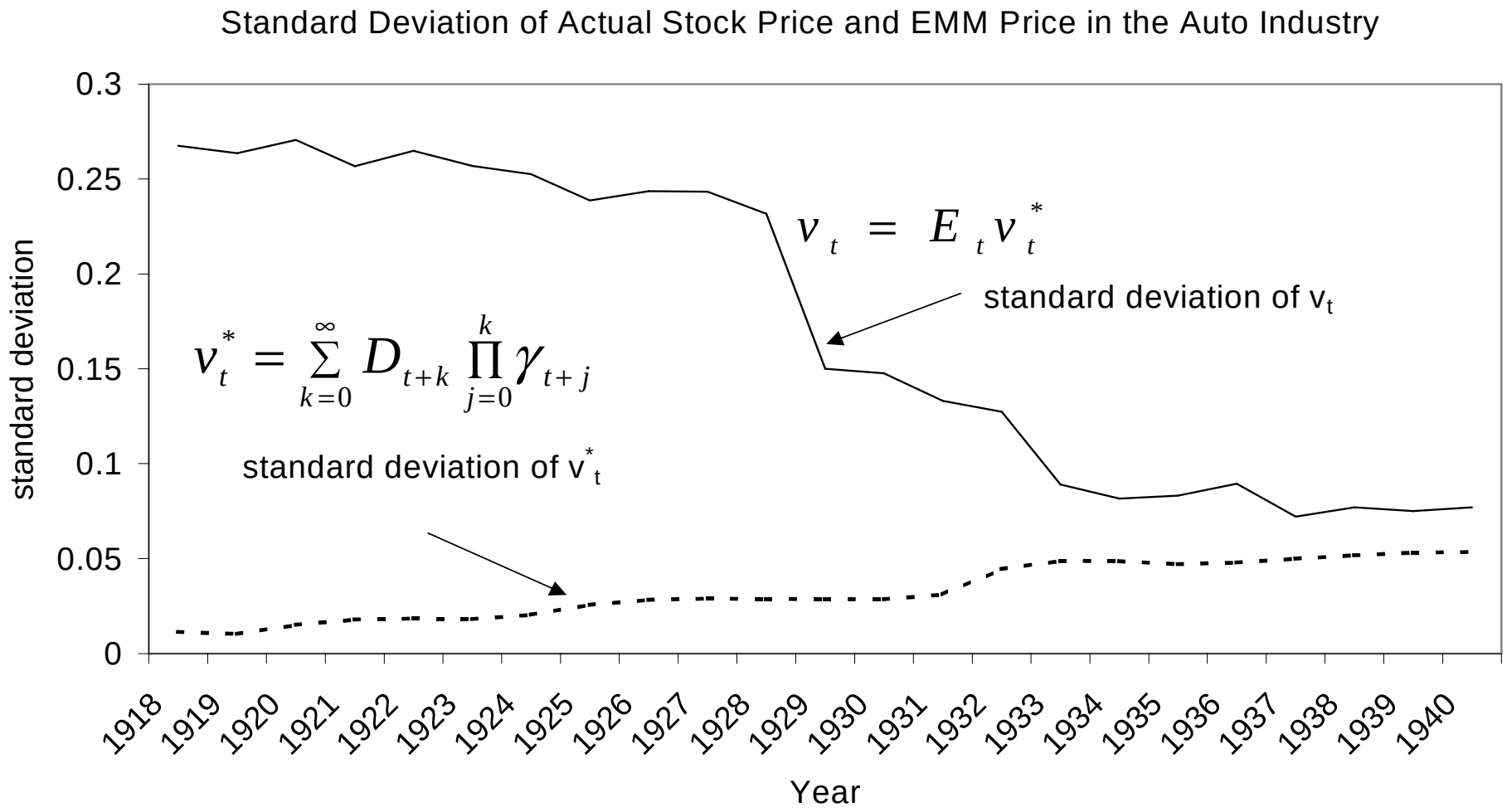
Coad and Rao (2008) Innovation is only important for the fastest growing firms. Successful innovation, and the 'super-star' growth performance that may result, requires risk-taking and "just a little bit of craziness".

