Quality of linked firm-level and micro-aggregated datasets: The example of the ESSLait Micro Moments Database

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Introduction and roadmap

- The impact of stepwise linking and aggregation of information from firm-level datasets in several countries on the representativeness and usefulness of indicators from the ESSLait Micro Moments Database (MMD)
- Distributed microdata research (DMD) and sources
- Data linking and statistical properties of linked datasets
- Overlap across samples and over time
- Representativeness – ex-post re-weighted variables
  - Use in descriptive statistics
  - Use for marginal analyses
- Final remarks

Distributed microdata research (DMD) and sources

ICT Impacts (2006)
14 European countries
DMD Method with “Common Code” software

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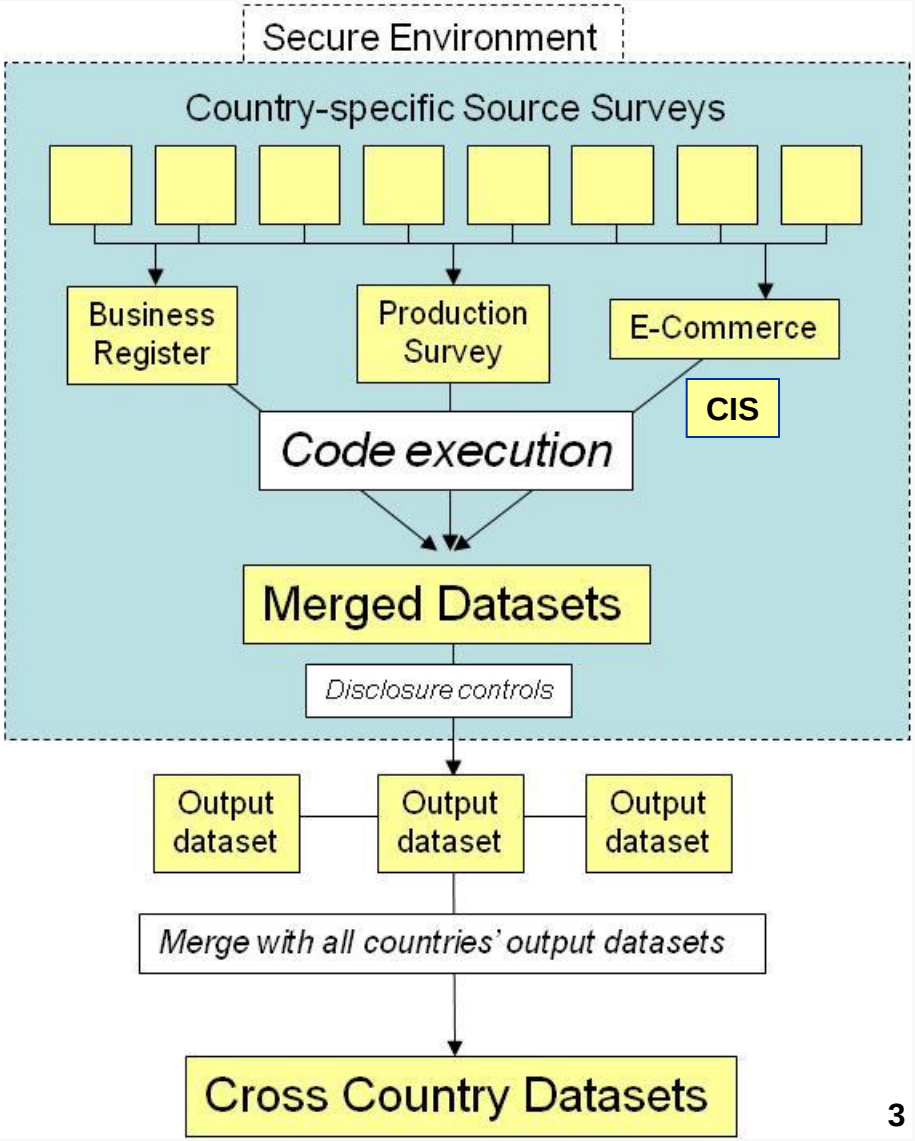

