Europe's Missing Yollies

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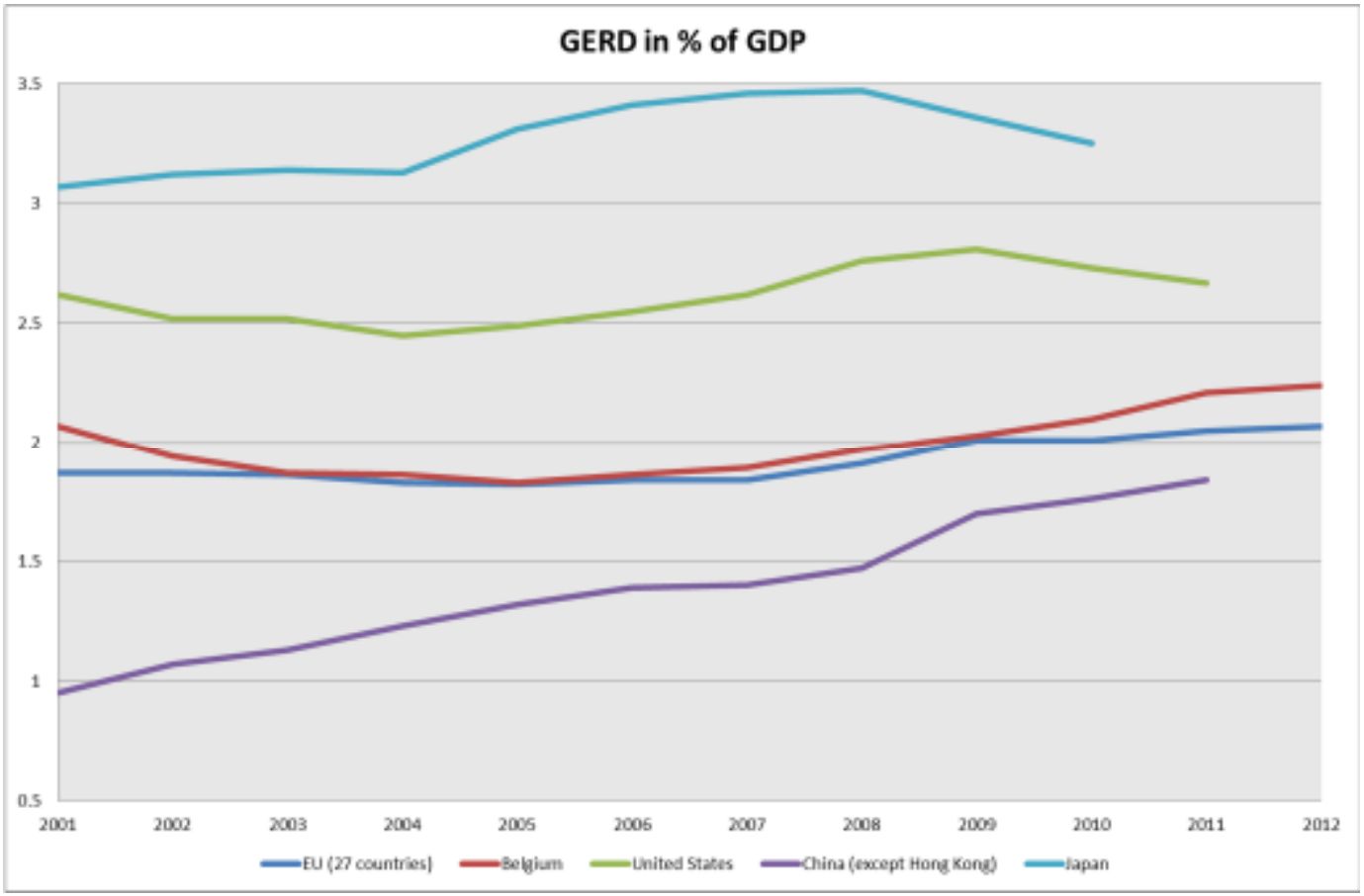
Outline

