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High-growth firms: Some facts and challenges ahead

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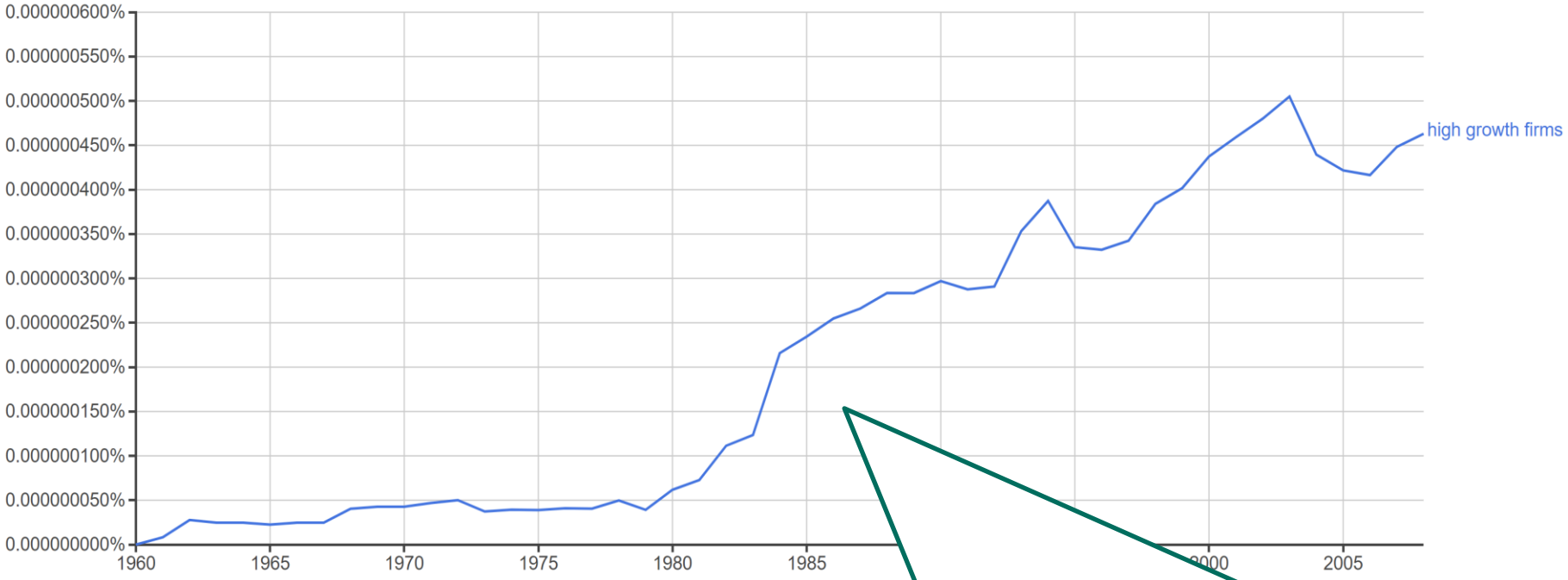


Seminal David L. Birch's studies on job creation in the U.S. (1979, 1981, 1987)

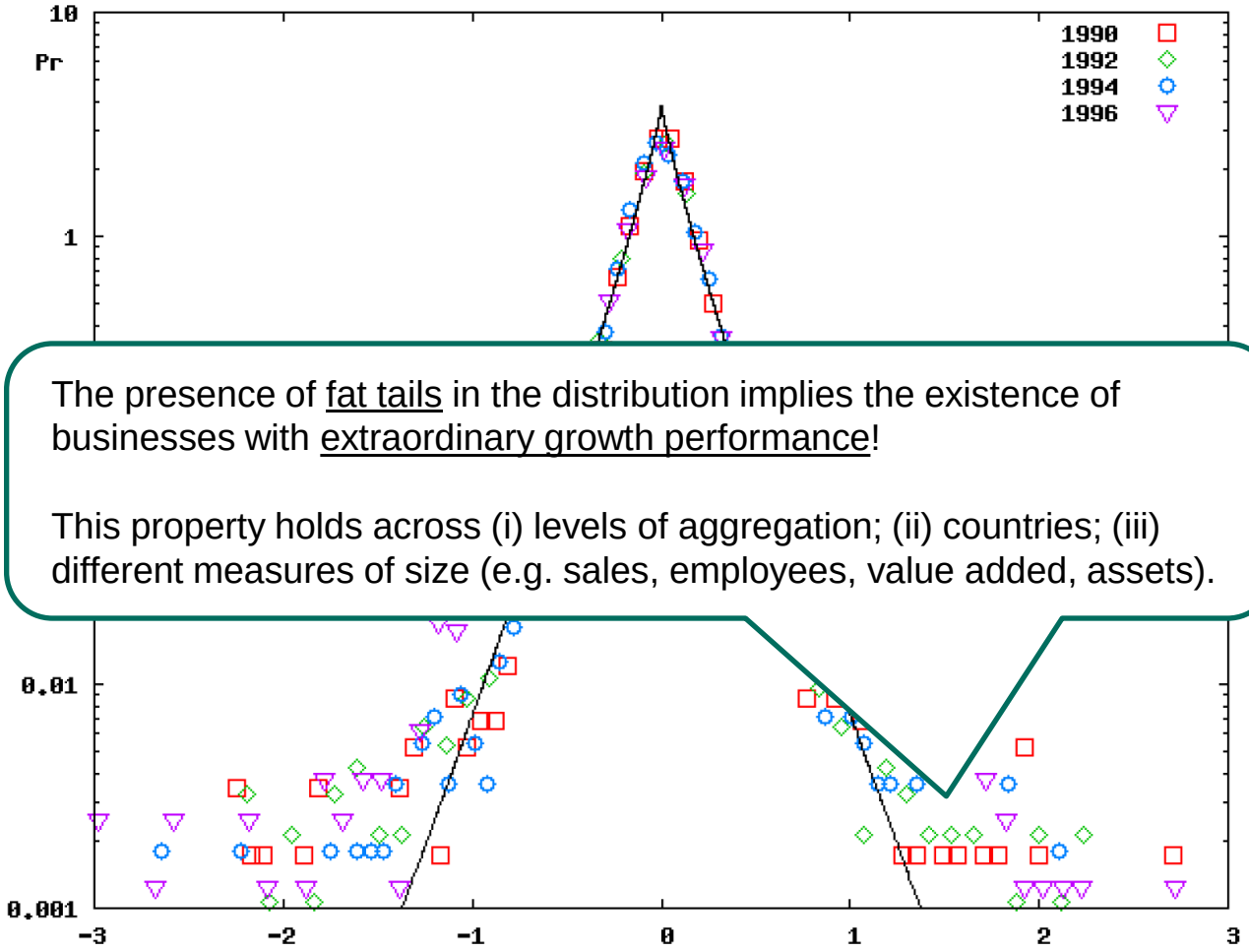
"[d]uring the period 1981-1985, firms with fewer than 20 employees accounted for 88.1% of overall employment growth" (Birch 1987)

- Economists: market selection and reallocation of resources (Bartelsman, Scarpetta, and Schivardi 2005 ICC; Haltiwanger, Jarmin, and Miranda 2013 REStat; Dosi, Moschella, Pugliese, and Tamagni 2015 SBE)
- Management scholars: understanding the "best practices", sales growth and durable competitive advantages (Teece 2007 SMJ; Katkalo, Pitelis, and Teece 2010 ICC)
- Practitioners (managers and consultants): replication of these practices within their own business or businesses of their clients

- HGFs at the center of the policy debate (see Chapter 5 of the EU competitiveness report 2014)
- Shane (2009): Why encouraging more people to become entrepreneurs is bad public policy …. *"[t]he typical start-up is not innovative creates few jobs, and generates little wealth [...] policy needs to focus more explicitly on generating more high growth firms."*
- Policy initiatives (Stangler 2010 KF; Mason and Brown 2013 SBE)
  - Revising the functioning of labour markets
  - Reducing barriers that prevent firms from expanding
  - Stimulating innovation
  - `Employment Package' part of the Europe 2020 strategy

Presentation objectives

- Explain why some firms grow more than others
  - Theoretical guidelines
  - A guide through some empirical evidences
- Five challanges for researchers
  - Challenge #1 – Data quality and arbitrary choices
  - Challenge #2 – Methodological considerations
  - Challenge #3 – The role of innovation
  - Challenge #4 – Persistent high-growth performance
  - Challenge #5 – Long-term performance of HGFs



The presence of fat tails in the distribution implies the existence of businesses with extraordinary growth performance!

This property holds across (i) levels of aggregation; (ii) countries; (iii) different measures of size (e.g. sales, employees, value added, assets).

Growth rates distributions in different years. Size measured in terms of Value Added. Italian aggregate manufacturing. *Source*: Dosi (2007)

What explains differences in growth rates?

Gibrat Model

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- Gibrat's book (*Les Inégalités Economiques*) published in Paris in 1931 contained the first formal model of the dynamics of firm size and industry structure
- Gibrat observed that the size distribution of French manufacturing establishments followed a skew distribution that resembled a log-normal
- What is the underlying growth process responsible for generating such a distribution?

