Experimentation within and between firms: Any role for policy and institutions?

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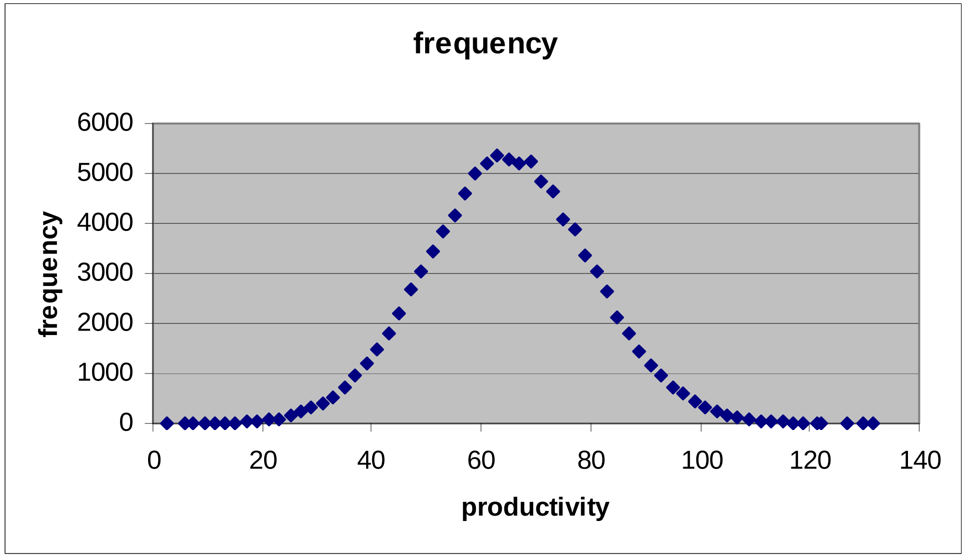
Overview

- **Productivity Framework**
  - **Defining Experimentation**
- **Data Collection**
- **Storyline in pictures and charts**
  - **Productivity Decompositions**
    - **Continuers, entry/exit**
  - **Productivity dispersion of entrants**
  - **High tail of productivity distribution**
  - **Entry and exit rates**
  - **Entrant size and post-entry growth**

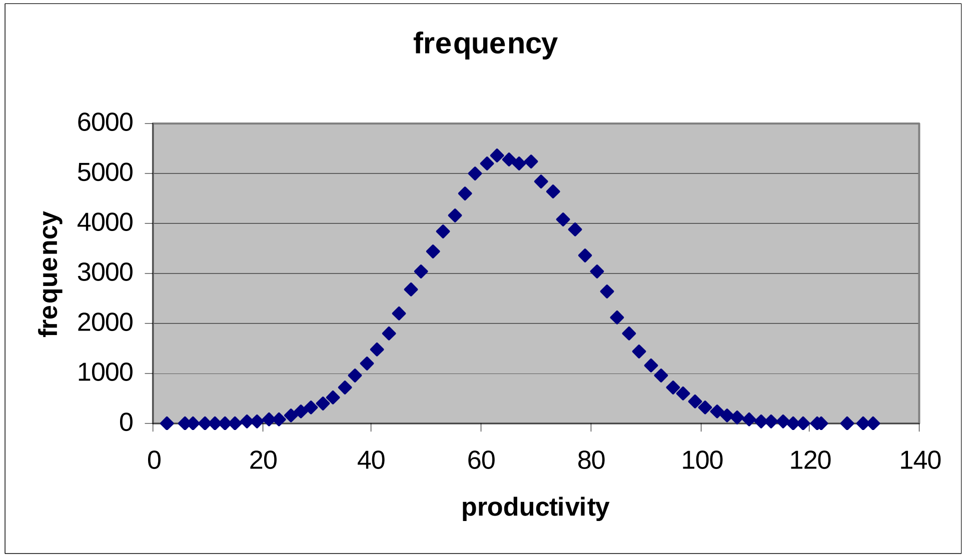
Framework

- **Productivity Levels**
  - **Dispersion across firms**
  - **Allocation among continuers, entry/exit**
- **Productivity Growth**
  - **Transitional growth through reallocation**
  - **Improving within-firm productivity**
  - **Pushing out the frontier: Innovation/Experimentation**



Aggregate Productivity depends on firm-level prod and labor allocation

$$P_t = (1/N_t)\sum_i P_{it} + \sum_i \Delta\theta_{it}\Delta P_{it}$$


frequency
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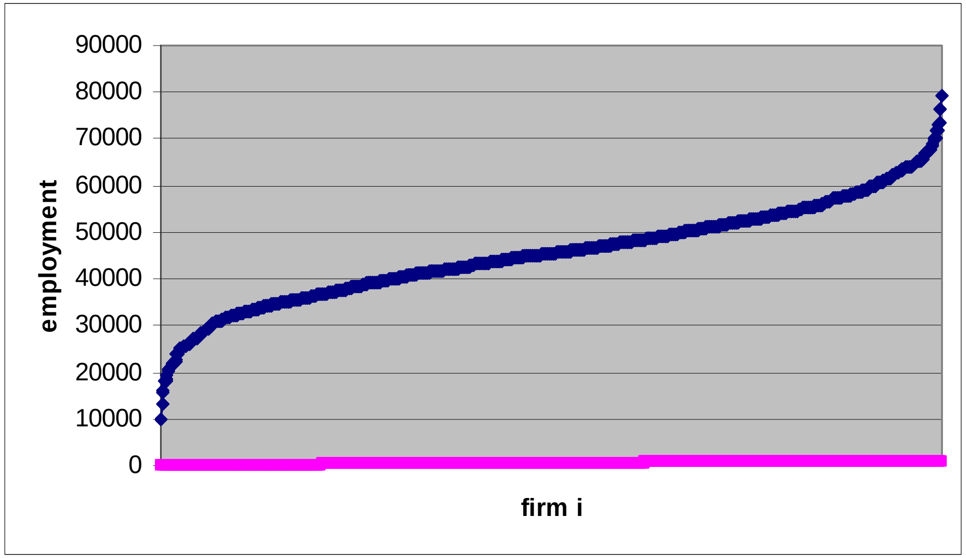
productivity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Framework

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  - ***Pushing out the frontier: Innovation/Experimentation***

Experimentation

- Expenditures leading to a ‘stock’ that provides as a flow: newer/better/cheaper ways to meet demand.
  - Is this different from product and process R&D?
  - Is this different from adopting newest technology embodied in capital?
- Two relevant characteristics:
  - uncertainty in path from expenditure to stock growth.
  - Rival nature of service flows coming from stock
- Experimentation yields stock generating non-rival service, but also requires complementary rival stocks.

