Entrepreneurship and Long-run Economic Growth

In context of managed economy

Rationale

In practice, the world has witnessed a substantial role of entrepreneurship in enabling some entrepreneurial economies which are positioned at the highest stage of economic development (e.g., USA or UK) to enhance productivity through which their competitiveness could be built and sustained since the late 1980s. In addition, an expanding literature has verified that entrepreneurship acts as knowledge-spillover mechanism obviously crucial to long-run economic growth. As a result, it is argued that entrepreneurship still be potentially beneficial to managed economies in term of contribution to long-run growth during the globalization era and that there are variations in entrepreneurship between managed and entrepreneurial economies.

Research objective

1. General objective: Find out entrepreneurship's contribution to long-run economic growth along stages of economic development
2. Specific objectives
    a. Determine whether entrepreneurship as a particular mechanism for knowledge-spillover is integral to long-run economic growth.
    b. Find out whether entrepreneurship's contribution to long-run growth varies between the stages of economic development.
    c. Determine if entrepreneurship differs between the stages of economic development.

Research questions and hypotheses

1. Research question
    a. Does entrepreneurship significantly contribute to long-run growth by facilitating knowledge-spillover?
    b. Does entrepreneurship's contribution to long-run growth depend on the stage of economic development?
    c. Does entrepreneurship differ between the stages of economic development?
2. Research hypotheses
    a. Entrepreneurship positively contributes to long-run growth.
    b. Entrepreneurship's contribution to long-run growth significantly differs between various stages.
    c. Entrepreneurship considerably varies between various stages.

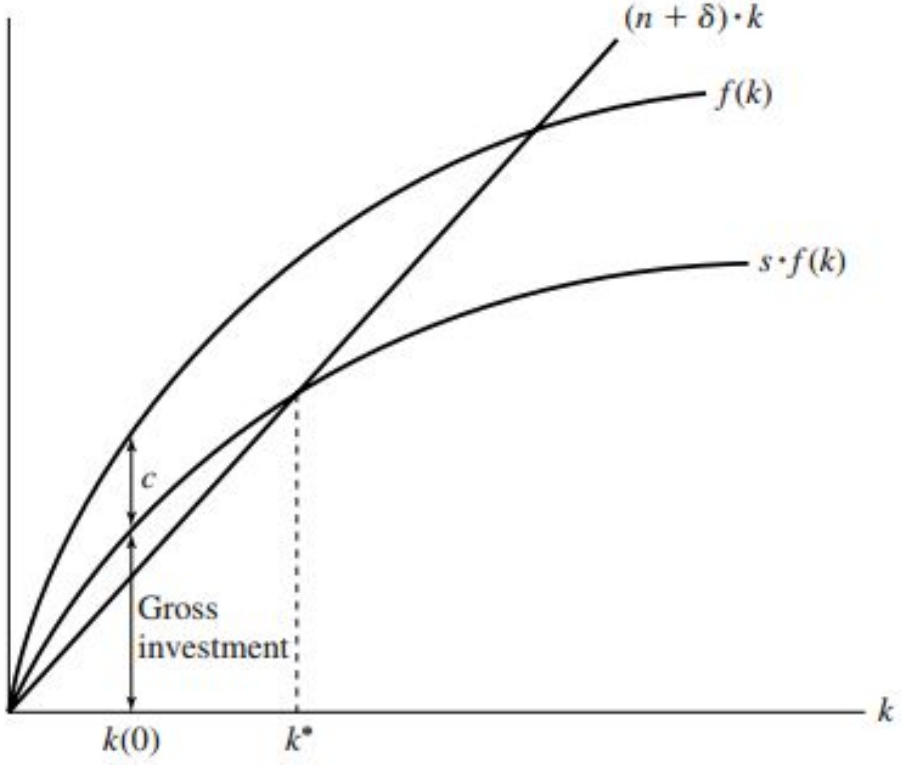
Organization

1. Economic growth theories
    a. Exogenous growth theory
    b. Endogenous growth theory
2. Stages of development
    a. Definition
    b. Distinctions
    c. Drivers of structural transformation
3. Entrepreneurship
    a. Definition
    b. Contribution to economic performance
    c. Knowledge spillover
    d. Endogenous entrepreneurship
4. Model
    a. Theoretical model
    b. Econometric model
5. Methodology
6. Data analysis
7. Conclusion