Let s_t be the size of a firm at time t, and let ε_t be a random variable denoting the proportionate rate of growth between period $t-1$ and period t, so that:

$$s_t - s_{t-1} = \varepsilon_t s_{t-1}$$

$$s_t = (1 + \varepsilon_t)s_{t-1} = s_0 (1 + \varepsilon_1) (1 + \varepsilon_2) \dots (1 + \varepsilon_t)$$

We take logarithms in order to approximate $log(1 + \varepsilon_t)$ by ε_t

$$log(s_t) \approx log(s_0) + \varepsilon_1 + \varepsilon_2 + \dots + \varepsilon_t = log(s_0) + \sum^{t} \varepsilon_s$$

When t becomes l

$$log(s_t) \approx \sum_{s=1}^{t} \varepsilon_s$$

Realizations of i.i.d. normally distributed growth shocks leads to the emergence of a lognormal firm size distribution

A firm's size at time *t* can be explained purely in terms of its idiosyncratic history of multiplicative shocks

- Gibrat's law (also known as Law of Proportionate Effect) maintains that firm growth rates are random and independent of firm size

- Implications
  - High-growth events are driven by "mere chance" or "good luck"
    → Little room for determinants and policy initiatives
  - High-growth performance cannot be correlated over time
    → Inability of firms to sustain high-growth rates

Empirical test:

$s_{i,\,t+1} = \alpha + \theta_i\, s_{i,\,t} + \varepsilon_{i,\,t}$

where s represents the size of the firm i at time t and $t+1$, α a sector-wide component of growth, and ε an independent identically and normally distributed random variable with zero mean

Three scenarios:

$\theta_i > 1$ → tendency toward concentration

$\theta_i < 1$ → regression to mean and "optimal size"

$\theta_i = 1$ → <u>firm growth is independent of size</u>

STUDY	METHODOLOGY	CONTROLS	DATA	RESULTS
Mansfield, 1962	Logarithmic specification	None	About 1,000 US firms in steel, petroleum and tires over 1916-57.	Gibrat's law fails to hold in about 50% of cases: smaller firms grow faster.
Brusco - Giovannetti - Malagoli, 1979	Logarithmic specification	None	1,250 Italian firms in ceramics, mechanical and textiles over 1966-77.	Gibrat's law fails to hold in most cases when only survived firms are included: smaller firms grow faster.
Kumar, 1985	Logarithmic specification	Persistence	1,747 UK quoted firms in manufact. and services over 1960-76.	Smaller firms grow faster.
Hall, 1987	Growth rate regression	Sample selection, heteroskedasticity	1,778 US manufact. firms over 1972-79 and 1976-83 (only incumbents)	Smaller firms grow faster.
Evans, 1987a and 1987b	Growth rate regression	Sample selection, heteroskedasticity	42,339 US manufacturing firms, subdivided in 100 sectors.	Smaller firms grow faster in 89 industries out of 100.
Contini - Revelli, 1989	Growth rate regression	Persistence	1,170 Italian firms over 1980-86 (only incumbents).	Moderate evidence that smaller firms grow faster.
Dunne – Roberts - Samuel				
Wagner, 1992				evidence that smaller
Dunne - Hughes, 1994				
Mata, 1994	Growth rate regression	Sample selection, heteroskedasticity	3,308 Portuguese manufacturing firms over 1983-87 (only entrants).	Smaller firms grow faster.
Solinas, 1995	Logarithmic specification	None	5,128 Italian firms over 1983-88 (only entrants).	Once the sample is limited to companies with at least one employee, smaller firms grow faster.
Hart - Oulton, 1996	Logarithmic specification	Heteroskedasticity, persistence	87,109 UK companies over 1989-93 (only incumbents).	Smaller firms grow faster.
Tschoegl, 1996	Logarithmic specification, growth rate regression	Heteroskedasticity, persistence	66 Japanese regional banks over 1954-93 (only incumbents).	Moderate evidence that smaller firms grow faster.
Weiss, 1998	Logarithmic specification	Sample selection, heteroskedasticity, persistence	43,685 Austrian farms over 1986-90 (only incumbents).	Smaller firms grow faster.
Harhoff – Stahl - Woywode, 1998,	Growth rate regression	Sample selection, heteroskedasticity	10,902 West German firms over 1989-94 (only incumbents).	Smaller firms grow faster.
Almus - Nerlinger, 1999	Logarithmic specification	Persistence	39,355 West German manufacturing firms over 1989-96 (only entrants).	Smaller firms grow faster.

Abundant empirical evidence suggests that Gibrat's law fails, mostly because of a negative dependence of growth rates on size and age!

Selected empirical studies on Gibrat's Law. *Source*: Lotti, Santarelli, and Vivarelli (2003)

Growth beyond Gibrat

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- Alternative models of firm growth
  - Firm-level heterogeneity, learning, selection (Jovanovic 1982 ECMA; Nelson and Winter 1982; Hopenhayn 1992 ECMA; Dosi, Marsili, Orsenigo, and Salvatore 1995 SBE)
  - Uncertainty arising from investment in research and exploration-type processes (Ericson and Pakes 1995 RES)
  - Frictions in the financial markets (Cooley and Quadrini 2001 AER)
  - Industry's exposure to trade (Melitz 2003 ECMA)
  - Exploitation of new business opportunities (Bottazzi and Secchi 2003 RAND)
  - Entry costs and size of the market (Asplund and Nocke 2006 RES)

- Three dimensions of the firm (productivity, profitability, and financial status) are linked with the process of growth
- Idiosyncratic shock (technology, organizational practices, etc.) typically as the first driver → increase of (relative) productivity
- The increase of productivity leads to an increase of profits and market shares
- Financial market imperfections allow some firms to dispose of more resources needed to invest and generate new growth opportunities
- HG events are the results of sounder operating capability!

Determinants

- Two types of determinants: (i) External or institutional factors; (ii) Micro-level and specific to the firm
- External factors
  - Geographical area (Gilbert, McDougall, and Audretsch 2006 JoM; Acs and Mueller 2008 SBE)
  - Technological districts (Acs and Armington 2006)
  - Policy environment such as taxation of entrepreneurial income, incentives for investments and capital accumulation, wage setting and labor market regulations (Davidsson and Henrekson 2002 SBE; Garsaa and Levratto 2015 SBE; Mason and Brown 2013 SBE)
  - Macroeconomic factors such as business cycles (Campello, Giambona, Graham, and Harvey 2011 RFS; Criscuolo, Gal, and Menon 2014 OECD; Peters et al. 2014 EU Report)

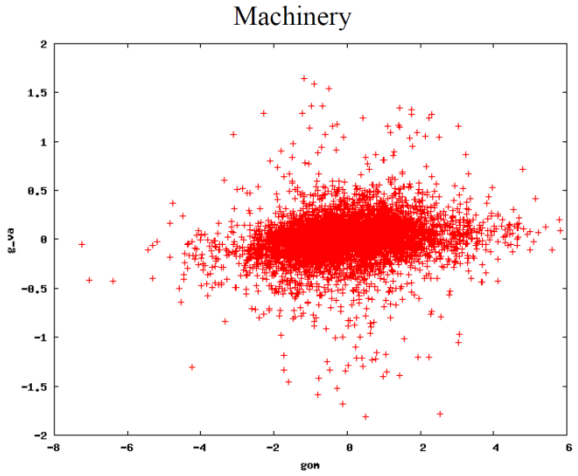
Internal factors 1/2

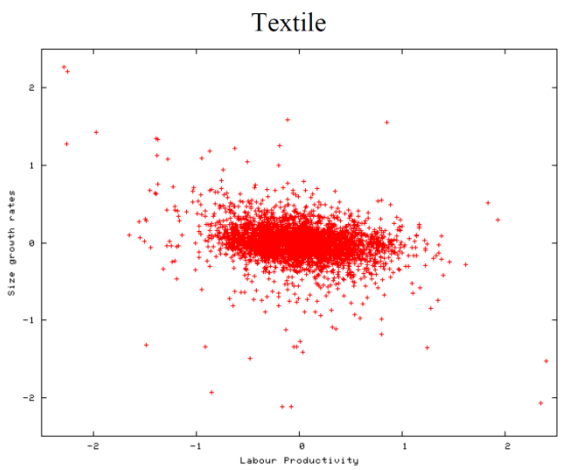
- Demographic characteristics: age, size, industry (Schreyer 2000 OECD; Delmar, Davidsson, and Gartner 2003 JBV; Haltiwanger, Jarmin, and Miranda 2013 REStat; Criscuolo, Gal, and Menon 2014 OECD; Daunfeldt, Elert, and Johansson 2015 ICC)
- Operating performance: productivity, profitability, financial conditions (Bottazzi, Dosi, Lippi, Pammolli, and Riccaboni 2001 IJIO; Coad 2007 SCED; Bottazzi, Tamagni, and Secchi 2008 ICC; Delmar, McKelvie, and Wennberg 2013 TCNV; Bottazzi, Tamagni, and Secchi 2014 SBE; Bianchini, Bottazzi, and Tamagni 2017 SBE)
- Innovation (Coad and Rao 2008 RP; Holzl 2009 SBE; Lachenmaier and Rottmann 2011 IJIO; Colombelli, Krafft, and Quatraro 2013 ICC; Harrison, Jaumandreu, Mairesse, and Peters 2014 IJIO; Bianchini, Pellegrino, and Tamagni 2016)

