ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
UNIVERSITY OF PATRAS

LECTURE 5- FIRM'S GROWTH & PROFITABILITY THE GILBRAT LAW

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Why Special topics in Business Economics?

- Test theoretical models via the scientific method.

– ideal, but difficult. Why?

- Document facts about industries and firms in an informed and careful way, without using theory

– Measure a specific quantity, such as a price elasticity

- answer a specific policy or regulatory question.

–What are the consequences of a particular merger for innovation in an industry?

–What is the rate of return to public R&D?

–How advertising boost firm's profit?

Introduction to applied IO/Business Economics

- What is it used for? Why do we study it?
- Methodology overview

– Descriptive analysis

– Structural modeling framework – static analysis

- Example of descriptive/statistical analysis:

– Gibrat's Law

– Do firms like other biological organizations approach senility or follows a Darwinian process that derives from initial endowments?

Methodologies

- Historical analysis

– e.g., David on QWERTY

- case study

– e.g., Farrell and Shapiro on HDTV, Henderson on photolithography

- Sample survey

– e.g., Levin, Klevorick, Nelson, & Winter; Cohen et al on IP and innovation

- Econometric analysis using existing data

– Descriptive (motivated by theory)

– Using structural models derived from theory

– http://www.stern.nyu.edu/networks/?page_id=22

Some facts

- Competitive industry, many small price-taking firms with identical U-shaped cost curves:

–Firm size distribution degenerate at a single

–Entry and exit driven by changes in demand or common cost function (so either one, but not both, occur)