1. Motivations
2. Introducing the Yollies (= Young Leading Innovators)
    - What the US has and the EU lacks: missing Yollies & better Yollies
    - Why missing Yollies matter: contribution to the EU's R&D intensity gap with US
    - Why EU Yollies are not better: missing the right sectors
3. Why does Europe have fewer Yollies?
    - Lower rates of returns to R&D
    - EU yollies more financially constraints
4. Implications for EU innovation policies
5. Conclusions

Motivations (1/3)



R&D and innovation = key drivers of competiveness:
→Lower cost
→Higher quality of new goods and services

Source: EUROSTAT (2014)

Motivations (2/3)

A common explanation raised for the EU's tame business R&D performance is its failure to change to new areas of growth

At the sectoral level, the EU continues to specialize in medium-tech sectors, missing strong positions in new high-technology sectors

The EU is especially lagging in new key information technology sectors, which were the drivers of growth in the late 1990s in the US (O'Mahoney and van Ark, 2003; Denis et al., 2005; European Commission, 2007; Moncada et al., 2010)

Motivations (3/3)

At the firm-level, evidence suggests that the EU's business R&D deficit may reflect constraints on the rapid growth of new, technology-based entrants in the EU compared to the US

It is particularly these companies which are key elements in industrial dynamics

They are particularly pivotal in the early stages of development of new sectors, being the drivers of "creative destruction" in the Schumpeter Mark I model (Klepper, 1996; Malerba, 2002; Aghion et al., 2008)

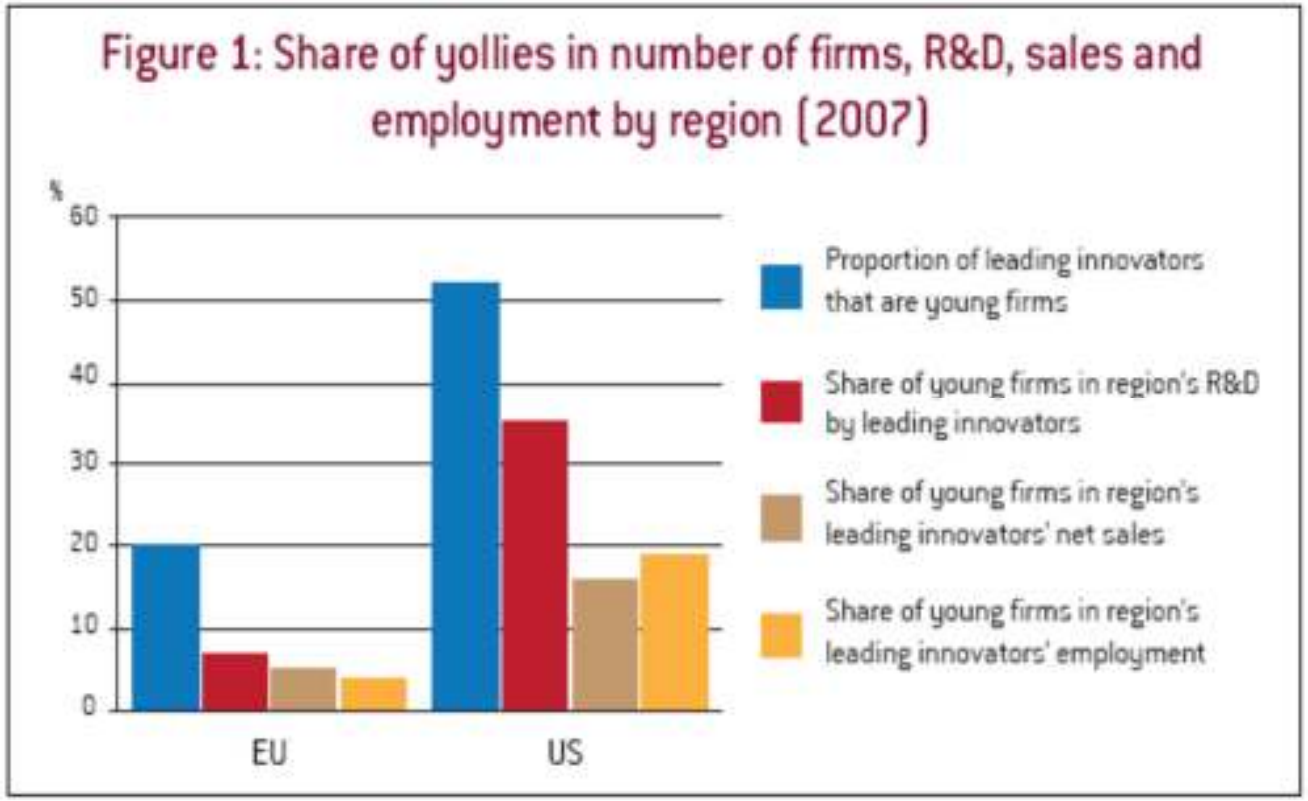
Cohen and Lorenzi (2000) already argued that the US economy is a more hospitable environment than the EU for new firms to grow large, particularly in Information Technology

