

BISS Bochum

GeoInno: Life-Cycle, spin-offs & industrial agglomeration

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Course Outline

- 🌐 Knowledge & externalities
- 🌐 Knowledge transfer
- 🌐 Proximities
- 🌐 Agglomeration & scaling
- 🌐 Spin-offs & life cycle
- 🌐 Evolutionary economics
- 🌐 Relatedness & knowledge space & complexity
- 🌐 Knowledge networks
- 🌐 Political support for innovation, collaboration, networks

Session Outline

Industry Life Cycle Theory

-  Motivation

-  Theory

-  Assessment of Industry Life Cycle Theory

Spin-offs and agglomeration

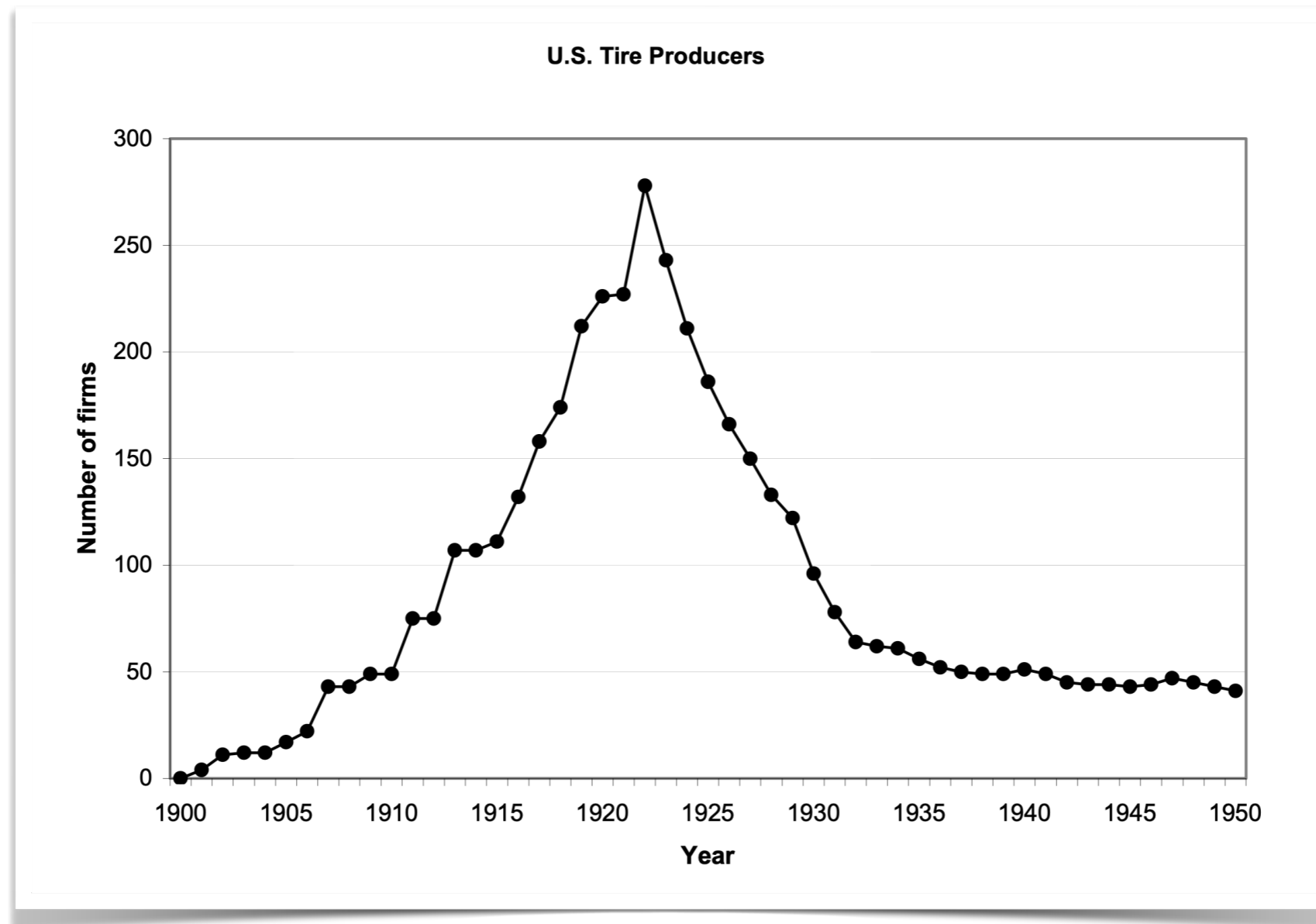
-  Motivation

-  Reasons for and peculiarities of spin-offs

-  Link to industrial agglomeration

Industry life cycle: Motivation

Striking empirical observation in many industries





Buenstorf, G., & Klepper, S. (2009). Heritage and agglomeration: The akron tyre cluster revisited. *Economic Journal*, 119(537), 705–733

Industry life cycle: Motivation



“Evidence on entry, exit, firm survival, innovation and firm structure in new industries is reviewed to assess whether industries proceed through regular cycles as they age. ... It is shown that the product life cycle captures the way many industries evolve through their formative eras...” (Klepper, 1997, p. 145)

Industry life cycle: Motivation

Seminal studies

-  Gort, M., & Klepper, S. (1982). Time paths in the diffusion of product innovations. *Economic Journal*, 92(3), 630–653.
-  Also: Utterback, J. M., & Abernathy, W. J. (1978). A dynamic model of product and process innovation. *Omega*, 3(6), 424–441

Gort & Klepper (1982)

-  Evolution of 46 industries (mix of consumer, industrial, and military products) originating between 1887 and 1960
-  Industry start with a substantial new innovation

Industry life cycle: Motivation

- ① Patterns in the development of firm numbers over industry development (Gort & Klepper 1982)
 - ① Industries pass through brief periods with few firms
 - ① Followed by rapid increase in firm numbers
 - ① Subsequent rapid fall to (relatively) stable level

Industry life cycle: Motivation

- Patterns in outputs and innovation over industry development (Gort & Klepper 1982)
 - Initially high output growth which declines steadily
 - Prices fall rapidly but at a decreasing rates
 - Rates of radical and incremental innovations rise, peak, and then remain stable over time
 - Major innovations peak earlier

