Alma Mater Studiorum Università di Bologna
LMEC – Department of Economics
Academic Year 2009-2010

Entrepreneurship: Economics and Policy

Lectures 2 and 3

Prof. Enrico Santarelli
enrico.santarelli@unibo.it
http://www2.dse.unibo.it/santarel/

1

Occupational choice model of entrepreneurship

2 – Heterogeneous entrepreneurial ability

According to Robert Lucas (1978) entrepreneurs differ from employees and among themselves in terms of 'innate entrepreneurial ability':

Let x denote ability, with $\underline{x}$ representing the lowest and $\overline{x}$ the highest entrepreneurial ability in the population, $f(x)$ the frequency of individuals with an entrepreneurial ability of x, and $F(x)$ the cumulative relative frequency;

Lucas (1978) also assumes that abilities are fixed and known with certainty by each individual (→ Jovanovic, 1982).

58

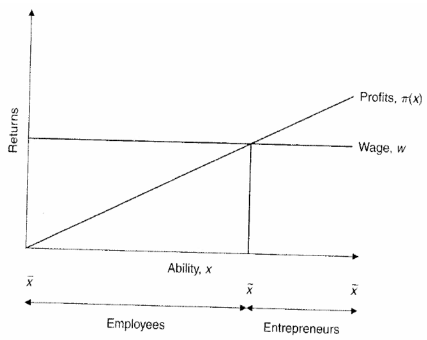
Occupational choice model of entrepreneurship

- ***2.1 – Lucas (1978)***

- x scales up an entrepreneur's output of q to give net profit of $\pi(x) = xq - c$, with c denoting the cost of using capital and labor to produce q.
- The output price is normalised to unity and all individuals are assumed to be risk-neutral.
- **All** (and only) individuals with $x > \tilde{x}$ will become entrepreneurs, where $\tilde{x}$ identify the 'marginal entrepreneur' who is indifferent between the two occupations:

$$\pi(\tilde{x}) = w$$

This leads that in the economy there are entrepreneurs, with the remaining $1 - F(\tilde{x})$ individuals working as employees for the entrepreneurs.



Occupational choice model of entrepreneurship

2.1.1 – Lucas (1978): dynamic variant

Lucas then focused on how entrepreneurs adjust their demand for capital and labour when the stock of capital increases as the economy develops:

- Denoting with σ the *technical elasticity of substitution*, that is the sensitivity of entrepreneurs' chosen capital-labour ratios to changes in the relative prices of capital and labour, and assuming that (consistent with **Gibrat's Law→**) firm growth rates are independent of firm size, Lucas shows that:

- If $\sigma < 1$ ($\sigma > 1$) ($\sigma = 1$) increases in per capita capital in the economy decrease (increase) (leave unchanged) the equilibrium number of entrepreneurs and increase (decrease) (leave unchanged) average firm size.

60

GIBRAT'S LAW – 1

GENERAL DEFINITION: "The probability of a given proportionate change in size during a specified period is the same for all firms in a given industry, regardless of their size at the beginning of the period".

1st VERSION: The law holds for all firms

2nd VERSION: The law holds only for survived firms

3rd VERSION: The law holds only for firms exceeding MES

61

GIBRAT'S LAW – 2

$$S_{i,t} = \varepsilon_t \cdot S_{i,t-1}$$

Where $S_{i,t}$ denotes actual size, $S_{i,t-1}$ initial size, and ε is a random variable distributed independently of $S_{i,t}$;
the log transformation of the above equation yields to the testable specification:

$$\log S_{i,t} = \alpha + \beta \log S_{i,t-1} + \varepsilon_t$$

β = 1 ⇒ Gibrat's Law confirmed
β < 1 ⇒ Smaller firms grow faster
β > 1 ⇒ Larger firms grow faster

62

SELECTED EMPIRICAL STUDIES ON GIBRAT'S LAW (I)

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.

SELECTED EMPIRICAL STUDIES ON GIBRAT'S LAW (II)

STUDY	METHODOLOGY	CONTROLS	DATA	RESULTS
Dunne – Roberts – Samuelson, 1989	Growth rate regression with grouping procedure	None	219,754 US manufacturing plants over 1967-82 (only entrants).	Smaller firms grow faster.
Wagner, 1992	Logarithmic specification	Persistence	About 7,000 West German manufact. plants over 1978-89; (only incumbents).	Gibrat's law fails to hold, but no evidence that smaller firms grow faster.
Dunne - Hughes, 1994	Logarithmic specification	Sample selection, heteroskedasticity, persistence	2,149 UK companies over 1980-85 (only incumbents).	Smaller firms grow faster.
Mata, 1994	Growth rate regression	Sample selection, heteroskedasticity	3,308 Portuguese manufacturing firms over 1983-87 (only entrants).	Smaller firms grow faster.
Hart - Oulton, 1996	Logarithmic specification	Heteroskedasticity, persistence	87,109 UK companies over 1989-93 (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.
Heshmati, 2001	Growth rate regression	Sample selection, heteroskedasticity	5,913 Swedish firms with fewer than 10 employees over 1993-98.	Results very sensitive with respect to the method of estimation.
Lotti - Santarelli - Vivarelli, 2001	Logarithmic specification	Sample selection, heteroskedasticity, persistence	129 micro-firms (<5 emp.) and 85 firms (>5) in Italian manufacturing over 1987-93 (only entrants)	Initially, smaller firms grow faster. A few years after entry a Gibrat-like pattern of growth is detected.

DATA

The data set from the Italian National Institute for Social Security (INPS) identifies **new manufacturing firms** born in January 1987 and tracks their post-entry **employment** performance at monthly intervals until January 1993.

- 1889 newborn firms
- 1570 after a cleaning procedure
- 964 in selected industries
- 560 surviving firms

THE SPECIFICATION OF GIBRAT'S LAW

(1) $\log S_{i,t} = \beta_0 + \beta_1 \log S_{i,t-1} + \varepsilon_{i,t}$

Where $S_{i,t}$ is the size of the ith firm at time t, $S_{i,t-1}$ is the size of the same firm at the previous period and ε is a random variable distributed independently of $S_{i,t-1}$

If growth and exit are not treated as homogeneous phenomena, empirical estimates need deal only with surviving firms. However, here the sample selection problem arises. Since growth can only be measured for firms which have survived over the entire examined period, and since slow growing firms are more likely to exit, small fast growing firms may be over-represented in the surviving sample and this may bias the results of the empirical research.

Heckman's two step procedure:

(2) $P(f_1 = 1) = F(\delta + \gamma \log S_{i,t-1} + \varphi \log S_{i,t-1}^2 + \mu_{i,t})$

With: $f_i = 1$ survivor; $f_i = 0$ exit; $\mu_{i,t}$ = disturbance

AN EMPIRICAL TEST OF GIBRAT'S LAW

MAIN QUESTIONS ADDRESSED:

1) Is the overall inverse relationship between size and growth, found by most of previous studies confirmed **during the infancy** of newborn firms?

2) Is there a convergence towards a Gibrat-like pattern of growth with the passage of time?

If the two hypotheses above were jointly supported by the data, Gibrat's Law would exhibit a behavior dependent on firm's life cycle: the Law would fail to hold during the first years after entry and would become acceptable once a given threshold in terms of size and age had been reached.