Some evidence from our research on Young Leading Innovators (Yollies) (1)

Using *EU Industrial R&D Investment Scoreboard on*
Regional and sectoral patterns of Yollies and their contribution to overall R&D (growth) in the EU and the US

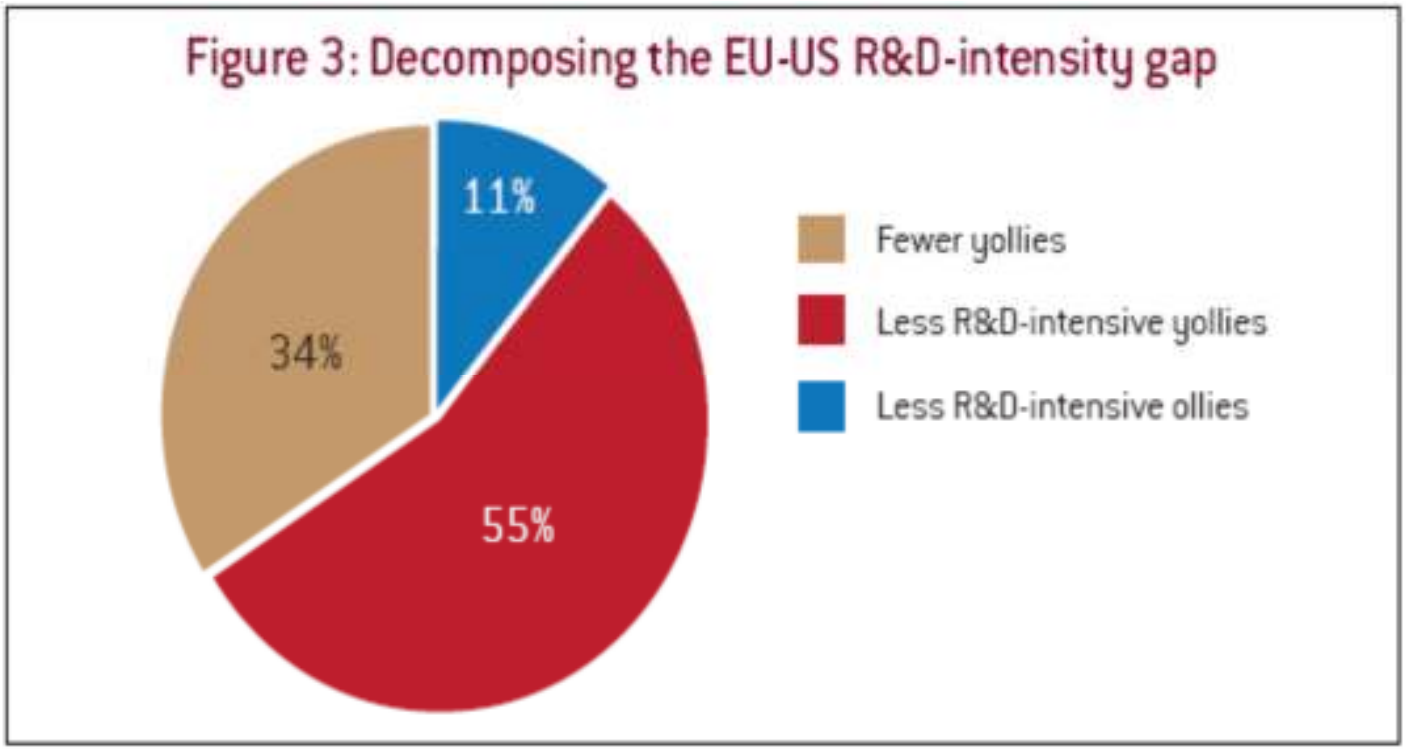
Source: Cincera, M., R. Veugelers (2010)
Europe's missing Yollies,
Policy Brief 2010/06, Bruegel, Brussels