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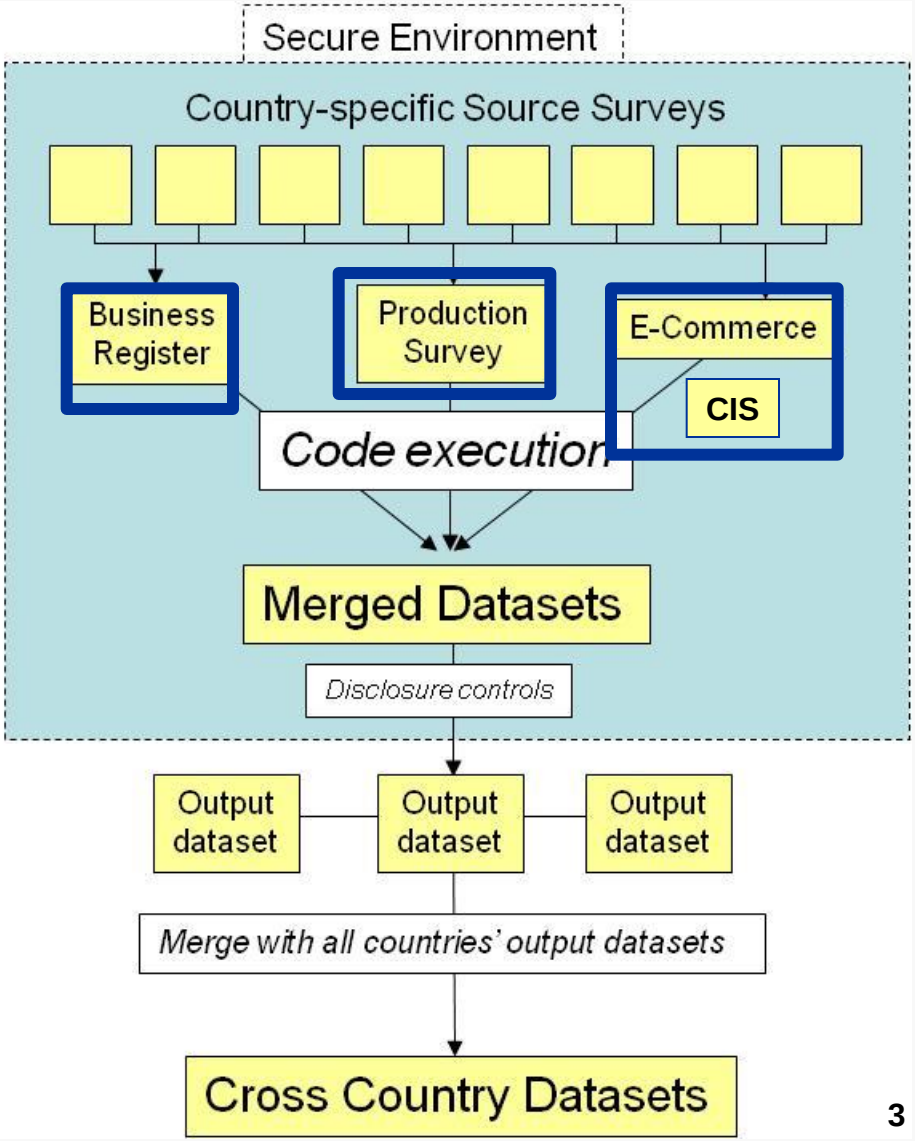

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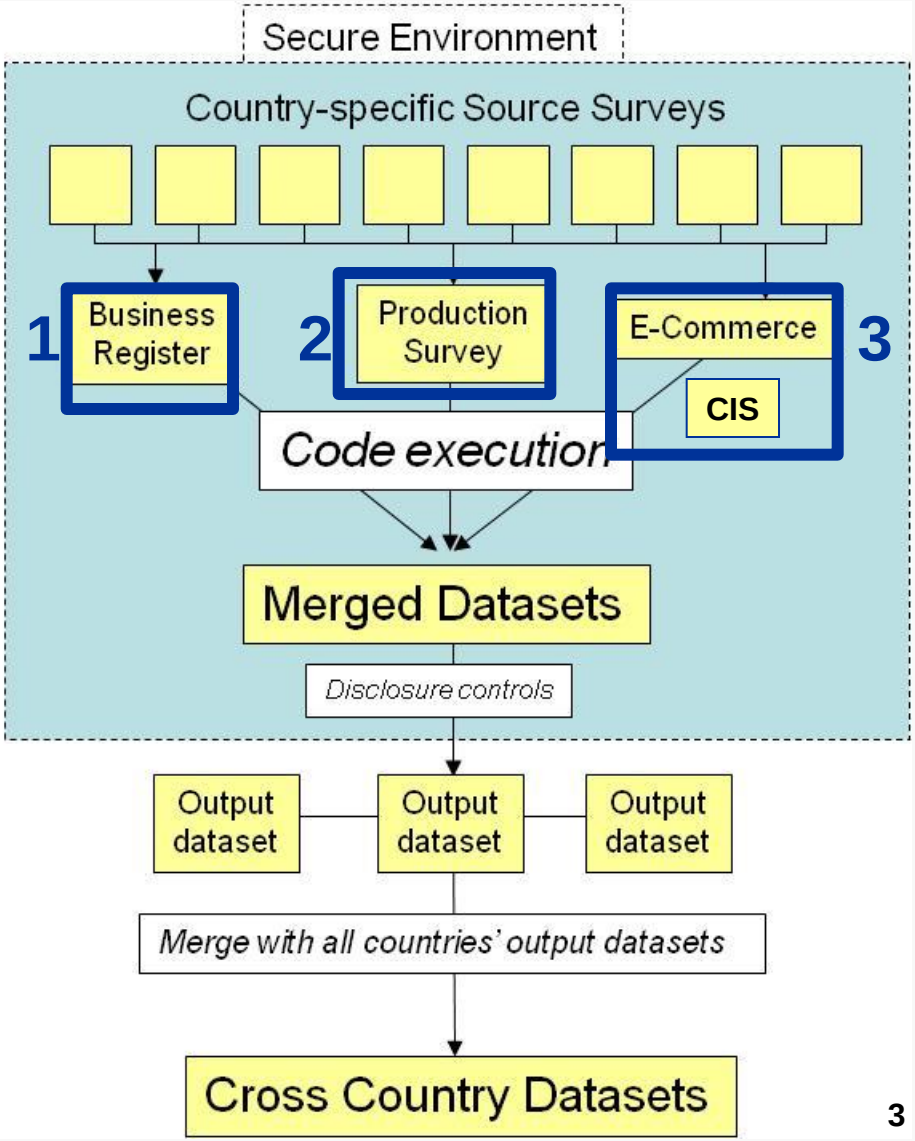
2. **Production Statistics PS: production values, exports, capital, employment, pay, educational achievement, ownership, affiliation**
3. **E-commerce Survey EC and Community Innovation Survey IS**