67

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Electrical & electronic engineering

	OLS 88-93	SSM 88-93	OLS 88	SSM 88	OLS 89	SSM 89	OLS 90	SSM 90	OLS 91	SSM 91	OLS 92	SSM 92	OLS 93	SSM 93
β_0	1.36***	1.30*	0.80***	0.72***	0.40***	0.35*	0.11	(a)	0.06	0.19*	-0.10	-0.10	-0.10	(a)
β_1	0.61***	0.61***	0.71***	0.73***	0.88***	0.89***	0.97***		0.98***	0.94***	1.04***	1.04***	1.02***	
ρ	—	0.12	—	1.00***	—	0.31	—		—	-0.93****	—	-0.01	—	
$t(\beta_1 = 1)$	4.11***	4.63***	3.63***	5.06***	3.00***	1.92*	1.00		0.50	1.29	1.00	0.44	0.67	
F	58.80***	29.04***	201.51***	108.55***	759.69***	443.18***	768.45***		577.28***	286.31***	763.13***	377.07***	1157.33***	
R^2 adj.	0.41	—	0.62	—	0.88	—	0.89	—	0.86	—	0.90	—	0.93	
LRI	—	0.19	—	0.34	—	0.80	—		—	0.70	—	0.78	—	
White §	2.67*	—	7.41***	—	7.11***	—	1.00	—	0.32	—	1.48	—	5.87***	
N. tot	129		129		123		104		101		94		86	
N. surv.	83		123		104		101		94		86		83	

*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
(a) the choice model is inestimable;
§ F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

68

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Instruments

	OLS 88-93	SSM 88-93	OLS 88	SSM 88	OLS 89	SSM 89	OLS 90	SSM 90	OLS 91	SSM 91	OLS 92	SSM 92	OLS 93	SSM 93
β_0	1.18***	1.44***	0.67***	0.61***	0.23***	0.24	0.01	-0.01	0.13*	0.11	0.05	0.15	0.08	0.03
β_1	0.62***	0.59***	0.77***	0.77***	0.95***	0.95***	1.02***	1.02***	0.94***	0.94***	0.96***	0.94***	0.94***	0.95***
ρ	—	-0.40	—	0.66***	—	-0.15	—	0.08	—	0.12	—	-0.70***	—	0.35
$t(\beta_1 = 1)$	3.53***	6.53***	5.75***	6.73***	2.50**	1.07	1.00	0.42	2.00**	0.98	1.33	1.55	2.00**	1.15
F	108.20***	53.78***	526.44***	266.17***	1408.94***	721.47***	1528.35***	766.45***	1035.51***	518.73***	1013.57***	503.11***	1064.19***	542.72***
R^2 adj.	0.45	—	0.72	—	0.88	—	0.90	—	0.87	—	0.88	—	0.89	—
LRI	—	0.20	—	0.42	—	0.71	—	0.73	—	0.65	—	0.66	—	0.72
White §	1.17	—	6.17***	—	3.86**	—	3.31**	—	2.29	—	1.05	—	0.29	—
N. tot	214		214		200		183		168		155		141	
N. surv.	131		200		183		168		155		141		131	

*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
§ , F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Food

	OLS 88-93	SSM 88-93	OLS 88	SSM 88	OLS 89	SSM 89	OLS 90	SSM 90	OLS 91	SSM 91	OLS 92	SSM 92	OLS 93	SSM 93
β_0	0.98***	1.72*	0.42***	-0.03	0.34***	0.34*	-0.01	0.06	0.10	0.12	-0.03	-0.05	-0.12	(a)
β_1	0.79***	0.78***	0.93***	1.03***	0.88***	0.88***	1.01***	1.00***	0.97***	0.97***	1.00***	1.00***	1.04***	
ρ	—	-0.62	—	0.98***	—	-0.04	—	-0.79*	—	-0.11	—	0.17	—	
$t(\beta_1 = 1)$	1.29	1.08	0.70	0.35	2.00**	1.27	0.25	0.00	0.50	0.29	0.00	0.00	1.33	
F	23.80***	15.98***	187.07***	98.15***	245.76***	120.68***	580.82***	300.59***	333.82***	163.45***	632.93***	318.19***	1317.64***	
R^2 adj.	0.38	—	0.66	—	0.81	—	0.92	—	0.88	—	0.94	—	0.97	—
LRI	—	0.19	—	0.44	—	0.53	—	0.75	—	0.63	—	0.82	—	
White §	0.87	—	7.89***	—	0.73	—	0.26	—	3.65**	—	2.35	—	0.50	—
N. tot	81		81		63		58		54		45		42	
N. surv.	39		63		58		54		45		42		39	

*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
(a) the choice model is inestimable;
§ F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Footwear & clothing														
	OLS 88-93	**SSM 88-93**	**OLS 88**	**SSM 88**	**OLS 89**	**SSM 89**	**OLS 90**	**SSM 90**	**OLS 91**	**SSM 91**	**OLS 92**	**SSM 92**	**OLS 93**	**SSM 93**
β_0	1.27***	1.09	0.86***	0.65***	0.25***	0.25	0.16**	0.15	0.20**	0.18	0.06	0.01	-0.02	0.08**
β_1	0.64***	0.63***	0.76***	0.80***	0.94***	0.94***	0.93***	0.93***	0.92***	0.92***	0.95***	0.96***	0.99***	0.97***
ρ	—	0.29	—	0.79***	—	0.00	—	0.05	—	0.08	—	0.18	—	-0.93***
$t(\beta_1 = 1)$	5.49***	3.79***	6.00***	3.80***	2.00**	1.04	2.33**	1.87	2.67**	0.46	1.25	0.33	0.50	0.83
F	96.10***	43.67***	416.09***	208.88***	1693.55***	841.97***	1003.16***	498.45***	697.09***	346.41***	501.06***	249.14***	1665.67***	912.11***
R^2 adj.	0.46	—	0.68	—	0.91	—	0.87	—	0.83	—	0.80	—	0.94	—
LRI	—	0.18	—	0.36	—	0.75	—	0.64	—	0.56	—	0.50	—	0.87
White §	0.52	—	6.07***	—	6.20***	—	0.32	—	0.16	—	0.56	—	1.19	—
N. tot	231		231		204		179		157		144		124	
N. surv.	112		204		179		157		144		124		112	

*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
§ , F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Wood and furniture														
	OLS 88-93	**SSM 88-93**	**OLS 88**	**SSM 88**	**OLS 89**	**SSM 89**	**OLS 90**	**SSM 90**	**OLS 91**	**SSM 91**	**OLS 92**	**SSM 92**	**OLS 93**	**SSM 93**
β_0	1.42***	1.41	0.86***	0.83***	0.12*	0.13	0.11	0.15	0.24	0.25*	0.38**	0.26**	0.03	0.03
β_1	0.56***	0.56	0.75***	0.76***	0.96***	0.96***	0.97***	0.98***	0.90***	0.90***	0.85***	0.88***	1.00***	1.00***
ρ	—	0.01	—	0.17***	—	-0.04	—	-0.70***	—	-0.53	—	1.00***	—	-0.01
$t(\beta_1 = 1)$	5.67***	…	5.00***	2.29**	1.33	0.80	1.00	0.26	1.43	1.55	2.14**	1.90*	0.00	0.00
F	63.01***	31.05***	299.32***	162.19***	1215.32***	601.11***	636.30***	323.96***	323.35***	160.31***	408.15***	201.29***	1002.02***	493.71***
R^2 adj.	0.47	—	0.75	—	0.93	—	0.89	—	0.81	—	0.85	—	0.94	—
LRI	—	0.26	—	0.51	—	0.93	—	0.77	—	0.60	—	0.76	—	0.95
White §	6.28***	—	22.46***	—	0.50	—	2.47*	—	5.54***	—	14.10***	—	6.64***	—
N. tot	115		115		100		91		81		78		72	
N. surv.	70		100		91		81		78		72		70	

*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
§ , F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