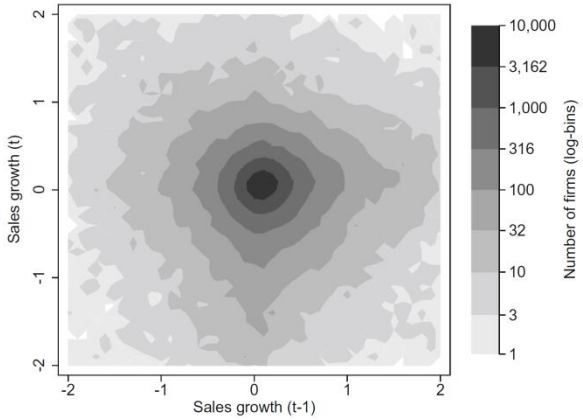
Internal factors 2/2

- Characteristics of the founder and/or founding team such as prior experience, educational background, gender, heterogeneity of background, size, and cohesiveness (Barringer, Jones, and Neubaum 2005 JBV; Wadhwa, Saxenian, Freeman, and Gereffi 2009 KF; Cohoon, Wadhwa, and Mitchell 2010 KF)
- Human and social capital such as network position, connections with other agents of the econsystem (Colombo and Grilli 2005 RP; Cohoon, Wadhwa, and Mitchell 2010 KF; Terjesen, Bosma, & Stam 2016 PAR)
- Organizational changes such as M&A and alliances (McKelvie and Wiklund 2010 ET&P; Mohr, Garnsey, and Theyel 2014 ICC)

- Heterogeneity of findings
- Extremely low explained variance!
- Inability to predict high-growth episodes
- *"[t]he most elementary `fact' about corporate growth thrown up by econometric work on both large and small firms is that firm size follows a random walk"* (Geroski 2002)







What can we do to improve our understanding?

Five challenges for researchers

Challenge #1: Data quality and arbitrary choices

- Data issues
  - Representativeness: "*We started with all firms that, in November 1996, […] had at least 20 employees*" (Delmar, Davidsson, and Gartner 2003 JBV)
  - Unit of observation: "*It is not entirely clear whether the business units reporting are enterprises or establishments*" (Holzl 2014 ICC)
  - Country-specific bias: "*Data [Netherlands 2001-2011] might be affected by breaks in the longitudinal structure of the business register*" (Criscuolo, Gal, and Menon 2014 OECD)
- Balanced vs. Unbalanced panel
  - "*We consider only continuing firms […]. Firms that entered midway through 1996 or exited midway through 2002 have been removed*" (Coad 2007 RIO)

- M&A
  - "*We exclude firms that have undergone any kind of modification of structure, such as merger or acquisition*" (Bottazzi, Coad, Jacoby, and Secchi 2011 AE)
- Dealing with real exit
  - "*Firms that terminated their operations during the period are excluded*" (Delmar, Davidsson, and Gartner 2003 JBV)
- Outliers

- High quality data: Comprehensive, longitudinal, cross-country harmonized datasets
- Consciousness
- Transparency
- Robustness analyses

Challenge #2: Defining high-growth

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- Three choices to make:
  - Focal variable: sales, employment, total assets, productivity, profits, etc. (see the discussion in Miller et al. 2013 OS)
  - Growth indicator: absolute, relative, log-difference, Birch index, DHS index, etc.
  - Time horizon : $s_{t+k} - s_t$, where k conventionally (but not necessarily) is 1
- HGFs according to OECD definition: "*All enterprises with average annualised growth greater than 20% per annum, over a three year period should be considered as high-growth enterprises. Growth can be measured by the number of employees or by turnover*"
- Not all HGFs are gazelles: "*All enterprises up to 5 years old with average annualised growth greater than 20% per annum, over a three year period, should be considered as gazelles*"

- In practice…
  - *"We thus define the HGFs as the 10% of the firms in the data set that exhibit the highest average annual increase in absolute employment"* (Davidsson and Henkerson 2002 SBE)
  - *"In order to be selected as a high-growth firm, we set the criterion that a firm had to be among the top 10% (cf. Storey, 1998) of all firms in terms of "annual average" on one, or more, of six growth indicators"* (Delmar, Davidsson, and Gartner 2003 JBV)
  - *"We use a relative cut-off methodology for gazelle counts and employ a relative cut-off point of the top 10 % and 5 % of growing SMEs"* (Holzl 2009 SBE)
  - *"We define as high-growth (HG) firms those companies whose average growth rate over the examined period falls into the top 10 % of the average growth rates distribution, in terms of at least one of the two growth measures (sales or number of employees)"* (Bianchini, Bottazzi, and Tamagni 2017 SBE)

- Sensitivity of results depending on which growth indicators are used to identify HGFs
  - Are HGFs the same firms irrespective of definition?
  - Is the economic contribution of HGFs the same irrespective of the definition?
  - Do relevant firm-level variables have the same influence on the probability of a firm being a HGF irrespective of the definition?

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Correlations between HGFs of different definitions over a seven-year period.
Source: Daunfeldt et al. (2014 JICT)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Absolute employment	1								
(2) Relative employment	0.2073*	1							
(3) Composite index	0.6874*	0.4726*	1						
(4) Absolute sales	0.4772*	0.1066*	0.3750*	1					
(5) Relative sales	0.0891*	0.3186*	0.2002*	0.0919*	1				
(6) Absolute value added	0.5822*	0.1278*	0.4526*	0.6084*	0.0804*	1			
(7) Relative value added	0.0803*	0.3191*	0.1853*	0.0553*	0.3911*	0.0700*	1		
(8) Absolute productivity	0.0059*	0.0183*	0.0135*	0.0826*	0.0815*	0.1327*	0.0720*	1	
(9) Relative productivity	−0.0041*	0.0220*	0.0043*	0.0130*	0.1588*	0.0197*	0.5171*	0.2113*	1

*denotes that the correlation is significant at the 1 % level

	Percentage contribution to			
	Economic growth	Employment growth	Productivity growth	Sales growth
Absolute employment	61,0	149,1	−1,6	55,3
Relative employment	17,4	61,9	−2,2	12,3
Composite index	51,3	122,9	−2,4	46,1
Absolute sales	70,7	106,2	6,7	84,2
Relative sales	10,7	35,5	8,3	11,1
Absolute productivity	24,0	−13,4	60,5	11,2
Relative productivity	3,3	−7,1	23,5	1,5
Absolute value added	89,1	112,4	14,6	64,7
Relative value added	10,5	30,4	10,1	7,5

The contribution of seven-year-HGFs to economic growth, employment, productivity and sales.
Source: Daunfeldt et al. (2014 JICT)

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Growth model with 95% confidence interval for B. *Source*: Delmar (2006)

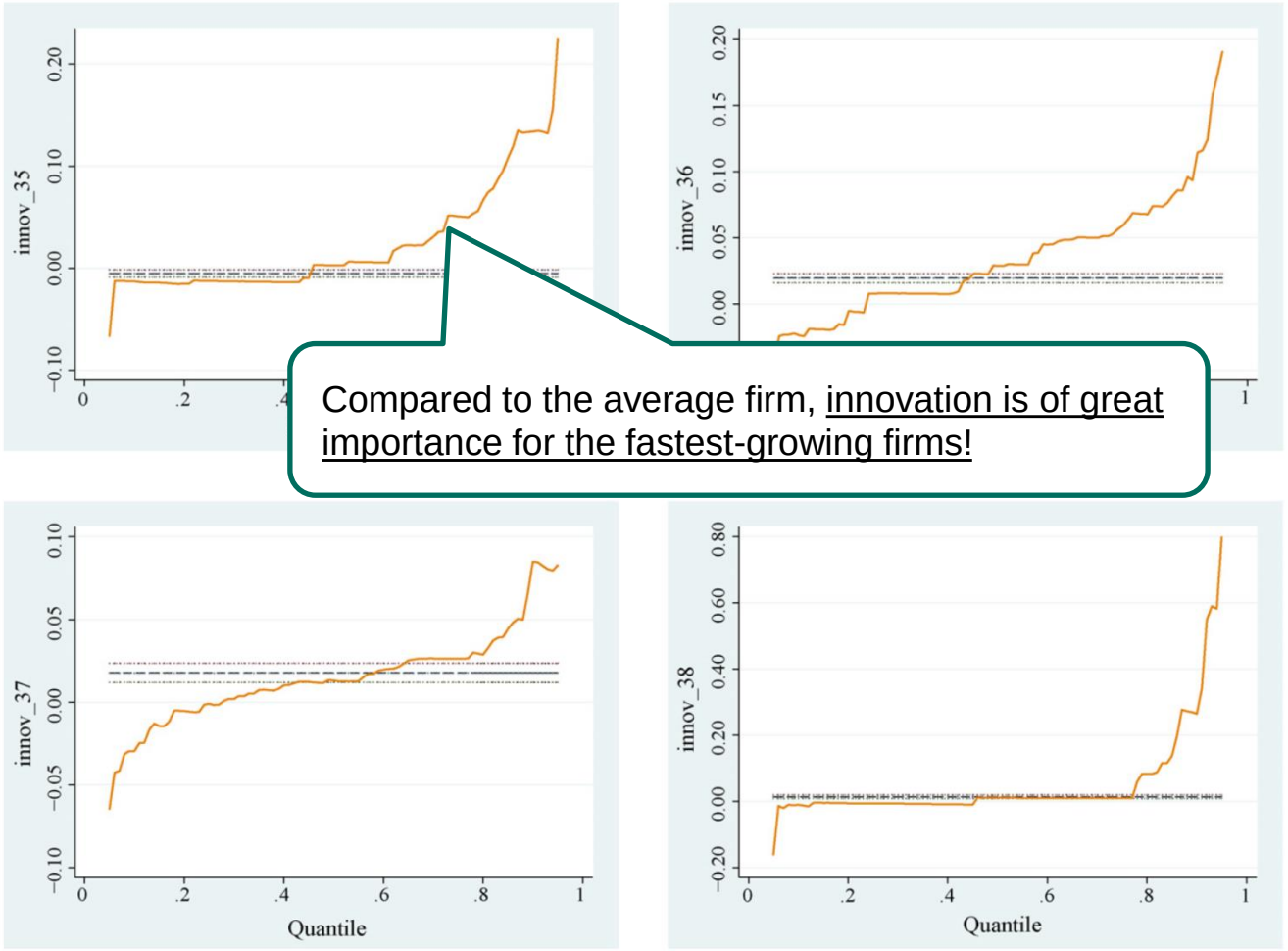
Growth measure	Variable	B	Lower bound	Upper Bound	Adj. R^2
Abs emplo	Constant	3.071	.345	5.797	.017
	Size	-.103	-.176	-.030	
Abs multiple	Constant	18.878	2.822	34.933	.005
	Competition	-3.464	-7.491	.562	
Abs sales	Constant	2.733	.761	4.705	.023
	Size	.086	.032	.141	
Rel emplo	Constant	.737	.163	1.311	.105
	Suppliers	.020	.011	.029	
	Birth year of entrepreneur	.016	.007	.026	
	Create	.253	.081	.425	
	Competition	-.115	-.198	-.032	
Rel multiple	Constant	.503	-.348	1.354	.106
	Suppliers	.038	.022	.054	
	Birth year of entrepreneur	.040	.022	.057	
	Create	.457	.140	.775	
Rel sales	Constant	.423	-.063	.909	.066
	Birth year of entrepreneur	.021	.011	.031	
	Suppliers	.017	.008	.027	