What the US has but the EU lacks: Yollies (=Young Leading Innovators created after 1975)



There are fewer EU-based than US-based yollies
This matters because yollies are more R&D intensive
In addition, EU-based yollies are less R&D intensive (4.4%) than their US counterparts (10.2%)

What the US has but the EU lacks: Yollies



The lower R&D intensity of EU yollies is contributing the most (55%) to the total EU-US R&D intensity gap

What the US has but the EU lacks: Yollies

Decomposition (shift and share) formula:

$$RDI^{us} - RDI^{eu} = \sum_i \left(w_i^{*us,y} RDI_i^{us,y} + w_i^{*us,o} RDI_i^{us,o} \right) - \sum_i \left(w_i^{*eu,y} RDI_i^{eu,y} + w_i^{*eu,o} RDI_i^{eu,o} \right)$$

$$= \sum_i RDI_i^{y} \left(w_i^{*us,y} - w_i^{*eu,y} \right) + \sum_i RDI_i^{o} \left(w_i^{*us,o} - w_i^{*eu,o} \right) + \sum_i w_i^{y} \left(RDI_i^{us,y} - RDI_i^{eu,y} \right) + \sum_i w_i^{o} \left(RDI_i^{us,o} - RDI_i^{eu,o} \right)$$

structural young + structural old + intrinsic young + intrinsic old

where:

$$RDI_i^{y} = \left(RDI_i^{us,y} + RDI_i^{eu,y} \right) / 2$$

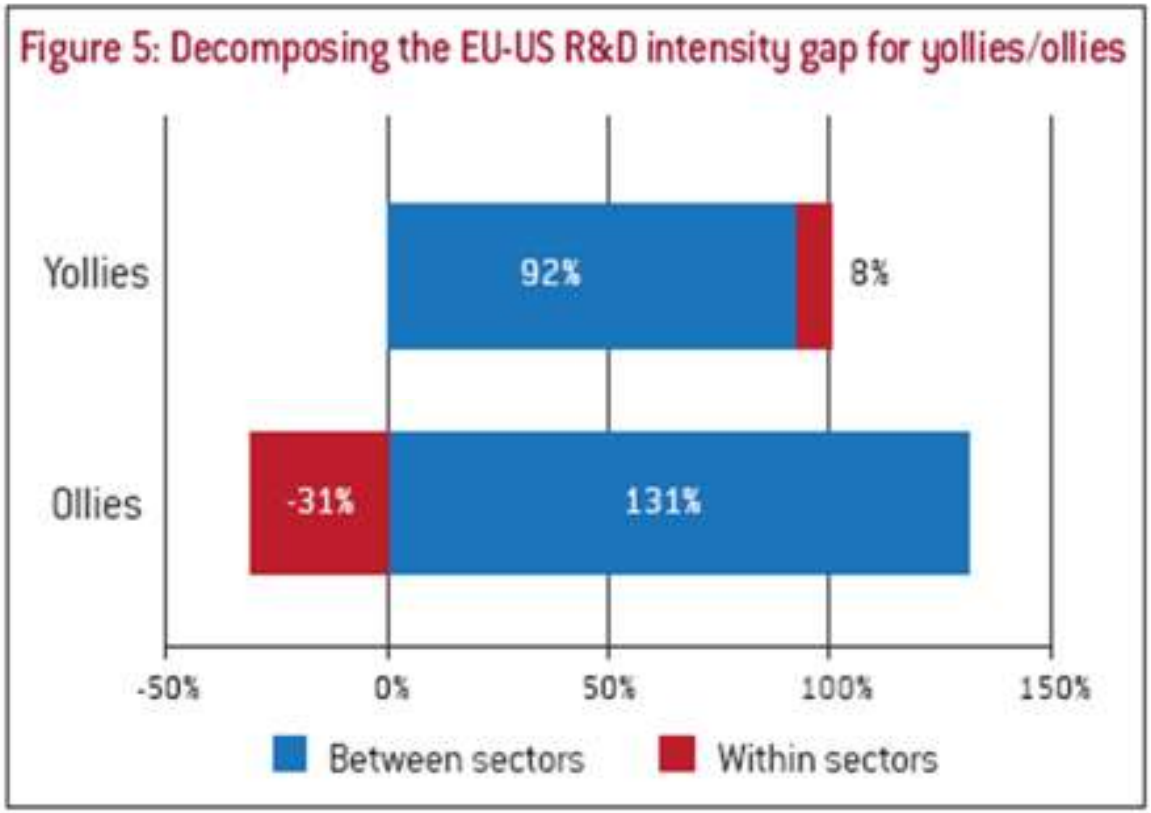
$$RDI_i^{o} = \left(RDI_i^{us,o} + RDI_i^{eu,o} \right) / 2$$