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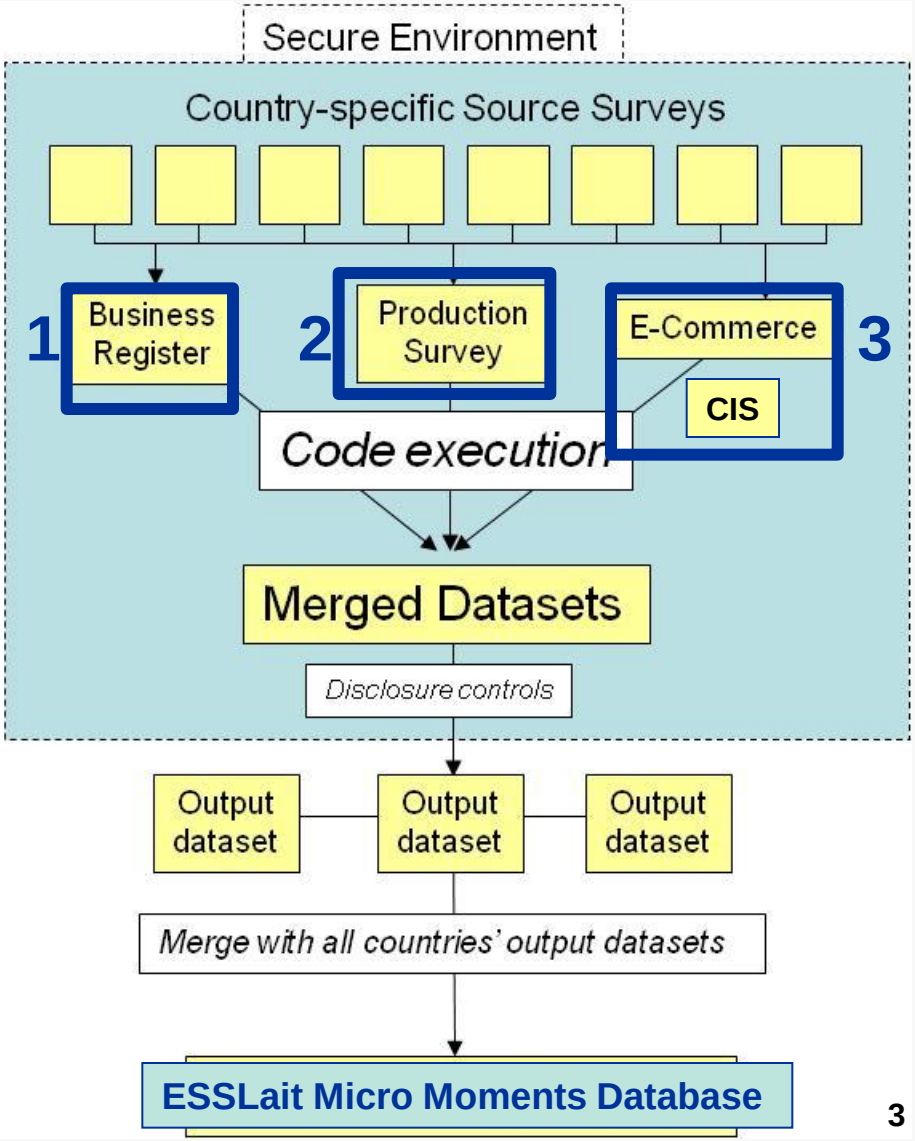
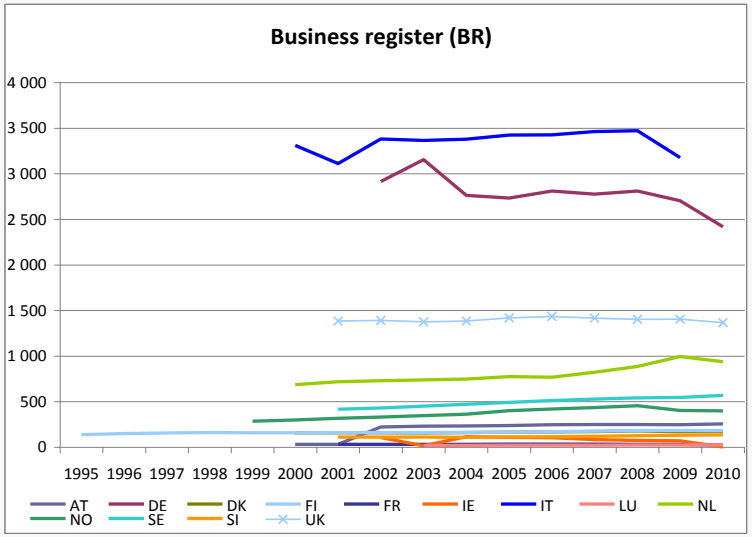
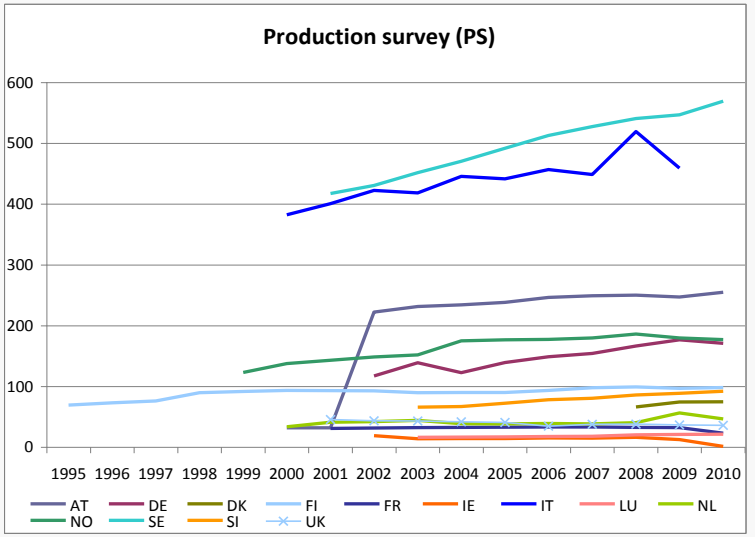