Industry life cycle: Motivation

🌐 Product life cycle with four stages (Vernon 1966)

🌐 **Introduction:** Creation of market

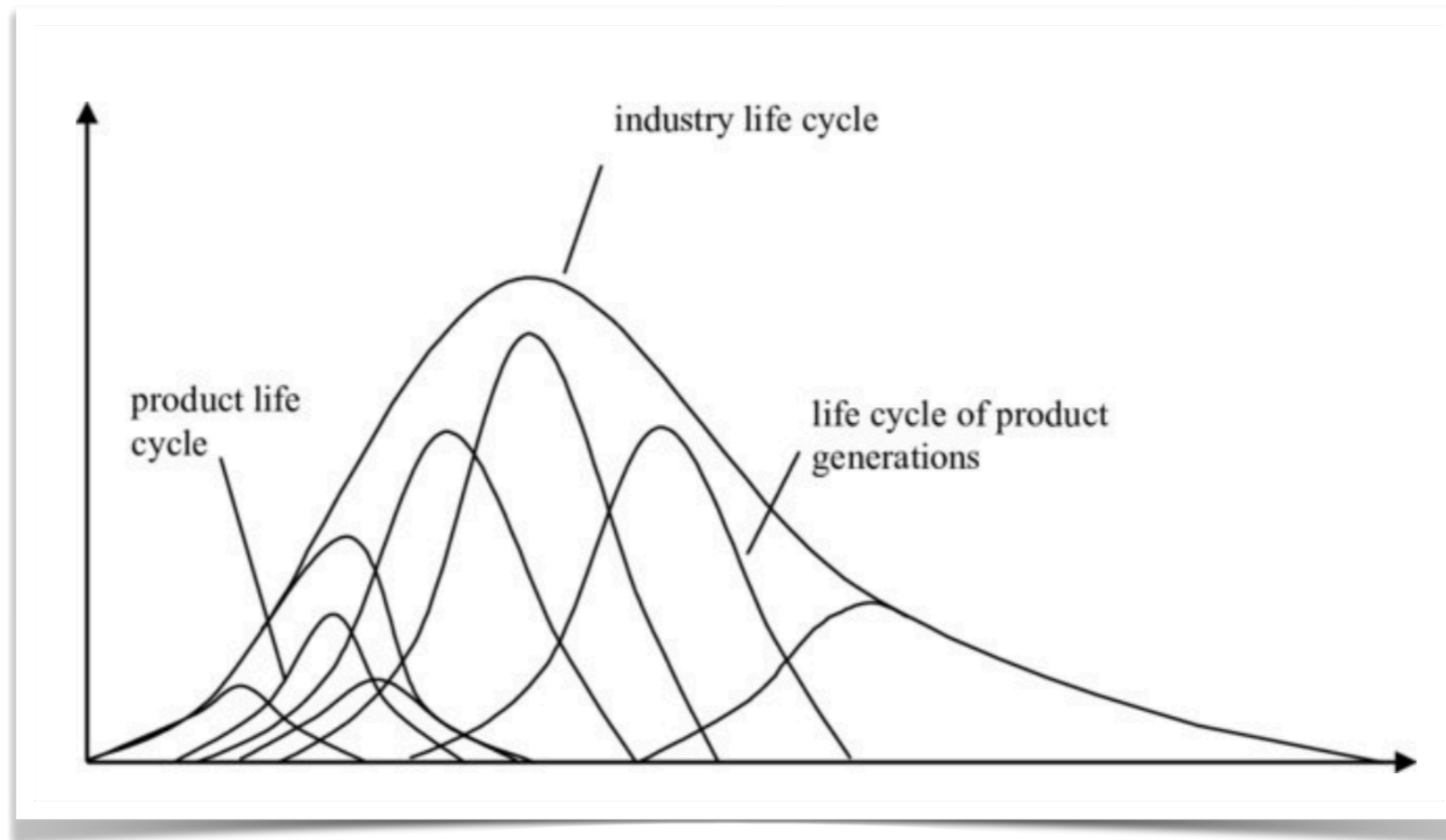
🌐 **Growth:** Increasing demand for product

🌐 **Maturity:** Markets saturates

🌐 **Decline:** Falling demand & production

Industry life cycle: Motivation

- Product life cycles + industries strongly dependent on dominant products -> **Typical industry development?**



Menhart et al. (2004). Product innovation and population dynamics in the German insurance market. *Zeitschrift Für Die Gesamte Versicherungswissenschaft*, 93(3), 477–519.

