



**Determinants of productivity growth:
Science and technology policies and the contribution of R&D
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R&D and Growth

Since R. Solow (1957)...

- The share GNP growth attributable to capital and labor is relatively small.
- The *RESIDUAL* is therefore a measure of technical progress...
- or of our ignorance.

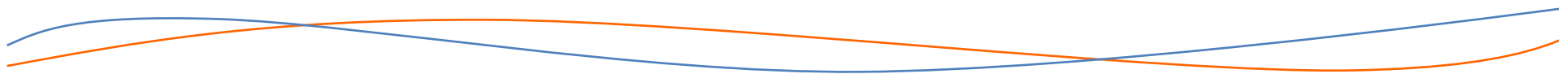
Objective of this paper:

- How much of it can be explained by a measure of our knowledge?
- Do science and technology policies play a role?
- Validate G&VP (2004), with longer period, and add IP matters

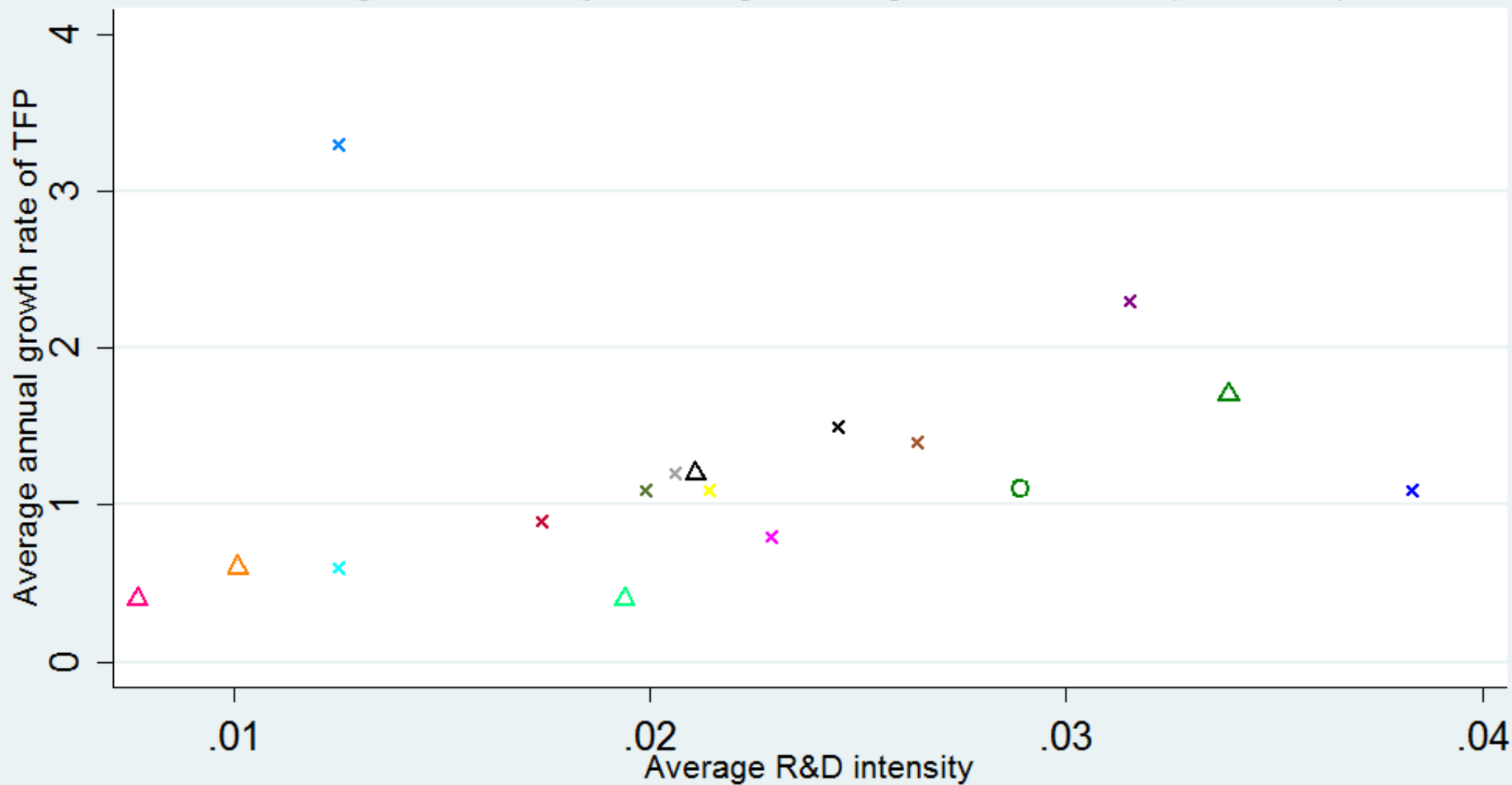


Four main sources of knowledge:

- **Business R&D (BERD)** generates new products and processes: it increases directly productivity.
- **Higher Education R&D (HERD)**: for academic research, essentially “basic” research that induces new knowledge
- **Public R&D (GOVRD)**: for public missions (no *direct* effect or no *measured* effect); for “oriented” research that induces new knowledge
- **Foreign R&D (FRD)**: new products and processes have a direct effect on productivity when implemented in the country (FDI, licences, imitation); an indirect effect through rent and knowledge spillovers



Average R&D intensity vs Average annual growth rate of TFP (1984-2007)



× AUS	× AUT	× BEL	△ CAN	× DNK
× FIN	× FRA	× DEU	× IRL	× ITA
△ JPN	× NLD	△ PRT	△ ESP	× SWE
△ GBR	○ USA			

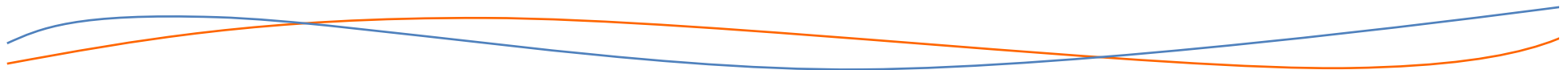
Annual growth rate of R&D expenses vs Annual growth rate of TFP (1984-2007)



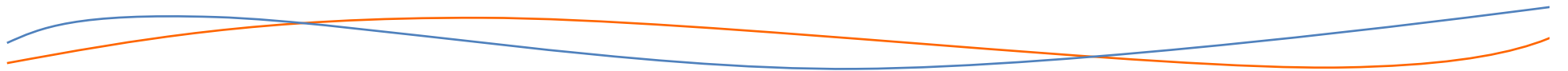
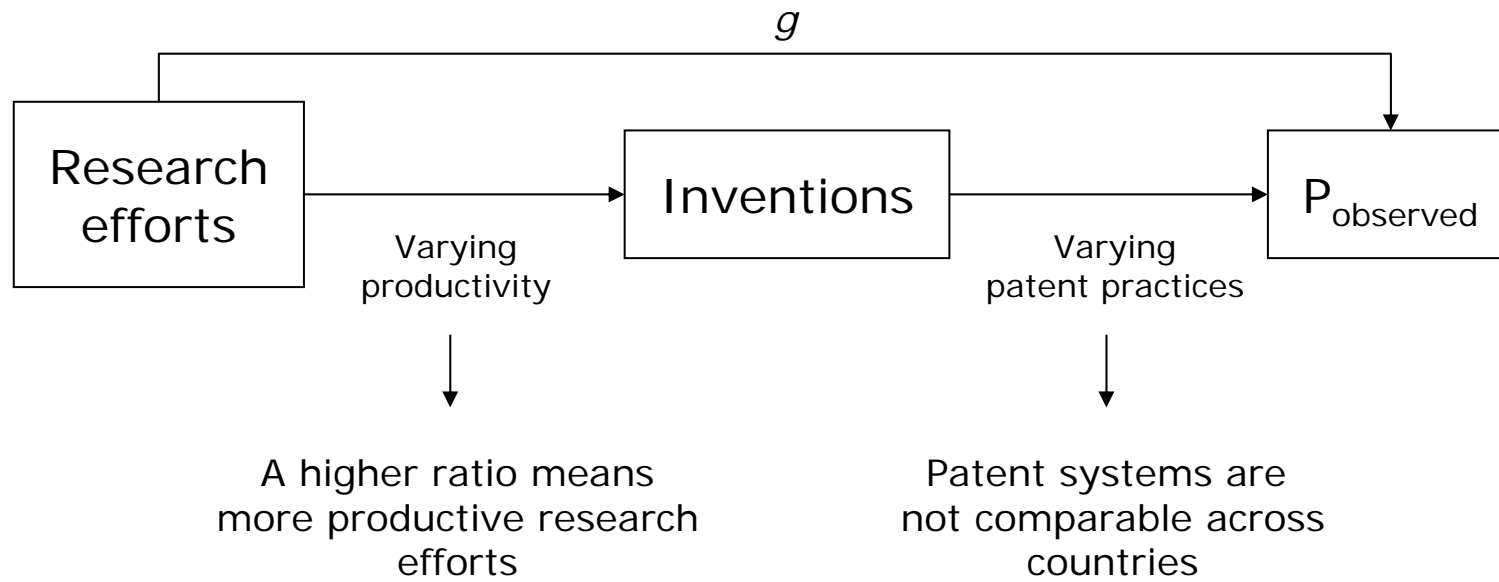
× AUS	× AUT	× BEL	△ CAN	× DNK
× FIN	× FRA	× DEU	× IRL	× ITA
△ JPN	× NLD	△ PRT	△ ESP	× SWE
△ GBR	○ USA			