Also reason why ***excess volatility*** is highest during technological revolutions

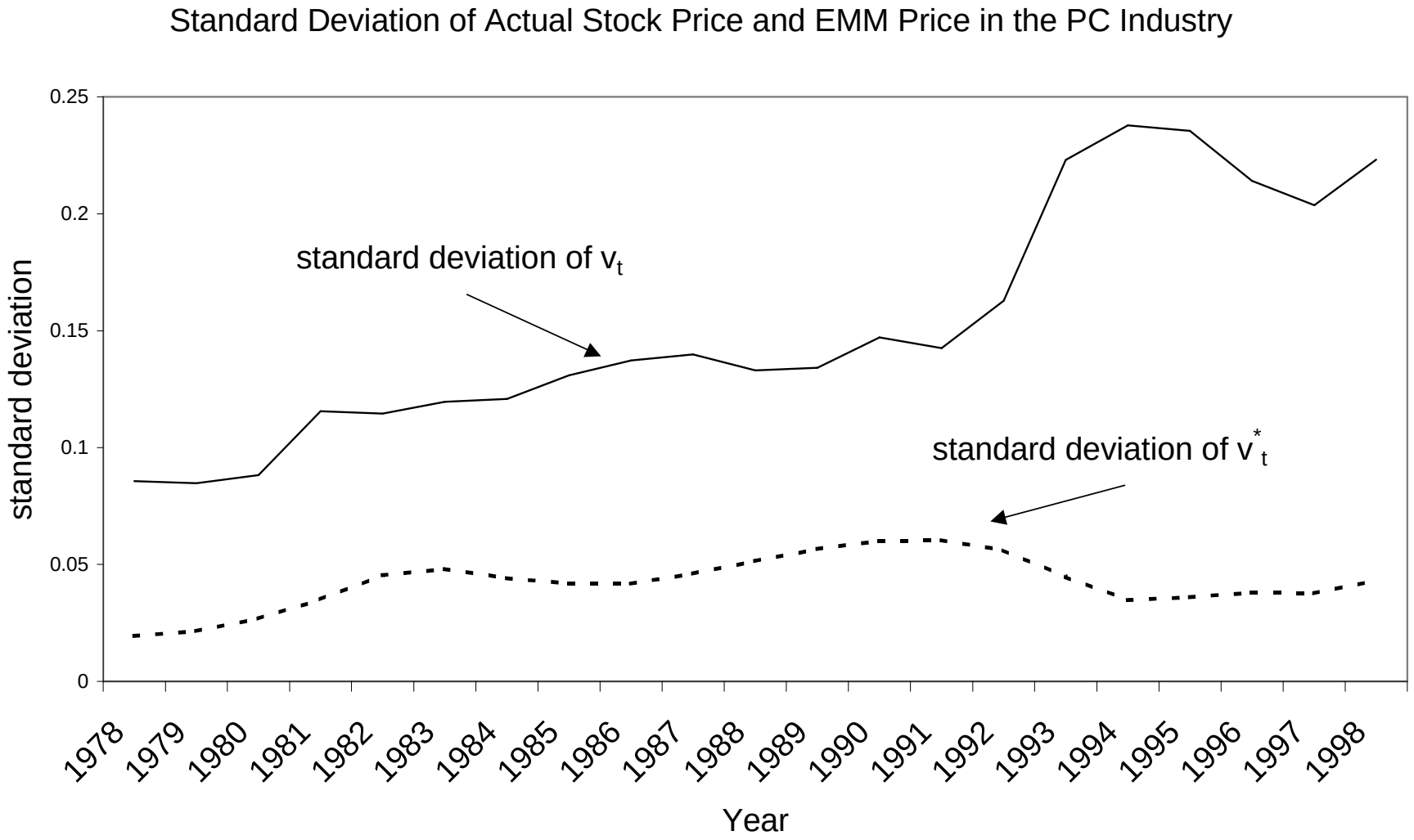


Shiller, R.J. (1981). "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends," AER, 71.

excess volatility in autos (Mazzucato 2002; 2004)