–P=MC in the shortrun => equal SR profits

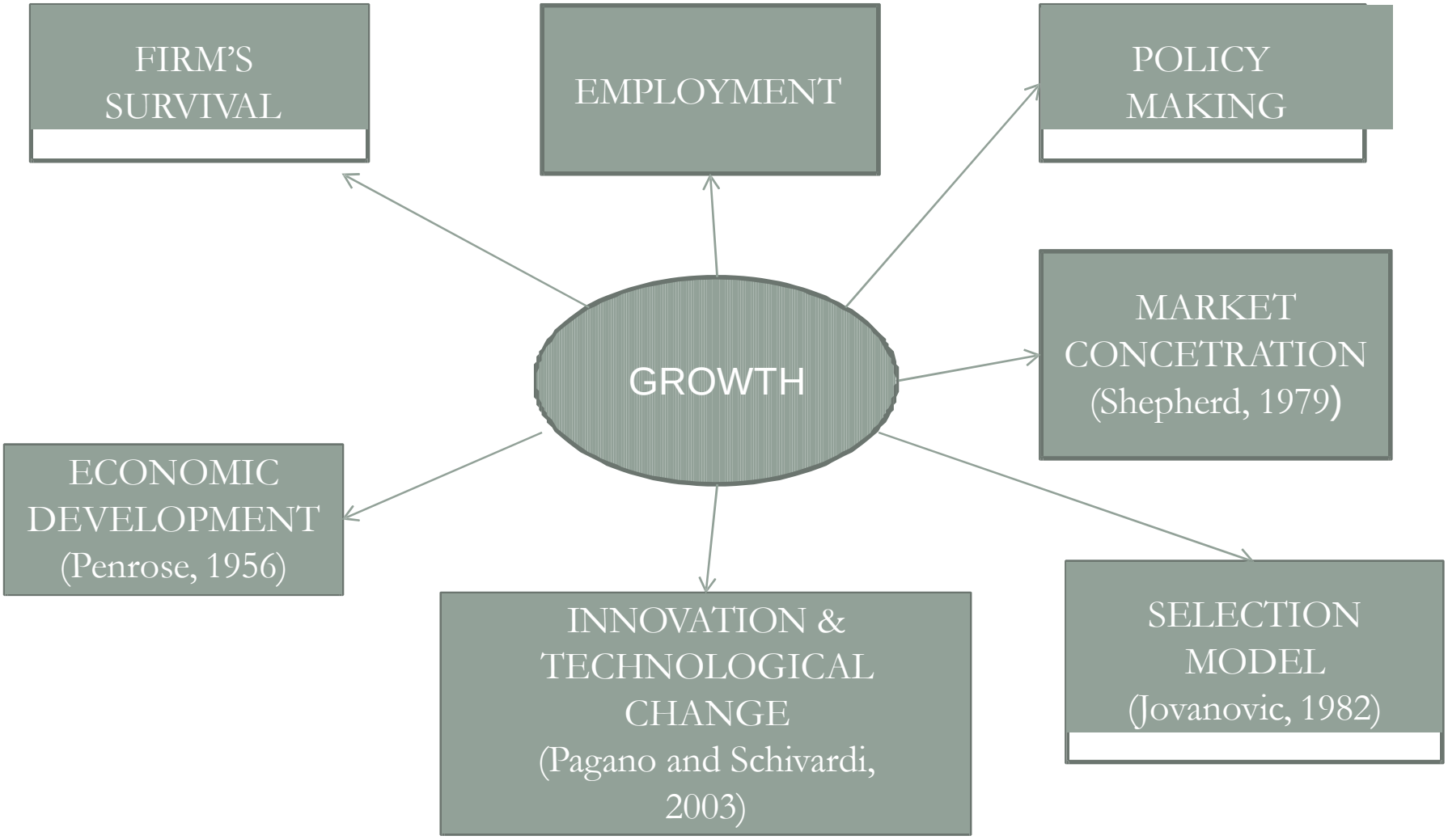
–P=AC in the longrun => zero LR profits

–No real dynamics

–Heterogeneity

- Do any industries really look like this?

Why examining Growth?



HETEROGENEITY

Firm's heterogeneity in different sectors? A reality.
Productivity, different growth rates, employment, capital structure, output e.t.c
Why?

- Uncertainty for development, adoption, marketing , production techniques for the products (Roberts and Weitzman, 1981)
- Uncertainty about future costs and demand (Lambson, 1991)
- Business and organizations capabilities (Dial and Murphy, 1995), CEO perceptions (Lucas, 1978)
- Location-Geography matters (Krugman, 1999)
- Knowledge diffusion (Nasbeth and Ray, 1974)
- Lags in the performance of homogeneous firms (Jovanovic and Rob, 1989)
- Creative destruction and growth (Aghion and Howitt, 1992)

Firm's Growth-The literature

What the literature presents concerning the theory of firm's growth?

- Neoclassical Theory of Optimal Size
- Penrose Theory
- Marris Theory
- Evolutionary Economics
- Population Ecology of Organizations
- Gilbrat Law

Neoclassical Theory of Optimal Size

- Competition in the market will lead firms to a U-shape behavior- minimum point of AC curve.
- This optimal point maybe indifferent from their minimum cost. Depends on their market power. Economies of scope has a significant role.
- Is it consistent with firm's profit maximizing?
- No empirical evidence (Geroski et al., 2003).

Penrose Theory

- Famous for the resource-based view of the firms theory.
- Human capital in firms is usually not entirely 'specialized' and can therefore be (re)deployed to allow the firm's diversification into new products and services.

Penrose effect describes a situation where high operational costs are tied with highly growth of firms.

- Penrose's view that firms possess excess resources, which can be used for diversification purposes (i.e trademarks, highly skilled labor, Wernerfelt, 1984). Dynamic capabilities role (Winter, 2003)
- A firm may be viewed as a collection of tangible resources and, second, that an optimal pattern of firm expansion may exist, which requires a balanced use of internal and external resources in a particular sequence.