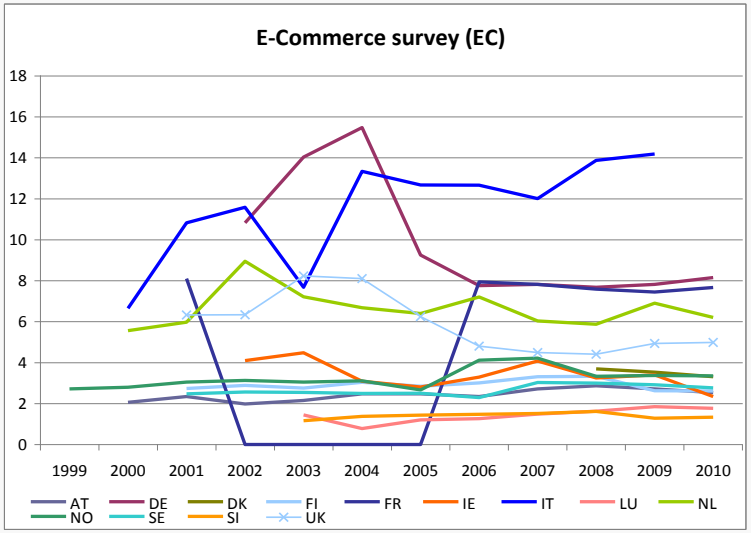
Data linking and statistical properties of linked datasets

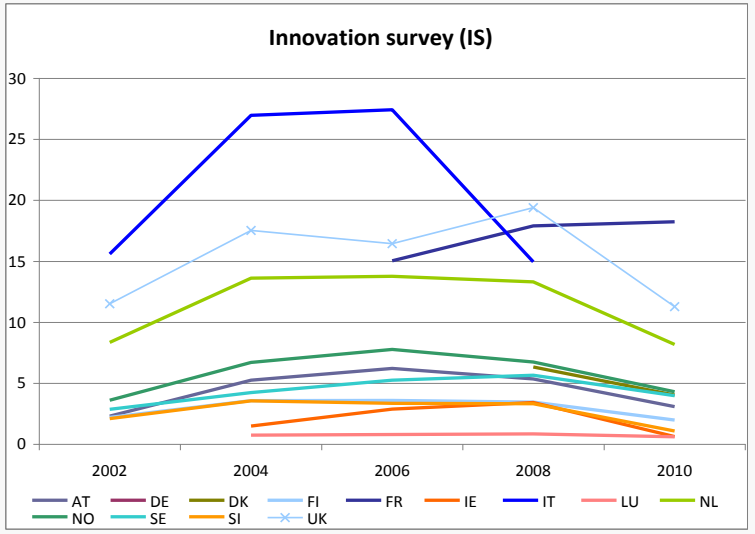
- Papers dealing with selection bias and sample representativeness in linked datasets: Chesher and Nesheim (2006), Ritchie (2004), Fazio et al. (2006)
- Multiple sources of bias
- Longitudinal data integrity issues
- Long-term solutions to dealing with sample bias in linked datasets
- Fazio et al. (2006) – short-term approaches:
  - Re-weighting
  - Conditioning variables
  - Banded regressions
- Our paper deals with the representativeness of single indicators in the process of linking different microdata sets in the short-run

Coverage over time – Number of firms per sample, for the source datasets (in thousands)