Main (provisional) results : dep var is MFP

	base	subsidies	Sub	HE	GOV			
BRD	0.18***	0.20***	0.18***	0.16***	0.18***			
FRD	0.13***	0.13***	0.13**	0.13**	0.13***			
GOVRD	-0.10**	-0.10**	-0.09**	-0.11**				
HERD	0.06*	0.07*	0.07**		0.07*			
Share of public funding of BRD*BRD		-0.40*						
Defense share			-1.10*					
Civil share			-0.18					
Defence share & HERD				-0.03				
Civilian share & HERD				0.09**				
Defence share & GOVRD					-0.15			
Civilian share*GOVRD					-0.09*			
Triadic patents per business researchers* BRD (PCT)								
Enforcement*BRD								
Loss of right*BRD								



Patent filings: productivity and propensity



Patent statistics as indicators of research efforts?

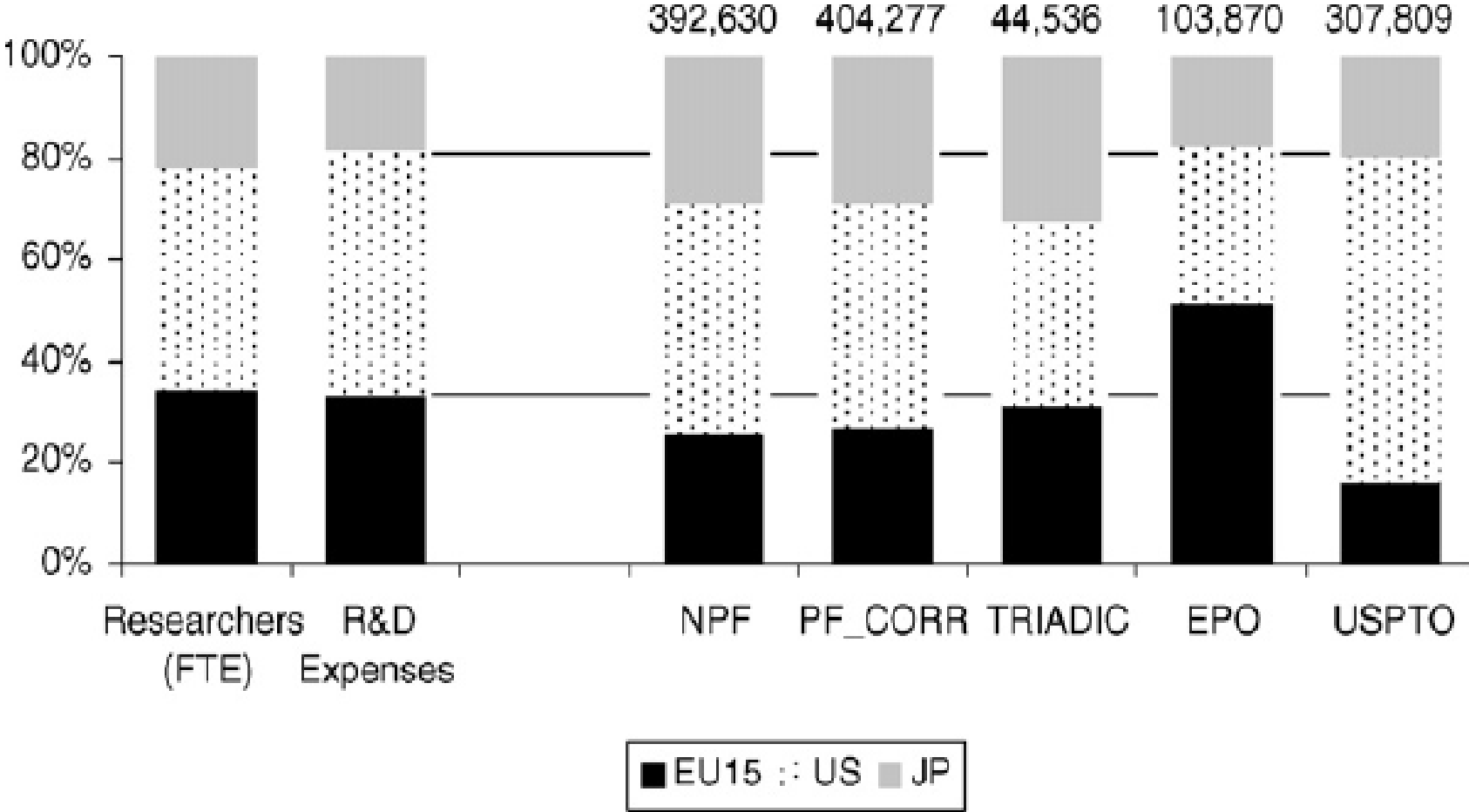
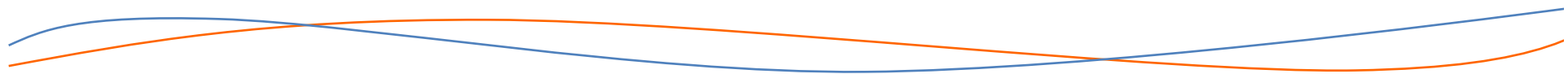