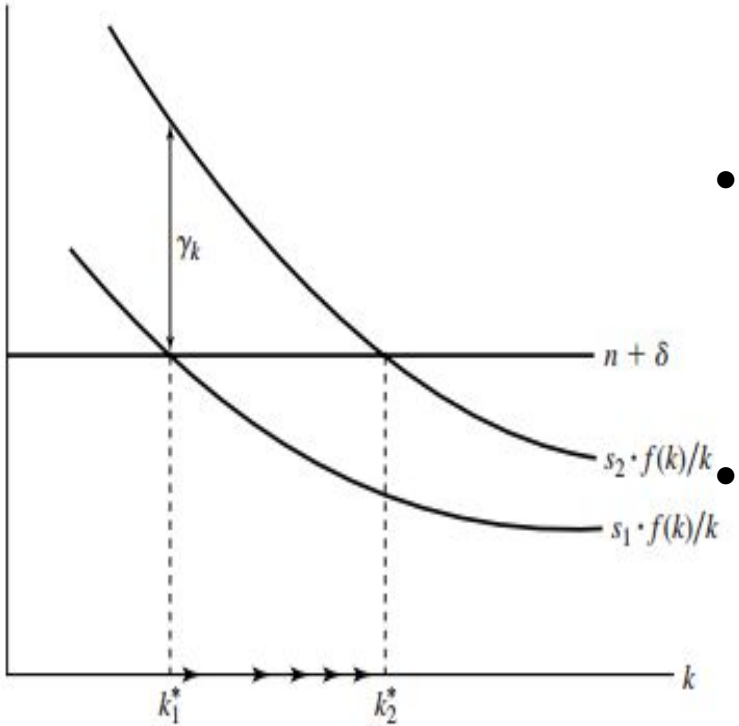
Solow-Swan model: Role of physical capital accumulation

$$\dot{k} = sf(k) - (n + \delta)k$$

- The balanced growth path & (absolute) convergence
  - Per capita quantities: $g_k = g_y = g_c = 0$
  - Aggregate variables: $g_K = g_Y = g_C = n$ (Note: “n” as assumed exogenous)
- The steady-state level of capital per capita quantities:
  - k*;
  - y* = f(f*);
  - c* = (1 - s)f(k*) (Note: “s” assumed constant)



Solow-Swan model: No sustained growth in per capita income without technological progress



- Permanent ▼n → (n+δ) shifts downward
  - (1) New higher steady-state level of k* → new higher y*;
  - (2) $g_k = g_y = 0$;
- Permanent ▲s → sf(k) shifts to the right
  - (1) New higher k* → new higher y*;
  - (2) $g_k = g_y = 0$;
  - (3) "s" ∈ [0;1]
- Permanent, once for all ▲x → sf(k) shifts upward
  - (1) New higher k* → new higher y*;
  - (2) $g_k = g_y = 0$;
  - (3) "x" without bound (vs "s" ∈ [0;1]).

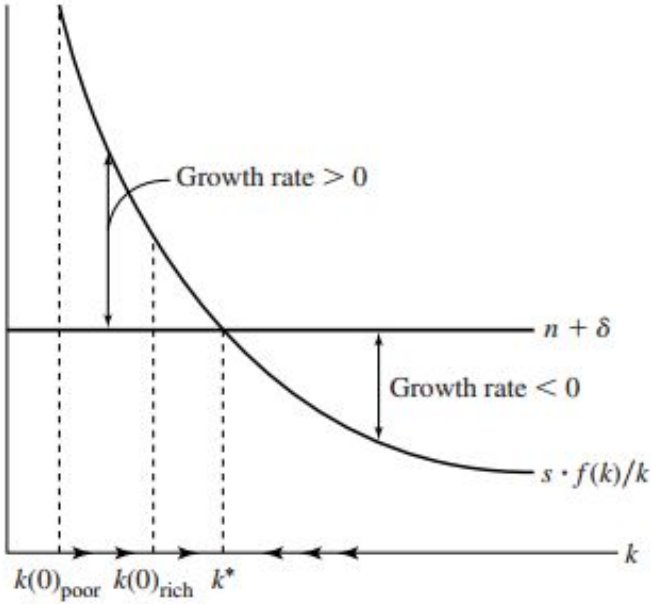
Diminishing returns to k ≈ Focus on Accumulation