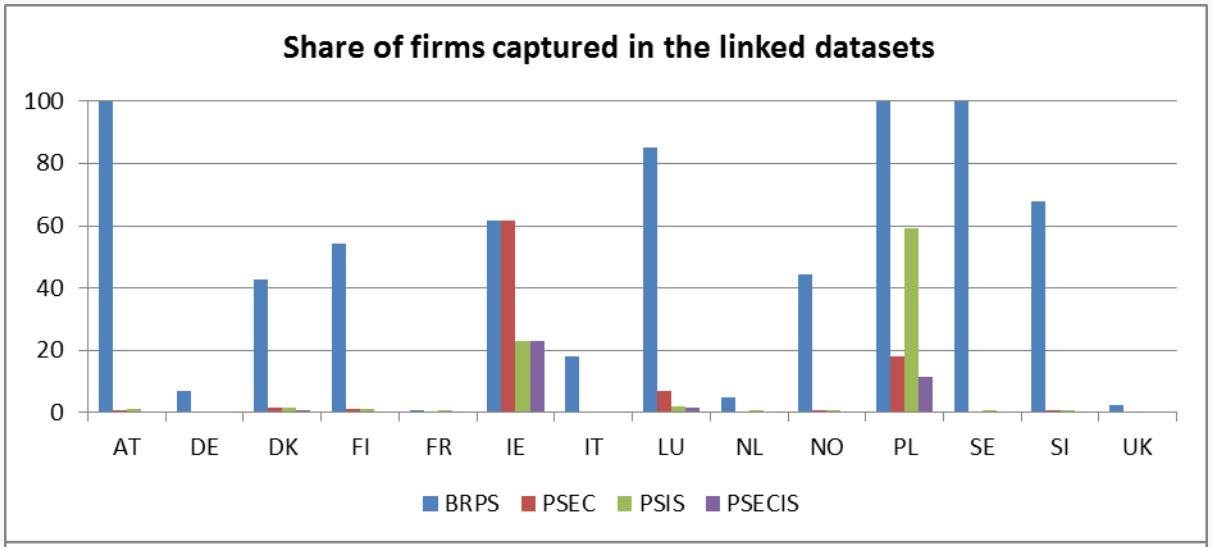


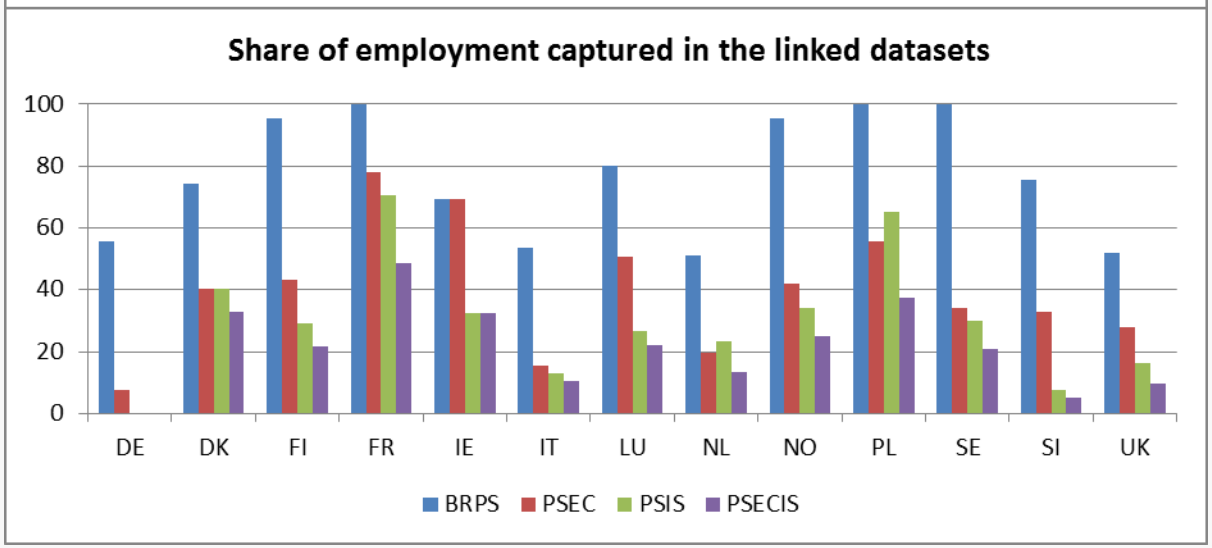






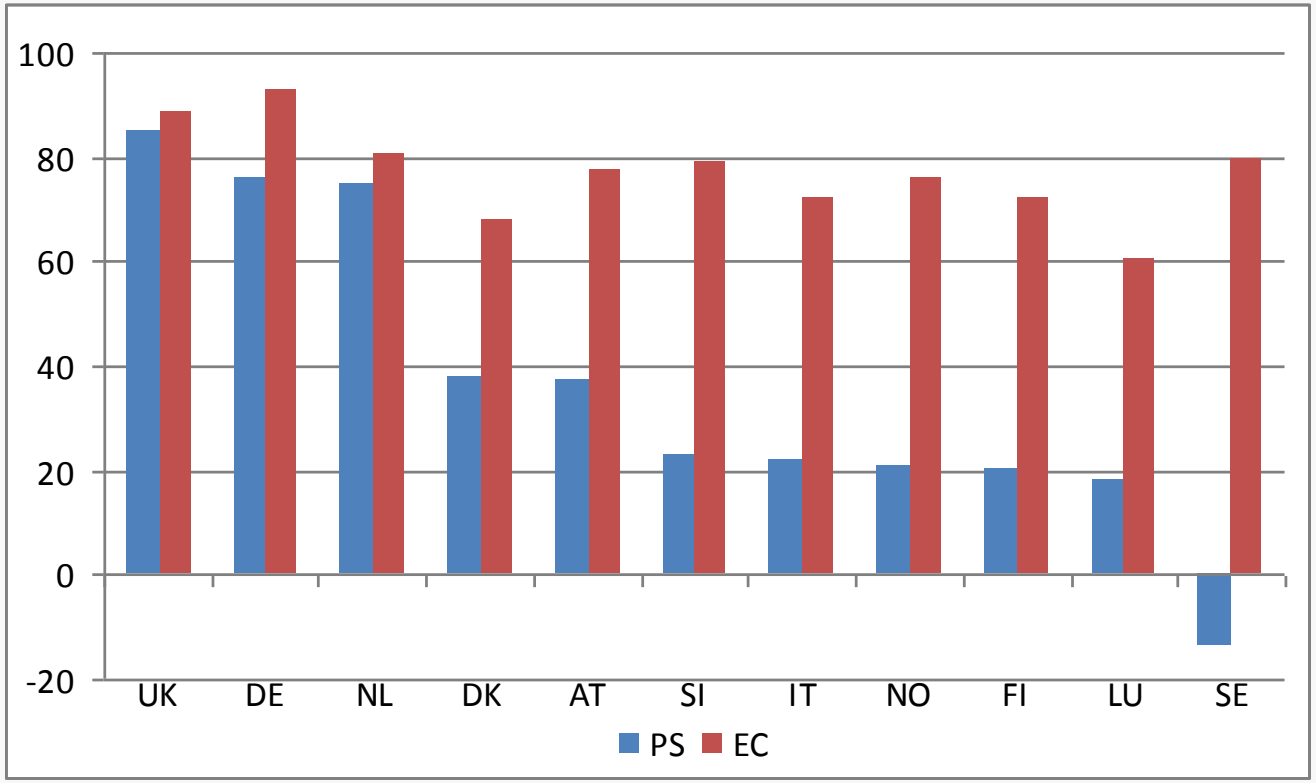
Coverage across samples, throughout the merging procedure (proportion of BR)