$$w_i^{y} = \left(w_i^{*us,y} + w_i^{*eu,y} \right) / 2$$

$$w_i^{o} = \left(w_i^{*us,o} + w_i^{*eu,o} \right) / 2$$

w*ius/eu,y/o = share of young/old firms in the us/eu sector total number of firms

What the US has but the EU lacks: Yollies



Almost all of the explanation for the lower R&D intensity of EU yollies can be found in a different sectoral composition: Europe simply has fewer yollies in the high R&D intensity sectors

What the US has but the EU lacks: Yollies

Table 1: Comparing EU to US yollies in key sectors

	European Union			United States		
	Yollies RDI	Ollies RDI	Yollies as % of firms	Yollies RDI	Ollies RDI	Yollies as % of firms
Semiconductors	17	16	10	18	16	20
Biotechnology	18	10	12	27	12	17
Telecom eqpt.	18	13	3	14	11	8
Pharmaceuticals	25	15	5	14	15	6
Healthcare	11	4	2	10	7	4
Computer h'ware		6	-	6	4	7
Internet			-	11		3
Computer services	3	5	7	6	6	1
Electronics	6	6	9	5	5	2
Software	17	14	20	15	13	17

There is an EU problem of missing yollies in the 'right' R&D intensive sectors, especially biotech and internet

Why Europe has fewer Yollies?

Typical stories in policy discussions on Europe's innovation deficit include:

- Risk-taking financial markets
- Segmented product markets
- More costly IPR
- Higher (Re-)entry & exit costs
- Inflexible labour markets
- Insufficient linking in "innovation system"
  - Industry science links
  - Large incumbents and small new entrants
  - Public Private partnerships
- Government policy
  - Funding
  - Procurement
  - ..

Some evidence from our research on Young Leading Innovators (Yollies) (2)

Using *EU Industrial R&D Investment Scoreboard on*
econometric analysis of differences in the rates of return to R&D large R&D firms and yollies in the EU and the US

Source: Cincera, M., R. Veugelers (2014)
Differences in the Rates of Return to R&D for European and US Young Leading R&D Firms, forthcoming in Research Policy

Rates of returns to R&D

- Cobb Douglas extended production function (Griliches, 1979)

$$\Delta y_{it} = \lambda \Delta t + \alpha \Delta l_{it} + \beta \Delta c_{it} + \rho \frac{R_{it}}{Y_{it}} + \varepsilon_{it}$$

where ρ is the gross (i.e. net of depreciation) rate of return to R&D

- Fixed effects
- Endogeneity
- Interaction terms

Rates of returns to R&D

All firms vs Yollies

sample	All firms		Yollies	
Constant	0.010	(0.004)	0.022	(0.012)
Δ ln Employees	0.467*	(0.008)	0.501*	(0.020)
Δ ln Physical capital	0.282*	(0.017)	0.271*	(0.036)
R&D intensity	0.070*	(0.014)	0.127*	(0.030)
# of observations	4505		1431	
R^2	0.19		0.19	