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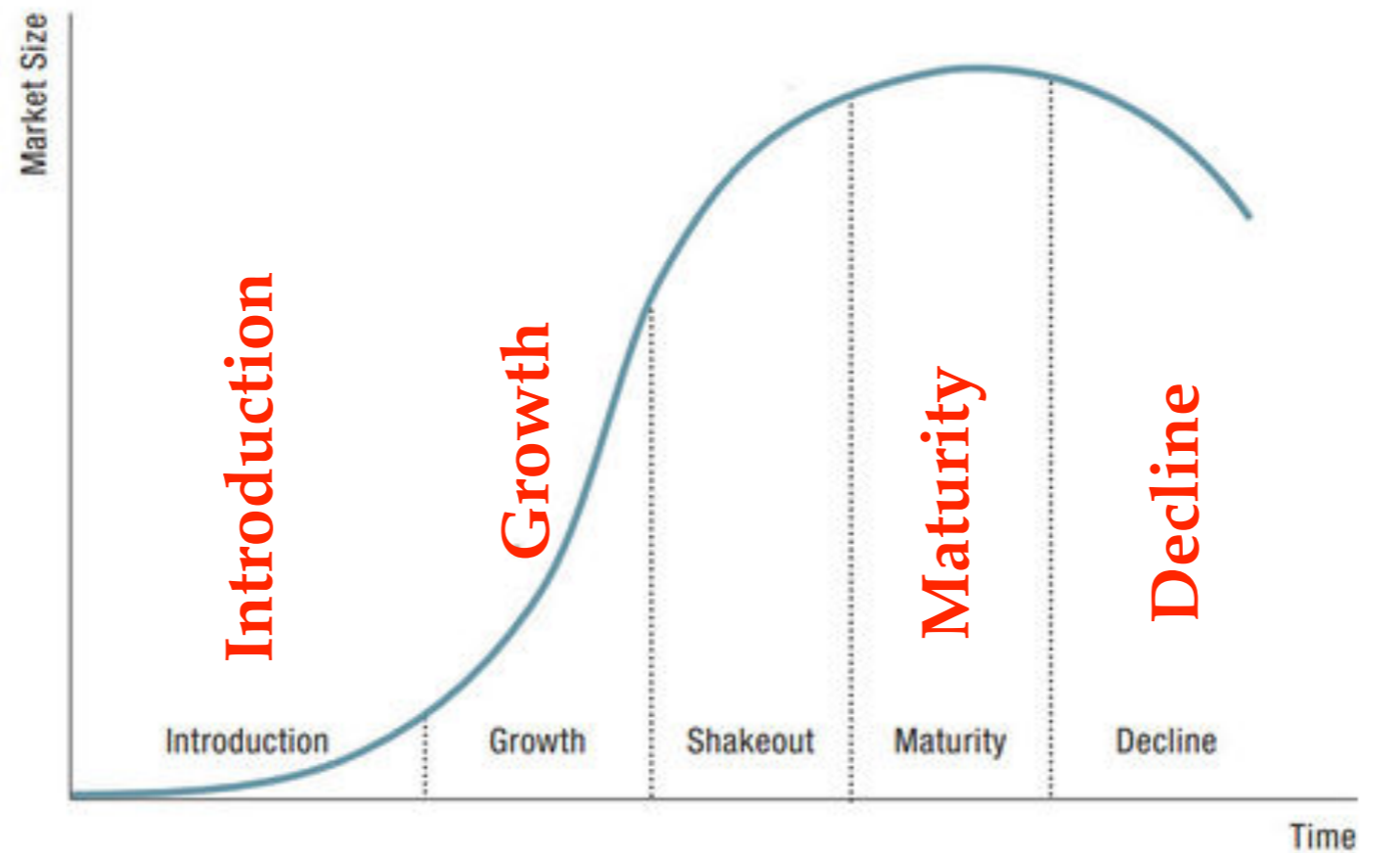
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Industry Life Cycle: Theory

- Industry Life Cycle (ILC) theory: industries' typical developments over time
 - Number of firms in the industry
 - Explanation through innovation, entry, and exit behaviour

Industry Life Cycle: Theory

- Division of evolution in 5 stages
 - Stages defined on the basis of firm entry



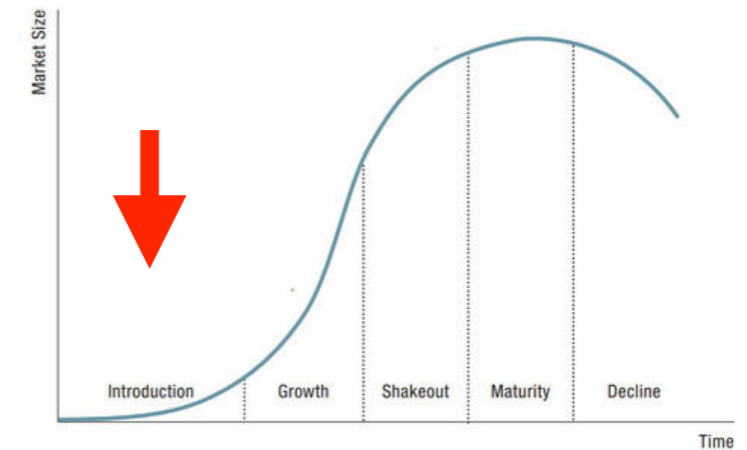
Industry Life Cycle: Theory

Introduction stage

- Buyers unfamiliarity with product and poor distribution channels
- High prices due to missing scale economies
- Barriers to entry are on access to technological expertise

Population characteristics

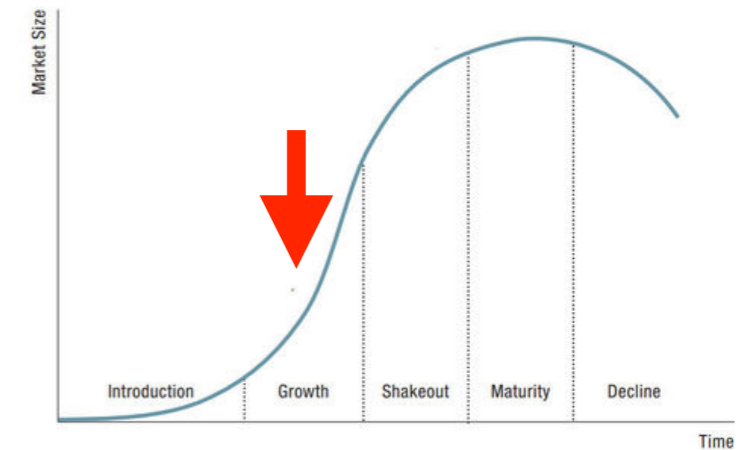
- Low entry and exit rates
- Few initial firms



Industry Life Cycle: Theory

🌐 Growth stage

- 🌐 Demand expands rapidly
- 🌐 Falling product prices due to scale economies
- 🌐 Distribution channels developed
- 🌐 High threat from potential competitors (entries) but low rivalry (no need for battling market shares)