Attrition

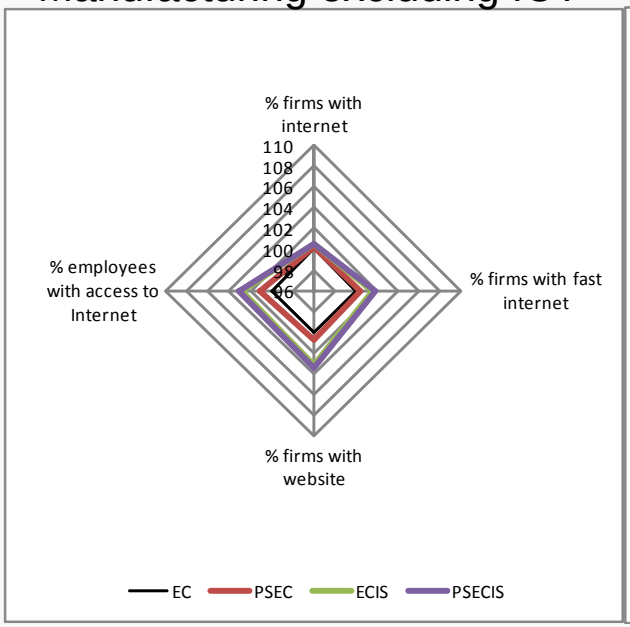
- Non-survival rates between 2003 and 2010 in the PS and EC



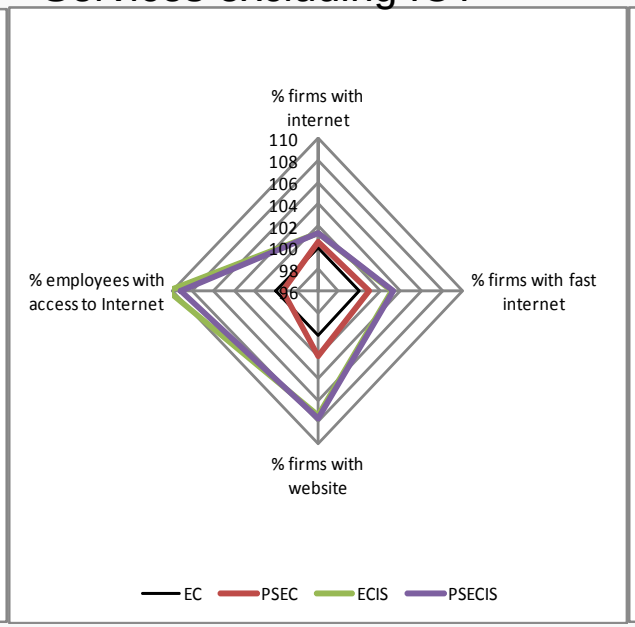
ICT indicators across samples

- Average ICT intensities in merged datasets, by industry across countries
- EC 2010=100