Evolutionary Economics

- Inspired by the work of Schumpeter and evolutionary biology gives an emphasis on rapid technological change.
- Evolutionary economics deals with the study of processes that transform economy for firms, institutions, industries, employment, production, trade and growth within, through the actions of diverse agents from experience and interactions, using evolutionary methodology.
- Evolutionary economics analyses the unleashing of a process of technological and institutional innovation by generating and testing a diversity of ideas which discover and accumulate more survival value for the costs incurred than competing alternatives
- Nelson and Winter (1982) concept of routines answers (i) how variation comes about, (ii) how selection takes place, and (iii) how what has been selected in one period is transmitted to the next period.

Organizational Theory (Marris)

- Managers consider their utility connected with their firm's size.
- No economic incentives are related with firm size.
- Mueller (1969) profit maximizing is not indifferent with growth maximizing.
- However, in other cases managers should choose between profit maximizing and their goals of firm's growth.

Population Ecology of Organizations

- Inspired by biology and the work of Hannan and Freeman (1977) supports the idea that firms demand resources that are specific to their positions with a specific diffusion ability.

Organizational ecology contains a number of more specific 'theory fragments', including:

- Inertia and change
- Niche width
- Resource partitioning
- Density dependence
- Age dependence

Gibrat's Law

$$\frac{S_{i,t+1}}{S_{i,t}} = aS_{i,t}^{\beta-1}\varepsilon_{i,t}$$

- Growth of the firm is independent from its size (purely random-shock effect) at the beginning of the period examined (*Law of Proportionate Effect, Gibrat 1931*)

$$\Delta \log S_{i,t} \equiv \log S_{i,t} - S_{i,t-1} = \varepsilon_{i,t} \quad \log S_{i,t} = \log S_{i,0} + \sum_{i=0}^{T} \varepsilon_{i,t}$$

- Gibrat Law can be tested in at least three different ways.

1. Holds only for firms that survive over the entire time period
2. Holds for all firms in a given industry, even those that have exited the industry during the examination period
3. Applies to firms large enough to have overcome the minimum efficient scale of a given industry.

Gilbrat Law Example

- Ijiri-Simon (1964) assumptions (see also Sutton, 1998):

1.Prob(next investment opportunity taken up by any particular firm) proportional to current size.

2.Prob (next investment opportunity taken up by new entrant) constant over time.

Generates log-normal size distribution and Gibrat's law.
How to test? Gibrat's law: firm growth is independent of size.

- An example of a statistical model that predicts a conditional expectation (*not a structural model*).

Gibrat's Law Tested-3 simple ways

- Holds for all firms on an industry, including those that have exited the industry during the period examined.
- Holds only for firms that have survive over the time period. Problems??? (smaller firms are more likely to exit comparing with the bigger counterparts).
- Applies to firms large enough to have overcome the MES of a given industry.

Empirical evidence

- Early work on large firms, small samples, confirms Gibrat's law
- Recent work has larger samples, more small firms, concludes that
- Gibrat is mostly correct but....
- Smaller and/or younger firms grow slightly faster than larger and/or older firms
- Negative relationship between initial size and post-entry of growth (Lotti and Santanelli, 2004)

Methodology

Growth of a firm between two periods t,t-1 is specified as (Chesher,1979)

: $S_{i,t} = \beta S_{i,t-1} + \varepsilon_{i,t}$ $\varepsilon_{i,t}$ i.id. error tem independent t

Let us consider three cases β=1, β<1 and β>1

But $\varepsilon_{i,t} = \rho\varepsilon_{i,t-1} + u_{i,t}$ thus $S_{i,t} = \beta S_{i,t-1} + \rho\varepsilon_{i,t-1} + u_{i,t}$ and for t-1 period we will have $S_{i,t-1} = \beta S_{i,t-2} + \varepsilon_{i,t-1}$ with $\varepsilon_{i,t-1} = S_{i,t-1} - \beta s_{i,t-2}$

$$S_{i,t} = \beta S_{i,t-1} + \rho\left(S_{i,t-1} - \beta S_{i,t-2}\right) + u_{i,t} \Leftrightarrow S_{i,t} = \left(\beta + \rho\right) S_{i,t-1} + \left(-\beta\rho S_{i,t-2}\right) + u_{i,t}$$

$H_0 : (\beta = 1, \rho = 0)$
$H_1 :$ otherwise

$$S_{i,t} = \gamma_1 S_{i,t-1} + \gamma_2 S_{i,t-2} + u_{i,t}$$

$H_0 : (\gamma_1, \gamma_2) = (1,0)$
$H_1 :$ otherwise

$$\mathrm{E}\left[\varepsilon_{i,t} \middle| S_{i,t}\right] = 0$$

Assumption!!