Note: A total of sixteen variables are tested with a forward stepwise selection procedure

- No generalization
- Consciousness (mostly at the policy-level) about high sensitivity of results
- Commonly accepted identification criteria (?)

Challenge #3: The role of innovation

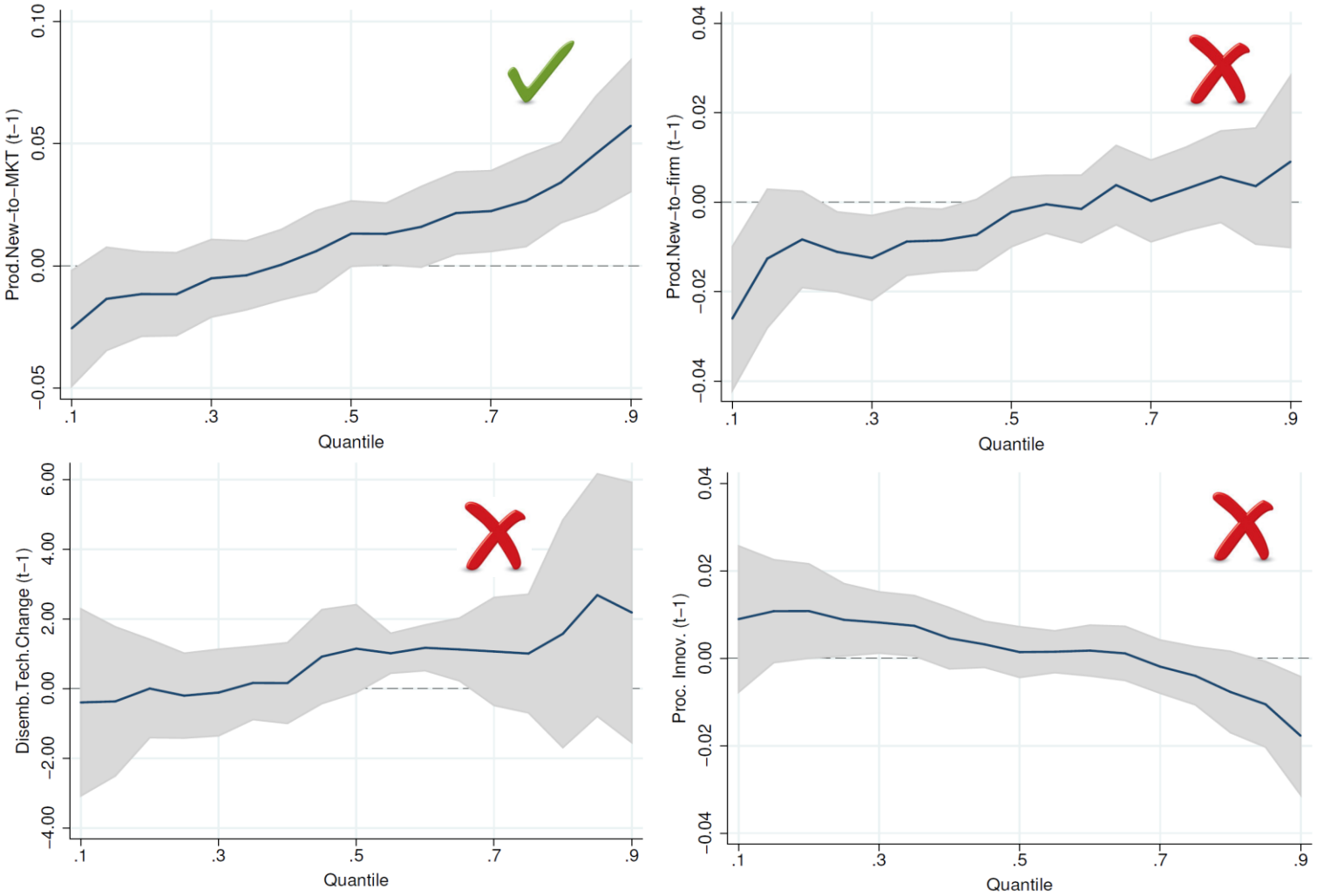
- Innovation as the key for firms wishing to expand their market shares
- The nexus between innovation and employment is very complex (see Vivarelli 2014; Calvino and Virgillito 2017 for extensive surveys)
- Empirical studies have for long failed to identify any strong link between innovation and (sales and employment) growth
- Beyond the effect on growth of the "average firm" → quantile regression techniques to disentangle the effect of innovation along the spectrum of the distribution of growth rates



Compared to the average firm, innovation is of great importance for the fastest-growing firms!

Variation in the coefficient on 'innovativeness' over the conditional quantiles.
Source: Coad and Rao (2008)

- … but many open questions
  - Methodological issues (cross-sectionality, endogeneity, etc.)
  - Are all innovation variables alike?
  - Role of moderating factors (age, size, sector, etc.)
  - Contribution of HGFs to the process of knowledge creation
  - Patterns of innovation and firm growth



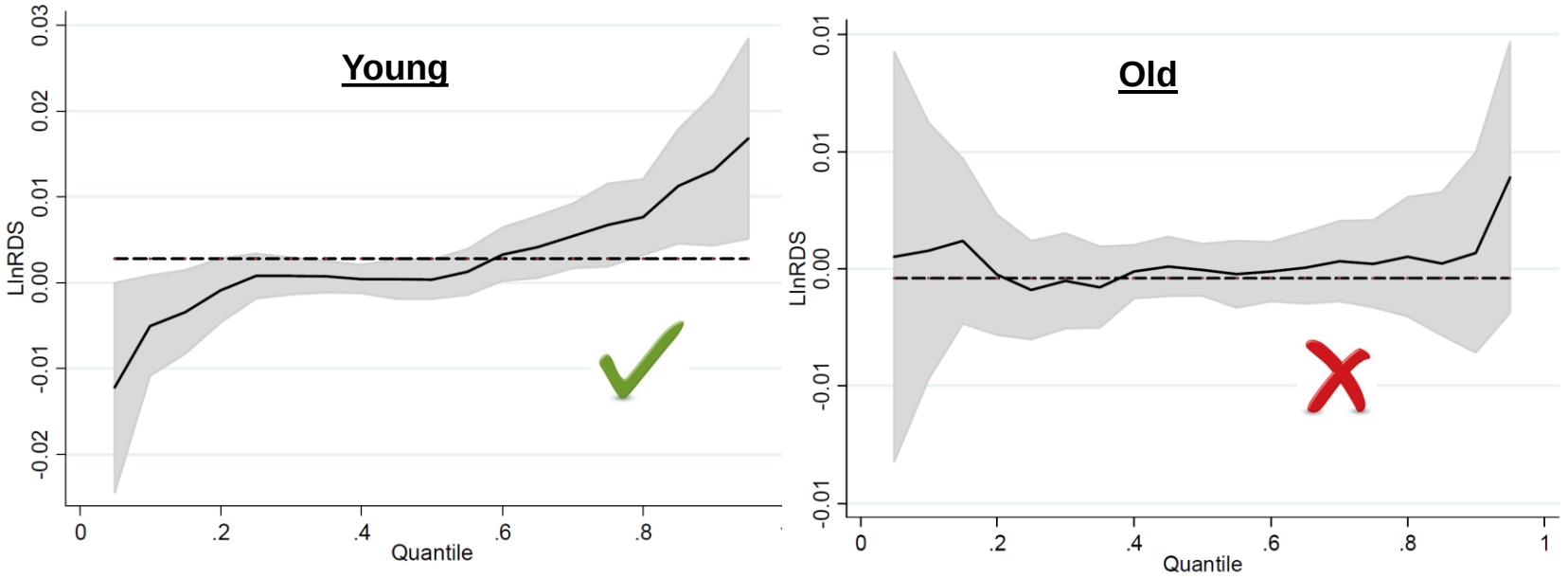
Fixed-Effects quantile regression estimates for different indicators. *Source*: Bianchini et al. (2016)