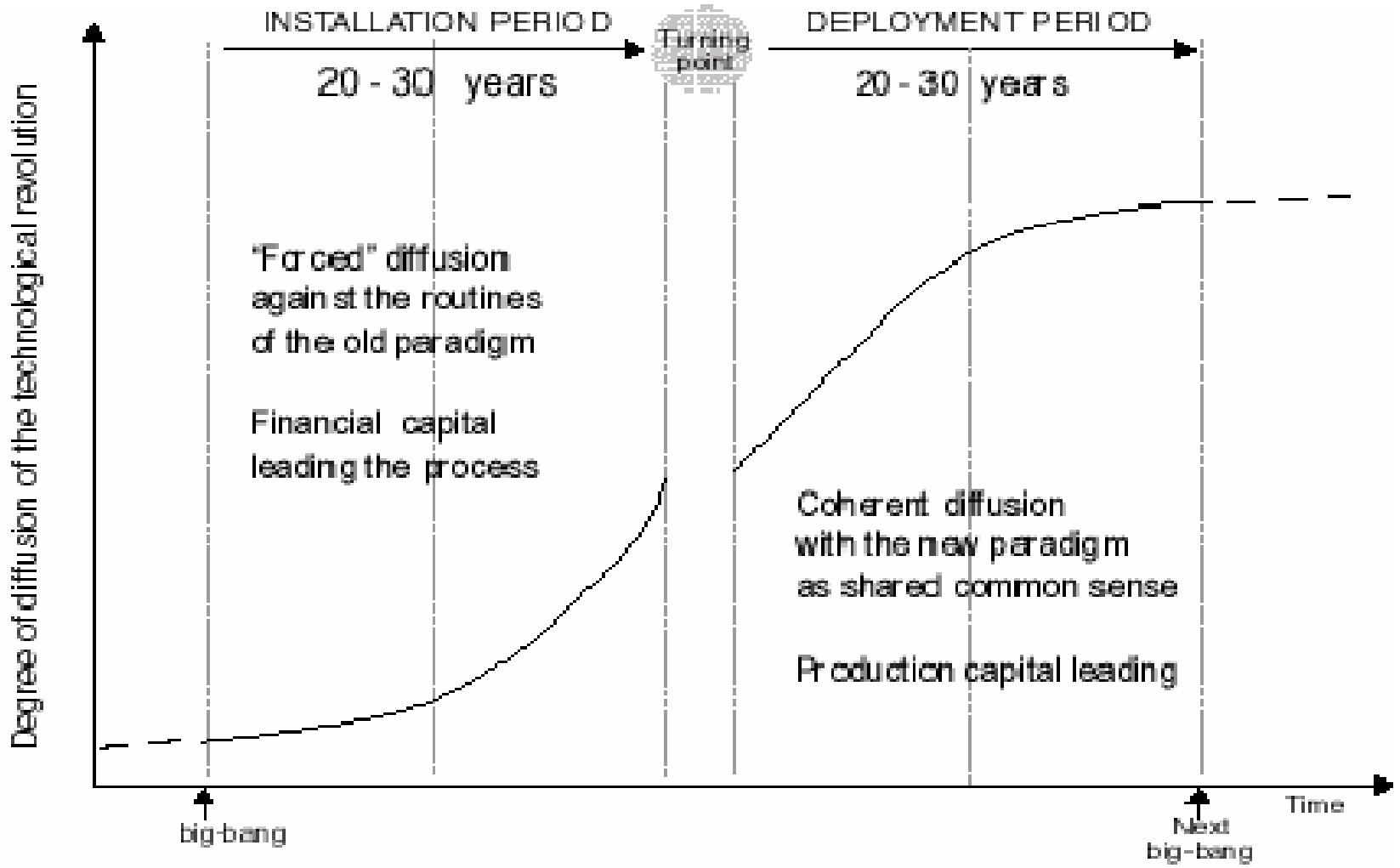


excess volatility in PCs (Mazzucato 2002; 2004)



So, which *crazy* agents take on this Knightian uncertainty—in the **early** most uncertain phase of innovation—and for the most **radically new** technologies?

Finance capital often gets the credit (Perez, 2003)



Paradigm blindness (Perez, 2003)

Over-adaptation to a particular technological paradigm...

- J.P. Morgan in 1878: funded Edison at beginning of electricity.
- J.P Morgan in 1900: rebuffed Ford considering autos as “rich men’s toys.

Finance is often scared away

Banks **too risk averse**.

Business angels **too few**.