EU vs US Yollies (in High-Tech sectors)

	EU & High-tech		US & High-tech	
Constant	0.002	(0.029)	0.046	(0.015)
Δ ln Employees	0.750*	(0.054)	0.517*	(0.025)
Δ ln Physical capital	0.215**	(0.095)	0.284*	(0.042)
R&D intensity	0.042	(0.063)	0.205*	(0.038)
# of observations	177		811	
R^2	0.26		0.21	

Rates of returns to R&D

EU vs US Yollies (in High-Tech sectors) 2000-2011

	EU & High-tech		US & High-tech	
Constant	-0.039	(0.041)	-0.042*	(0.015)
Δ ln Employees	0.702*	(0.049)	0.524*	(0.017)
Δ ln Physical capital	0.265*	(0.081)	0.316*	(0.033)
R&D intensity	0.064	(0.057)	0.125*	(0.031)
# of observations	284		1357	
R^2	0.25		0.25	

EU vs US Yollies (in High-Tech sectors) 2000-2007

	EU & High-tech		US & High-tech	
Constant	0.002	(0.029)	0.046	(0.015)
Δ ln Employees	0.750*	(0.054)	0.517*	(0.025)
Δ ln Physical capital	0.215**	(0.095)	0.284*	(0.042)
R&D intensity	0.042	(0.063)	0.205*	(0.038)
# of observations	177		811	
R^2	0.26		0.21	

Some evidence from our research on Young Leading Innovators (Yollies) (3)

Using *EU Industrial R&D Investment Scoreboard on*

Econometric analysis whether young leading innovators in the EU face more severe financing constraints for their R&D investments, as opposed to older firms in the EU and in the US as well as young leading innovators in the US

Source: Cincera, Ravet & Veugelers (2014)
R&D financing constraints of young and old innovation leaders in the EU and the US, forthcoming in Economics of Innovation and New Technology

R&D Financing constraints and Yollies

Equation for R&D capital

Jorgenson, 1963 : $c_{it} = \alpha_t + \beta y_{it} - \sigma ucc_{it}$

ADL(2,2) :

$$c_{it} = \alpha_i + \alpha_t + \rho_1 c_{it-1} + \rho_2 c_{it-2} + \beta_0 y_{it} + \beta_1 y_{it-1} + \beta_2 y_{it-2} + \varepsilon_{it}$$

$$\Delta c_{it} = \alpha_i + \alpha_t + \delta_0 \Delta c_{it-1} + \delta_1 \Delta y_{it} + \delta_2 \Delta y_{it-1} + \delta_3 (c_{it-2} - y_{it-2}) + \delta_4 y_{it-2} + \varepsilon_{it}$$

$$\frac{R_{it}}{C_{it-1}} = \alpha_i + \alpha_t + \delta_0 \frac{R_{it-1}}{C_{it-2}} + \delta_1 \Delta y_{it} + \delta_2 \Delta y_{it-1} + \delta_3 (c_{it-2} - y_{it-2}) + \delta_4 y_{it-2} + \varepsilon_{it}$$

R&D Financing constraints and Yollies

Fazzari et al. (1988): Investments of credit-constrained firms are more sensitive to the availability of internal finance

$$\frac{R_{it}}{C_{it-1}} = \alpha_i + \alpha_t + \delta_0 \frac{R_{it-1}}{C_{it-2}} + \delta_1 \Delta y_{it} + \delta_2 \Delta y_{it-1} + \delta_3 (c_{it-2} - y_{it-2}) + \delta_4 y_{it-2}$$

$$+ \delta_5 \frac{CF_{it}}{C_{it-1}} + \delta_6 \frac{CF_{it-1}}{C_{it-2}} + \varepsilon_{it}$$

System GMM estimations (Blundell and Bond, 1998)