Strategy	INT	EXT	NEWP	PROC	Combination
STR_0	0	0	0	0	No inno
STR_1	0	0	0	1	PROC
STR_2	0	0	1	0	NEWP
STR_3	0	0	1	1	NEWP&PROC
STR_4	0	1	0	0	EXT
STR_5	0	1	0	1	EXT&PROC
STR_6	0	1	1	0	EXT&NEWP
STR_7	0	1	1	1	EXT&NEWP&PROC
STR_8	1	0	0	0	INT
STR_9	1	0	0	1	INT&PROC
STR_{10}	1	0	1	0	INT&NEWP
STR_{11}	1	0	1	1	INT&NEWP&PROC
STR_{12}					
STR_{13}					
STR_{14}					
STR_{15}					

Innovation str

Specific combinations of innovation activities foster HG performance:(i) product and process innovation; (ii) Intra-mural R&D and product innovation

Similar findings for developing countries in Goedhuys and Veugelers (2012 SCED)



Impact of R&D intensity on firm growth for young and old firms. *Source*: Coad et al. (2017)

Variable	Whole database		Manufacturing industries		Service industries	
	HGF (employees)	HGF (sales)	HGF (employees)	HGF (sales)	HGF (employees)	HGF (sales)
Probability of becoming an HGF						
Determinants of innovation						
RDeffort	0.0182**	0.0302***	0.0217**	0.0367***	0.0176	0.0217**
	(0.0073)	(0.0058)	(0.0105)	(0.0077)	(0.0107)	(0.0090)
intRD	0.230**	0.148**	0.390**	0.326***	−0.0165	−0.156
	(0.115)	(0.0753)	(0.162)	(0.101)	(0.175)	(0.129)
extRD	0.0187	0.0509	0.0529	0.0534	0.0002	0.0734
	(0.0443)	(0.0338)	(0.0567)	(0.0400)	(0.0721)	(0.0648)

Probability of becoming HGF. *Source*: Sagarra and Teruel (2014)

	Sales growth ($t-1$)	Knowledge coherence ($t-1$)	Knowledge capital ($t-1$)	Cognitive distance ($t-1$)	Related variety ($t-1$)	Unrelated variety ($t-1$)	Knowledge variety ($t-1$)	Number of observations
Sales growth	0.101***	0.						
	(0.008)	0.						
Knowledge coherence	−0.021***	−0.						
	(0.007)	0.						
Knowledge capital	0.013***	0.						
	(0.003)	0.005)	(0.0		.015)	(0.022)	(0.041)	
Cognitive distance	−0.008***	0.002		.013**	0.004	−0.012	0.057	1288
	(0.003)	0.004)	(0.009)	(0.005)	(0.014)	(0.019)	(0.037)	
Related variety	0.0004	0.010	0.130***	0.020**	−0.240***	−0.021	0.195***	1366
	(0.005)	0.007)	(0.017)	(0.010)	(0.024)	(0.033)	(0.063)	
Unrelated variety	−0.00006	−0.0001	0.004	0.003	0.042**	−0.072***	0.015	1366
	(0.004)	0.005)	(0.013)	(0.008)	(0.019)	(0.027)	(0.051)	
Knowledge variety	0.005**	0.001	0.081***	−0.010**	0.026**	0.036**	−0.239***	1366
	(0.002)	(0.003)	(0.008)	(0.004)	(0.011)	(0.016)	(0.030)	

Notes: Bootstrapped standard errors between parentheses. $^{*}P<0.1$; $^{**}P<0.05$; $^{***}P<0.01$.

"The empirical results suggest that within the group of HGFs, increasing sales growth rates stimulate the creation of new technological knowledge and also drive search behaviors characterized by the screening of complementary fields across the technology landscape that are not too far from the firm's existing technological competences."

Sales growth and properties of knowledge; results of VAR estimation. *Source*: Colombelli et al. (2013)

Time	*Firm A*	*Firm B*	*Firm C*	*Firm D*	*Firm E*	*Firm F*
1	Inno = 0	Inno = 1	Inno = 1	Inno = 0	Inno = 1	Inno = 0
2	Inno = 0	Inno = 0	Inno = 1	Inno = 0	Inno = 1	Inno = 1
3	Inno = 0	Inno = 1	Inno = 1	Inno = 0	Inno = 0	Inno = 0
4	Inno = 0	Inno = 0	Inno = 1	Inno = 1	Inno = 1	Inno = 1
5	Inno = 0	Inno = 0	Inno = 1	Inno = 0	Inno = 0	Inno = 1
6	.	.	.	Inno = 0	Inno = 0	Inno = 1
7	.	.	.	Inno = 0	Inno = 1	Inno = 0
8	.	.	.	Inno = 1	Inno = 1	Inno = 1
9	.	.	.	Inno = 0	Inno = 0	Inno = 1
10	.	.	.	Inno = 0	Inno = 0	Inno = 1
Pers_Inno	0	0,4	1	0.2	0.5	0.7

Measuring persistence in innovation with a simple indicator. *Source*: Bianchini and Pellegrino (2017)

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Dep.Var. is GRE	(1)	(2)	(3)	(4)	(5)	(6)
Product $_{t-1}$	0.0447*					
	(0.023)					
Pers. Product $_{t-1}$		0.1705***				
		(0.058)				
Process $_{t-1}$			0.0379*			
			(0.020)			
Pers. Process $_{t-1}$						
Product&Process $_{t-1}$					)396	
					025)	
Pers. Product&Process $_{t-1}$						0.0964*
						(0.054)
ln(Age)$_t$	-0.0553***	-0.0598***	-0.0505***	-0.0478***	-0.0552***	-0.0540***
	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
ln(Labor productivity) $_{t-1}$	0.0600*	0.0627*	0.0643*	0.0576*	0.0664**	0.0685**
	(0.033)	(0.033)	(0.036)	(0.034)	(0.034)	(0.033)
Other controls $_{t-1}$	Not sign	Not sign	Not sign	Not sign	Not sign	Not sign
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.305	0.212	0.269	0.488	0.179	0.282
Sargan	0.172	0.143	0.074	0.149	0.161	0.240
Hansen	0.273	0.231	0.216	0.256	0.238	0.252
Obs	22,795	22,795	22,795	22,795	22,795	22,795

Notes: Robust standard errors in parenthesis: ***, ** and * indicate significance at 1%, 5% and 10% level, respectively. We report p-values of Arellano-Bond test for first and second order serial correlation, AR(1) and AR(2), together with p-values of Sargan and Hansen tests for overidentifying restrictions.

Persistence in product innovation boosts the process of employment growth

Innovation, persistence of innovation, and employment growth. *Source*: Bianchini and Pellegrino (2017)

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Dep.Var. is GRE	(1)	(2)	(3)	(4)	(5)	(6)
Product $_{t-1}$	0.0447*					
	(0.023)					
Pers. Product $_{t-1}$		0.1705***				
		(0.058)				
Process $_{t-1}$			0.0379*			
			(0.020)			
Pers. Process $_{t-1}$				0.0005		
				(0.038)		
Product&Process $_{t-1}$					0.0396	
					(0.025)	
Pers. Product&Process $_{t-1}$						0.0964*
						(0.054)
ln(Age)$_t$	-0.055					0.0540***
	(0.01					(0.016)
ln(Labor productivity) $_{t-1}$	0.0600*	0.0627*	0.0643*	0.0576*	0.0664**	0.0685**
	(0.033)	(0.033)	(0.036)	(0.034)	(0.034)	(0.033)
Other controls $_{t-1}$	Not sign	Not sign	Not sign	Not sign	Not sign	Not sign
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.305	0.212	0.269	0.488	0.179	0.282
Sargan	0.172	0.143	0.074	0.149	0.161	0.240
Hansen	0.273	0.231	0.216	0.256	0.238	0.252
Obs	22,795	22,795	22,795	22,795	22,795	22,795

Notes: Robust standard errors in parenthesis: ***, ** and * indicate significance at 1%, 5% and 10% level, respectively. We report p-values of Arellano-Bond test for first and second order serial correlation, AR(1) and AR(2), together with p-values of Sargan and Hansen tests for overidentifying restrictions.