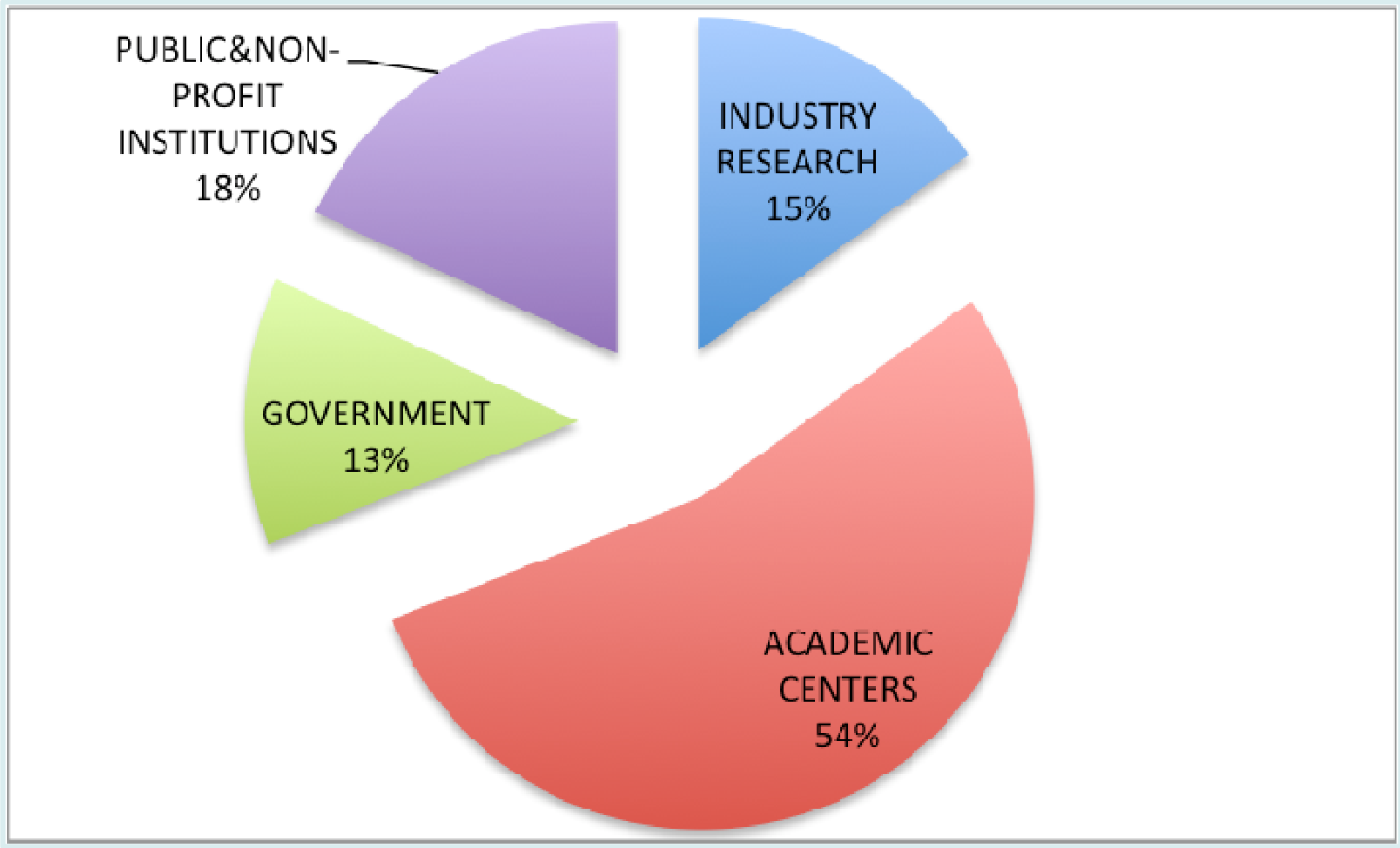
Venture capital **too late**: only once government has absorbed most of the real uncertainty (e.g. Biotech).

And once in, VC more interested in $ from IPO process than products. Virtually all biopharma IPOs are **PLIPOs** (*product-less* initial public offerings). Biotech firms firms are essentially R&D entities.

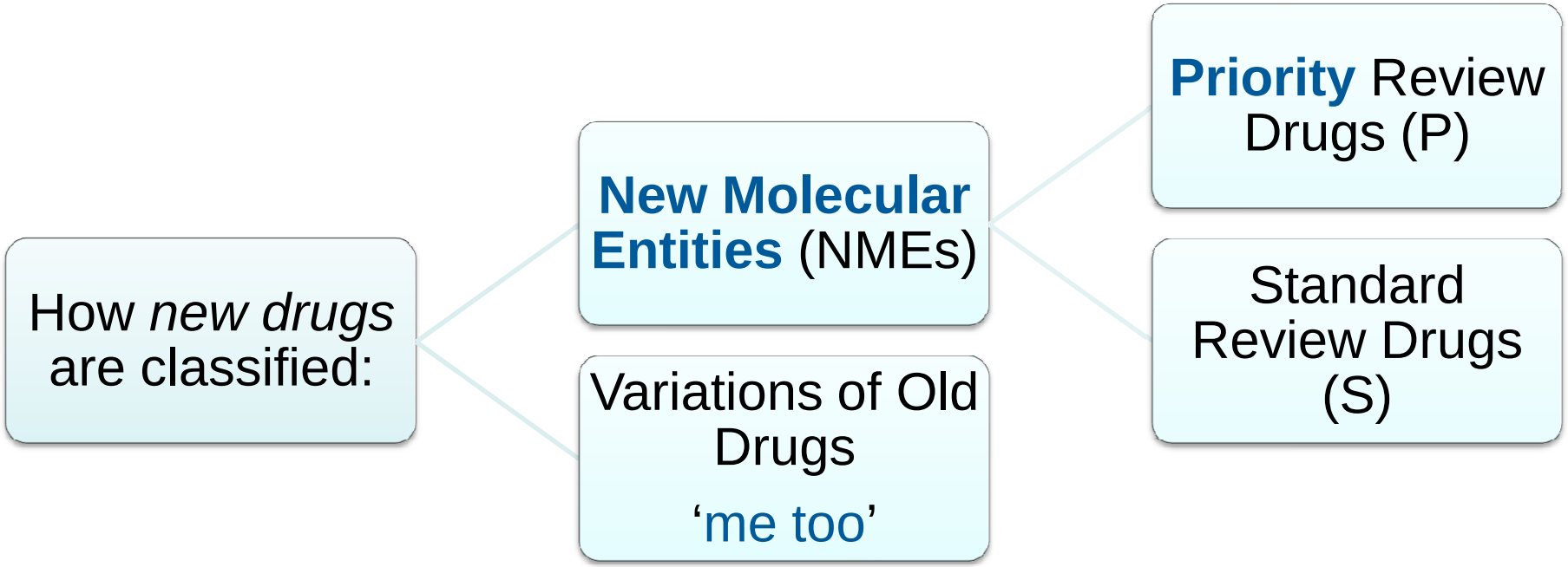
Role of finance depends on innovation *division of labour* within sector and during ILC