🌐 Population characteristics

- 🌐 “Take off stage”
- 🌐 Rapid entry & strong growth of firm number

Industry Life Cycle: Theory

🌐 Shake-out stage with extreme fall of firm number

- 🌐 Few first-time buyers

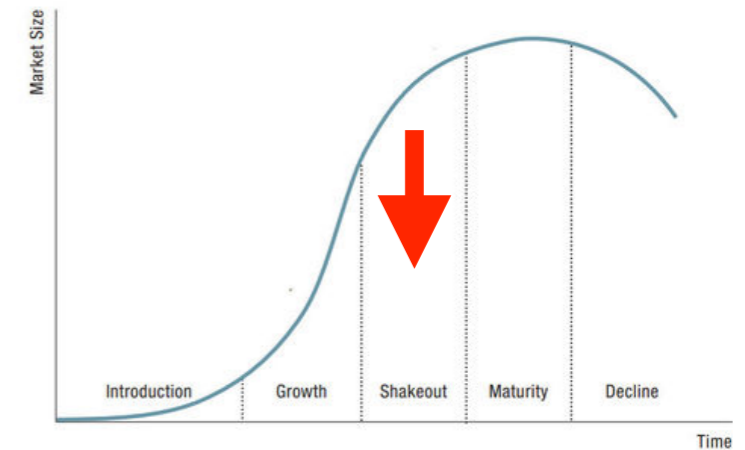
- 🌐 Price wars with bankruptcies of inefficient companies and deters new entry

- 🌐 “Dominant design” destroys diversity and competition through variation

🌐 Population characteristics

- 🌐 Massive firm exits

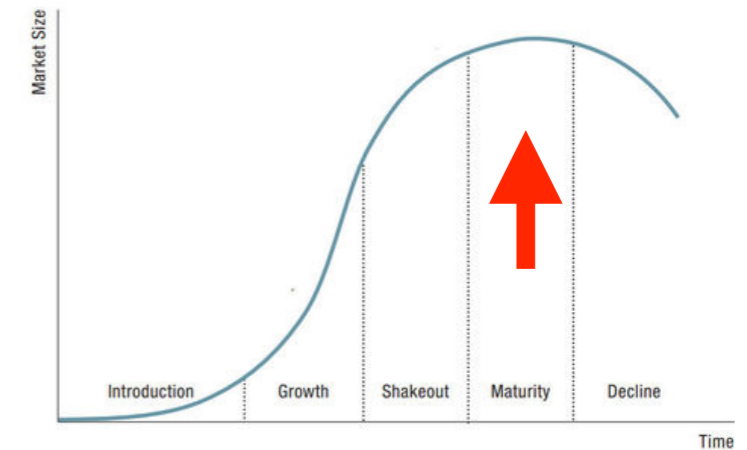
- 🌐 Population number decreases extremely



Industry Life Cycle: Theory

🌐 Maturity stage

- 🌐 Market saturated, demand limited to replacement
- 🌐 Market growth low or zero
- 🌐 Industries consolidate, oligopolies form
- 🌐 Increasing barriers to entry, decreasing threat of from new competitors
- 🌐 Companies avoid price wars



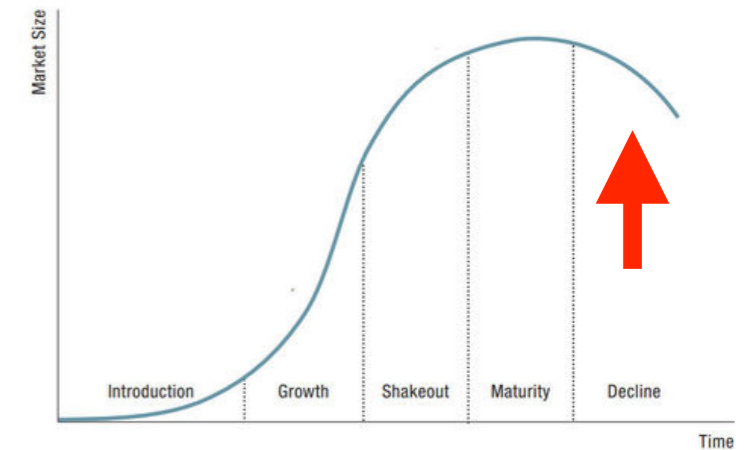
🌐 Population characteristics

- 🌐 Firm number fairly constant
- 🌐 Eventually entry rates fall, exit rates increase

Industry Life Cycle: Theory

Decline stage / negative growth

- Technological substitution (alternative products)
- Social changes
- International competition, falling demand results in excess capacity
- Rivalry among established companies increases



Population characteristics

- Falling firm numbers
- Exit rates > entry rates
- Eventually stable population

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Industry Life Cycle: Assessment

- Frequently observed pattern, but far from universal
- Length of stages varies considerably from industry to industry
 - E.g. growth phases of 1 year & maturity stage > 40 years => Still same industry?
- Magnitude of firm population changes differs across industries
 - No dramatic fall in firm numbers in 19 of 46 industries in Gort & Klepper (1982)

Industry Life Cycle: Assessment

- ① Useful way of thinking about industry development
- ① No explanatory power - more descriptive
- ① What causes the (frequent) emergence of this pattern?

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Motivation: Emergence of agglomerations

- How and why do industrial agglomerations emerge and persist?
- Traditional externality-based explanation (e.g., Marshall (1920)):
Agglomeration of firms in one locations generates advantages
 - Labour market pooling
 - Specialised suppliers
 - Shared infrastructure
 - Knowledge spillover

Motivation: Emergence of agglomerations

- Link between Industry Life Cycle and agglomeration externalities
 - New industries emerge in diversified urban regions (urbanisation externalities)
 - Success in later stages determined by Marshallian externalities

Motivation: Emergence of agglomerations

- 🌐 Later stages of Industry Life Cycle = maturation of products
 - 🌐 Standardisation => price competition => costs are crucial
 - 🌐 Process innovations require specialised skills and knowledge (Marshallian externalities)
 - 🌐 Shift of optimal location from **diversified** (urban) to **specialised** regions (second tier regions) along life cycle creating **local industrial agglomerations**

However: There is an alternative explanation

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Reasons for and peculiarities of spin-offs

- 🌐 Spin-off: “*Startups organized by former employees of firms active in the same industry*” (Buenstorf & Fornahl 2009)
 - 🌐 Parts of firms become independent with assets, employees, intellectual property, technology, or existing products of (former) parent company
 - 🌐 Parent firm and spin-off firm separate entities after split
 - 🌐 Usually, no cash flow to the parent firm
 - 🌐 Sometimes, parent firm remains shareholder



Reasons for and peculiarities of spin-offs

Reasons for spin-offs

-  Improved focus and reduction of negative synergies
-  Improved investment efficiency -> diversified firms may allocate investment funds less inefficiently
-  Reduction of information asymmetry
-  Offering better incentive contracts to managers
-  Tax and regulatory-related reasons