Persistence in process innovation has no effect on the process of employment growth

Innovation, persistence of innovation, and employment growth. *Source*: Bianchini and Pellegrino (2017)

Research should progress on (at least) four fronts:

- Innovation strategies and HG performance: (i) simultaneous combinations of activities, (ii) sequential adoption of simple or complex strategies, (iii) existence of complementarities
- Contribution of HGFs to the process of knowledge creation: (i) properties of knowledge generated; (ii) actors involved in the process; (iii) the role of institutional factors
- Patterns of innovation and HG performance: (i) persistence of innovation; (ii) virtuous cycles innovation-growth
- Theory behind moderating factors (age and industry *in primis*)

Challenge #4: Persistence of HG performance

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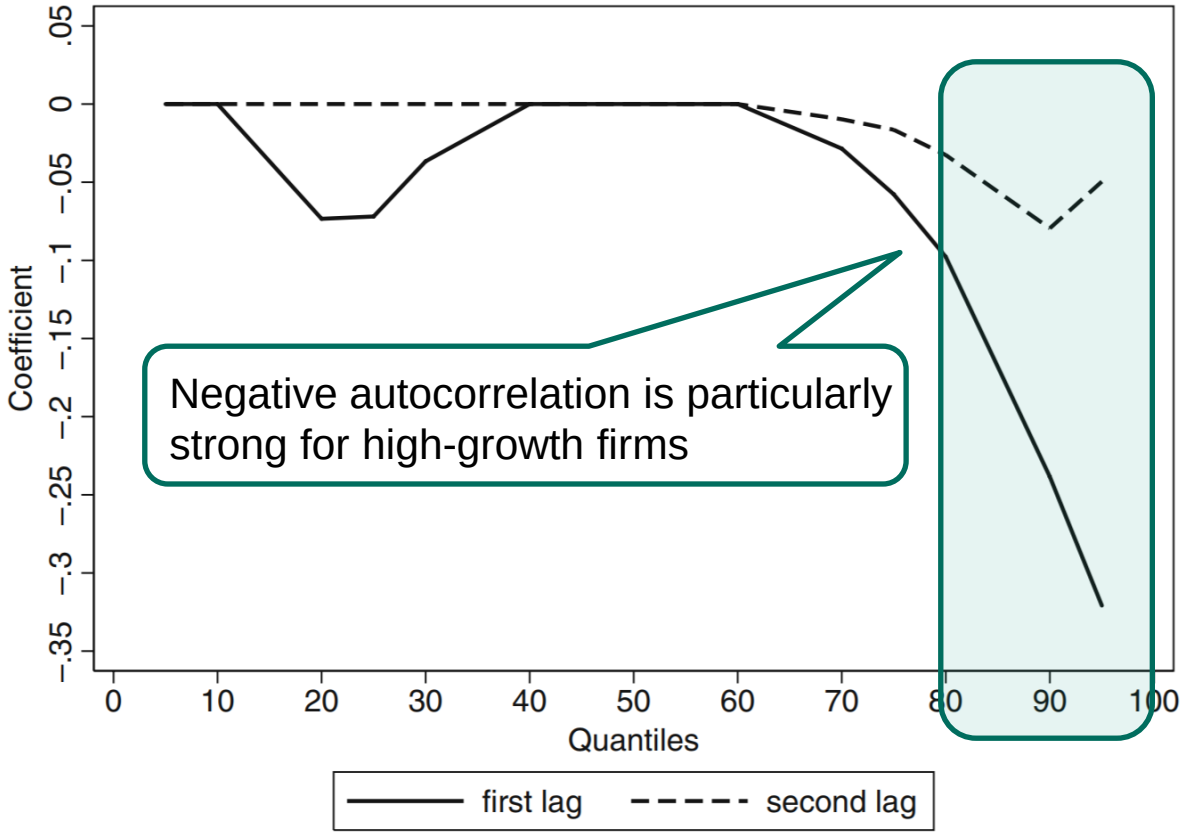
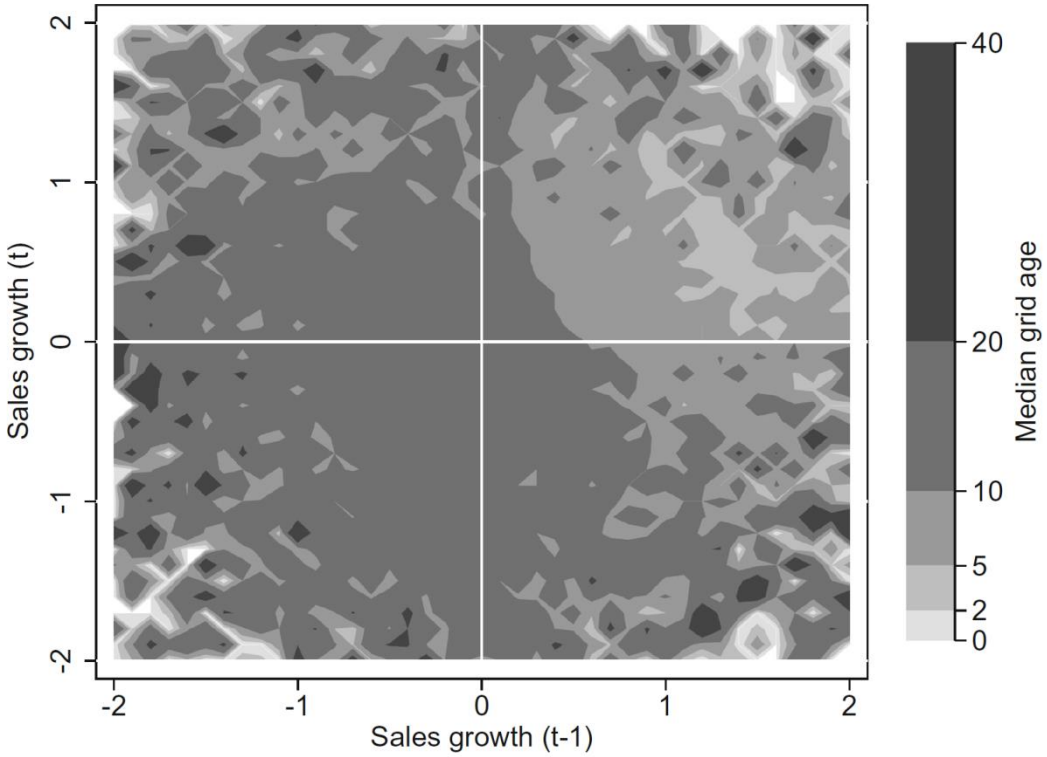
- Persistent asymmetries in production efficiency, profitability, innovation capabilities (Dosi 2007; Dosi, Faillo, and Marengo 2008 OS)
- Persistence in corporate growth is much more controversial!
- Vast empirical literature on the autocorrelation of growh rates with mixed results (see Coad 2009 for a survey)
- Shift of attention toward longer-term high-growth history (McKalvie and Wiklund, 2010; Coad, Daunfeldt, Hölzl, Johansson, and Nightingale 2014)



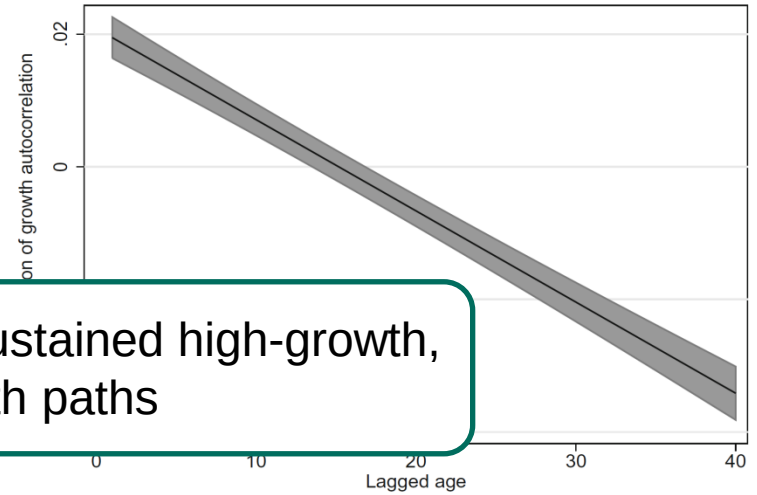
Regression quantiles for employment growth autocorrelation coefficients.
Source: Coad and Holzl (2009)

- High growth episodes in firms are rare and most unlikely to be repeated (Parker, Storey, and van Witteloostuijn 2010; Hölzl 2013; Daunfeldt, Elert, and Johansson 2015)
- HGFs are essentially "one-hit wonder"!
- But not all HGFs are alike… and we always identify a bunch of firms with persistent HG performance