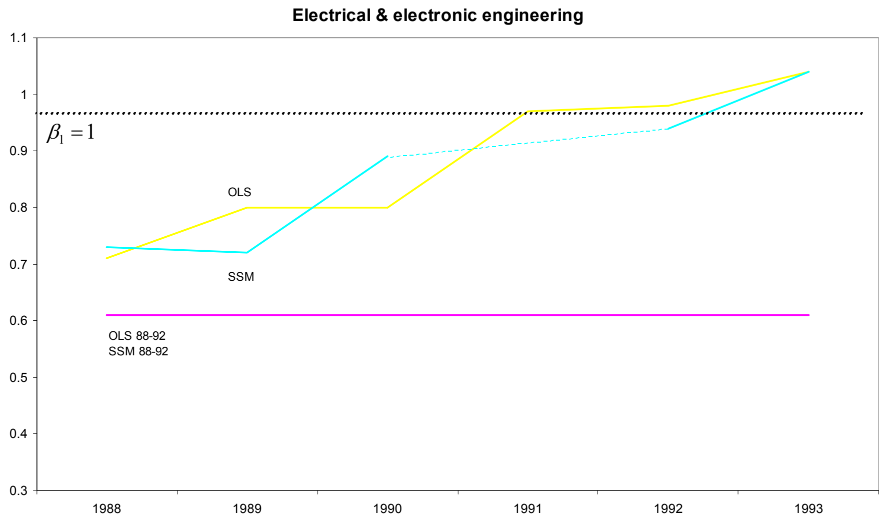
OLS AND SSM ESTIMATES OF GIBRAT'S LAW

Paper & printing

	OLS 88-93	SSM 88-93	OLS 88	SSM 88	OLS 89	SSM 89	OLS 90	SSM 90	OLS 91	SSM 91	OLS 92	SSM 92	OLS 93	SSM 93
β_0	1.25***	0.61	0.39***	0.35**	0.20**	0.29***	0.24***	0.22	0.14*	0.20	0.22	-0.75***	0.24***	0.19**
β_1	0.55***	0.60***	0.86***	0.87***	0.91***	0.91***	0.92***	0.92**	0.94***	0.93***	0.90***	1.35***	0.91***	0.92***
ρ	—	0.82***	—	0.29	—	-0.78***	—	0.13	—	-0.67	—	1.00***	—	0.93
$t(\beta_1 = 1)$	6.59***	3.77***	3.50***	2.12**	2.25**	1.01	2.00**	0.19	1.50	1.05	1.67	2.77***	3.00***	1.79*
F	65.04***	32.46***	422.55***	212.67***	413.36***	205.52***	507.20***	251.07***	679.87***	372.17***	350.23***	177.31***	878.12***	432.62***
R^2 adj.	0.52	—	0.81	—	0.83	—	0.87	—	0.91	—	0.85	—	0.94	—
LRI	—	0.28	—	0.53	—	0.56	—	0.67	—	0.82	—	0.65	—	0.98
White §	0.05	—	2.01	—	1.39	—	0.13	—	1.33	—	2.96*	—	0.80	—
N. tot	109		109		99		88		77		68		64	
N. surv.	60		99		88		77		68		64		60	

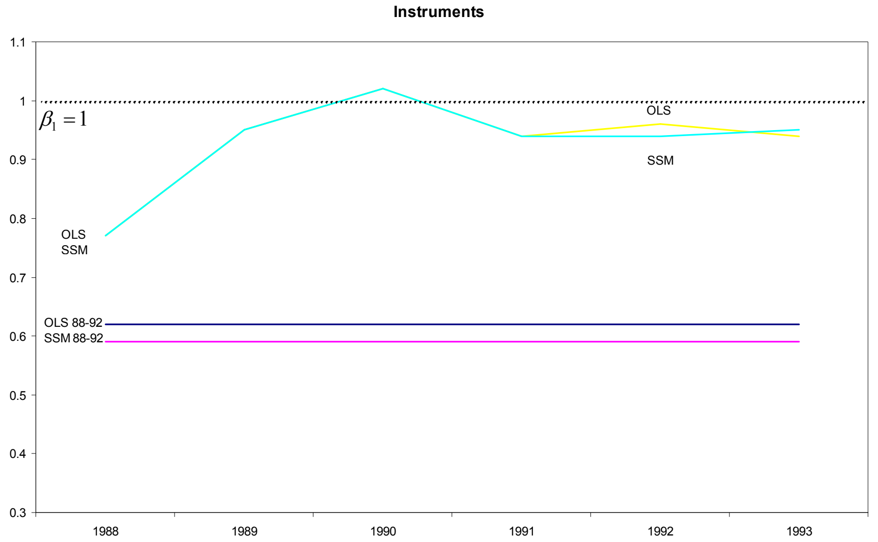
*** = significant at 99% level of confidence; ** = significant at 95% level of confidence; * = significant at 90% level of confidence.
§ , F- statistic; null hypothesis: homoskedasticity; in case of heteroskedasticity (at least at 90% level of confidence) a consistent covariance matrix was used (White's correction).