Reasons for and peculiarities of spin-offs

Reasons for spin-offs

-  Frequently related to events in parent firm (changes in leadership, mergers & acquisitions, ...)
-  Strategic conflicts (employees with different vision of business than parent firm) -> Histories of SAP & HP as prominent examples




Reasons for and peculiarities of spin-offs

Two types of spin-offs

-  **Opportunity spin-offs:** employees (or parent firm) identify opportunity for new business with higher profits
-  **Necessity spin-offs:** due to external event -> independent firm as possibility to remain in business




Reasons for and peculiarities of spin-offs

Relation spin-off and parent company



-  Success breeds success: successful parents have more successful spin-offs (Klepper 2002)
-  Success breeds more: successful spin-offs with more children of their own (Agarwal et al. 2004)
-  University spin-offs as commercialisation of (public) university knowledge (Lawson 2003)

Reasons for and peculiarities of spin-offs

Peculiarities of spin-offs

-  Spin-offs tend to outperform other entrants (diversification, independent founding, ...) (Klepper & Sleeper 2005)
-  Potentially due to more (related) experience
-  Duration and occupations of spin-off founders matters for success (Dahl & Reichstein 2006)

Spin-offs as potent **sources of economic growth**

-  As independent firms
-  As industrial process

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Spin-offs and industrial agglomeration

- 🌐 Spin-offs as explanation for emergence of industrial agglomerations
- 🌐 Core idea
 - 🌐 Some regions lucky with successful entrants during introduction stage of Industry Life Cycle (e.g., Silicon Valley with Fairchild)
 - 🌐 Successful entrants => more spin-offs that are more successful
 - 🌐 Spin-offs tend to stay in regions of parent firms
 - 🌐 Local diffusion of successful routines
 - 🌐 Self-reinforcing process

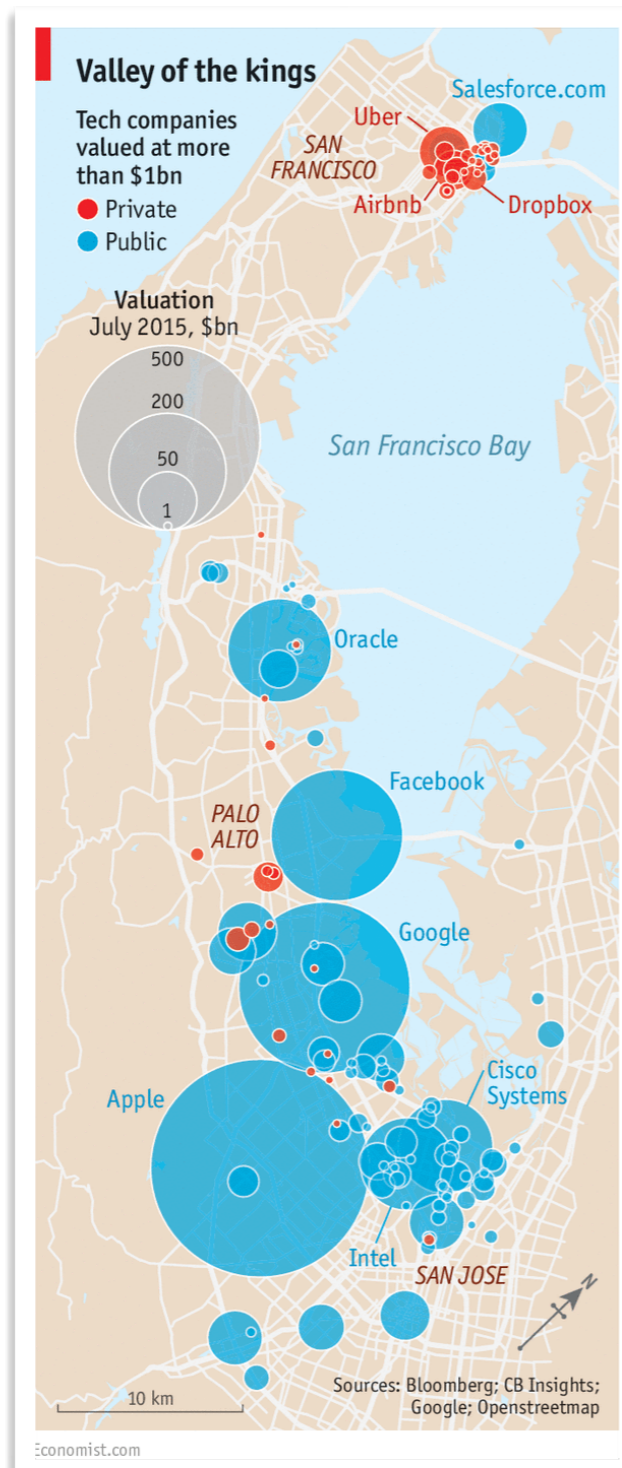
Spin-offs and industrial agglomeration

- Spin-off based explanation independent of externalities
 - **However:** Spin-offs could be seen as “local knowledge spillover”!
- **Two alternative hypotheses** for the emergence of industrial agglomerations (“*Marshall vs. Klepper*”)

Spin-offs and industrial agglomeration

- Klepper and co-authors engaged in rigorous testing of theory with extensive data collection (heritage and performance of all firms in a region!)
 - US tire industry in Akron, Ohio (Buenstorf & Klepper 2009)
 - **US semiconductors in Silicon Valley (Klepper 2010)**
 - **US automobile industry in Detroit (Klepper 2007, 2010)**

Spin-offs and industrial agglomeration



Spin-offs and industrial agglomeration

- Nobel Prize in Physics 1956 awarded to William Bradford Shockley, John Bardeen and Walter Houser Brattain "*for their researches on semiconductors and their discovery of the transistor effect*"
- William Shockley founds Shockley Semiconductor in 1957, as a division of Beckman Instruments in Silicon Valley
 - Authoritarian and unpopular management style
 - Unsuccessful research