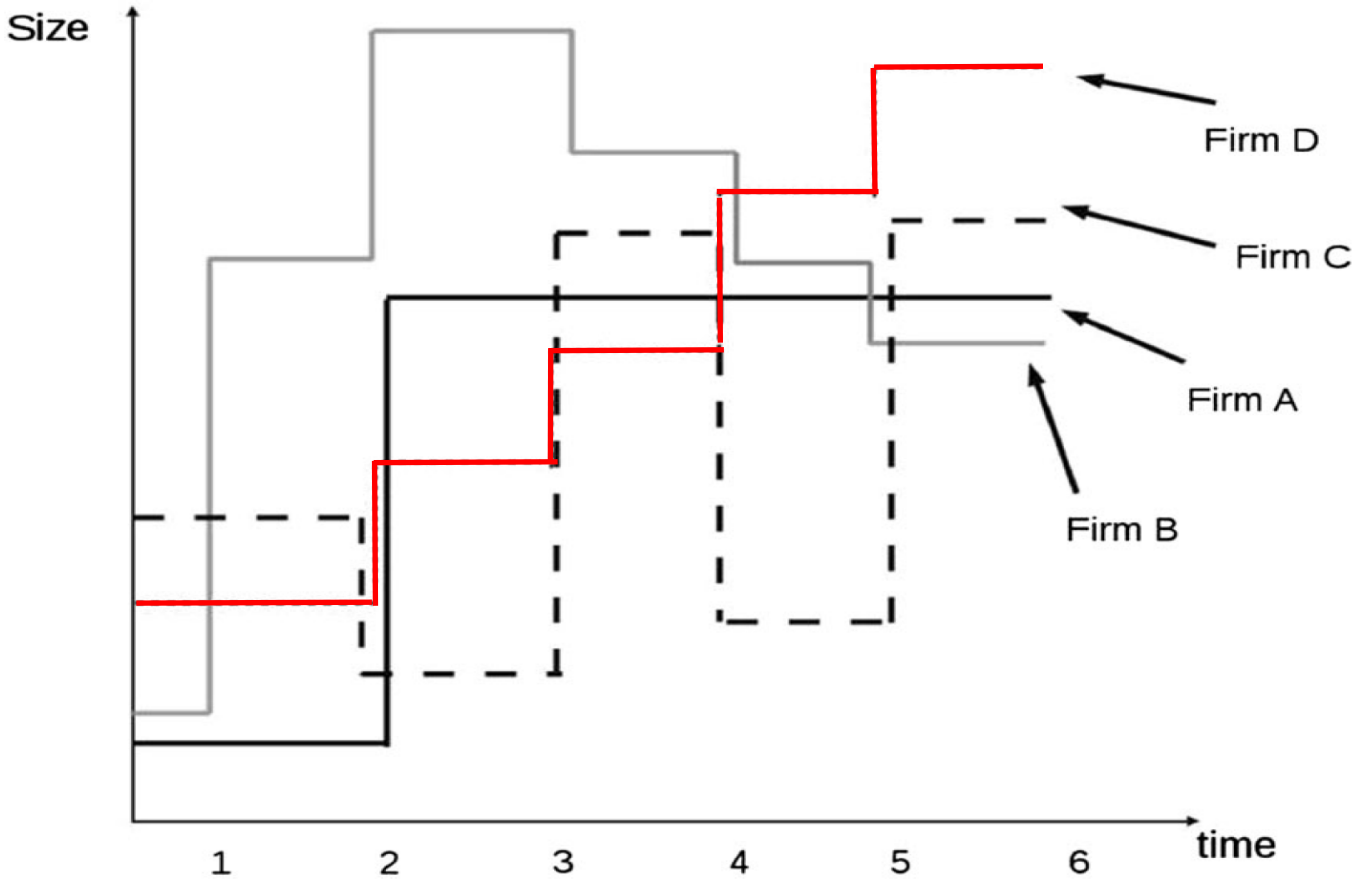
Contour plot over median grid age for pairs of consecutive growth rates in 2006–2008. *Source*: Coad et al. (2017)

New firms experience an early burst of sustained high-growth, whilst older firms have more erratic growth paths



Average marginal effects of sales growth (t-1) as a linear function of age with 95% Cis . *Source*: Coad et al. (2017)

- Most studies on HGFs have linked the occurrence of high-growth events both to macro-level and firm-specific characteristics from a static point of view
- Shift of attention toward longer-term high-growth history
  (McKalvie and Wiklund, 2010; Coad, Daunfeldt, Hölzl, Johansson, and Nightingale 2014)
- Emerging literature aimed at identifying drivers of persistent high growth performance



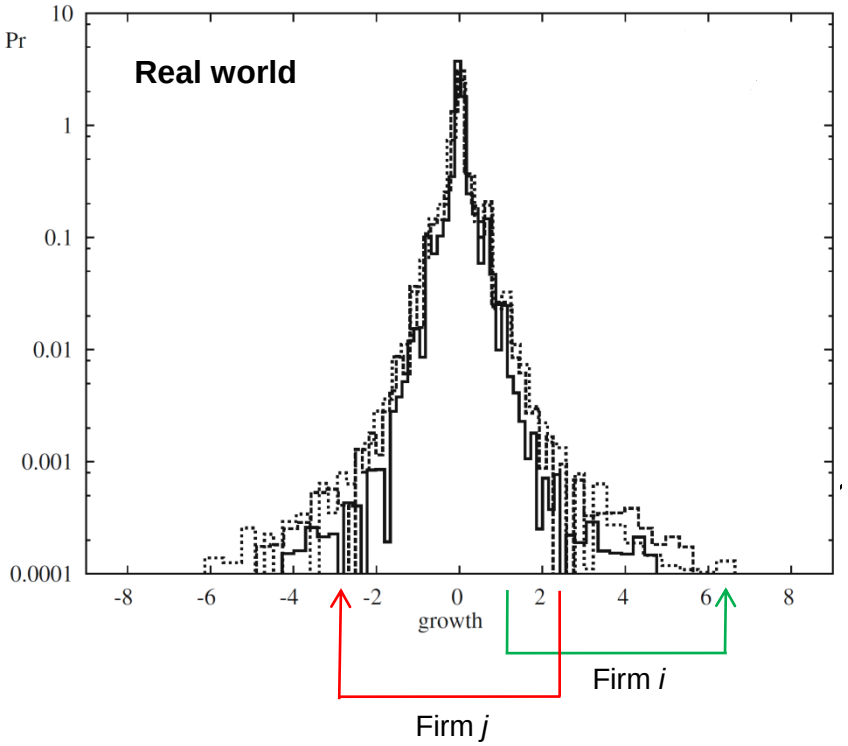
Examples of different high-growth patterns over time (PHGFs in red). *Source*: Bianchini et al. (2017)

	Pooled (1)	Italy (2)	Spain (3)	France (4)	UK (5)
ROA	0.0492	0.0272	0.0446	0.0313	0.1128
	(0.0325)	(0.0561)	(0.0661)	(0.0892)	(0.0997)
IE/S	0.0211	0.0360	0.0188	−0.1744	0.0547
	(0.0315)	(0.0693)	(0.0584)	(0.1083)	(0.1587)
LEV	[illegible]	[illegible]	[illegible]	[illegible]	0.1594
					(0.0984)
log(TFP)					0.0805
					(0.1132)
AGE					−0.2049
	(0.0600)	(0.0687)	(0.1568)	(0.1679)	(0.2212)
log(SIZE)	−0.2342***	−0.3304***	−0.1735	−0.1249	−0.0551
	(0.0640)	(0.0863)	(0.1185)	(0.1431)	(0.1323)
log(INTASS)	0.0185	0.0221	−0.0641	0.1476	0.0447
	(0.0497)	(0.0648)	(0.0697)	(0.1088)	(0.1387)
Country dummies	Yes	–	–	–	–
Observations	20,822	8687	7537	3141	1457
Log Pseudo-likelihood	−9752.11	−4067.63	−3506.58	−1457.33	−668.84
Chi^2	666.365	451.100	143.440	104.552	25.179

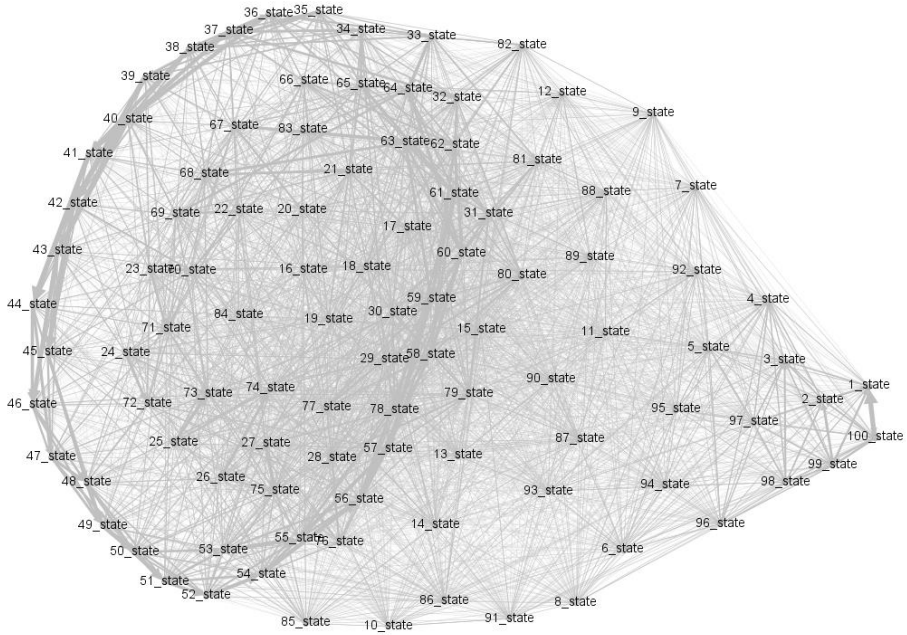
No systematic difference in terms of structural characteristics between HGFs and PHGFs!