OLS AND SSM ESTIMATES OF GIBRAT'S LAW



74

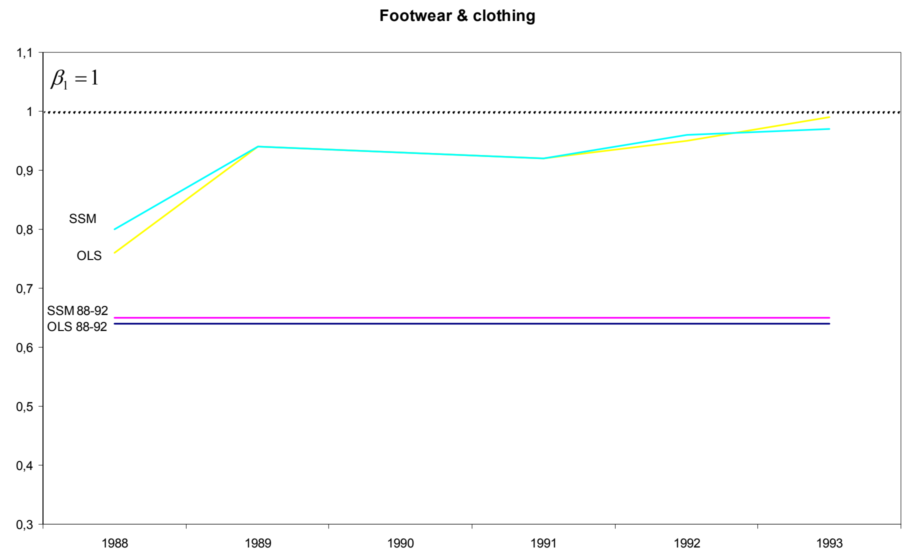
OLS AND SSM ESTIMATES OF GIBRAT'S LAW



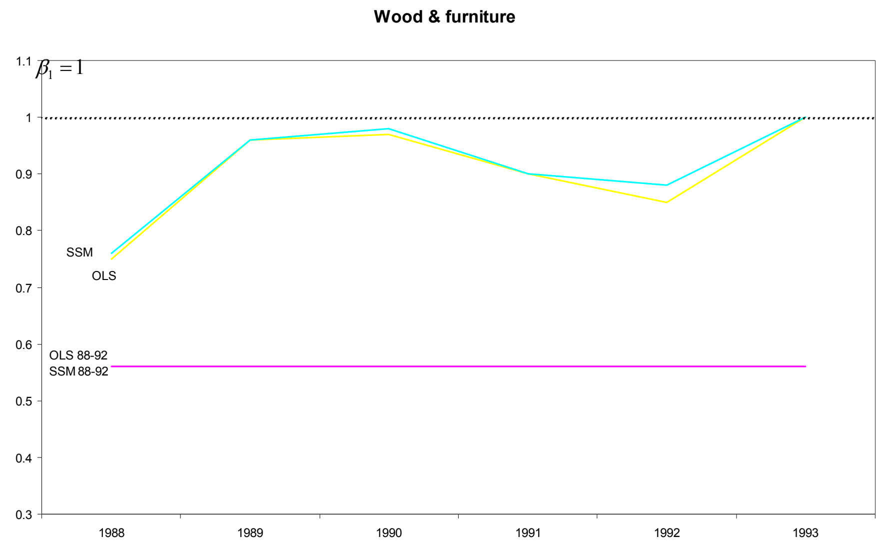
75

OLS AND SSM ESTIMATES OF GIBRAT'S LAW

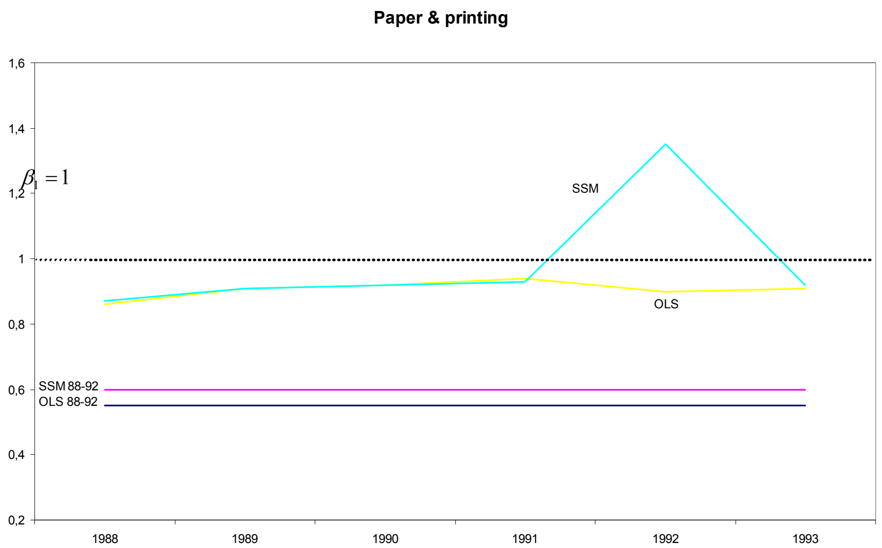
OLS AND SSM ESTIMATES OF GIBRAT'S LAW



OLS AND SSM ESTIMATES OF GIBRAT'S LAW



OLS AND SSM ESTIMATES OF GIBRAT'S LAW



PERSISTENCE IN FIRMS' PATTERNS OF GROWTH

$$G_t = \alpha_0 + \alpha_1 G_{t-1} + \eta_t \quad \sim \text{AR(1)}$$

where G_t is the growth rate at time t

Electrical & electronic engineering						
	1988-93	**1989**	**1990**	**1991**	**1992**	**1993**
α_0	-0.02	0.31***	0.13***	0.08*	0.05	-0.02
α_1	0.00	-0.03	-0.04	0.02	-0.15	-0.07
F	0.00	1.04	0.56	0.03	2.08	0.56
R^2	0.00	0.01	0.00	0.00	0.02	0.01
White §	0.30	1.59	0.06	1.72	1.45	1.84
Instruments						
	1988-93	**1989**	**1990**	**1991**	**1992**	**1993**
α_0	0.01	0.24***	0.14***	0.16*	0.04	0.00
α_1	0.00	0.02	-0.08	-0.48*	-0.04	0.00
F	0.00	0.69	1.51	11.99***	0.73	0.00
R^2 adj.	-0.01	0.00	0.00	0.07	0.00	-0.01
White §	1.36	3.44**	0.90	5.70***	1.59	0.52

80

CONCLUSIONS (I)

• In some selected industries in Italian manufacturing, Gibrat's Law of Proportionate Effect exhibits a behavior which depends on the life cycle of the firm. This evidence supports the two main hypotheses that:

1) The overall inverse relationship between size and growth, found by most studies, is confirmed also <u>during the infancy</u> of newborn firms;

2) A convergence towards a Gibrat-like pattern of growth emerges with the passage of time.

81

CONCLUSIONS (II)

•These results corroborate also John Sutton's (*JEL*, 1997) assumption that any industry, as conventionally defined, usually contains several clusters of products, some of which compete closely whereas other do not compete at all. For any industry, two opposite effects therefore obtain:

⇒ a **strategic interdependence** effect, which explains why within certain submarkets smaller firms have to rush in order to survive;

⇒ an **independence effect**, corresponding to the presence of many independent submarkets each of which is "large enough to accommodate exactly one entrant". The operation of this effect explains why within certain submarkets very small entrants do not have to grow fast in order to survive.

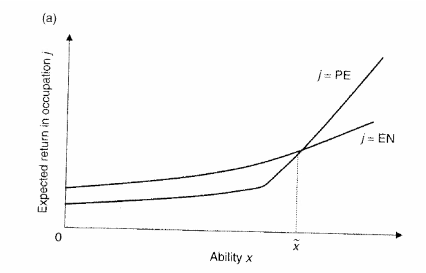
• The combination of the interdependence and the independence effects determines the patterns of post-entry growth observed in each industry.

82

Occupational choice model of entrepreneurship

- Various extensions to Lucas' model have been discussed in the literature. A set of extensions assume that also the outside wage w is a function of ability x, so that w = w(a).
- 1) This may lead that the least able individuals become entrepreneur (Figure 2,3(a), where PE = paid employees; EN = entrepreneurs):
  - PE attracts the ablest entrepreneurs

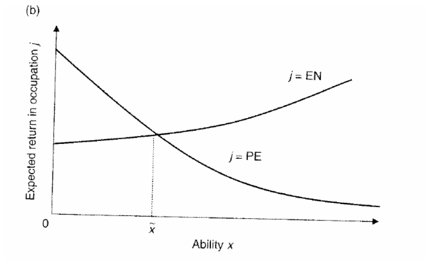
  $x > \tilde{x}$ enter PE



Occupational choice model of entrepreneurship

- Another possibility is that π(x) is an increasing function of ability x, while w(x) is a decreasing function of x.
- 2) In this case – Figure 2.3(b) – as in Lucas' model, only th ehighest ability types become entrepreneurs:
  - EN attracts the ablest entrepreneurs:

  $x > \tilde{x}$ enter EN



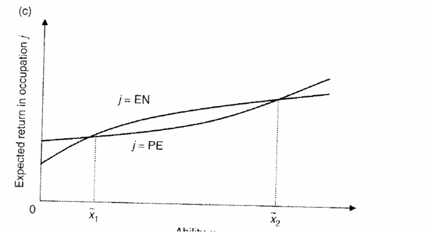
Occupational choice model of entrepreneurship

•3) For the case of the 'marginal entrepreneur' who is indifferent between occupations, so that

$$\pi(\tilde{x}) = w(\tilde{x})$$

several outcomes can arise, including that of multiple marginal entrepreneurs represented in Figure 2.3(c):

Multiple marginal entrepreneurs: $\tilde{x}_1$ and $\tilde{x}_2$

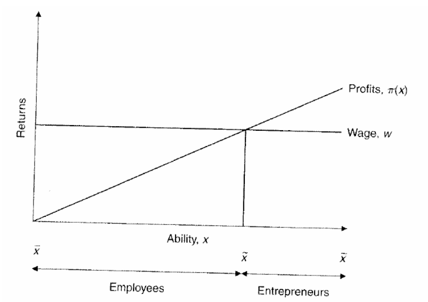


Occupational choice model of entrepreneurship

3 – Heterogeneous risk attitudes

According to Kihlstrom and Laffont (1979), who extend the model developed by Knight and by Oxenfeldt (←), assuming that risk attitutde is the only source of heterogeneity:

- More risk-averse individuals are willing to pay a premium in order to insure themselves against risk;
- If there is a continuum of agents differentiated only by their risk attitude, only the least risk-averse will become entrepreneurs
- Interpreting *x* as an inverse measure of risk-aversion leads to conclude that everyone who is less risk-averse than the marginal entrepreneur becomes an entrepreneur, and everyone who is more risk-averse becomes an employee.



Occupational choice model of entrepreneurship

3 – Heterogeneous risk attitudes

According to Kihlstrom and Laffont (1979), who extend the model developed by Knight and by Oxenfeldt (←), assuming that risk attitutde is the only source of heterogeneity:

- More risk-averse individuals are willing to pay a premium in order to insure themselves against risk;

- If there is a continuum of agents differentiated only by their risk attitude, only the least risk-averse will become entrepreneurs

Occupational choice model of entrepreneurship

4 – Competitive selection model (Jovanovic, 1982)

- 1 Atomicity:
  - There are many suppliers in the market, each of which so small that its actions have no significant impact on other suppliers;
- 2 Product homogeneity
  - All firms supply the same product
- 3 Perfect information
  - All economic agents (consumers and firms) know the prices set by all firms
- 4 – No equal access to the same technology;
- 5 – Sunk costs of entry into the market.
- Firm heterogeneity:
  - *Different firms have different efficiency parameters (and cost functions);*
  - *Each firm is uncertain about its own efficiency parameters.*

Occupational choice model of entrepreneurship

4.1 – Competitive selection model

- Jovanovic's model of *passive learning* deals with a small industry in which:
  - the product is homogeneous;
  - the time-path of the demand for the product is deterministic and known;
  - the factors are supplied at a constant price.
- In this competitive environment:
  - firms are initially endowed with different (uncertain and time-invariant) characteristics (i.e. efficiency parameters, corresponding to cost functions);
  - for each firm the mean of its costs is a proxy of its "true cost".