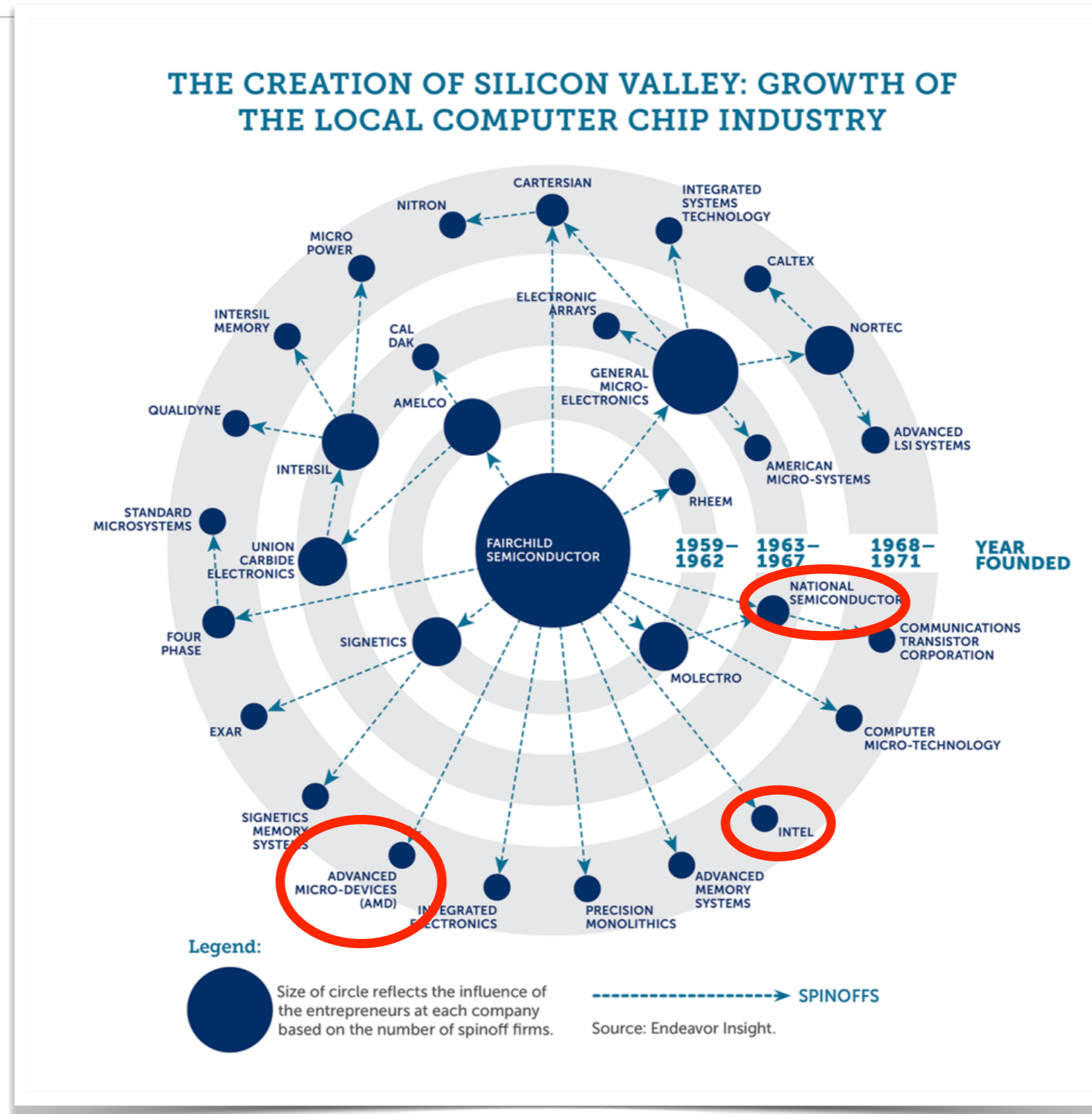
Spin-offs and industrial agglomeration

- “*Traitorous Eight*” leave Shockley Semiconductor and found Fairchild Semiconductor



Steve Jobs: *“Fairchild Semiconductor was like a ripe dandelion, you blow on it and the seeds of entrepreneurship spread on the wind.”*

Spin-offs and industrial agglomeration



Spin-offs and industrial agglomeration

- Silicon Valley's (early) success closely related to spin-off processes at core companies
- Yet, other factors contributed as well (Saxenian 1991)
 - Highly skilled migrants
 - Intensive intra- and inter-regional networks
 - Excellent research (Stanford university)

Spin-offs and industrial agglomeration

🌐 US automobile industry and Detroit

- 🌐 No indication of Detroit dominating car making in industry's early years
 - 🌐 None of 69 companies entering the car industry between 1895-1900 located there
- 🌐 Olds Motor Works first major carmaker relocated from Lansing in 1900
- 🌐 Founder (Ransom Olds) outsourced work to companies in Detroit's flourishing manufacturing sector (**relatedness!**)
- 🌐 Firms building car parts eventually learned to launch own brands (**relatedness!**)

Spin-offs and industrial agglomeration

● Olds' famous subcontractors / spin-offs

● Briscoe brothers => **Buick**

● Henry Leland => **Cadillac and Lincoln**

● Dodge brothers => **Dodge**

● Other "spin-offs"

● Ransom Olds => REO car company





● Executives from Olds => Chalmers and **Hudson**

Spin-offs and industrial agglomeration

- In addition to Olds, William Durant (**GM**) crucial for Detroit
 - William Durant (horse-drawn vehicles) bought Buick in 1904 made it part of his **General Motors** company
 - William Durant exited industry (1915) and reentered it by (co-)founding **Chevrolet**
- Detroit's car manufacturing industry driven by **spin-offs** and related diversification