Traditional View

	Uncertainty	
	Low	**High**
Rival	Tangible Investment	
Non-Rival		Intangible Inv. e.g. R&D

Experimentation

	Uncertainty	
	Low	**High**
Rival	Tangible Inv. R&D (markets for inputs and technology licences for outputs)	Experimentation: Uncertainty of market response. Non-rival outcome. Leveraged through rival assets
Non-Rival		

Experimentation

- **Flexibility in scale encourages experimentation**
- **Market ‘responsiveness’ encourages experimentation**
- **Areas where technological advance includes uncertainty in market response require experimentation**
  - **‘It takes a dog to test the dog food’**
- **More experimentation:**
  - **Small entrants, fast growth of ex-post successful firms.**
  - **Higher dispersion in productivity of entrants**
  - **High growth of firms in top tail of distribution/low growth of firms in bottom tail.**

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Reasons for data collection

- **Policy question:** are there differences in firm dynamics across countries that can contribute to explain the different pace of innovation. Recent growth trends suggest <u>widening growth disparities</u> between EU and US
- **Problem:** firm-level data are not readily available for different countries …

  … and existing micro studies do not allow for meaningful cross-country comparisons, because of differences in: i) underlying data; ii) methodologies; iii) sectoral and time coverage etc.
- Hence, need for assembling ***micro data trying to minimise country differences***.

Distributed micro-data collection

- **EU Sample (10 countries)**
  - Productivity decompositions
  - Sample Stats and correlations by quartile
- **World Bank sample (10-15 countries CEU/LA/SEA)**
  - Demographics (entry/exit) and survival
  - Productivity decompositions
- **OECD Sample (7-10 countries)**
  - Same variables

Data sources

- **Business registers for firm demographics**
  - **Firm level, at least one employee, 2-digit industry**
- **Production Stats, enterprise surveys for productivity analysis**

Distributed micro data research

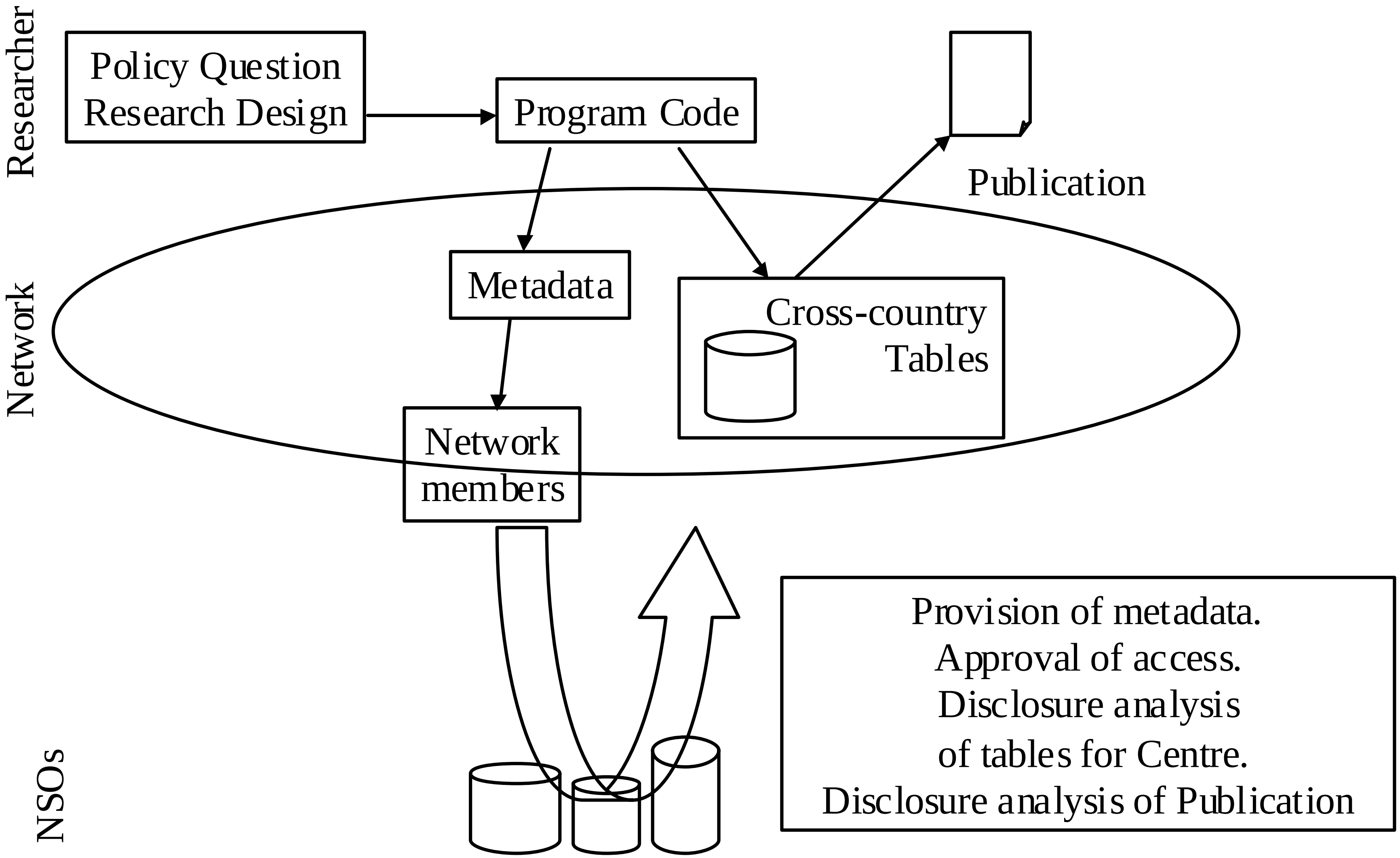

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Table C-3: Labour productivity per quartile for ICT-producing, ICT-using and non-ICT sector

	ICT-producing		ICT-using		Non ICT	
	US	EU	US	EU	US	EU
Q4	123	118	74	58	90	75
Q3	88	87	51	48	69	53
Q2	61	72	40	46	50	48
Q1	38	68	26	41	32	47

Relative Productivity: Top Quartile to mean

regressed on country and industry dummies

	LPQ	LPV	TFP	MFP
FIN*	2.27	1.98	1.20	1.21
	(.017)	(.009)	(.007)	(.003)
FRA	2.10	1.70	1.59	
	(.030)	(.017)	(.014)	
GBR	2.09	1.88	1.75	1.32
	(.022)	(.012)	(.010)	(.004)
ITA			1.79	
			(.008)	
NLD	2.04	1.64	1.56	1.22
	(.021)	(.012)	(.009)	(.004)
USA	2.33	2.19	2.13	1.58
	(.043)	(.024)	(.020)	(.009)
Note: standard errors in parentheses. *TPF and MFP are log of mean level for quartiles in Finland. Means of log level elsewhere.				

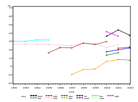
Table C-6: Average productivity relative to top quartile productivity in the US

	ES	FIN	FRA	GBR	NLD	SWE	US
Food products, beverages and tobacco	0,04	0,22	0,25	0,29	0,38	0,34	0,40
Textiles, textile products, leather and footwear	0,06	0,27	0,38	0,42	0,61	0,39	0,40
Wood and products	0,06	0,43	0,47	0,47	0,64	0,63	0,48
Pulp, paper, paper products, printing and publishing	0,09	0,34	0,41	0,46	0,60	0,56	0,47
Chemical, rubber, plastics and fuel products	0,08	0,26		0,32	0,45	0,39	0,43
Other non-metallic mineral products	0,05	0,35	0,34	0,37	0,64	0,40	0,48
Basis metals	0,13	0,33		0,37	0,47	0,53	0,50
Fabricated metal products	0,07	0,28		0,38	0,50	0,42	0,53
Machinery and equipment	0,06	0,24	0,25	0,36	0,42	0,45	0,48
Transport equipment	0,07	0,23	0,41	0,42	0,41	0,45	0,47
Other manufacturing	0,06	0,29	0,38	0,40	0,54	0,42	0,49