Fig. 1. Research efforts and patenting activity, 2003.

Main (provisional) results :

	base	subsidies	Sub	HE	GOV	PAT		
BRD	0.18***	0.20***	0.18***	0.16***	0.18***	0.1**		
FRD	0.13***	0.13***	0.13**	0.13**	0.13***	0.1**		
GOVRD	-0.10**	-0.10**	-0.09**	-0.11**		-0.13***		
HERD	0.06*	0.07*	0.07**		0.07*	0.1**		
Share of public funding of BRD*BRD		-0.40*						
Civil share			-1.10*					
Defence share			-0.18					
Defence share & HERD				-0.03				
Civilian share & HERD				0.09**				
Defence share & GOVRD					-0.14			
Civilian share*GOVRD					-0.09*			
Triadic patents per business researchers* BRD (PCT)						3.9***		
Enforcement*BRD						(-0.73)		
Loss of right*BRD								

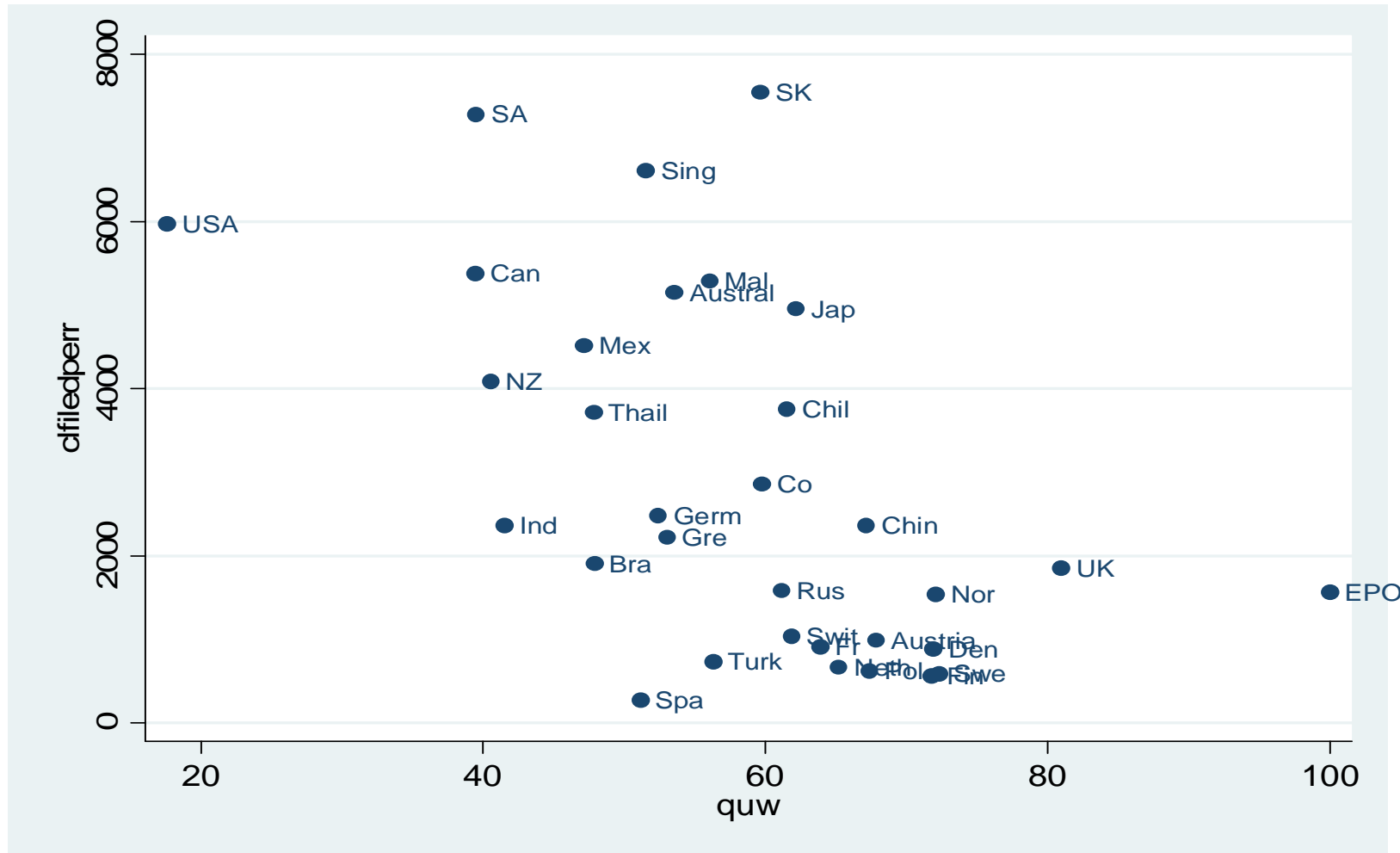


US Patent Reform, 2011: small convergence on quality

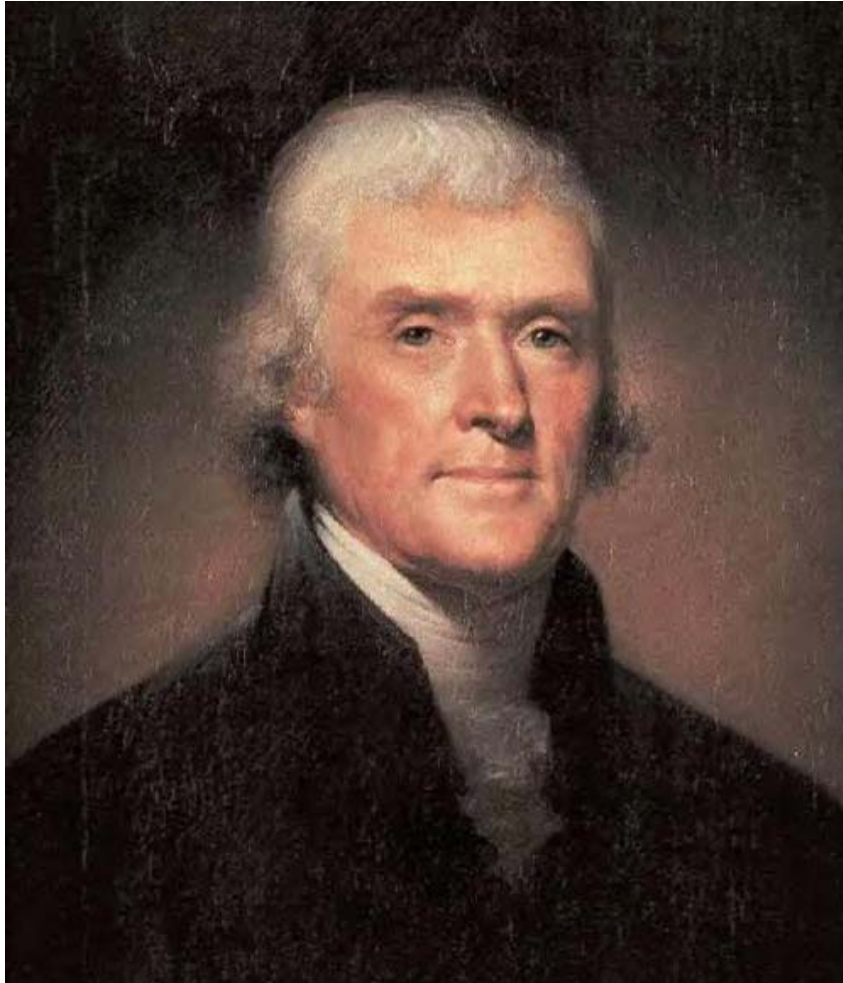


President Barack Obama signs the America Invents Act September 16, 2011, at Thomas Jefferson High School for Science and Technology in Alexandria, Va.