Spin-offs and industrial agglomeration

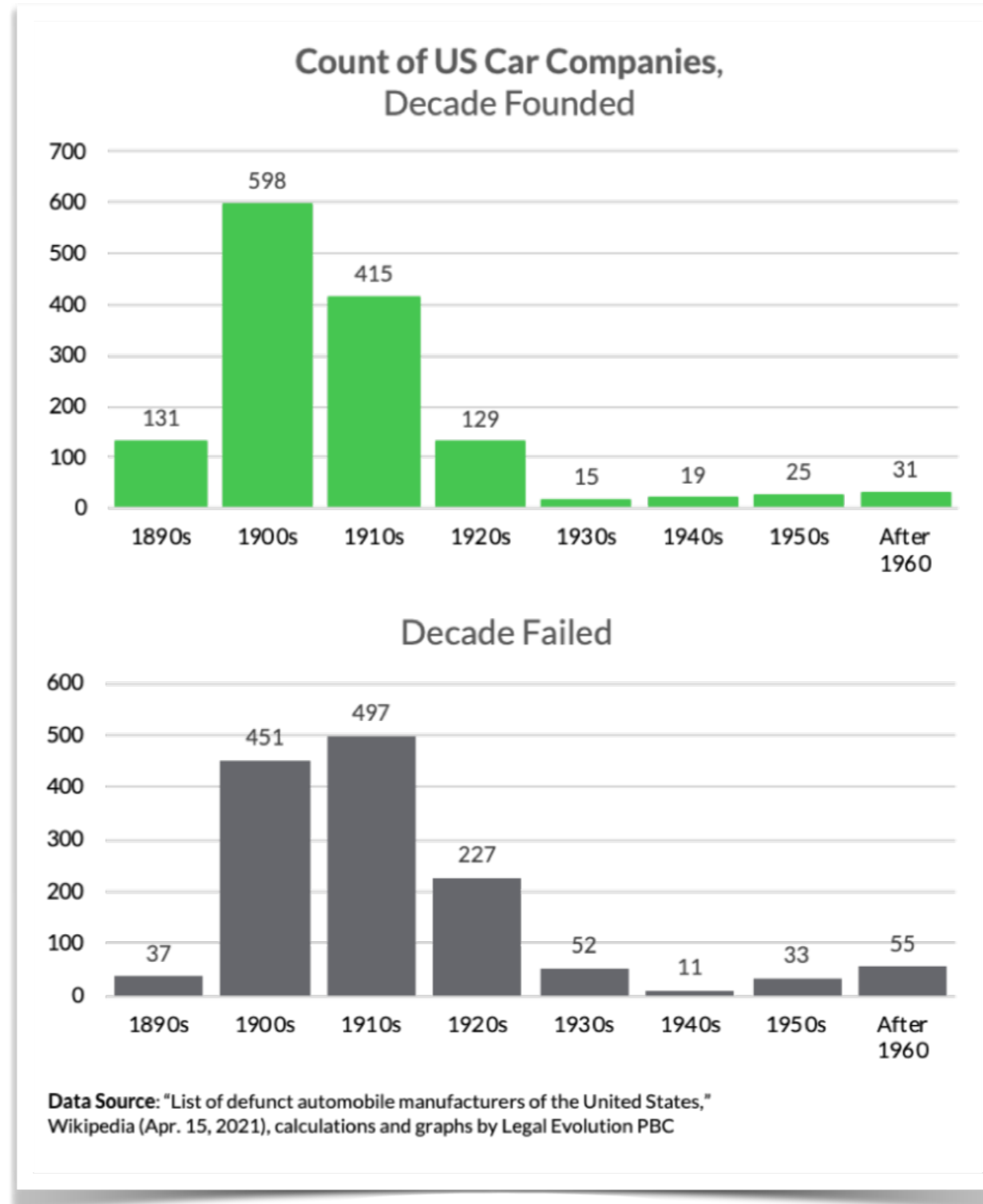
The success of Detroit

-  Number of U.S. carmakers peaked at 272 in 1909
-  **1915:** 13 out of the country's 15 most popular car brands located in Detroit
-  Other companies relocated R&D to Detroit, e.g., Ford's R&D investments primarily in Detroit
-  Increasing agglomeration in Detroit ("Motown") => harder for companies in other regions to compete