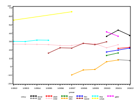
Table C-5: Top quartile productivity relative to US top quartile productivity

	ES	FIN	FRA	GBR	NLD	SWE	US
Food products, beverages and tobacco	0,12	0,54	0,47	0,86	0,81	0,73	1,00
Textiles, textile products, leather and footwear	0,16	0,45	0,73	0,84	1,09	0,82	1,00
Wood and products	0,20	0,76	0,71	0,92	0,88	1,10	1,00
Pulp, paper, paper products, printing and publishing	0,24	0,70	0,71	0,94	0,95	0,96	1,00
Chemical, rubber, plastics and fuel products	0,28	0,68	0,00	0,69	0,87	0,76	1,00
Other non-metallic mineral products	0,23	0,76	0,59	0,77	1,19	0,76	1,00
Basis metals	0,30	0,68	0,00	0,66	0,79	0,92	1,00
Fabricated metal products	0,21	0,45	0,00	0,71	0,77	0,68	1,00
Machinery and equipment	0,18	0,40	0,41	0,69	0,66	1,02	1,00
Transport equipment	0,20	0,36	0,68	0,79	0,66	0,81	1,00
Other manufacturing	0,18	0,53	0,66	0,84	0,89	0,78	1,00

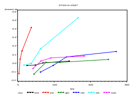
Weighted/Unweighted Productivity



Weighted/Unweighted Productivity

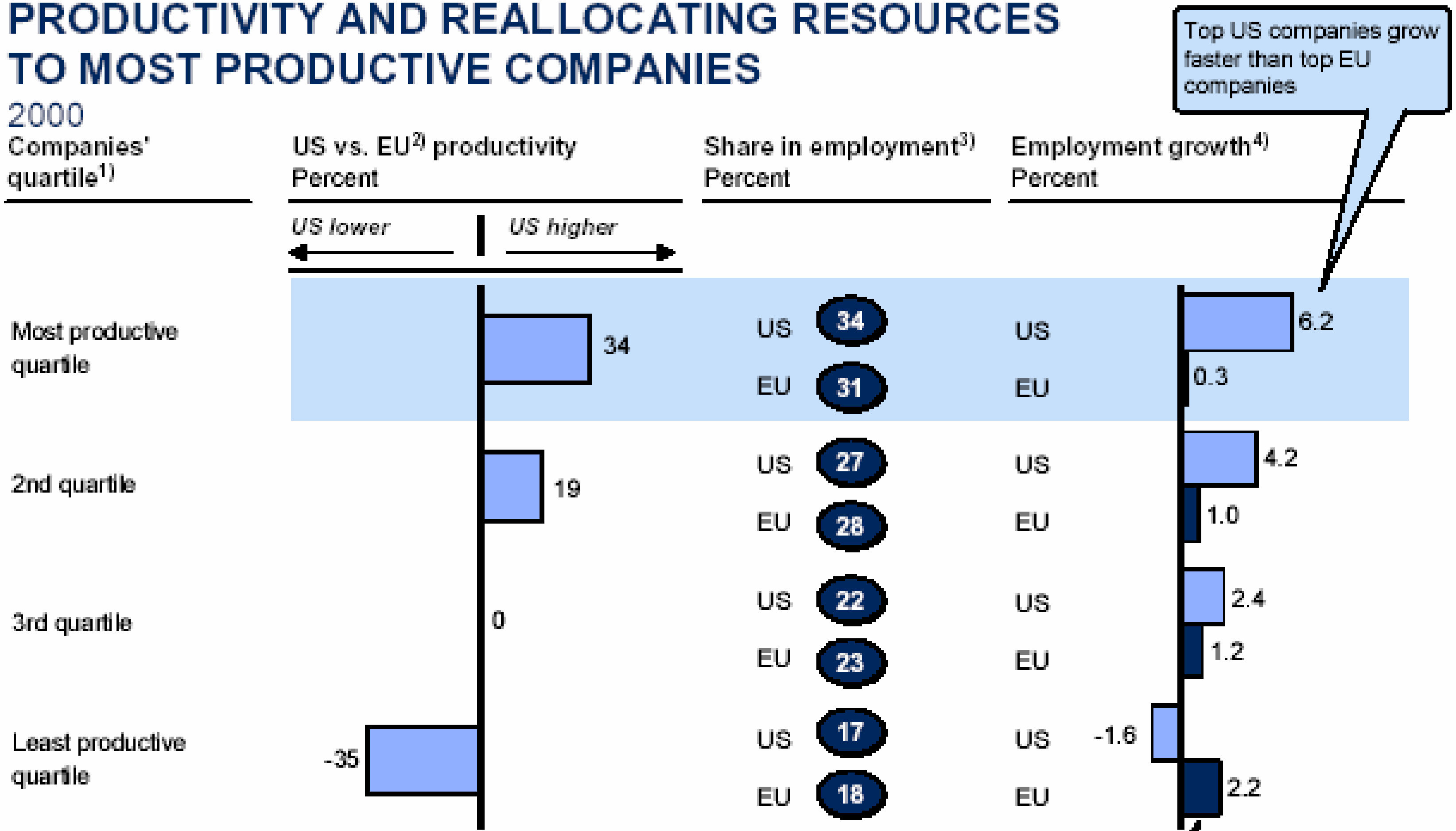


Dynamic Reallocation



THE US IS BETTER AT ACHIEVING EXCELLENT PRODUCTIVITY AND REALLOCATING RESOURCES TO MOST PRODUCTIVE COMPANIES