- *Large firms*
- *Small firms*
- *Government funded labs*
- *Universities*
- *Banks*
- *VC*

e.g. who FUNDS drug research? …



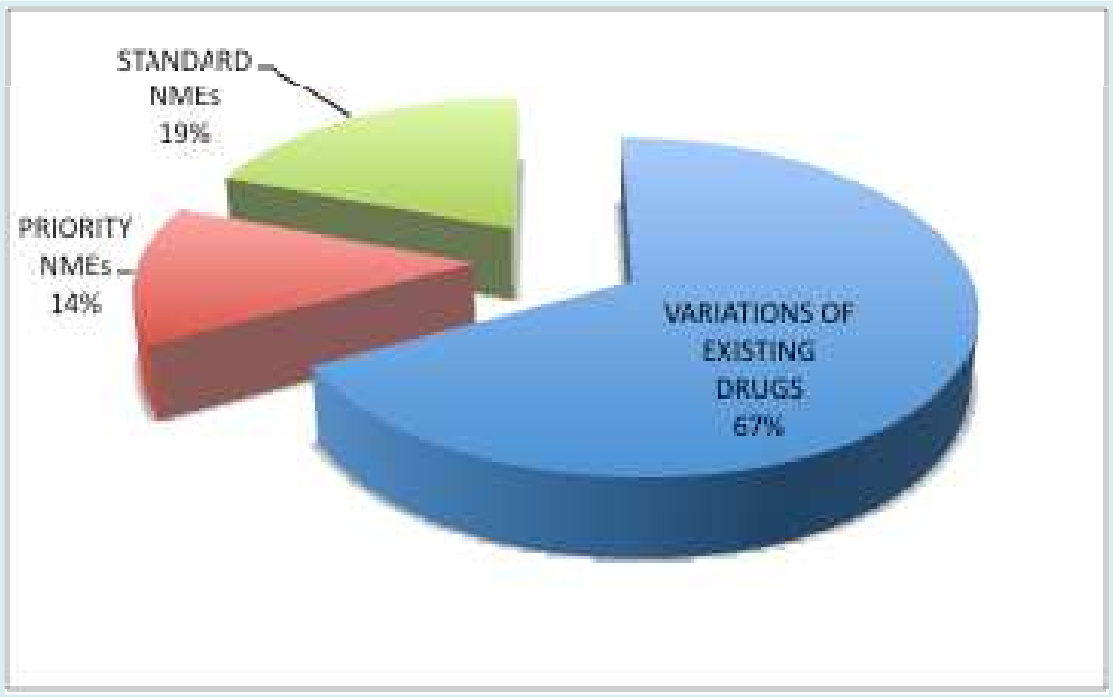
WHO FUNDS THE MOST ***INNOVATIVE*** DRUGS?



2/3 of NME with P rating funded by NIH—private pharma focusses mostly on 'me too' drugs.

Out of a total of 1072 drugs approved by the FDA between 1993 and 2004, only 146 were NMEs with priority review, only 14% of the total.

FDA APPROVALS (1993-2004)			
tot n°drugs approved	1072	% on tot drugs approved	
tot n° NMEs	357	33	%
tot n° variations od old drugs	720	67	%
tot n° P NMEs	146	14	%
tot n° S NMEs	206	19	%



year	P NMEs
1993	13
1994	13
1995	9
1996	18
1997	9
1998	16
1999	19
2000	9
2001	7
2002	7
2003	9
2004	17

Source: www.fda.gov/cder/rdmt/pstable.htm

In fact, government not private finance has often been the leading **entrepreneurial agent** in funding radical innovation:

- *Aerospace*
- *Pharma*
- *Biotech*
- *Internet*
- *Green technology today!*

Financial markets often penalise rather than reward innovation...

e.g. When Microsoft announced that it would start to compete with Google by investing billions in a new search engine, its stock price dropped 11%, reducing its capitalisation by 30%. Microsoft survived. What about smaller firms?