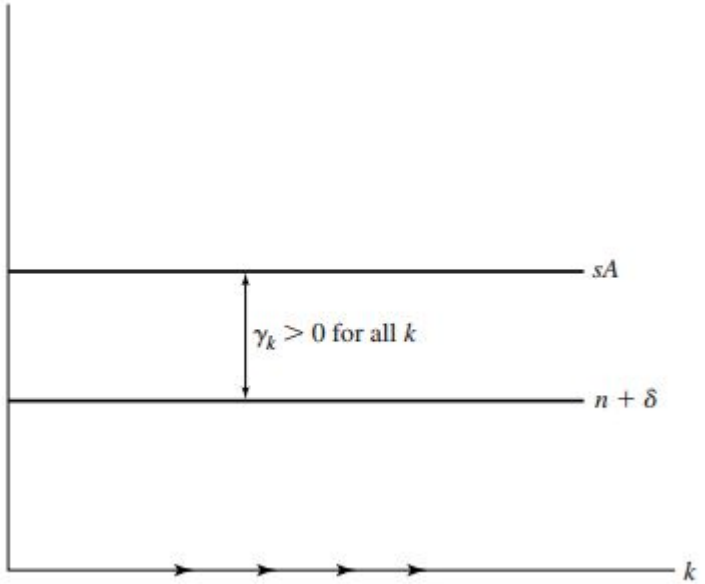
Endogenous-growth model: Absence of diminishing returns

- Absence of diminishing returns at the aggregate level ≈ Focus on Productivity
- Assumptions: (1) Existence of externality effect; (2) Imperfect competition
- Non-diminishing returns: 1st wave
  - Learning by doing, (*The Economic Implications of Learning by Doing*, Kenneth Arrow, 1962))
  - *Balanced Growth and Stability in the Johansen Vintage Model*, E. Sheshinski, 1967
  - Romer (1986); Lucas (1988) and Rebelo (1991) all built on the works of Arrow (1962) and Sheshinki (1967)
  - No theory of technological change
  - The new concept, “broad capital” consisting of both physical and human capital, is introduced to the Solow-Swan model with the hope that broad capital is not subject to diminishing return. As result, growth in per capita quantities are sustained (Robert and Xavier, 2004, p.61)
  - Knight (1944) emphasized that diminishing returns probably apply to the broad (Robert and Xavier, 2004, p.63)
- Non-diminishing returns: 2nd wave
  - Variety model, Romer (1987, 1990); Aghion and Howitt (1992); Grossman and Helpman (1991)
  - Theory of technological change and imperfect competition
  - Semi-endogenous, Jones (1995)

Endogenous-growth model: AK model featuring broad capital

- $Y = AK \rightarrow y = Ak$.
- $\lim(MP_k) = \lim(AP_k) = A > 0$ as $k \rightarrow \infty$ (≈ violation of Inada condition) → No convergence among economies characterized with different parameters e.g., n, A & **δ**.
- Balanced growth path: $g_k = g_y = g_c = sA - (n+\delta)$ ≈ positive long-run growth in per capita quantities without technological changes





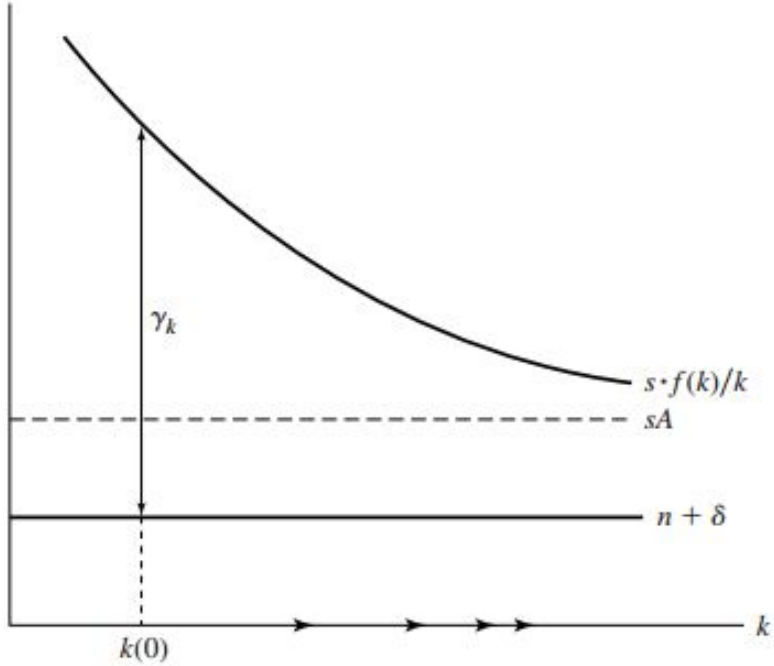
Endogenous-growth model: Broad capital introduced