89

Occupational choice model of entrepreneurship

4.2 – Competitive selection model

- Thus, in every period each firm has to decide its strategy; whether to:
  - exit;
  - continue with the same size;
  - grow in size;
  - reduce its productive capacity.
- Firms discovering that their entrepreneurial idea is a successful one, and that entered the market at a sub-optimal scale, experience rapid post entry growth.

90

Entrepreneurship: An overview

(The General Entrepreneurship Monitor)

Entrepreneurship as opportunity recognition and new venture creation

- Following Kirzner (1997 and 2009) neo-Austrian approach, the "alert" entrepreneur (←) is an individual "perceiving profit opportunities" and "driving the competitive-equilibrative forces of the market".
- Consistent with this approach, in the business studies entrepreneurship is usually equated to opportunity recognition and new venture creation.
- The business studies approach is operationalised in the **Global Entrepreneurship Monitor (GEM)** data collection exercise, which defines "entrepreneur":
  - Any adult who is engaged in setting up or operating a new venture which is less than forty-two months old.

Entrepreneurship in the GEM

- The Global Entrepreneurship Monitor (GEM) is based on a broad definition of entrepreneurship, seen as a mix of:
- People creating new Firms:
  - Start-up phase, before firm operational;
  - Young firms, up to 3.5 yrs old;
  - Some innovative and growth-oriented, most not;
  - *Intrapreneurs*, i.e. people already working for established firm but thinking about starting a new one;
- Measurable by means of
  - Surveys of representative samples of the adult population;
  - Identification of adults active in new firm creation.

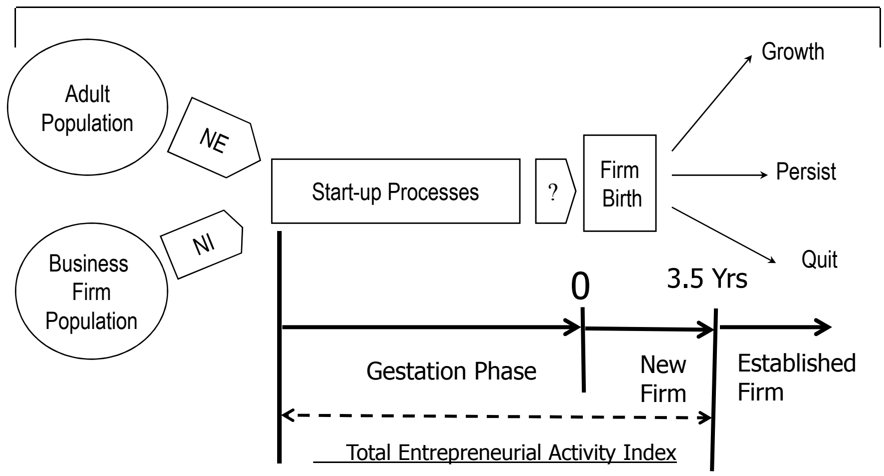
93

Total Entrepreneurial Activity Index

- Based on survey of adults in the population
- Locate those entrepreneurially active
- Count those in start up process
  - Active, will own, no salary/wage payments for over 3 months
- Count those owning/managing a new firm
  - Active, do own, salary/wage payments 3-42 months
- Add them together for TEA index
  - Count once if person doing both, as 6% are
- High correlations with other measures of activity
  - Men, women, high growth, high technology, etc.