Look at something different

$$\frac{S_{i,t+1}}{S_{i,t+1}} = a_i S_{i,t}^{\beta-1} (R\&D)_{i,t}^{d} \varepsilon_{i,t}^{V_{i,t}}$$

$$\log S_{i,t} - \log S_{i,t} = \log a_i + d \log(R\&D)_{i,t} + V_{i,t}$$

Growth of the
Firm and innovation

$$\log S_{i,t} = \beta_0 + \beta_1 \log S_{i,t-1} + \beta_2 \log(AGE)_{i,t} + \beta_3 INNOPRO_{i,t} +$$

$$\beta_4 INNOPRO_{i,t} + \beta_5 SEC_{i,t}^{j} + V_{i,t}, \; j = 1,2,\ldots m$$

EMPIRICAL EVIDENCE

- Hymer and Pashigian (1962):Growth independent from size.
- Singh and whittington (1975): Positive relationship.
- Kumar (1985) rejects HP (1962) evidence.
- Fotopoulos and Louri (2004) size and age has negative impact.
- Hart (2000) small firms growth has been attributed to technology.
- Hart and Oulton (1996) and Audretsch (1995) reveal the heteroscedasticity problem for small firms.
- Elston (2002) rejects Gilbrat Law.
- Lotti et al., (2003) a long-run effect of Gilbrat Law.
- Fotopoulos and Giotopoulos (2010) rejects the GL for micro, small and young but not for large Greek firms.

Why SCP is notworking?

- Traditional analysis relates concentration to profitability and productivity (see Salinger article, and Schmalensee survey)
- Given market shares *si*, concentration measured as $CR_k = \sum_{i=1}^{K} S_i$
- K-firm concentration ratio
- Herfindahl $H_k = \sum_{i=1}^{K} S_i^2$
- Profitability measured as
- Accounting profits (intertemporal problems)
- Tobin's q, forward looking but volatile and omits intangibles
- "Lerner" index or markup = *(P-MC)/P*. The role of Innovation, R&D.
- NEIO theory
- Concentration and performance in a correlation exercise.

Some stylized effects (Schmalensee)

- Correlation among accounting RORs are high and results not sensitive to choice of measure. Correlation with PCM (Lerner) lower and with *q* even lower, affecting results.
- Accounting profitability differences among firms tend to persist for long periods.
- At the firm level, industry characteristics account for about 10-25 per cent of cross section variation in accounting RORs.
- Measures of scale economies or capital intensity tend to be positively correlated with industry-level accounting profitability and negatively related to entry.

Some stylized effects (Schmalensee)

- The cross-section relation between concentration and profitability is weak statistically, usually small, and unstable over time and space.

That between market share and profitability is somewhat stronger, across but not within industry.

- In manufacturing, both advertising and R&D tend to be positively related to profitability (and concentration), except possibly when concentration is very high.
- Ratio of imports to domestic consumption tends to be negatively correlated with domestic firm profitability, especially when concentration is high.

Data Issues

- Entry and exit occur frequently
- Balanced or unbalanced panel?
- Bias from exit or entry?

–Evans and Hall find mortality higher for smaller/younger firms

–If slow-growing small firms exit and slow-growing large firms do not, it will appear that small firms grow faster in the surviving sample

–Do small firms create more jobs? Not if they also exit more rapidly (Davis and Haltiwanger, 2013)

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