2000

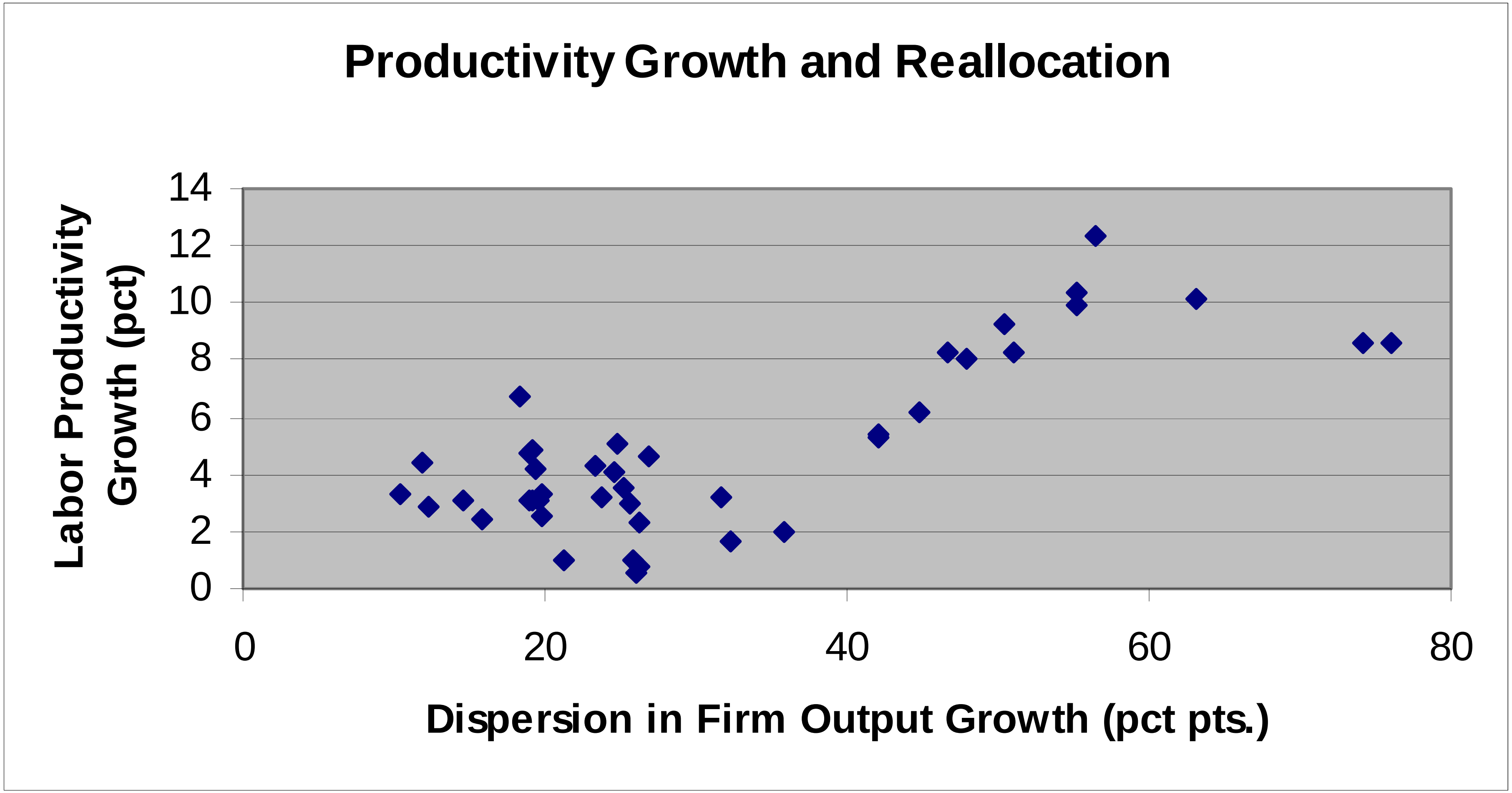


1) Aggregated data for manufacturing sector, STAN 15t37
2) Weighted average of EU countries for which data were available; Finland, France, United Kingdom, the Netherlands and Sweden
3) Average share 1995-2000
4) Average annual growth in resources, 1995-2000

Source: ESI-VU

Incentives for firm-level productivity growth

- The relationship between variability in market share of firms in an industry and productivity growth of the industry.
  - Market share turbulance: the mean output growth of the fastest growing quartile of firms minus the mean output growth of the slowest growing quartile of firms in an industry;
  - Productivity growth: either LPQ, LPV
- A regression of productivity growth in most disaggregated industries, for countries and years, on market share turbulance. Industry of country dummies included in regressions.



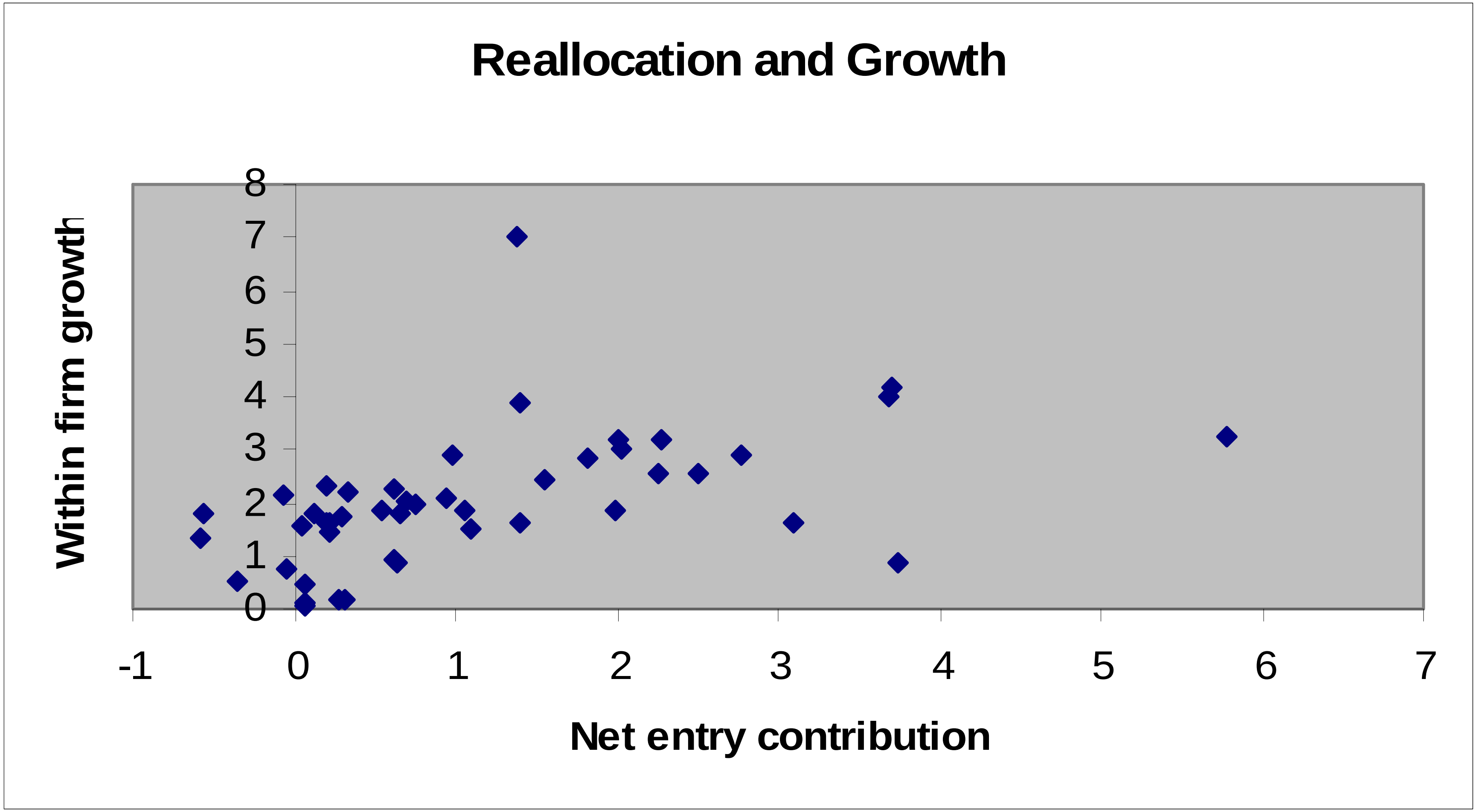
Productivity Growth and Reallocation
Labor Productivity Growth (pct)
14
12
10
8
6
4
2
0
0
20
40
60
80
Dispersion in Firm Output Growth (pct pts.)