Are financial markets interested in speculation for innovation (**Schumpetarian speculation** necessary due to uncertainty) or speculation for the sake of speculation (**Sorosian speculation**)?

Are hedge funds schumpetarian or sorosian?

New Innovations in Funding increasingly important:

- UK early stage VC funds under management approx £25m/fund v $1bn for US funds. Now such large early stage European Funds (not national) are emerging i.e. Index Ventures.
- VC funding in UK biotech 2006 £87m
- AIM investment in UK tech firms 2006 £4-5bn
- Hedge funds now major investors in UK biotech with large liquid funds for very short term equity investments (>24months, seeking x3 money). **One large US hedge fund (i.e. ValueAct Capital) may have more funds for equity investments than entire EU early stage VC**!
- Venture hedge funds emerging that exploit a) options to appropriate extra value from European innovation, b) private banking as sources for equity investment. Replicating Californian experience.

(data from research by Paul Nightingale in FINNOV)

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EUROPEAN POLICY BRIEF

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Do Financial Markets Reward innovation?

On-going project **Spring 2010**

SUMMARY

Objectives of the research	Financial markets are driven by the 'real' economy, and in turn have a profound effect on it. They impact the process of innovation and the way firms in different sectors exploit innovations. The purpose of the FINNOV project is to analyze, empirically and theoretically, the relationships between financial markets and the real economy, leading to a better understanding of how *differences* in financial agents and institutions affect such relationships and outcomes.
Scientific approach / Methodology	Understanding the interactions of financing mechanisms, innovation trajectories, and differential impacts on the stock market requires an inter-disciplinary approach. In FINNOV we bring together expertise in finance, economics of innovation and business history. FINNOV employs empirical and theoretical methods that allow modeling of heterogeneity among firms, sectors and institutions, and micro-macro interactions.
New knowledge and/or European added value	FINNOV will lead to new knowledge on the relationship among financial markets, innovation and growth in different types of firms, industries, and national contexts — critical to the Lisbon Agenda's (2005) goal of fostering growth through innovation.

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some results

- **VC**: not enough and not soon enough
- **Credit ratings:** problem is not just ‘bad banks’ but rating methods that ignore *industrial* measures of performance
- **Credit crunch**: penalising most innovative firms
- **Financialisation**: buyback mania at the expense of R&D

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Do credit ratings capture innovative effort?

- A study of Italian firms, across different sectors, shows that the impact of financial indicators on defaults do not reflect the industrial characteristics, and productivity of the firms, both over the longer and the shorter run.

- In view of the current crisis, evidence warns that risk assessment devices have devoted too little attention to important economic rather than financial factors. The result is an apparent failure of the market to select the best performers and thus allocate capital efficiently.