- The new concept, “broad capital” consisting of both physical and human capital, is introduced to the Solow-Swan model with the hope that broad capital is not subject to diminishing return. As result, growth in per capita quantities are sustained (Robert and Xavier, 2004, p.61)

	Without Human capital (HC)	With human capital
Function	$y = Ak^{\alpha}$	$y = Ak^{\alpha}h^{\eta}$
g_y	$\frac{\dot{y}}{y} = \alpha\frac{\dot{k}}{k}$	$\frac{\dot{y}}{y} = \alpha\frac{\dot{k}}{k} + \eta\frac{\dot{h}}{h}$

Endogenous-growth model: AK model with constant return and convergence at once

- $Y = AK+BK^{\alpha}L^{1-\alpha} \rightarrow y = Ak+Bk^{\alpha}$
- As $k \rightarrow \infty$, $Lim(AP_k) = A + Bk^{-(1-\alpha)} \rightarrow$ Convergence among economies characterized with different parameters e.g., n, A & **δ**. Economies with lower k grow faster
- Balanced growth path: $g_k = g_y = g_c = sA - (n+\delta) \approx$ positive long-run growth in per capita quantities without technological changes



Endogenous-growth model: The expanding variety of intermediate goods

Production function of a firm: $Y_i = AL_i^{1-\alpha} NX_i{}^{\alpha} = AL_i^{1-\alpha} (NX_i)^{\alpha} N^{1-\alpha}$

Marginal product of NX_i: $MP_{NX_i} = \alpha AL^{1-\alpha} (\frac{1}{X_i})^{1-\alpha}$

As NXi → ∞ in term of Xi: $\lim_{NX_i \to \infty} MP_{NX_i} = 0$

As NXi → ∞ in term of N: $\lim_{NX_i \to \infty} MP_{NX_i} = \alpha AL^{1-\alpha} (\frac{1}{X_i})^{1-\alpha}$

Endogenous-growth model: The expanding variety of intermediate goods

Production function of an economy	Rate of return
$Y = A^{1/(1-\alpha)} L N \alpha^{2\alpha/(1-\alpha)}$	$r = \frac{L}{\eta} A^{1/(1-\alpha)} \left(\frac{1-\alpha}{\alpha}\right) \alpha^{2/(1-\alpha)}$

Growth of consumption

$$\frac{\dot{C}}{C} = \frac{1}{\theta}(r - \rho)$$

Steady-state growth rates of variables N, Y and C ≃ growth rate of y and c (Because L is constant)

$$g = \frac{1}{\theta}\left[\frac{L}{\eta} A^{1/(1-\alpha)} \left(\frac{1-\alpha}{\alpha}\right) \alpha^{2/(1-\alpha)} - \rho\right]$$

Endogenous-growth model: Theory of technological change

- g_N depends on (1) Negatively η, cost of R&D ; (2) Positively L which lead to L_A = (1-λ)L; (3) Positively A
- Romer (1990) introduces a production function for ideas. The productivity of researchers increases with level of "N". Stated differently, there is positive linear relationship between researcher and technological change.

$$\dot{N} = \frac{N}{\eta}(1-\lambda)L$$

- ϕ=1 because of the premise of Romer that technological knowledge is a non-rivalrous input. All invented knowledge is employed in invention of new knowledge.
- ω = 1 means there is spillover of knowledge among researchers.