94

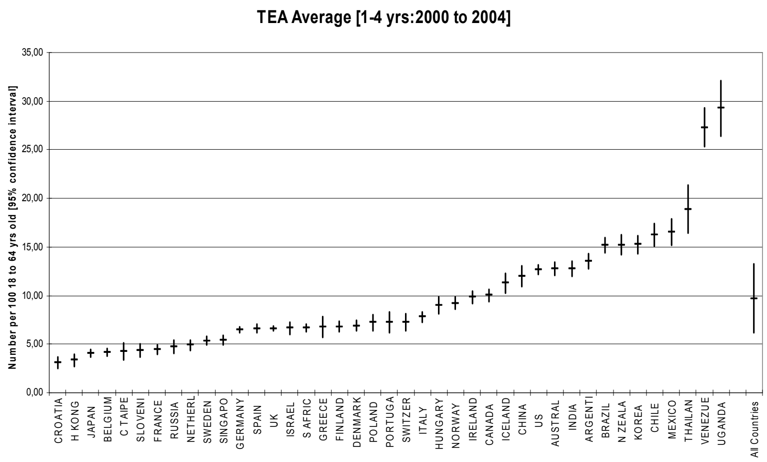
Total Entrepreneurial Activity Index



NE = Nascent Entrepreneur; NI = Nascent Intrapreneur

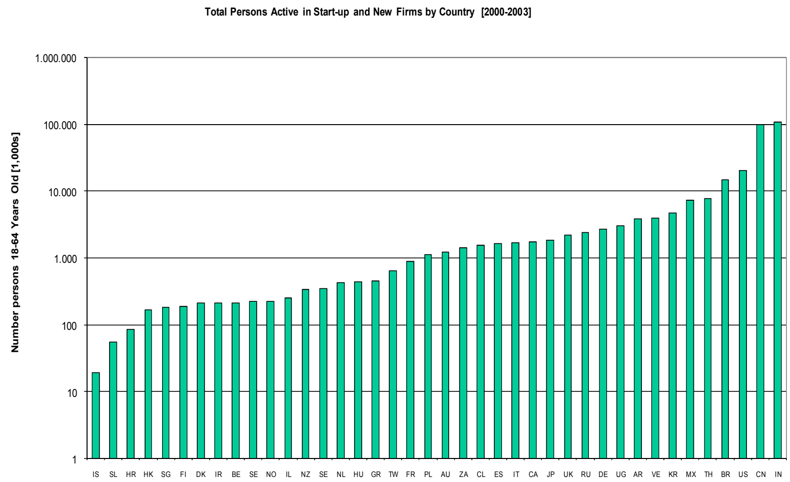
95

Total Entrepreneurial Activity Index



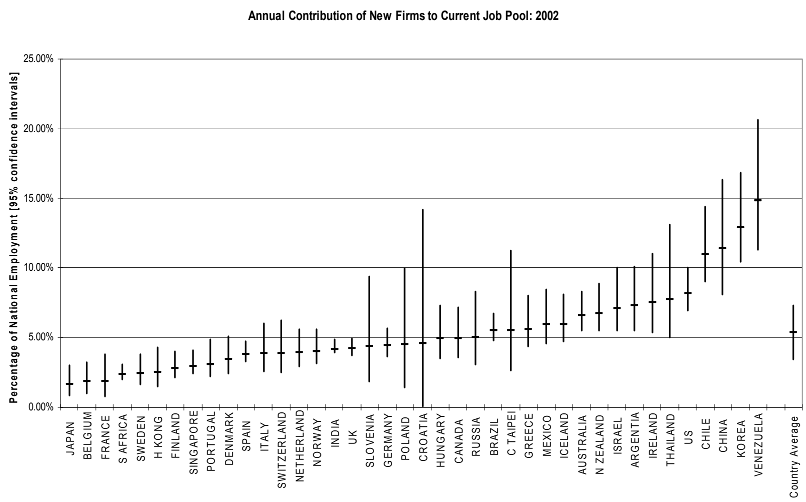
96

Total Entrepreneurial Activity Index



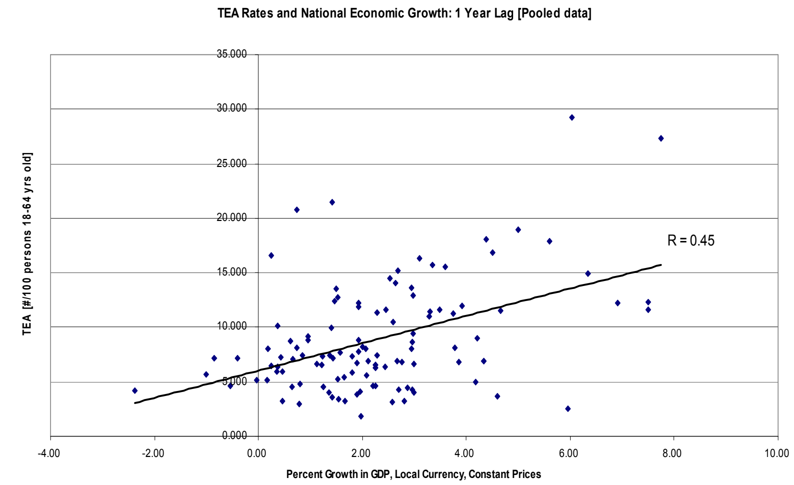
97

Total Entrepreneurial Activity Index



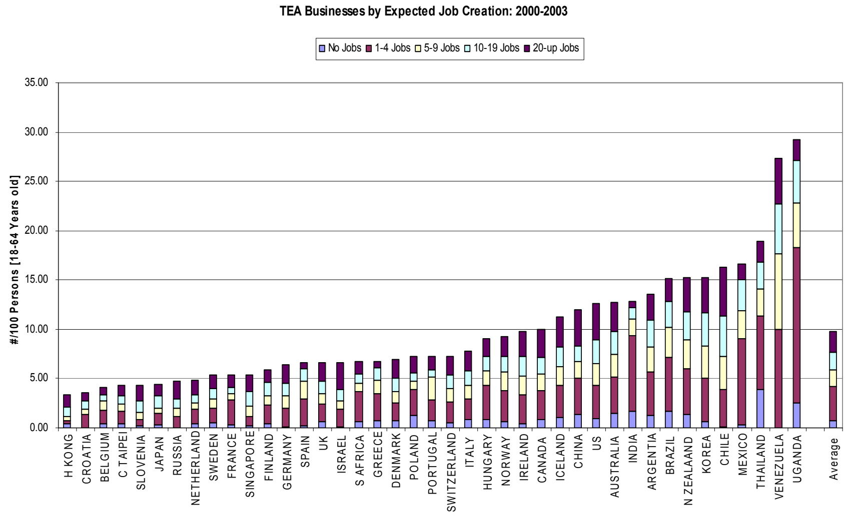
98

Total Entrepreneurial Activity Index

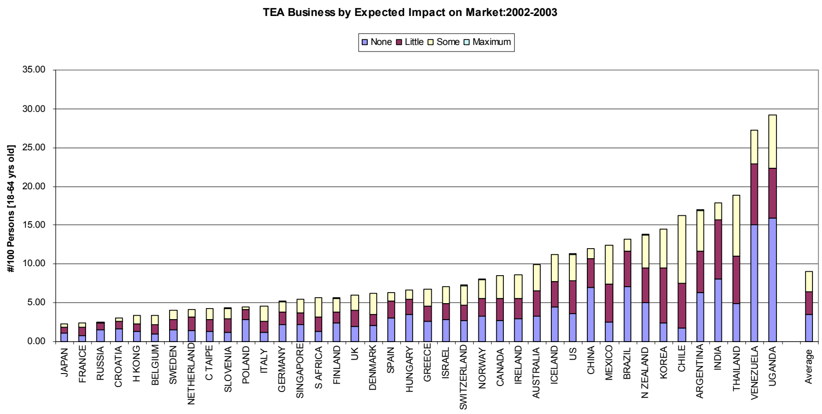


99

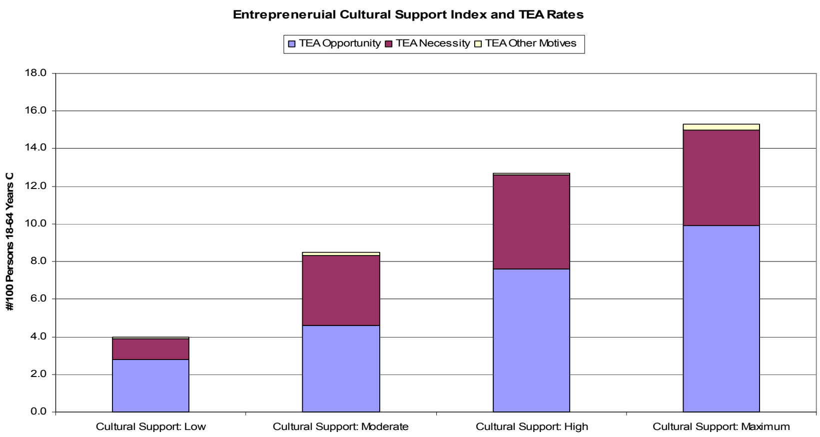
Total Entrepreneurial Activity Index



100



Market impact inferred from responses to three items: 1) Extent of competition, 2) Customer familiarity with product, 3) use of new technology.



Cultural support reflects positive responses to the perception that:1) starting a new business is a desirable career choice, 2) successful entrepreneurs have status and respect, and 3) the media have stories about successful new businesses. 102

Firm entry and exit

The competitive selection mechanism

103

Entry and exit rates

- According to the perfect competition model, in any given period there will be:
- 1 – **entry**: in industries in which active firms are earning supranormal profit rates;
- 2 – **exit**: from industries in which active firms are earning infranormal profit rates.

- Empirical evidence: entry and exit take place at the same time, with the gross entry and exit rates being much higher than the net entry rate.

104

Measures of firm demographics

- **BIRTH RATE: ratio of the number of new firms to the number of active ones.**
- **DEATH RATE: ratio of the number of exited firms to the number of active ones.**
- DEVELOPMENT INDEX: newborn – exited/active.
- DYNAMICS INDEX: newborn + exited/active
- **BUSINESS OWNERSHIP (standard): share of business owners in the labor force.**

Annual gross entry and exit rates

Country	Gross entry	Gross exit	Net entry
Belgium/m	5.8	6.3	-0.5
Belgium/s	13.0	12.2	0.8
Canada	4.0	4.8	-0.8
FRG	3.8	4.6	-0.8
Korea	3.3	5.7	-2.4
Norway	8.2	8.7	-0.5
Portugal	12.3	9.5	2.8
UK	6.5	5.1	1.4
US	7.7	7.0	0.7

WHAT DO WE KNOW ABOUT ENTRY? - 1

- **STYLIZED FACTS:**
- 1 – Entry is common. Large number of firms enter most markets in most years; however, entry rates ar far higher than penetration rates;
- 2 – Between-industry variation in entry do not persist for very long. Within-industry variation is higher;
- 3 – Entry and exit are positively correlated;
- 4 – The survival rate of entrants is very low (less than 50% after six years);
- 5 – *De novo* entry is more common (but less successful) than entry by diversification;
- 6 – Entry rates vary over time (higher in the early stages of the industry life cycle);
- 7 – Costs of adjustment penalize large scale initial entry (Jovanovic)

107

WHAT DO WE KNOW ABOUT ENTRY? - 2

- **STYLIZED RESULTS:**
- 1 – Entry is slow to react to high profits;
- 2 – Entry barriers are high in most industries;
- 3 – However, entry rates can hardly be explained with conventional measures of profitability and entry barriers;
- 4 – Entry exerts modest effects on industry price-cost margins;
- 5 – High rates of entry are associated with high rates of innovation;
- 6 – The response by incumbents to entry is selective;
- 7 – Incumbents do not use prices to block entry;
- 8 – **Firm size and age are correlated with the survival and growth of entrants**.