R&D Financing constraints and Yollies

	EU			***US***		
	yollies	*ollies*	*High-tech yollies*	*yollies*	*ollies*	*High-tech yollies*
Constant	0.868***	0.300***	0.344***	0.0445*	0.102***	0.0704***
	(0.0103)	(0.0137)	(0.0135)	(0.0161)	(0.0130)	(0.0113)
R_{t-1}/C_{t-2}	-0.216***	0.346***	0.454***	0.575***	0.684***	0.594***
	(0.0103)	(0.0137)	(0.0135)	(0.0161)	(0.0130)	(0.0113)
Δy_t	-0.0639***	0.116***	0.0355***	0.156***	0.0793***	0.122***
	(0.0208)	(0.0177)	(0.00701)	(0.0176)	(0.00627)	(0.0108)
Δy_{t-1}	0.0897***	0.0195**	0.0994***	0.0430***	0.0320***	0.0362***
	(0.0173)	(0.00881)	(0.00446)	(0.00754)	(0.00347)	(0.00690)
$c_{t-2} - y_{t-2}$	-0.174***	-0.00695	-0.0639***	-0.0337***	-0.00179	-0.0406***
	(0.0113)	(0.00440)	(0.00568)	(0.00503)	(0.00181)	(0.00440)
CF_t/C_{t-1}	0.0882***	0.0244***	-0.00324	0.0230***	-2.75e-05	0.0387***
	(0.00322)	(0.00111)	(0.00245)	(0.00351)	(0.000157)	(0.00451)
CF_{t-1}/C_{t-2}	0.0294***	0.00535***	-0.00549***	-0.0103***	0.00145***	-0.00993***
	(0.00110)	(0.000775)	(0.000535)	(0.00191)	(0.000202)	(0.00126)
y_{t-2}	-0.153***	-0.0245***	-0.0490***	0.00157	-0.00602***	-0.00258
	(0.0113)	(0.00247)	(0.00456)	(0.00389)	(0.00132)	(0.00292)
N	870	805	518	1,009	906	802
Hansen	98.05	91.02	81.49	96.71	81.32	74.87
H prob.	0.053	0.131	0.341	0.064	0.346	0.548
Sargan	2189.74	408.80	184.77	425.41	269.63	391.60
S prob.	0.000	0.000	0.000	0.000	0.000	0.000
AR1	-1.17	-2.32	-3.61	-1.75	-3.01	-3.07
AR1 prob.	0.241	0.020	0.000	0.080	0.003	0.002
AR2	-0.68	-0.73	-0.61	-0.74	-1.35	-0.87
AR2 prob.	0.497	0.466	0.545	0.459	0.176	0.002

R&D Financing constraints and Yollies

Main findings:

- Over last decade yollies appear to be more affected by financing constraints compared to their older counterparts
- EU yollies exhibit higher sensitivities of R&D investment to cash-flow compared to US yollies
- For US yollies, R&D financing constraints appear to be more important for the ones operating in the high-tech sectors

Recommendations for EU's innovation policy

- Overall innovation policy is necessary but not sufficient
- Policies need to address the specific barriers of new sectors and firms that are rooted in market failures and which government policy can redress
  - Non-sector specific measures
    - Access to finance
      - Cf proposal for EU programme of financing early stages of highly risky innovative projects
    - Reducing the costs of IPR protection
    - Competition policy for new innovative markets
  - Sector specific measures
    - Public procurement for nurturing early stage innovations and potential competition in sectors where public sector is pivotal user
    - Regulations and Standards to nurture innovations and potential competition
      - Technology neutral, open, global
- Invest in prospective technology analysis, sectoral monitoring and policy experimentation/evaluation capacity

Conclusions

- Less Yollies in EU vs. US
- EU Yollies less R&D intensive

→ Explain 92% of EU-US R&D intensity gap

- Lower Rates of returns to R&D for:
  - Yollies vs. Ollies
  - EU Yollies vs. US Yollies
- Same conclusions for R&D financing constraints
- What's next?
  - R&D growth rates of EU and US Yollies