Effect of turbulence on incumbent productivity growth

Unweighted avg incumbents productivity growth regressed on:

'turbulence': interquartile range of cross-sect distribution of output growth

		LPQ			LPV	
Turbulance in market share	.14	.13	.11	.13	.12	.08
t-stat	(14.0)	(12.1)	(5.4)	(8.)	(7.2)	(3.0)
Dummies	-	Industry	Country	-	Industry	Country
R-sq	.21	.27	.29	.12	.19	.25
# obs	712	712	712	455	455	455


Reallocation and Growth
Within firm growth
8
7
6
5
4
3
2
1
0
-1
0
1
2
3
4
5
6
7
Net entry contribution

Indirect effect of net-entry to incumbent productivity growth (OECD)

Productivity growth of incumbents regressed on net-entry contribution

	GR				FHK			
	LPQ	**LPV**	**MFP**	**TFP**	**LPQ**	**LPV**	**MFP**	**TFP**
Const	0.14	0.18	-0.02	0.12	0.14	0.18	-0.02	0.12
	(4.46)	(3.87)	(1.07)	(2.71)	(4.50)	(3.96)	(1.14)	(2.75)
NE	0.54	1.00	0.96	0.74	0.53	1.06	0.94	0.87
	(7.83)	(10.29)	(8.01)	(6.88)	(7.75)	(11.03)	(7.66)	(7.74)
R_sq	0.38	0.32	0.41	0.22	0.38	0.33	0.40	0.24
nobs	515	515	451	703	515	515	451	703

note: industry & country dummies included; countries vary per regression; t-stat in parenthesis

Indirect effect of entry/exit to incumbent productivity growth (WB MIC)

Productivity growth of incumbents regressed on net-entry contribution

	LPQ 3	LPQ 5	LPV 3	LPV 5	MFP 3	MFP 5	TFP 3	TFP 5
Const.	0.03	0.02	0.02	0.05	-0.10	-0.06	-0.09	-0.08
	(0.8)	(0.4)	(0.4)	(0.8)	(1.7)	(1.1)	(1.1)	(0.9)
Entry	0.33	0.69	0.47	0.70	2.21	1.22	1.32	0.21
	(3.4)	(4.9)	(2.6)	(3.7)	(11.5)	(5.0)	(5.5)	(1.0)
Exit	-0.24	-0.66	-0.73	-0.77	-1.36	-0.46	-0.58	-0.68
	(2.8)	(5.5)	(4.5)	(4.8)	(6.3)	(2.0)	(2.0)	(3.0)
R-sq	0.24	0.28	0.15	0.21	0.44	0.42	0.41	0.10
Nobs	927	742	631	510	780	609	604	496

Note: industry & country dummies included; countries vary per regression

Experimentation among entrants

Coefficient of variation of entrant productivity: country effects

	LPQ	LPV	TFP	MFP
FIN*	.106	.117	.156	.176
	(.001)	(.001)	(.004)	(.003)
FRA	.095	.099	.175	
	(.002)	(.003)	(.007)	
GBR	.055	.061	.095	.084
	(.002)	(.002)	(.005)	(.003)
ITA			.279	
			(.004)	
NLD	.099	.102	.189	.115
	(.001)	(.002)	(.004)	(.003)
USA	.139	.175	.352	.247
	(.003)	(.004)	(.010)	(.007)
Note: standard errors in parentheses. *TPF and MFP distribution in levels in Finland. In log-level elsewhere.				

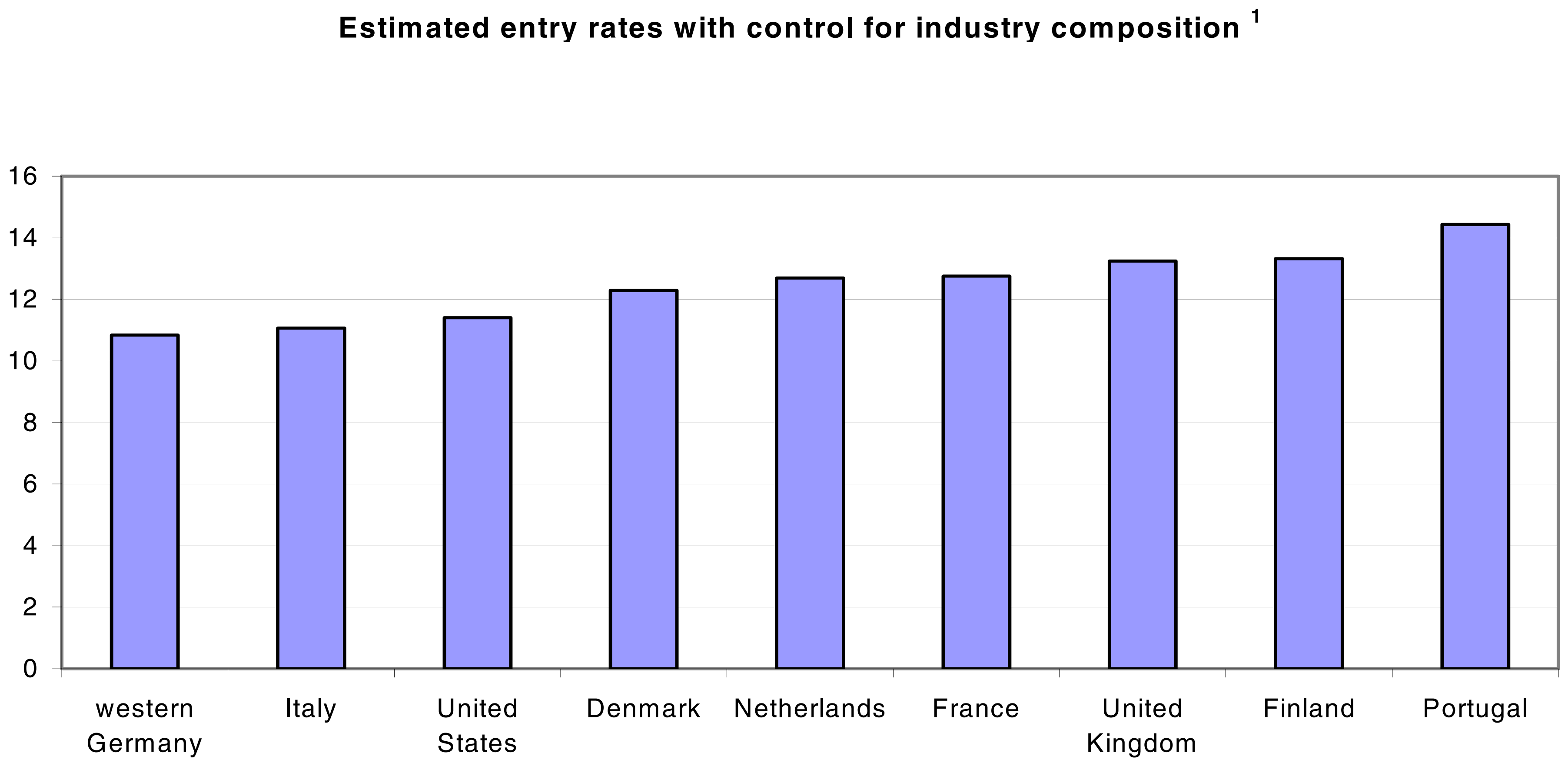
Experimentation among entrants, interacted with technology groups