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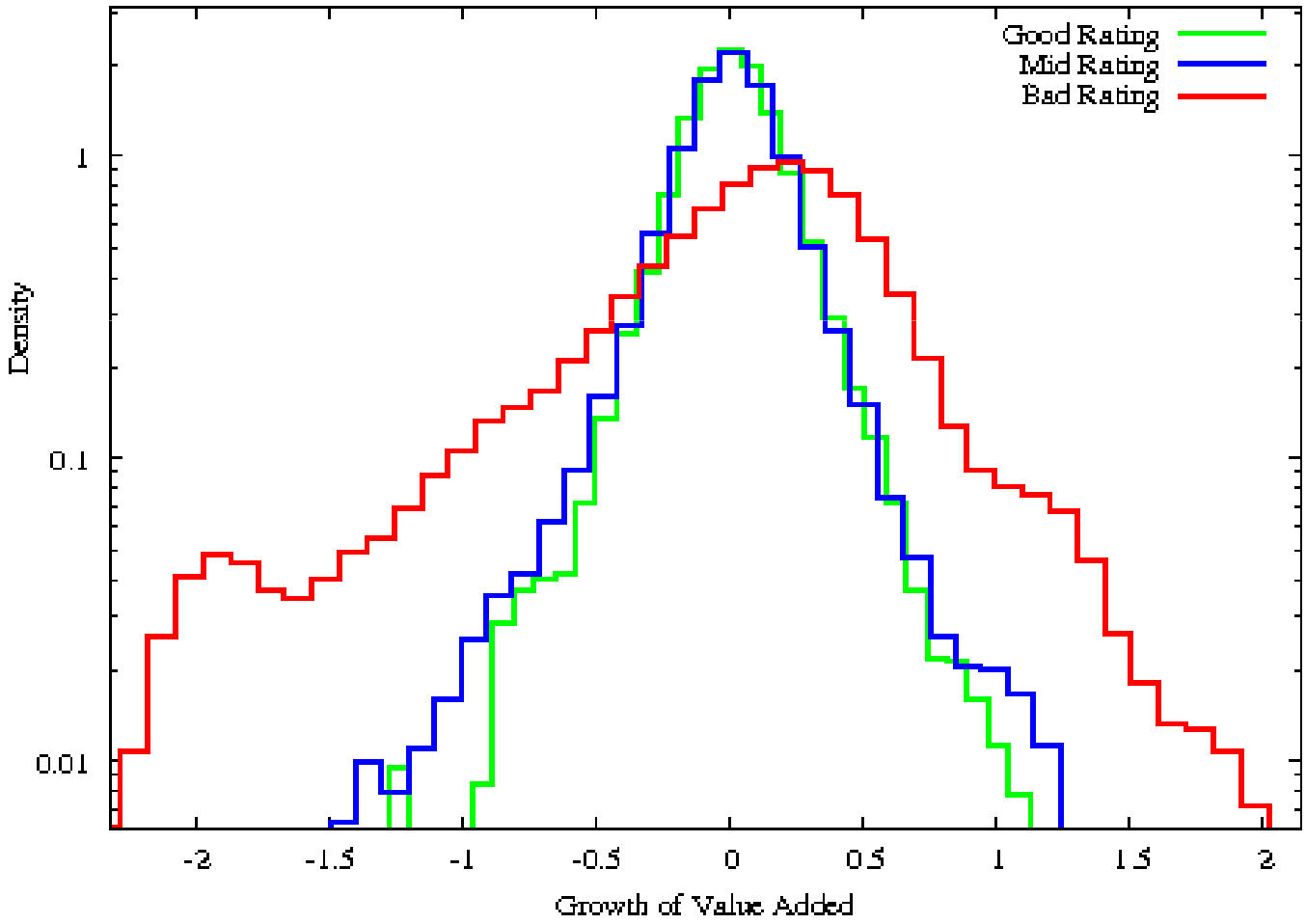
Credit rating vs. Value added (2003)



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Crisis: innovative firms penalised more

Innovators appear to have been hit harder than non- innovative firms by the rising cost of credit, a likely consequence of the increasing risk aversion of lenders.

CBR SME Survey, 2008 (captured first impact of credit crunch), size < 500 employees, 1,925 firms. Benchmark surveys: 1991, 2004

Finance vs. Demand constraints: Firms were asked to assess the relevance of market demand constraints vs. the cost of finance in both the 1991 and 2008 surveys. In both recessions, demand constraints were indicated as more important, but their perceived impact relative to cost-of-finance constraints was twice as large in 2008.

Costs of finance in innovative vs. non innovative firms: 37% of innovators vs. 29% of non-innovators reported increases in interest rates on overdraft and 47% of innovators vs. 38% of non-innovators reported increased in the size of arrangement fees. It is highly likely that these increased difficulties are related different risk profiles of the two groups of firms.

WP EXPERIMENTATION: *Capital Markets and Innovation: Financing Business Experimentation in Europe (Cambridge University)*

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Does a strategy to maximize shareholder value help or hinder the development of innovation capabilities?

- Shareholders are interested less in the internal operation of a company itself and more in how external financial markets value it, which has in turn had a marked impact on investment decisions in technology and innovation.
- Through stock buybacks (repurchases) and dividends, established corporations in different sectors have been distributing substantial sums of cash to shareholders. In this way public investment in R&D has been leveraged to increase the market valuation of these companies and depress the aggregate level of public and private investment in R&D.

WP GOVERNANCE: *Corporate Governance & Innovation: Implications for Stable & Equitable Growth (University of Bordeaux, Lazonick)*