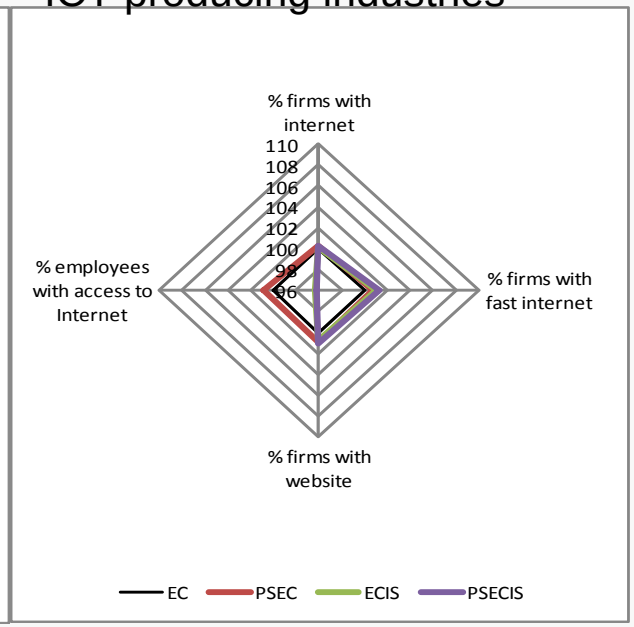
Manufacturing excluding ICT



Services excluding ICT



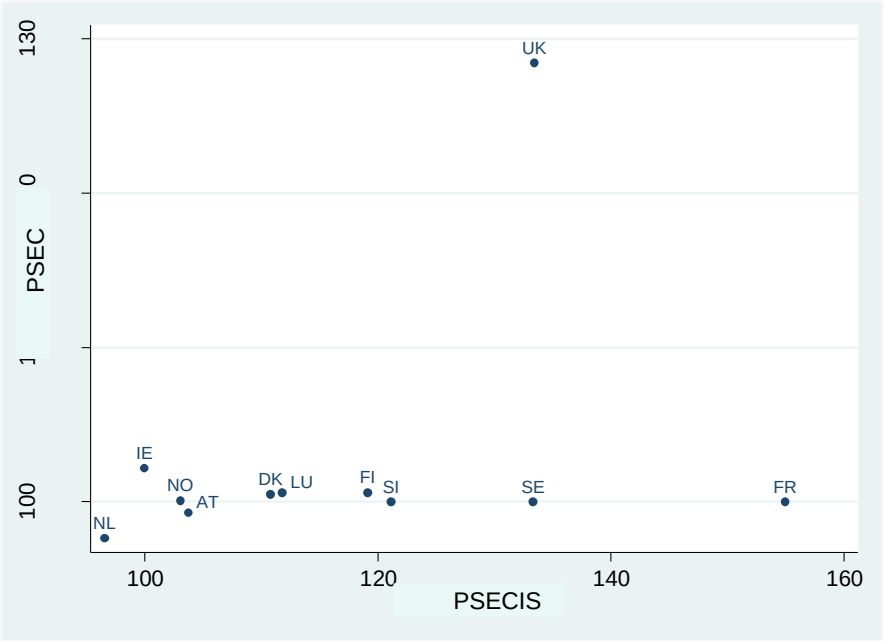
ICT producing industries



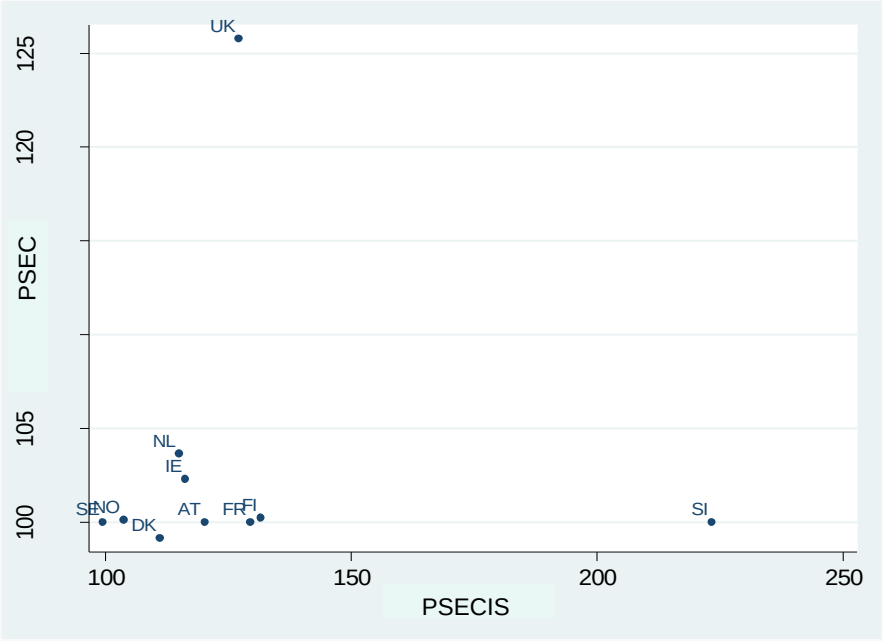
ICT indicators across samples

- Average ICT use in manufacturing (excluding ICT) across samples, as share of firms with e-sales

2006. Index, EC 2006=100



2010. Index, EC 2010=100



Ex-post control of selection bias

- Original weights become inappropriate after linking
- Reweighting – the variables become more representative of the underlying universe of firms
- Each descriptive Micro Moments dataset includes the aggregated average value of each variable as well as three different sets of re-weights for key variables:
  - First set: based on data available in the business register
  - Second set: constructed using firm size (measured as number of employees) at the sample and population levels
  - Third set: a combination of the business register and the firm size weights

Ex-post control of selection bias

- Comparison of mean values for employment for the PS and PSEC samples, by different reweighting approaches (in thousands):

Country	PS, BR reweighting	PSEC, no reweighting	PSEC, BR reweighting	PSECIS, no reweighting	PSECIS, BR reweighting
DK	1 010	509	1 070	207	413
IE	766	237	741	69	308
NO	1 110	468	1 140	221	635

- Comparison of mean values for AESELL for the PS and PSEC samples, by different reweighting approaches:

Country	EC, BR reweighting	PSEC, no reweighting	PSEC, BR reweighting	PSEC, empl. reweighting	PSEC, BR & empl. rewg.
FI	0.20	0.31	0.20	0.55	0.44
NO	0.27	0.34	0.27	0.46	0.40
SE	0.25	0.35	0.25	0.60	0.47