Spin-offs and industrial agglomeration

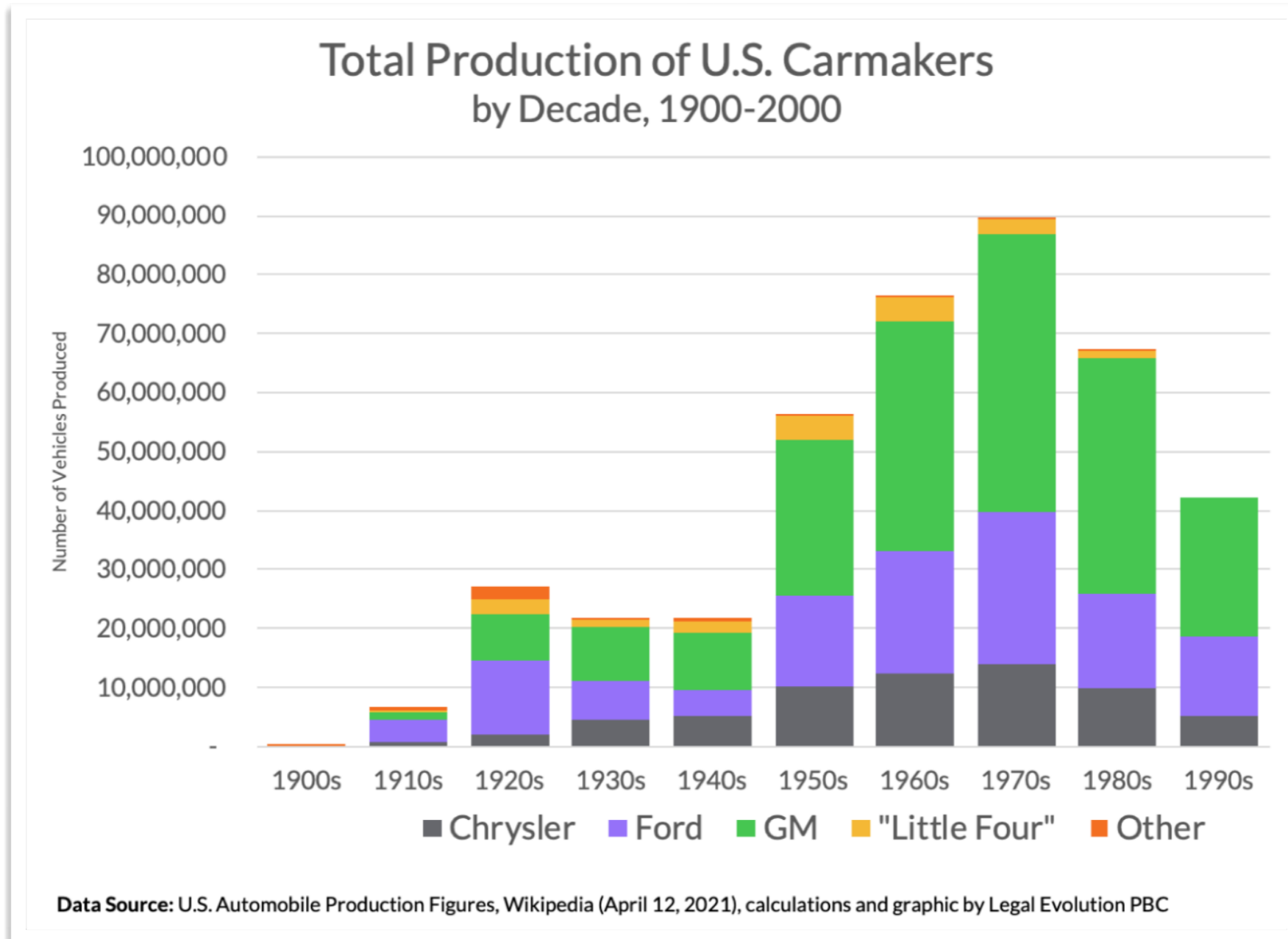
The success of Detroit

Source: <https://www.legalevolution.org/2021/04/the-best-metaphor-for-todays-legal-market-is-the-auto-industry-circa-1905-231/>



Spin-offs and industrial agglomeration

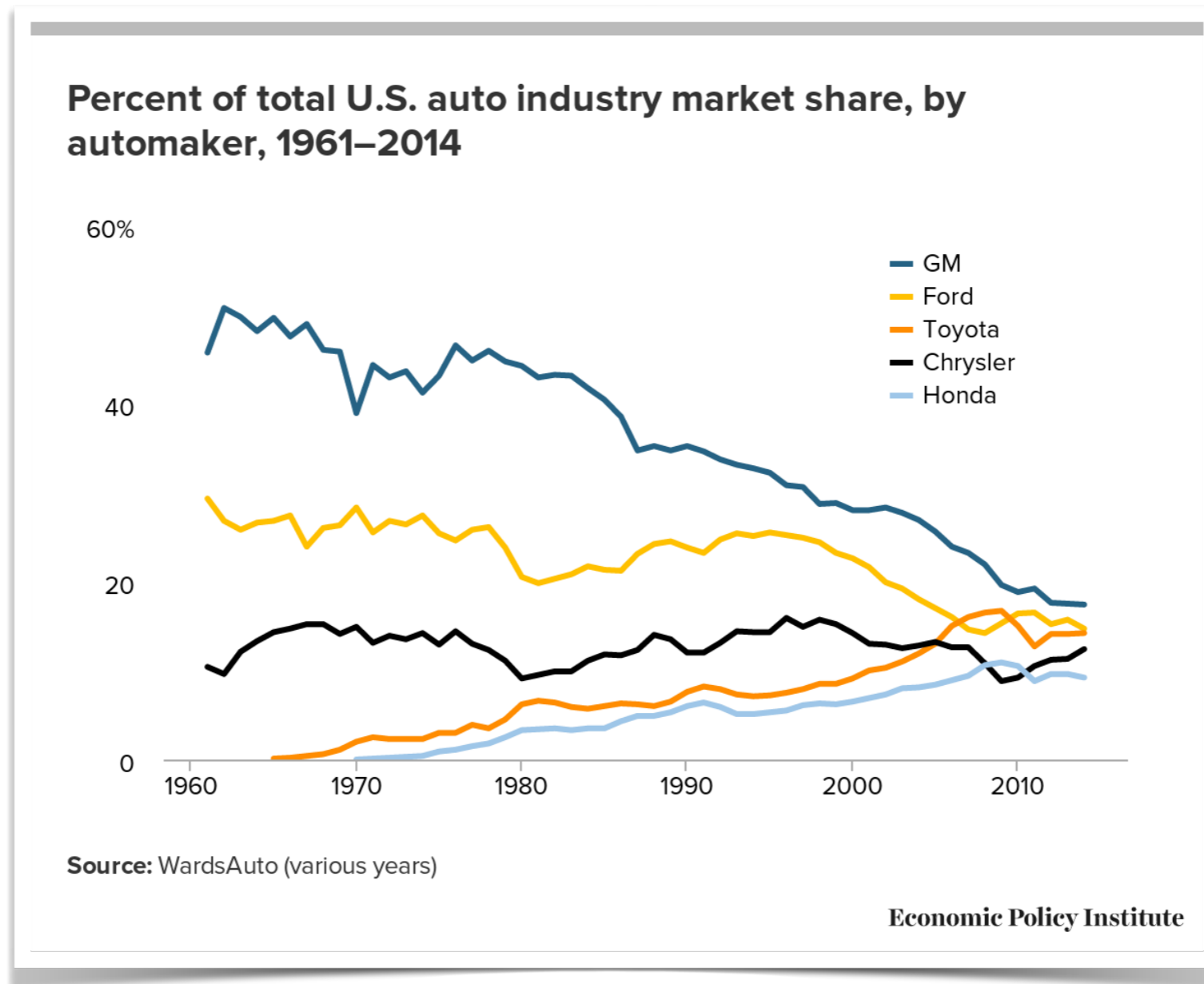
The success of Detroit



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Spin-offs and industrial agglomeration

🌐 The success of Detroit and its end



Source: <https://www.epi.org/publication/the-decline-and-resurgence-of-the-u-s-auto-industry/>

Spin-offs and industrial agglomeration

- 🌐 Spin-offs contribute to emergence of industrial agglomerations
- 🌐 Famous industrial locations shaped by **spin-off** and **entrepreneurial** processes (Silicon Valley, Detroit, Berlin)
- 🌐 Yet, (Marshallian) **externalities** and **other mechanisms** at play as well (Boschma & Frenken 2009)

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