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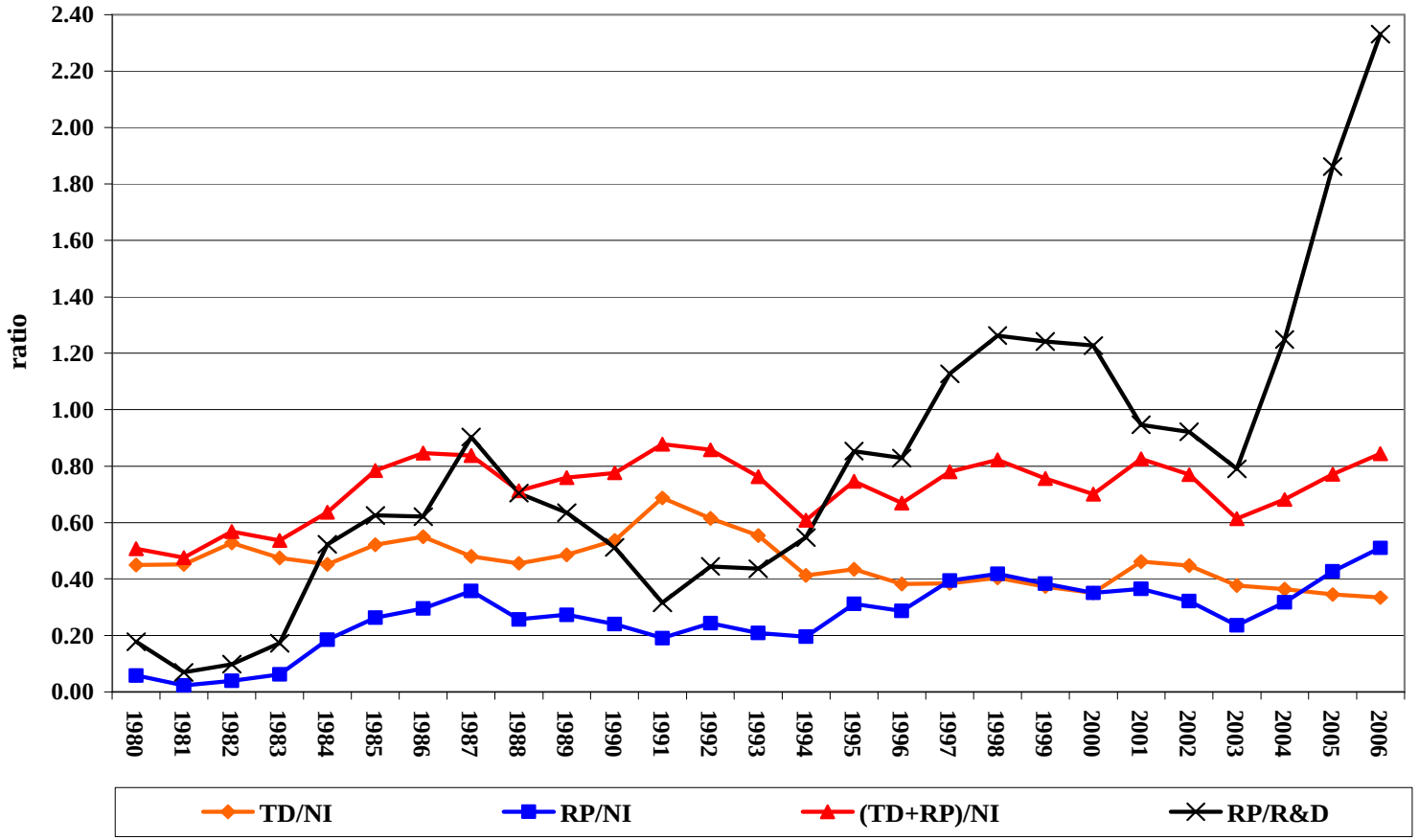
Repurchases, dividends, net income, R&D expenditures, 1980-2006

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



Pharma: buybacks as % of net income and R&D

	RP/NI%	TD/NI%	(RP+TD)/NI%	RP/R&D%
Pfizer				
1996-1999	54	45	99	58
2000-2003	102	61	163	85
2004-2007	71	69	140	80
J&J				
1996-1999	21	36	57	31
2000-2003	46	37	83	69
2004-2007	45	46	91	55
Amgen				
1996-1999	95	0	95	118
2000-2003	152	0	152	63
2004-2007	128	0	128	122
Merck				
1996-1999	63	45	108	151
2000-2003	42	45	87	107
2004-2007	24	73	98	25

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Key messages to policy makers:

Market selection operates on a broad mix of firm characteristics.

Financial reform should aim to help credit markets create valuation tools which reward the most efficient firms,.

Financial reform should aim to help (not penalize) the most innovative firms during the post-crisis recovery.

Stock buybacks have been at the expense of investments in innovation. For the sake of innovation, the EU must ensure that a highly financialized business model does not take root in Europe.

One size will not fit all the important actors in this policy space. Policy must be guided by models which adequately take heterogeneity into account, and which study the co-evolution between heterogeneity and the competitive selection mechanism.

Lesson: beware policy makers!

It is not only about regulating post-crisis financial markets but understanding how for the last decades financial markets have often been risk averse, and in the process penalised the most innovative firms.

To have innovation led growth financial markets must reward not penalise innovaiton.

And government, one of the main entrepreneurial agents must survive the current fiscal consolidation if we are hoping for more tech revolutions.....

and some surprises too.....(hedge funds good or bad?)

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EC 2020

- **SMART GROWTH:** Creating value by basing growth on knowledge
- **INCLUSIVE GROWTH:** Empowering people in inclusive societies
- **SUSTAINABLE GROWTH:** Creating a competitive, connected and greener economy

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