Industry-level analysis

- Consider the type of relationship examined when deciding which set of weights should be used (if any):
  - firm-level relationships – un-weighted variables can be used
  - macroeconomic relationships – employment-based weights seem the best at emphasizing the relevance of larger firms
- Comparison of reweighting schemes in pooled regressions:

Dependent variable: Labour productivity (appropriately weighted)

Reweighting scheme \ Sample	PS	PSEC	PSIS	PSECIS
HKpct, no reweighting	-0.18	0.12	0.24	0.13
(t-stat)	(1.51)	(0.84)	(1.57)	(0.84)
HKpct, BR reweighting	-0.46	-0.14	-0.39	-0.60
(t-stat)	(3.38)	(0.56)	(1.35)	(2.55)
HKpct, empl. reweighting	0.38	0.65	0.72	0.84
(t-stat)	(3.40)	(5.11)	(5.65)	(5.96)
HKpct, BR & empl. reweighting	0.28	0.39	0.35	2.55
(t-stat)	(2.55)	(3.06)	(2.45)	(3.28)

Firm-level analysis

- Firm-level regressions with ICT intensive human capital across samples

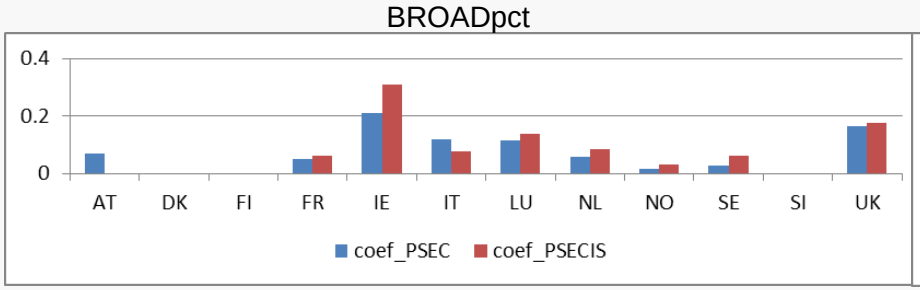
Dependent variable: (log) Labour productivity						
	Sample					
		PS			PSEC	
Country	FI	NO	SE	FI	NO	SE
HKITpct	0.260	0.178	0.135	0.280	0.307	0.318
t-stat	(43.31)	(30.70)	(26.46)	(13.00)	(5.17)	(8.06)
R-squared	0.884	0.751	0.602	0.879	0.899	0.808
Observations	171983	430460	551106	10651	3722	7344
BROADpct				0.045	0.041	0.101
t-stat				(4.57)	(2.54)	(8.32)
ECpct				0.015	0.016	-0.001
t-stat				(1.28)	(1.34)	(-3.26)

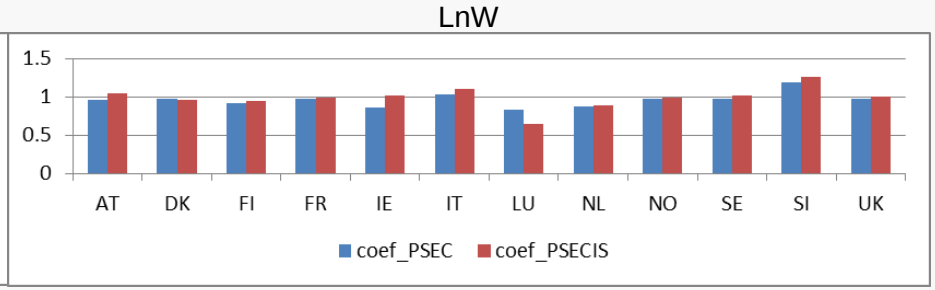
- Merging one smaller sample survey with a larger dataset or census does not seem to distort regression estimates, but may change them slightly

Firm-level analysis

- Firm level regressions with ICT intensity variable across samples

	Country	AT	DK	FI	FR	IE	IT	LU	NL	NO	SE	SI	UK
BROADpct	coef_PSEC	0.068	-0.001	0.011	0.049	0.209	0.117	0.113	0.058	0.015	0.028	-0.004	0.165
	coef_PSECIS	0.026	0.003	0.017	0.061	0.308	0.077	0.139	0.083	0.029	0.063	-0.004	0.175
LnW	coef_PSEC	0.964	0.969	0.915	0.974	0.862	1.024	0.83	0.872	0.978	0.973	1.185	0.979
	coef_PSECIS	1.049	0.96	0.942	0.989	1.021	1.095	0.646	0.885	0.99	1.013	1.253	1.006
R-squared	PSEC	0.92	0.93	0.93	0.95	0.83	0.89	0.79	0.92	0.94	0.94	0.91	0.87
	PSECIS	0.94	0.92	0.91	0.95	0.84	0.91	0.84	0.9	0.92	0.94	0.93	0.85





Conclusions

- Indicators become upward biased as more surveys are linked
- Specific values of ICT indicators appear less biased:
  - if the PS in a country is large or a census, if a sample co-ordination system is in use
  - for ICT and manufacturing firms
- Re-weighting can shift variable values from the smaller linked dataset closer to the larger dataset
- Inconclusive results for the use of re-weighting in industry-level regressions
- Firm-level estimations seem robust against selection bias (Fazio et al. (2006), Ritchie (2004))
- The major effect is a slightly higher estimate that does not significantly change the interpretation of results