Endogenous-growth model: Dissatisfaction with Romer (1990) ⇛ Semi-endogenous (Jones, 1995)

- Number of R&D employments in the US significant increased from 544,000 in 1970 to 960000 in 1991 however the productivity rate of R&D not has not risen. This pattern also were seen in OCED nations when numbers of R&D employment increased from 172000 to 511000 in Japan, 82000 to 176000 in Germany and 58000 to 129000 in France without increase in productivity growth rates (Martin and Xavier, 2004)
- As a result, $0 < \omega \leq 1$ and $0 \leq \phi < 1 \rightarrow$ Semi-endogenous by Jones (1995)

$$\dot{N} = \frac{N^{\phi}}{\eta}[L(1-\lambda)]^{\omega}$$

- According to Jones (1995); Kortum (1997) and Segerstrom (1998), the semi-endogenous also is preferred to long-run growth in the one-R&D-sector model.
- Even in the two-R&D-sector model, the semi-endogenous growth still emerges as general case while endogenous growth becomes a special case. *The long-run growth becomes semi-endogenous under mild conditions. In contrast, endogenous growth requires two knife-edge conditions of parameters. Long-run growth can be endogenous if and only if such a double coincidence occurs* (Chol-Won Li, 1999, p.1)

Stages of economic development: Michael Porter

- **Definition**: Economic development is a process of successive upgrading
- **Successive**: there are various sequential stages through which the economy should go through in the purpose of upgradation.
- **Upgrading**: an economy employs increasingly sophisticated and productive. In addition, the upgrading process poses different characteristics and challenges to an economy at each stage.
- **Competitiveness**: Going through each stages as the way that an economy can create and sustain competitiveness.
- Stages of development
    - Factor-driven stage
    - Investment-driven stage
    - Innovation-drive stage

Managed versus Entrepreneurial economies

CATEGORY	ENTREPRENEURIAL	MANAGED
Underlying forces	Location	Globalization
	Change	Continuity
	Jobs and high wages	Jobs or high wage
External environment	Turbulence	Stability
	Diversity	Specialization
	Heterogeneity	Homogeneity

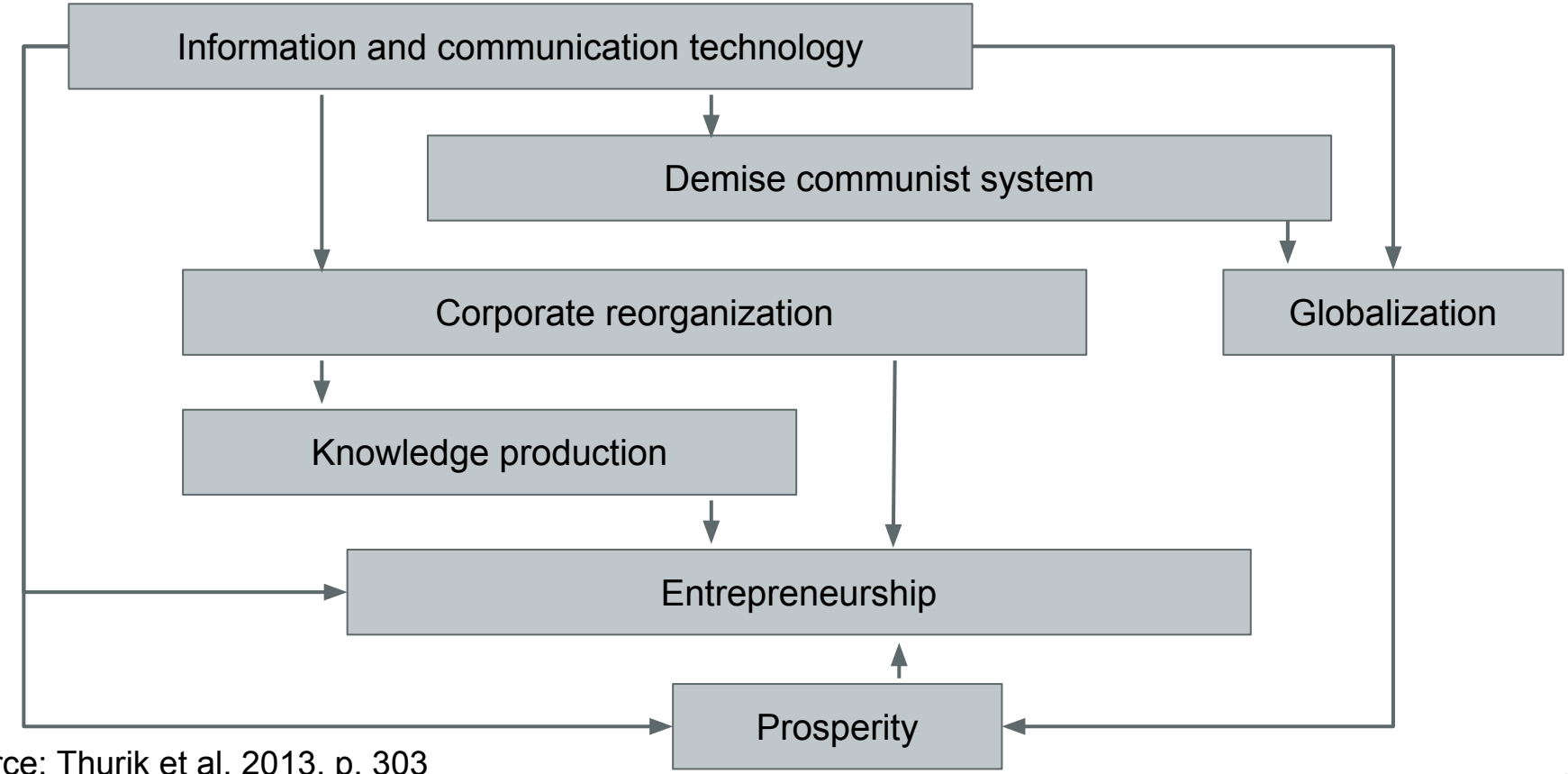
Source: Audretsch and Thurik, 2004, p.161