Multinomial probit estimates, taking high-growth firms as the baseline category.
Source: Bianchini et al. (2017)

- Sustained superior growth performance as a simple by-product of chance (Barney 1986 MS; Denrell, Fang, and Liu 2014 OS)
- Chance mechanisms might offer explanations of several firm-industry dynamics
- Some tests on sustained interfirm profitability differences (Levinthal 1991 ASQ; Denrell 2004 MS; Henderson, Raynor, and Ahmed 2012 SMJ)



Artificial words (random growth)



Benchmarking real and random growth transitions in the states space, 5 economies (UK, IT, FR, ES, DE), first order Markov. *Source*: Bianchini and Korzinov (ongoing)

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p-value	Relative Growth Measure									
	UK		ES		FR		IT		DE	
p<0.05	1950.6 (39.7)	**2422**	13128.0 (119.5)	**15427**	10067.5 (87.6)	**12008**	5743.6 (72.3)	**7026**	1951.5 (43.0)	**2549**
p<0.01	287.9 (16.3)	**588**	2039.2 (50.9)	**2979**	945.8 (33.0)	**1477**	694.8 (29.6)	**833**	398.2 (17.7)	**906**

p-value	Log-difference Growth Measure									
	UK						IT		DE	
p<0.05	1959.8 (41.5)	**2**					566.6 (73.8)	7396	1781.3 (44.2)	**2379**
p<0.01	291.4 (20.3)	**5**					674.8 (30.4)	**902**	354.1 (19.6)	**827**

p-value	UK						IT		DE	
p<0.05	2479.3 (50.2)	**2942**	[illegible] (96.8)	**12863**	6669.5 (76.5)	**7523**	2919.0 (54.8)	**3532**	2675.4 (54.0)	**3512**
p<0.01	241.4 (13.6)	**587**	1210.3 (29.1)	**2424**	720.8 (26.4)	**1475**	528.0 (23.4)	**1139**	189.4 (13.7)	**585**

For top 20% growth performance and p-value < 0.01, 241 or fewer UK firms were expected to meet their respective benchmarks due to randomness… but we find 587 firms meeting those standards!

Number of PHGFs exceeding the benchmark (randomness). *Source*: Bianchini and Korzinov (ongoing)

Research should progress on (at least) three fronts:

- Measurement and identification of PHGFs: (i) economic contribution; (ii) PHG vs. Other patterns of HG
- Drivers of sustained HG performance: (i) the role of innovation; (ii) factors of more direct derivation from the management literature (i.e. capabilities, organizational characteristics, managerial strategies); (ii) the role of institutional factors
- Chance mechanisms as alternative explanation

Challenge #5: Heros today but what about tomorrow?

- An organization's efficiency lies in the quality of its routines and organizational practices (explicit line of authority, the implicit hierarchy, the distribution of roles, etc.) (Nelson and Winter 1982; Dosi, Faillo, and Marengo 2008 OS)
- It takes time to develop good routines and organizational practices!
  - *"[i]f a firm deliberately or inadvertently expands its organization more rapidly than the individuals in the expanding organization can obtain the experience with each other and with the firm that is necessary for the effective operation of the group, the efficiency will suffer, even if the optimum adjustments are made in the administrative structure; in the extreme case this may lead to such disorganization that the firm will be unable to compete efficiently in the market, and a period of stagnation may follow"* (Penrose, 1959)
- Few empirical investigations on the matter

	(1)	(2)	(3)	(4)	(5)	(6)
Ln(ft. equivalents), t	0.842**	0.842**	0.876**	0.881**	0.786**	0.884**
	(0.025)	(0.025)	(0.024)	(0.024)	(0.027)	(0.024)
Ln(Emp at start-up)	-0.409**	-0.408**	-0.360**	-0.329**	-0.301**	-0.347**
	(0.030)	(0.030)	(0.029)	(0.030)	(0.030)	(0.029)
Ln(emp growth, age 0-2)	-0.046**	-0.041**	-0.031**	-0.025*	-0.014	-0.025*
	(0.006)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Clock5_ln(emp g., 0-2)		-0.002	-0.003	-0.002	-0.002	-0.002
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Emp turn ratio, t						-0.006**
						(0.000)
Turn ratio, age 0-2						
				(0.001)		
Ln(inflow ratio, age 0-2)					-0.060**	
					(0.012)	
Ln(inflow ratio), t					0.108**	
					(0.010)	
Ln(outflow ratio), t					-0.147**	
					(0.008)	
Emp tenure, age 2						0.150**
						(0.029)
Log-likelihood	-5840	-5840	-5665	-5647	-5643	-5652
Observations	50,027	50,027	50,027	50,027	50,027	50,027
Firms	15,007	15,007	15,007	15,007	15,007	15,007
Firm failures	4,197	4,197	4,197	4,197	4,197	4,197

Initial higher employment growth has a negative effects on firms' survival

Effects of high initial growth on firm survival (after the fifth year). *Source*: Gjerløv-Juel and Guenther (2012)

	(1)	(2)	(3)	(4)	(5)
Emp at start-up	-0.517**	-0.688**	-0.636**	-0.434**	-0.671**
	(0.052)	(0.054)	(0.054)	(0.041)	(0.054)
Ft. equivalents, t-1	-0.005	-0.013	-0.007	-0.011	-0.009
	(0.010)	(0.011)	(0.011)	(0.008)	(0.011)
Firm age, t	-0.841**	-0.731**	-0.734**	-0.455**	-0.728**
	(0.085)	(0.084)	(0.084)	(0.070)	(0.084)
Ln(emp growth, age 0-2)	-0.699**	-0.925**	-0.816**	-0.685**	-0.821**
	(0.076)	(0.076)	(0.077)	(0.066)	(0.077)
Clock_5 x ln(emp growth, 0-2)	0.053*	0.062**	0.065**	0.056**	0.064**
	(0.021)	(0.021)	(0.021)	(0.018)	(0.021)
Emp turn ratio, t					0.124**
					(0.005)
Turn ratio, age 0-2					
ln(Inflow, age 0-2)				-0.214**	
				(0.078)	
Ln(inflow), t				10.929**	
				(0.111)	
Ln(outflow), t				-9.463**	
				(0.120)	
Emp tenure, age 2					2.168**
					(0.249)
chi2	863	1336	1393	11204	1367
Observations	74,788	74,788	74,788	74,788	74,788
Firms	15,007	15,007	15,007	15,007	15,007

Initial higher employment growth has a persistent negative effect on future employment growth

Effects of high initial growth on future growth performance. *Source*: Gjerløv-Juel and Guenther (2012)

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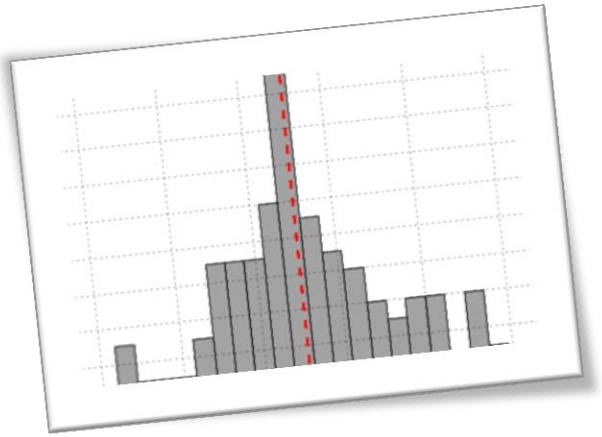


$$\frac{E_2 - E_1}{E_1}$$

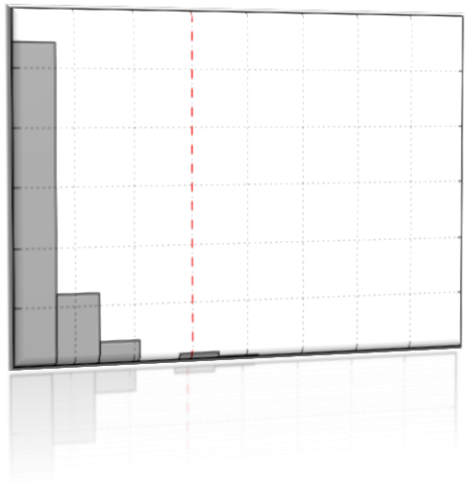
$$\log(E_2) - \log(E_1)$$

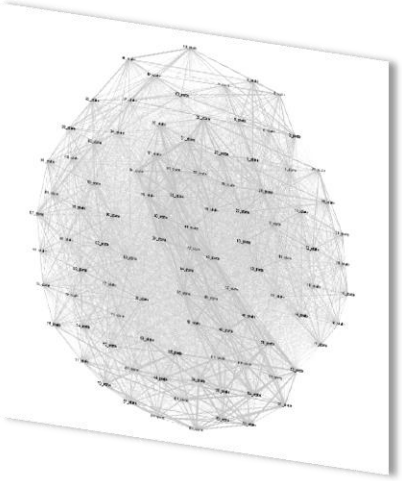
$$E_2 - E_1$$

$$growth_i = \log(age_i) + size_i + industry_i + time_i + \varepsilon_i$$

$$\Pr(X_t = x_t | X_{t-1} = x_{t-1}, X_{t-2} = x_{t-2}, \ldots, X_1 = x_1) = \Pr(X_t = x_t | X_{t-1} = x_{t-1})$$

THANKS FOR YOUR ATTENTION!





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