Coefficient of variation of entrant productivity: country X technology effects

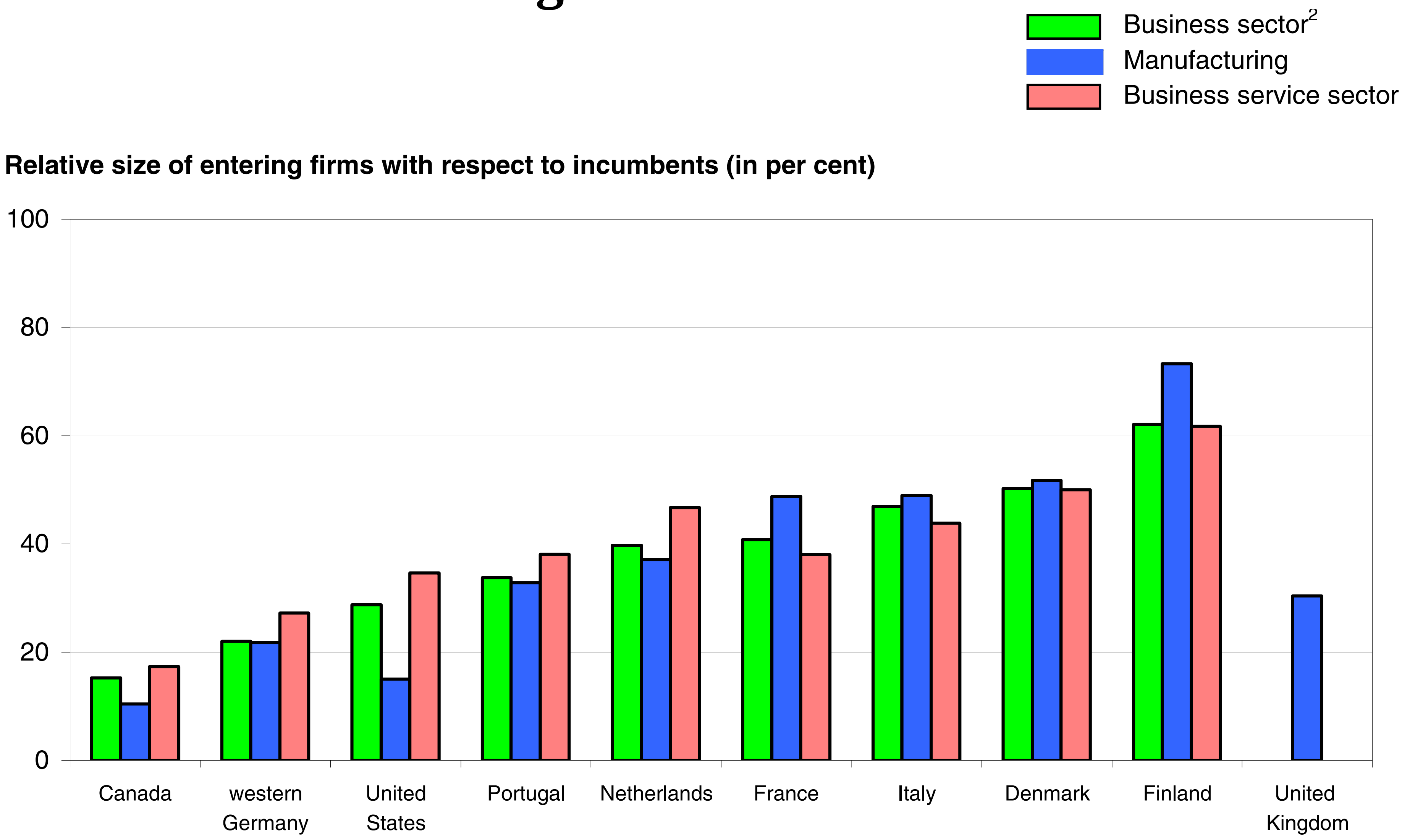
	LPQ	LPV	TFP	MFP
FIN*	.009	.004	-.004	.005
	(.003)	(.003)	(.010)	(.006)
FRA	.003	-.001	-.008	.006
	(.005)	(.006)	(.018)	(.010)
GBR	.006	.002	-.005	.005
	(.004)	(.004)	(.013)	(.008)
ITA			.014	
			(.011)	
NLD	.015	.006	.008	.028
	(.003)	(.004)	(.011)	(.007)
USA	.019	.017	.065	.049
	(.008)	(.009)	(.026)	(.015)
Note: standard errors in parentheses. *TPF and MFP distribution in levels in Finland. In log-level elsewhere.				

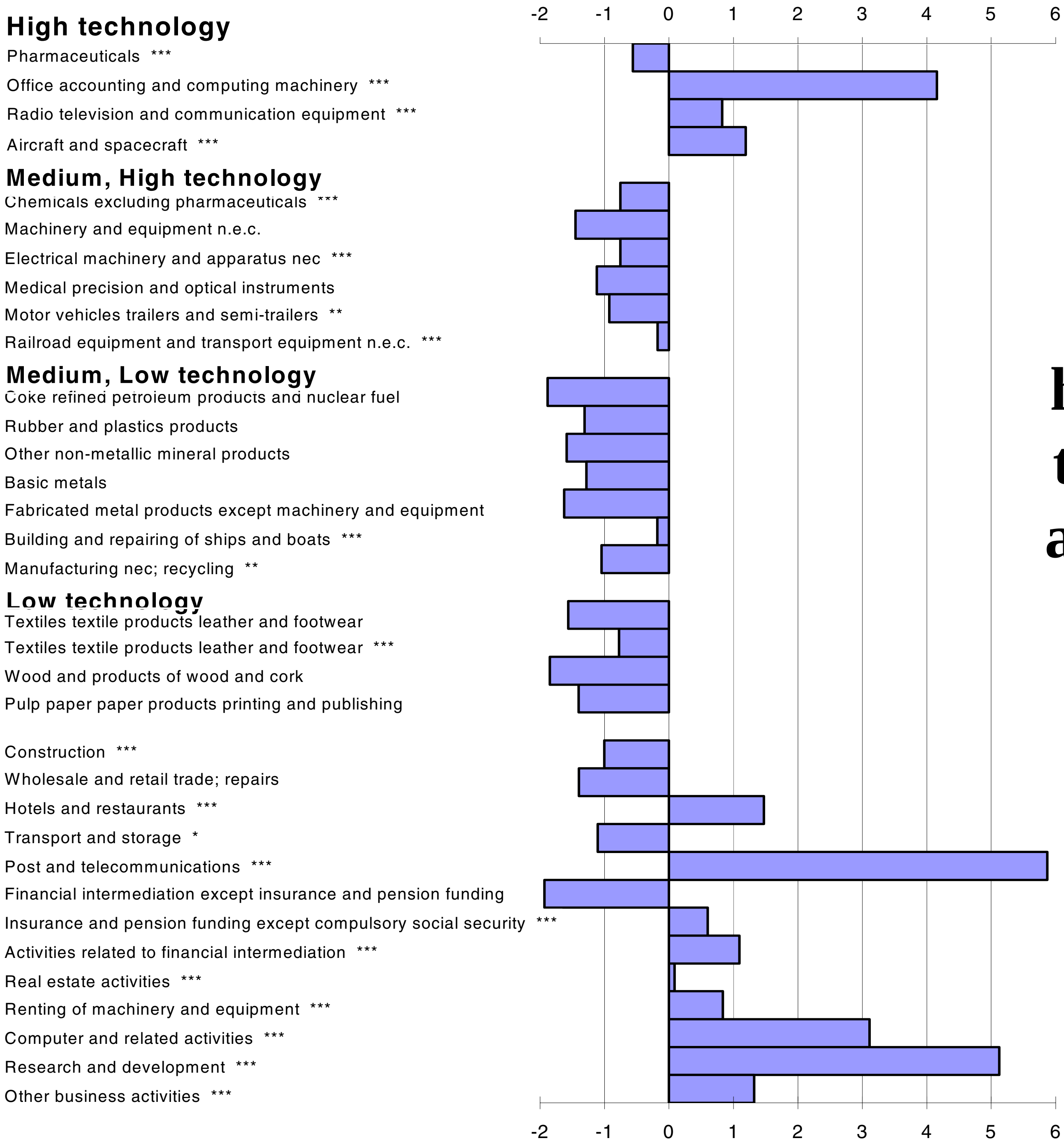
➢Entry rates tend to be similar across countries