Managed versus Entrepreneurial economies

CATEGORY	ENTREPRENEURIAL	MANAGED
How firms function	Motivation	Control
	Market exchange	Firm transaction
	Competition and cooperation	Competition or cooperation
	Flexibility	Scale
Government policy	Enabling	Constraining
	Input targeting	Output targeting
	Local locus	National locus
	Entrepreneurial	Incumbent

Source: Audretsch and Thurik, 2004, p.161

Factors originate structural transformation



Source: Thurik et al, 2013, p. 303

Entrepreneurship: definition (Hebert and Link, 1988)

Authors	**CLASSICAL** R. Cantillon (1755)	**GERMAN TRADITION** Schumpeter (1911, 1934)	**CHICAGO TRADITION** F. Knight (1921) T. Schultz	**AUSTRIA TRADITION** Mises Kirzner
Assumptions	Imperfect foresight not a defect but a part of human condition	() Role of disequilibrium () Circular flow () Development disturbing economic status quo () “Equi” - “Disequi” (≠ Schultz)	#Schultz: () Role of equilibrium; () “Disequi” - “Equi”; () Entrepreneur not limited to biz men #Knight: Distinction b/w risk & uncertainty	#Kirzber: () “Disequi” - “Equi”; () Information asymmetry
Distinction	() Buy at certain price, sell at uncertain price → profit or loss (= Frank) () Lack of perfect foresight → Uncertainty → Business judgment () Entrepreneurs: Robber; farmer but landlord; paid wage laborer	() Entrepreneur: the bearer of the mechanism for change and development; agent of change; innovator () Entrepreneur carries out new combinations e.g., new products, new org, new method () Entrepreneur ≠ capitalist, landowner; laborer, inventor (≠ Schultz’s entrepreneur)	# Knight:Entrepreneurship as dealing with uncertainty # Schultz: () Entrepreneurship as ability to deal with disequilibrium rather than dealing with uncertainty; () Entrepreneur supply as scare source because of human capital	#Kirzner: () Entrepreneur as equilibrating force in economic system; () Sequence of Alertness; Spontaneous learning and entrepreneurial discoveries

Entrepreneurship: Definitions

Entrepreneurship usually has a special meaning in this context. It pertains to the actions of risk taker, a creative venturer into a new business or the one who revives an existing business e.g. Steve Jobs (Wennekers and Thurik, 1999, p.47)

Entrepreneur are agents of change and growth in a market economy and they can act to accelerate the generation, dissemination and application of innovation ideas. Entrepreneurs not only seek out and identify potentially profitable economic opportunities but are also willing to take risk to see if their hunches are right (OECD, 1988)

Entrepreneurship as engine of economic performance

NEOCLASSICAL THEORIES (STATIC)
Solow-Swan (1956)

Private input
Knowledge

EFFIC-IENCY → SCALE → Large firm

NEW THEORIES (DYNAMIC)

- Javanovic (1982)
- Lambson (1991)
- Ericson and Pakes (1995)
- Klepper (1996)
- Audretsch (1995)