108

THEORIES OF NEW FIRM FORMATION

- **SELF-EMPLOYMENT**

  Unemployed workers tend to become self-employed entrepreneurs in the same industry ⇒ DEFENSIVE NATURE

- **DEMAND PULL**
  - Workers employed in a given industry start their own business in the same industry when this exhibits a favourable performance ;
  - Firms already active in other industries start a new business in a different industry exhibiting a favourable performance ⇒ PRO-CYCLICAL NATURE

 109

NEOCLASSICAL THEORY (Mansfield, 1962)

$$E_{it} = aP_{it}^{a}C_{it}^{-b}Z_{it}^{c}$$

$$\log E_{it} = \alpha + \beta \log P_{it} - \gamma \log C_{it} + z_{it}$$

- *with*:
- **E_{it}** = Entry rate; new firms started in industry *i* at time (year) *t* and survived until the end of the period (8 years), as a share of the number of firms active at the end of the year preceding *start-up*;
- **P_{it}** = ratio of the average book rate of return in industry *i* to that in Σi at time *t*;
- **C_{it}** = capital requirements for starting a firm at the minimum efficient scale (MES) level of output;
- **Z_{it}** = error term.
- **Industries considered**: steel, motor vehicles, oil, tire.

110

Self-employment theory

- 1) Income choice
- 2) Aims at explaining also the relationship between unemployment and new firm formation;
  - Tipical chicken-egg situation:

$\Delta U_t \longrightarrow \Delta E_t$

$\Delta U_t \longleftarrow \Delta E_t$

111

SELF-EMPLOYMENT THEORY

- Creedy - Johnson (1983)
- $R = 5.325 + 0.079\log\Pi - 0.674\log Y$
  . (4.202)* (2.135)* (-4.973)* .
  $- 0.092\log C + u$
  (-3,917)
- * = t statistics

- R = entry rate (net)
- Π = gross profits
- Y = average wage per employee
- C = net fixed investment in small firms

- Hamilton (1989)
- $Y_t = -0.154 + 0.12U_{t-1} - 0.003U^2_{t-1}$.
  . (….) (8.158)* (-3.588)*
  $R^2=0.94$
- * = t statistics

- Y_t = New firms/resident population
- U = unemployment rate
- The relation between U and Y for a value of U > 18%

112

INCUBATOR EFFECT

- **(Gudgin (1978), Storey (1982)**
- $E_i = -0.320 + 0.011X_{1i} - 0.048X_{2i}$ $R^2 = 0.59$
  . (….) (0.002)* (-0.008)*
- * = standard error

- E_i = entry rate
- X_{1i} = market share of firms having less than 20 employees
- X_{2i} = variation of the unemployment rate in the relevant period

113

Alternative definitions of entrepreneurship

Table 4 – Entrepreneurial motivation in Italian new-born firms

Motivation	%
SCHUMPETERIAN	47.8
Entrepreneurial success	36.9
Family tradition	6.2
Innovative idea	4.7
YOUNGHIAN	23.4
Previous knowledge of the industry	12.7
Dissatisfaction with previous employment	8.0
Subcontractors	2.7
OPPORTUNIST	9.6
Market opportunities	9.2
Subsidies	0.4
INTRINSICALLY MARGINAL	16.1
OTHER	3.1

Source: own calculations on Unioncamere data

Source: Piergiovanni, R. and E. Santarelli (2006), "What is the Best Policy for Innovative Entrepreneurship", in E. Santarelli (Ed.), *Entrepreneurship, Growth, and Innovation: the Dynamics of Firms and Industries*, Springer, New York, p. 268.

A TEST FOR ITALIAN MANUFACTURING

•THE SOURCES OF DATA (ITALY)

•INPS FILE

Provides information o:n all active firms with at least one paid employee. More reliable when focusing on the employment performance of new-born firms (post-entry growth).

•UNIONCAMERE (CHAMBERS OF COMMERCE)

Provides information also on firms with no paid employees. More reliable when focusing on self-employment.

115

NEW-FIRM FORMATION IN ITALY

- $BIR_{it} = a_0 + a_1 \Delta EMPEF_{i,\,t-1} + a_2 SFP_{i,t-1} + a_3 PROF_{i,t-1} - a_4\, WAGE_{i,t-1} + u_{i,t}$
- $u_{i,t}$ = error term;
- i = 1, 2, …, 21 (selected industries);
- $\Delta EMPEF_{i,\,t-1}$ = annual rate of change of employment in industry *i;*
- $SFP_{i,t-1}$ = share of sales in industry *i* accounted for by firms having between 20 and 49 employees;
- $PROF_{i,t-1}$ = standardized index of profitbility (profits in industry *i* minus weighted average of profits in all industries, divided by the standard deviation of profits among industries);
- $WAGE_{i,t-1}$ = standardized index of labour earnings (wages in industry *i* minus weighted average of wages in all industries, divided by the standard deviation of wages among industries).

116

NEW-FIRM FORMATION IN ITALY

- **Birth rate (BIR/FIRM): Number of new-born firms/average number of active ones.**
- **Weighted birth rate (BIR/EMPL): Number of new-born firms/average number of employees in active ones.**

Birth and death rates by industry (new/exited firms on the average number of active firms). Average annual rates 1985-89. Italy

Industries	Birth rate	Death rate
Mining & transformation of metals	6,10	9,81
Metal working	6,75	6,01
Mining &transformation of other minerals	5,53	7,44
Other mineral working	6,30	6,73
Chemicals	6,59	6,40
Man-made fibres	8,47	8,84
Fabricated metal products	8,68	6,86
Mechanical engineering	7,54	6,86
Office machinery & computers	23,38	4,61
Electrical & electronic engineering	10,65	7,32
Motor vehicles & parts	7,97	6,67
Other means of transport	9,35	7,17
Instruments	11,45	7,41
Food	8,30	7,85
Sugar, beverages & tobacco	8,28	6,96
Textiles	9,51	8,63
Leather products	9,93	9,60
Footwear & clothing	11,96	9,61
Wood & furniture	7,37	7,95
Paper & printing	8,61	6,25
Rubber & plastics	8,69	7,04
All industries	9,21	7,77

Birth and death rates by industry (new/exited firms on the average number of employees). Average annual rates 1985-89. Italy

Industries	**Birth rate**	**Death rate**
Mining & transformation of metals	0,14	0,23
Metal working	0,13	0,12
Mining & transformation of other min.	0,55	0,74
Other mineral working	0,44	0,47
Chemicals	0,13	0,12
Man-made fibres	0,06	0,06
Fabricated metal products	0,88	0,70
Mechanical engineering	0,42	0,38
Office machinery & computers	0,33	0,07
Electrical & Eletronic engineering	0,53	0,36
Motor vehicles & parts	0,04	0,04
Other means of transport	0,13	0,10
Instruments	1,17	0,76
Food	1,15	1,09
Sugar, beverages & tobacco	0,39	0,33
Textiles	0,60	0,55
Leather products	1,06	1,03
Footwear & clothing	1,00	0,80
Wood & furniture	1,10	1,19
Paper & printing	0,65	0,48
Rubber & plastics	0,55	0,45
All industries	0,66	0,56

119

Pooled cross-section, time series regressions (LSDV model)
(21 industry observations for: 1986, 1987, 1988, 1989 (*)

Dep. Var.	Const.	D86	D87	D88	EMPEF	SFP	PROF	WAGE	R2 agg.	F
BIR/FIRM										
	8.084 (7.86)	3.570 (3.03)	5.134 (4.27)	2.679 (2.34)	1.421 (6.38)	-9.396 (-3.30)			0.36	10.44
	5.773 (7.29)	3.451 (3.15)	4.792 (4.30)	2.541 (2.39)	1.279 (6.21)			1.691 (5.03)	0.45	14.66
	5.773 (7.25)	3.466 (3.15)	4.848 (4.27)	2.555 (2.39)	1.289 (6.16)		-0.126 (0.33)	1.726 (4.87)	0.45	12.09
BIR/EMPL										
	-0-045 (-0.56)	0.271 (2.90)	0.346 (3.63)	0.223 (2.46)	0.097 (5.50)	1.905 (8.46)			0.58	23.52
	0.34 (5.36)	0.286 (2.82)	0.405 (3.91)	0.246 (2.49)	0.121 (6.34)			-0.217 (6.94)	0.50	17.41
	0.394 (5.49)	0.296 (2.98)	0.439 (4.30)	0.254 (2.64)	0.127 (6.75)		-0.077 (-2.21)	-0.196 (-6.13)	0.52	16.06

* All the independent variables are inserted with a one year lag; *t* statistics in brackets.