(country effects in regressions which control for size and sectoral composition)



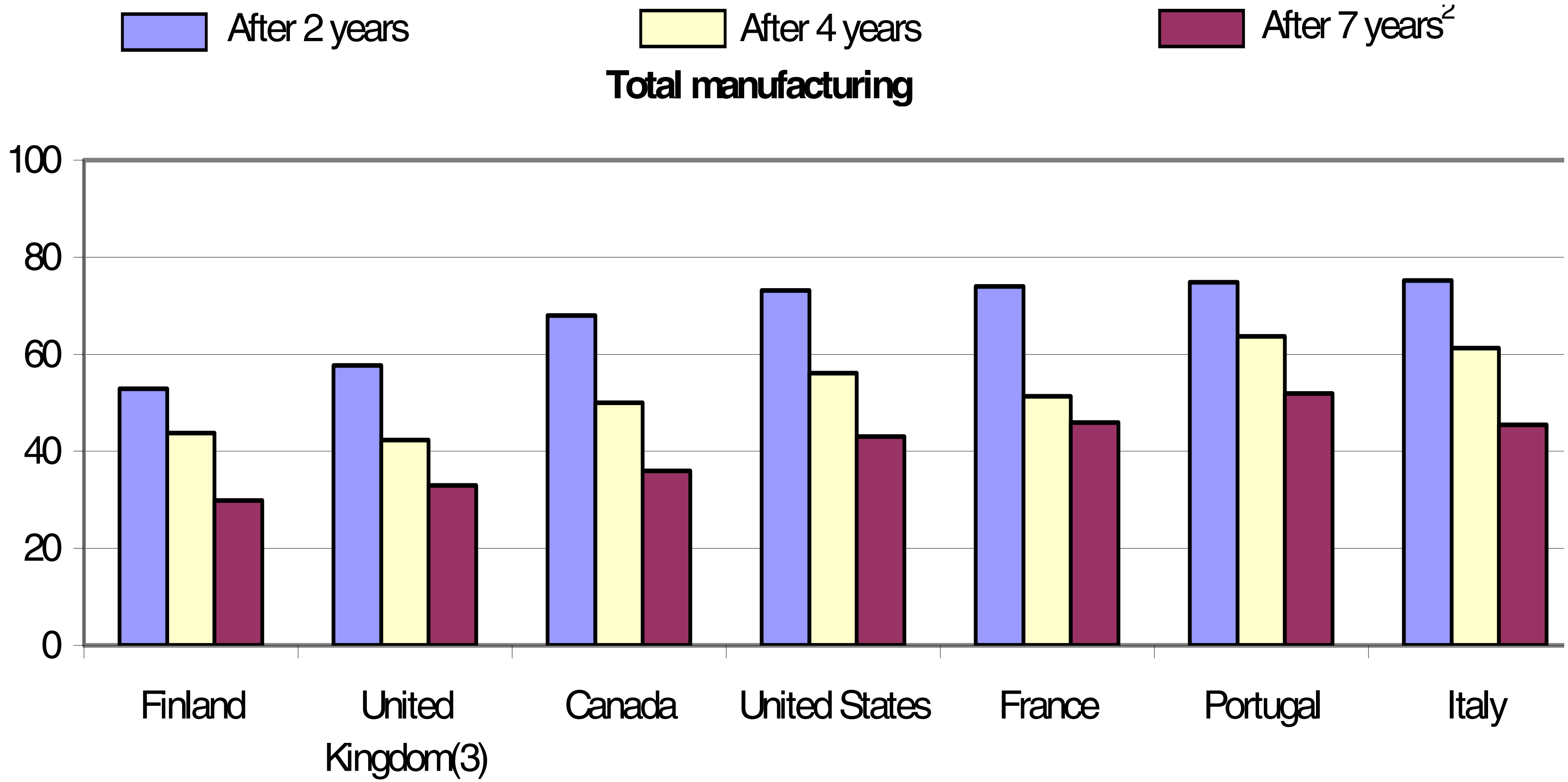
➢…but entering firms are smaller in US



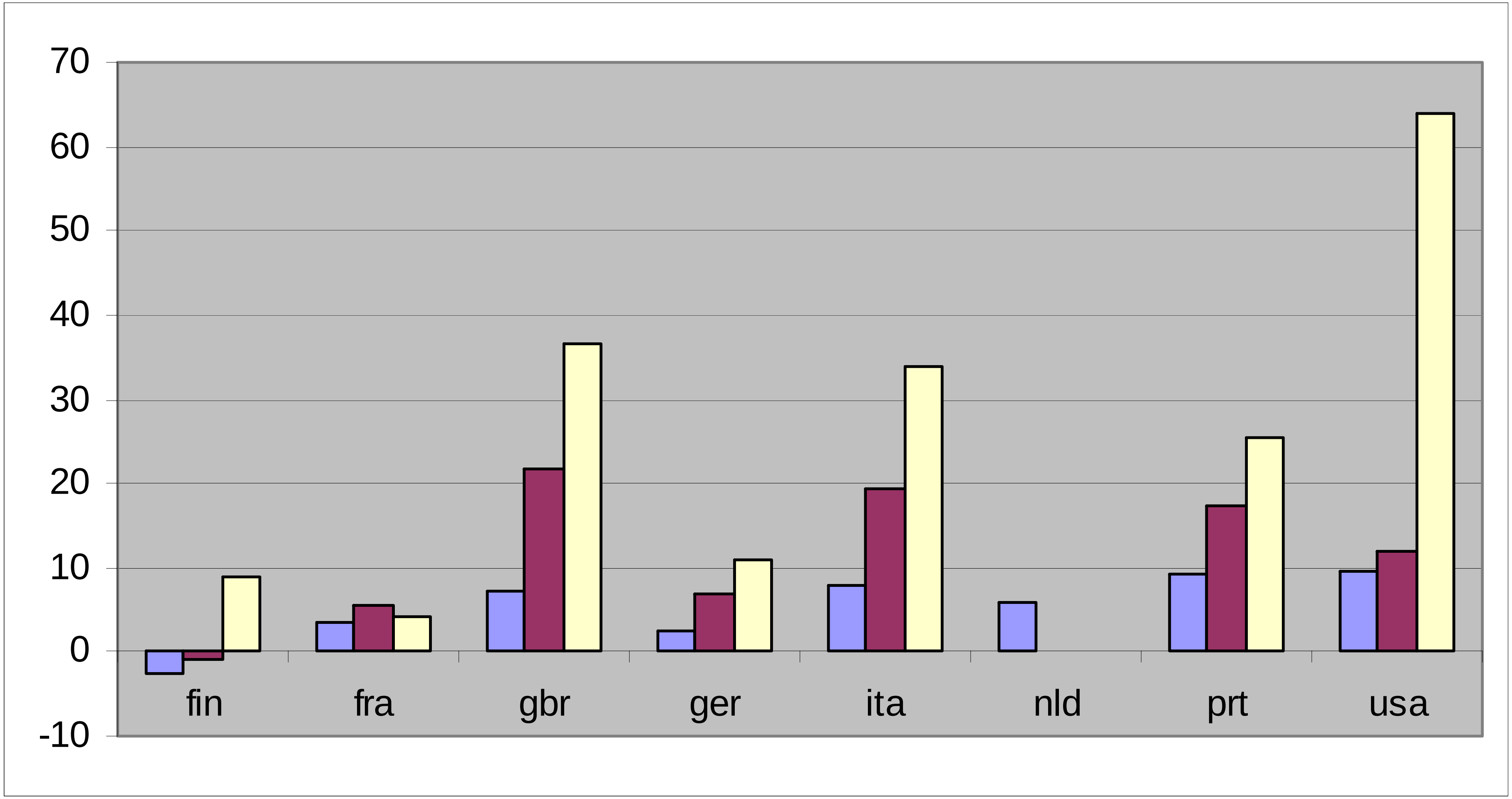


- **Entry rates tend to be higher in high-tech industries and in business services**

➢Survivor rates suggest high firm failure in the initial years



Avg firm size relative to entry size
Manufacturing



❑Any role for PM and LM regulations on entry rates?

- Entry is assumed to be proportional to *expected post-entry profits* defined net of *entry costs*. A simple model can be written as:

$$Entry_{i,j,t} = \beta\left(\pi^{e}_{i,j,t} - F_{i,j,t}\right) + \mu_{i,j,t}$$

π^e = post-entry profits proxied by (smoothed) *growth rate of industry VA* (relative to total business sector) plus certain *indicators of costs of adjustment*

F = entry costs proxied by (smoothed) *K/Y* plus different *indicators of PM regulations* (start-up costs)

❑Any role for PM and LM regulations on entry rates?

	A	B	C	D	E	F	G	H
	2.86 ***	**2.95** ***	**3.05** ***	**3.24** ***	**3.28** ***	**4.22** ***	**4.30** ***	**2.25** **
	(0.40)	*(0.41)*	*(0.42)*	*(0.41)*	*(0.41)*	*(0.56)*	*(0.56)*	*(0.89)*
ΔlogVA	**0.46**	**-3.49** *	**-2.55**	**-2.66**	**-2.54**	**-2.73**	**-2.98**	**-3.40** *
	(1.82)	*(1.97)*	*(1.93)*	*(1.94)*	*(1.94)*	*(1.93)*	*(1.93)*	*(1.96)*
ΔlogVA (less than 20)		**10.36** ***	**11.21** ***	**11.07** ***	**11.07** ***	**11.40** ***	**11.96** ***	**11.09** ***
		(2.69)	*(2.82)*	*(2.81)*	*(2.82)*	*(2.79)*	*(2.77)*	*(2.66)*
LogKY	**-0.23** *	**-0.20**	**-0.24** *	**-0.27** **	**-0.28** **	**-0.31** **	**-0.34** ***	**-0.29** **
	(0.13)	*(0.13)*	*(0.12)*	*(0.12)*	*(0.12)*	*(0.12)*	*(0.12)*	*(0.13)*
PM regulations (PMR)			**-0.15**					
			(0.10)					
PM (administrative regulations)				**-0.32** ***				
				(0.06)				
PM (admin. barriers to start up) * size(less than 20)						**-0.70** ***		
						(0.19)		
PM (admin. barriers to start up) * size(20-49)						**-0.60** ***		
						(0.14)		
PM (admin. barriers to start up) * size(50-99)						**-0.25** *		
						(0.13)		
PM (admin. barriers to start up) * size(100-499)						**0.03**		
						(0.10)		
PM (admin. barriers to start up) * size(500 and more)						**0.47** **		
						(0.24)		
PM (sector specific)					**-1.64** ***			
					(0.38)			
PM (sector specific) * size(less than 20)							**-5.33** ***	**-6.35** ***
							(0.93)	*(1.05)*
PM (sector specific) * size(20-49)							**-3.95** ***	**-2.70** ***
							(0.77)	*(0.96)*
PM (sector specific) * size(50-99)							**-1.65** **	**-1.05**
							(0.75)	*(0.93)*
PM (sector specific) * size(100-499)							**0.83**	**2.53** ***
							(0.58)	*(0.94)*
PM (sector specific) * size(500 and more)							**3.25** **	**-2.32**
							(1.35)	*(1.94)*
EPL * size(less than 20)								**0.23** *