Private input
Knowledge

START-UP

- Asymmetric
- Uncertain
- Distinctive

Entrepreneurship and knowledge spillover

$$\dot{N} = \tau N^{\Phi} L_A^{\omega} \rightarrow \log(\dot{N}) = \tau + \phi \log(N) + \omega \log(L_A)$$

- Φ, the parameter of codified knowledge spillover: (1) primarily determined within research sector; (2) exogenous to an economy
- **ω**, the parameter of tacit knowledge spillover
- Manipulation of parameter of tacit knowledge spillover, **ω** (Zoltan and Attila, 2005)

$$\omega = \beta_1 + \beta_2 \log(entrepreneur) + \beta_3 \log(Agglomeration)$$

The knowledge spillover theory of entrepreneurship (Audretsch et al, 2006)

- In reality, not all new knowledge (from R&D) could be successfully commercialized.
- New knowledge = New economic knowledge + Unexploited knowledge
- γ = New economic knowledge/New knowledge
- The new unexploited knowledge left behind represent entrepreneurial opportunities

$$\dot{N}_{opp} = (1-\gamma)\tau N^{\Phi} L_A^{\omega}$$

- Change in new unexploited knowledge is a function of L_A and N^{ϕ}. (note: $\gamma > 0$; $\omega > 0$; $\tau > 0$)

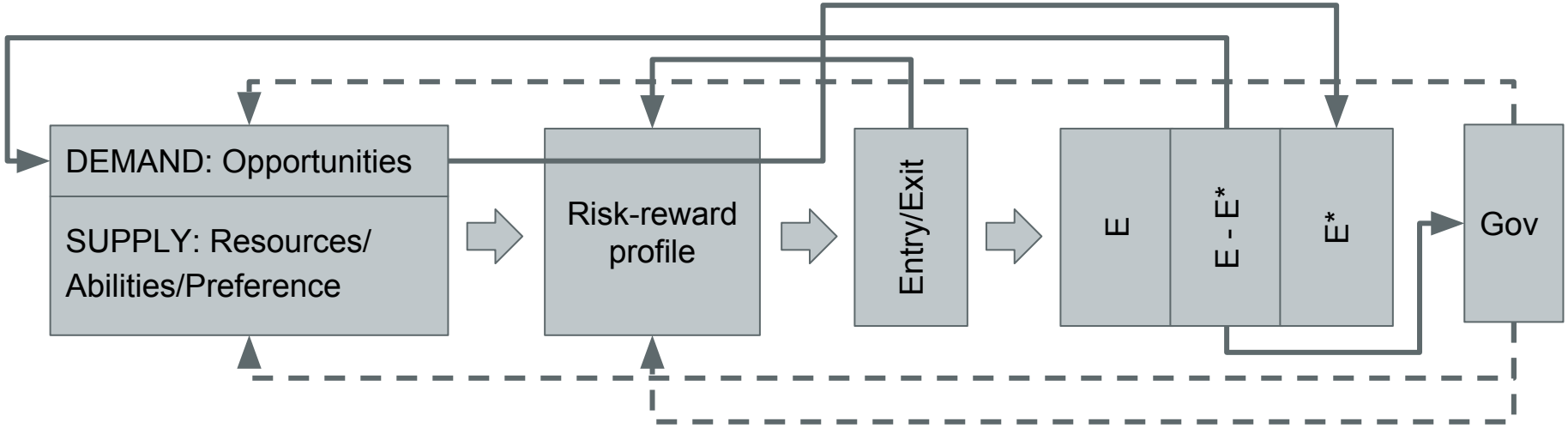
Positive marginal contribution of N^{ϕ} means that the unexploited knowledge increases with codified knowledge spillover	$\frac{d\dot{N}_{opp}}{dN^{\Phi}} = (1-\gamma)\tau L_A^{\omega}$
Positive and diminishing marginal contribution of L_A means that the unexploited knowledge increases with amount invested in R&D	$\frac{d\dot{N}_{opp}}{dL_A} = (1-\gamma)\tau\omega N^{\Phi} L_A^{\omega-1}$

Endogenous entrepreneurship (Audretsch et al, 2006)