120

Firm entry and exit

Determinants of survival and net entry

121

Survival and exit analysis

Why are the survival rates so low?:

1: More firms attempt to entry than the market can adjust (barriers to entry too low?)

2: Shortage of financial resources and external support in general (barriers to entry too high?)

3: Shortage of entrepreneurial and managerial capabilities (learning processes too slow in new-born firms?)

122

New firm entry (abs. N), average S-U size, and survival rates: 1987-93

Industry	N	Start-up size[a]	% surviv. 1/93
Mining & transf. of metals	16	7.9 (13.08)	81.3%
Metal working	29	28.4 (74.86)	65.5%
Min. & transf. of oth. metals	20	6.3 (7.05)	60%
Stone, clay, glass	73	13.73 (22.41)	57.5%
Chemicals	49	65.88 (196.20)	55.1%
Metal products	118	9.11 (13.43)	55.9%
Mechanical engineering	101	20.24 (48.46)	70.3%
Office machinery	7	7.43 (14.05)	37.5%
Electric & electronic engin.	129	12.43 (38.92)	64.3%
Other means of transport	20	19.5 (38.86)	55.0%
Instruments.	214	12.17 (30.18)	61.2%
Food	82	11.07 (35.16)	47.6%
Sugar and beverages	27	14.6 (31.23)	66.7%
Textiles	102	15.6 (29.55)	52.9%
Leather products	54	9.74 (15.48)	61.1%
Footwear & clothing	231	14.61 (34.62)	48.5%
Wood & furniture	115	11.51 (24.58)	60.9%
Paper & printing	109	10.23 (24.57)	55.0%
Rubber & plastics	85	7.23 (9.60)	77.6%

a = standard deviation in brackets

123

Survival and hazard rates of new firms in Italian industry: 1987-93

Month	Survival		Hazard	
	N of survivors	Survival rate[a]	N of exited firms	Hazard rate[b]
January 1987	1570			
January 1988	1435	91.1%	141	9.4%
January 1989	1286	81.6%	149	11%
January 1990	1183	75.1%	103	8.3%
January 1991	1077	68.3%	106	9.4%
January 1992	988	62.7%	89	8.6%
January 1993	932	59.1%	56	5.8%

[a] = Share of new firms started up in January 1987 and still in existence as of January of each subsequent year;
[b] = ratio of firms exiting in each year after start-up to the average number of firms surviving during that year.

124

CENSORED AND TRUNCATED DEPENDENT VARIABLES

- *Censoring* is a form of missing data problem very common in survival analysis.
- Typically, it implies that only the fact that the date of death occurs after some date is known (*right censoring)*.
  - Accordingly, right censoring occurs for those subjects whose birth date is known and who are (likely) still alive when the study ends.
- If a subject's lifetime is known to be less than a certain duration, the lifetime is said to be *left-censored*.
- Often, subjects with a lifetime less than some threshold may not be observed at all: in this case we have a *truncation* problem:
  - Truncation is different from left censoring:
    - Whereas for a left censored datum, we know that the subject exists, for a truncated datum we may be completely unaware of the subject.

CENSORED AND TRUNCATED DEPENDENT VARIABLES

- A censored (or a truncated) variable has a large fraction of observations at a minimum or a maximum;
- Since it is not observed over its entire range, ordinary estimates of the mean and variance of a censored variable will be biased:
  - OLS estimates of its regression on a set of explanatory variables will also be biased
  - These estimates are not consistent, i.e. the bias does not become smaller when the sample size increases;
- The maximum likelihood estimates are consistent, i.e. the bias is small in large samples.

The likelihood of survival of new-born firms

To identify whether firm-specific factors enhance the likelihood of being a successful firm, the possible positive correlation between start-up size and survival is usually investigated. This latter analysis can be conducted using a simple logit model (with survival at the end of the period equal to 1 and early failure equal to zero), and then a tobit model which took account of the fact that the data distribution was truncated in January 1993:

(1) $y_i = \beta' x_i + \varepsilon_i$

LOGIT MODEL: with y = 1 in case of survival at the end of the period, y = 0 in case of early failure; x = start-up size (in terms of employment); ε = random disturbance.

LOGIT ESTIMATES :Relationship between likelihood of survival and start-up size: Manufacturing (1987 – 1993)

Industries	*N*	Constant	S-U size	χ^2	LRI
Stone, clay, glass	*73*	0,440	-0,010	1,010	0,010
		(1,57)	(-0,97)		
Fabricated metal products	*118*	0,177	0,007	0,223	0,001
		(0,79)	(0,46)		
Mechanical engineering	*101*	0,566	0,022	4,268	0,036
		(2,13)	(1,51)		
Electric & electronic engineering*	*129*	0,567	0.002	0,155	0,001
		(2,93)	(0,37)		
Instruments	*214*	0,37	0,005	1,016	0,004
		(2,60)	(0,94)		
Chemicals	*49*	0,302	-0,002	1,027	0,016
		(0,32)	(-0,91)		
Food	*82*	-0,072	-0,002	0,083	0,001
		(-0,30)	(-0,26)		
Textiles	*102*	-0,065	0.012	2,532	0,018
		(-0,28)	(1,38)		
Leather products	*54*	0.038	0,051	2,738*	0,039
		(0,10)	(0,04)		
Clothing & footwear	*231*	-0,157	0,007	2,035	0,006
		(-1,03)	(1,16)		
Wood & furniture	*115*	0,455	-0,001	0,021	0,001
		(2,16)	(-0,15)		
Paper & printing	*109*	0,140	0,006	0,573	0,004
		(0,66)	(0,71)		
Rubber & plastics	*85*	1,430	-0,024	0,608	0,007
		(4,00)	(-0,98)		

Student's *t* in brackets; * including office machinery & equipment.

SURVIVAL ANALYSIS: TOBIT MODEL

The TOBIT model is commonly used when the dependent variable is a censored variable (no follow-up beyond a certain threshold): For analyzing a censored distribution, we star from the standard tobit model:

$$y_i^* = \beta' x_i + \varepsilon_i$$

And define a new random variable, y_t, obtained from transformation of the original y^* in the following way:

chosing **T** as threshold value.

Maximum likelihood estimates are performed.

129

TOBIT ESTIMATES: duration (in months) on start-up size: Italian Manufacturing (1987 – 1993)

Industries	Constant	Start-up size	N
Stone, clay, glass	81.28 (9.97)	-0.155 (-0.63)	73
Fabricated metal products	78.00 (91.3)	-0.03 (-0.90)	49
Mechanical engineering	73.70 (10.67)	0.210 (0.57)	118
Electric & electronic engineering*	59.00 (26.46)	0.064 (1.50)	101
Instruments	89.48 (11.41)	0.043 (0.26)	129
Chemicals	56.63 (34.50)	0.655 (1.09)	214
Food	66.07 (9.60)	-0.134 (-0.60)	82
Textiles	67.27 (11.29)	0.330 (1.56)	102
Leather products	66.88 (5.41)	1.580 (1.38)	54
Clothing & footwear	25.73 (5.31)	0.127 (0.62)	231
Wood & furniture	82.46 (10.73)	0.071 (0.32)	115
Paper & printing	72.91 (11.87)	0.11 (0.50)	109
Rubber & plastics	12.71 (6.80)	-0.890 (-0.96)	85

Student's *t* in parentheses

130