Thank you for your attention

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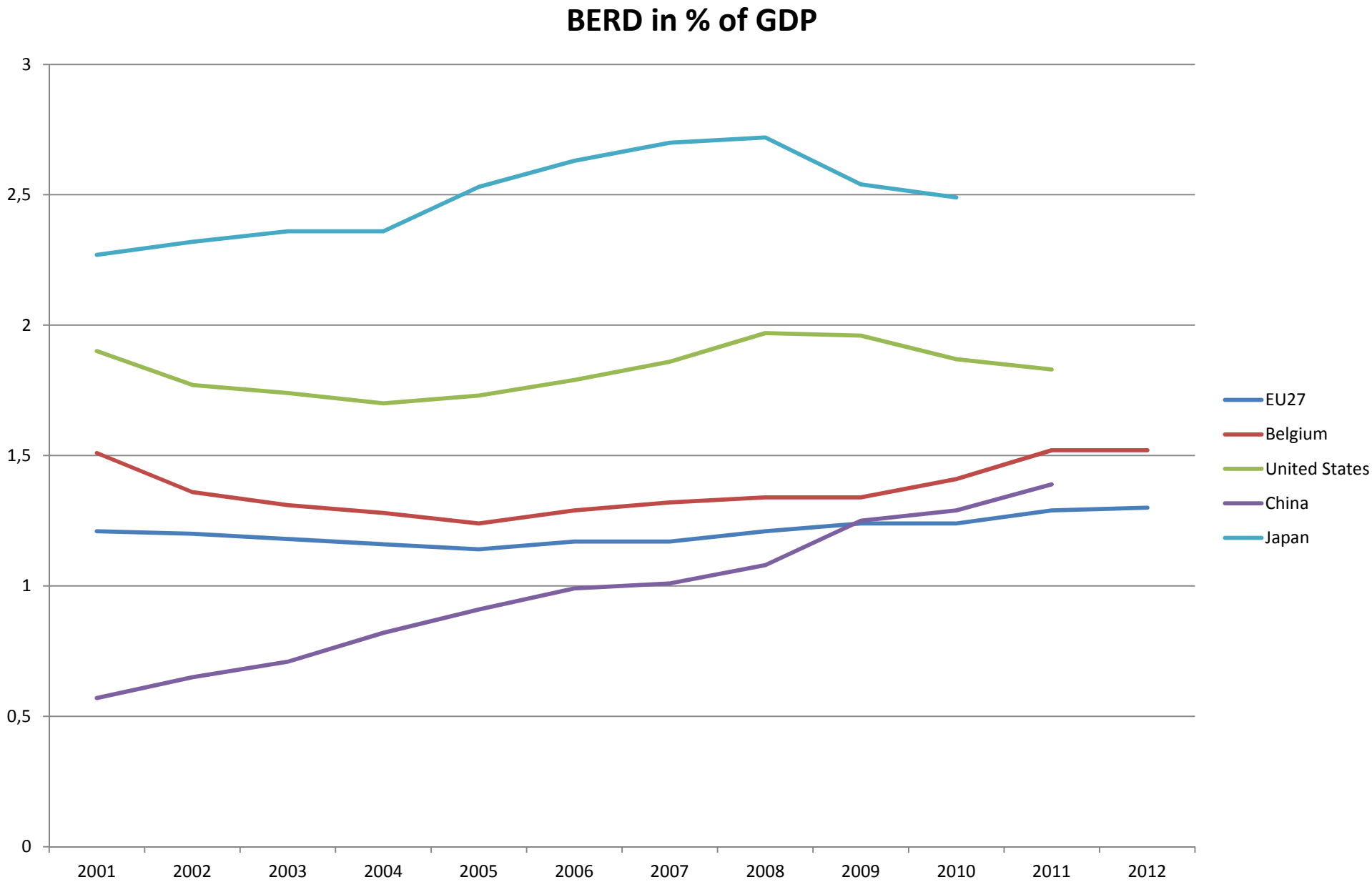
BERD in % of GDP
3
2,5
2
1,5
1
0,5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
EU27
Belgium
United States
China
Japan