								(0.12)
EPL * size(20-49)								**-0.28** ***
								(0.10)
EPL * size(50-99)								**-0.13**
								(0.10)
EPL * size(100-499)								**0.07**
								(0.34)
EPL * size(500 and more)								**0.87** ***
								(0.20)
Number of observations	3197	3196	3196	3196	3196	3198	3198	3196
Country dummies	Yes	Yes	No	No	No	No	No	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

See main text for the definition of entry rates.
Robust standard errors are in brackets. * : significant at 10 % level; ** at 5% level; *** at 1% level.

Empirical evidence on entry equations

- ✓ **The results suggest that the <u>growth rate of industry value added</u> enters with the expected positive sign;**
- ✓ **<u>Capital intensity</u> has the expected negative sign;**
- ✓ **The different indicators of the <u>stringency of product market regulations</u> are always negatively signed and, in most cases, statistically significant.**
- ✓ **In particular, <u>administrative regulations on entrepreneurial activities</u> seem to have a strong negative effect on entry rates. This effect is mainly felt by small and medium-sized firms (up to 49 employees)**
- ✓ **There is also clear evidence of an additional negative effect from <u>tight regulations on hiring and firing</u>. The effect is positive for micro firms (fewer than 20 employees) and negative for small-medium sized firms (20-49 employees). This is consistent with EPL exemption granted to micro firms in many OECD countries.**
- ✓ **Ex.: a reduction in the administrative barriers equal to two standard deviations could lead to an increase in entry rates amongst small firms by about 1.3 percentage points, with an additional increase amongst small- and medium-sized firms of about 0.7 percentage points, with a similar easing of employment protection legislation.**

U.S. *v* Europe:

- There is a ***similar degree of firm churning and 'infant mortality*** in Europe and in the United States.
- The distinguishing features are:
  - ***a smaller relative size of entering firms***
  - ***a lower level of labour productivity of entrants*** relative to the average incumbent, but greater variance
  - a ***much stronger expansion of successful entrants*** in the initial years,
  - A higher tail of the productivity distribution, overall
- These differences may point to a **different degree of *market experimentation* in the U.S. than in Europe**. Why?
  - More market-based financial system
  - Lower administrative costs of start up
  - Lower costs of adjusting the workforce to accommodate changes in demand
- Does it matter? Maybe not, but in a period of diffusion of a new technology requiring market experimentation, one system may be better than another.

Avg firm size relative to entry size
Total Business Sector