Unweighted quality index (QUW) and the relative demand for patent rights (claims filed per 000 researchers), 2008



Thomas Jefferson, 1794

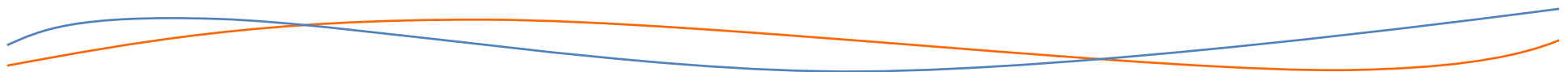


‘Patents should draw a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not.

Patents are, after all, government-enforced monopolies and so there should be some 'embarrassment' (and hesitation) in granting them.

Main (provisional) results :

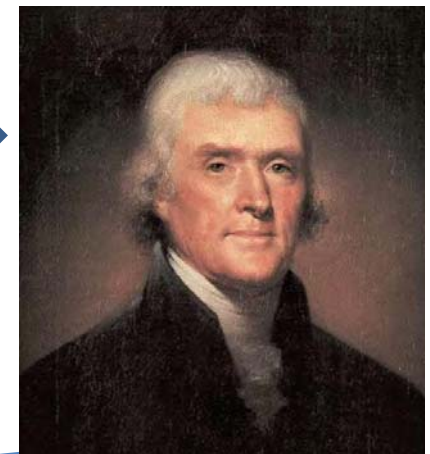
	base	subsidies	Sub	HE	GOV	PAT	Strength	Stren.
BRD	0.18***	0.20***	0.18***	0.16***	0.18***	0.1**	0.3***	0.08*
FRD	0.13***	0.13***	0.13**	0.13**	0.13***	0.1**	0.13***	0.14***
GOVRD	-0.10**	-0.10**	-0.09**	-0.11**		-0.13***	0.01	-0.08*
HERD	0.06*	0.07*	0.07**		0.07*	0.1**	0.08**	0.07*
Share of public funding of BRD*BRD		-0.40*						
Civil share			-1.10*					
Defence share			-0.18					
Defence share & HERD				-0.03				
Civilian share & HERD				0.09**				
Defence share & GOVRD					-0.14			
Civilian share*GOVRD					-0.09*			
Triadic patents per business researchers* BRD (PCT)						3.9*** (-0.73)		
Enforcement*BRD							-0.26***	
Loss of right*BRD								0.19***



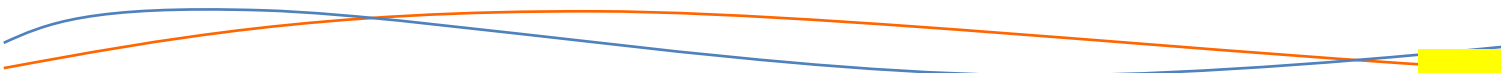
'only' evidence on relative positions; no insight into optimal level:
RQ: Impact on rate of return to R&D; or on innovation?



**Lemley (2001)
Rational ignorance?**



**Or Jefferson's
hesitation?**



Policy Implications for growth

- Doing R&D is important for productivity and economic growth
- Policy leverages:
 - mechanisms for providing funds for R&D to firms
 - improve the reactivity of the public labs.
 - support basic research in HE
 - ensure the openness of the economy to foreign sources of knowledge
 - subsidies/funding with civilian objectives
 - triadic patents per researchers is a good indicator of “productivity” (not PCT)
 - “stronger” means “weaker” (less restrictions and more enforcement rights)
 - “strong” patent systems reduces the return to R&D (Ginarte and Park, 1997)

Main references

de Saint-Georges M. and B. van Pottelsberghe de la Potterie, 2011, *A quality index for patent systems*, **ECARES Working paper series**.

Guellec D. and B. van Pottelsberghe de la Potterie, 2004, *From R&D to productivity growth: do the institutional settings and the sources of funds of R&D matter?*, **Oxford Bulletin of Economics and Statistics**, 66(3), 353-376.