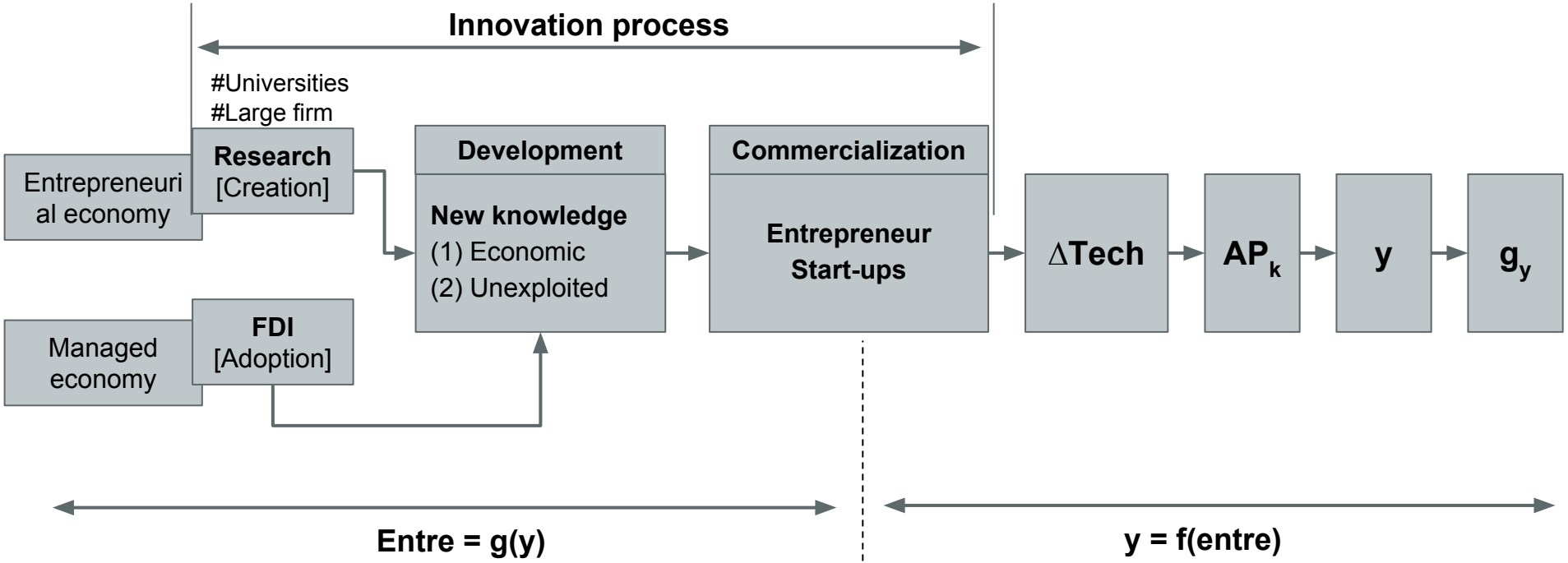
$$E^* = \frac{1}{\psi} g\left(\pi^*\left(\dot{N}_{opp}, \gamma\right) - w\right)$$

- E* represents entrepreneurial opportunities derived from knowledge spillover
- E* positively depends on (1) L_A ; (2) N^{ϕ}; (3) γ
- E* negatively depends on (1) w; (2) ψ such as risk aversion, lack of social acceptance or financing constraints

Entrepreneurship: Determinants (David Audretsch, 2003)



Theoretical model



Econometric model

- **Equation 1: y = f(Entre)**

$$\log(y) = a_0 + a_1 A + a2 INFRAST + a_3 HC + a_4 K + a_5 L + a_6 AxENTRE + a_7 AxAGGL + a_8 ENTRE + a_9 AGGL + a_{10} ENTRExD$$

- **Equation 2: Entre = g(y)**

$$ENTRE = b_0 + b_1 A + b_2 FDI + b_3 GOV + b_4 W + b_5 Log(y) + b_6 PATENT + b_7 AGGL + b_8 INFRAST + b_9 HC + b_{10} Log(y)xD$$

Method: Variable definition & Data source

VARIABLE	DEFINITION	SOURCE
A: Technological knowledge stock	R&D expenditures (%GDP)	World Development Indicator, World Bank
PATENT: Knowledge filter	Total patent application (resident as well as non-resident)	World Development Indicator, World Bank
ENTRE: Entrepreneurship	New registrations per 1000 people ages 15 - 64	World Development Indicator, World Bank
FDI: Openness of the economy	FDI net inflow (%GDP)	World Development Indicator, World Bank
GOV: Barrier to entrepreneur	General government final consumption expenditure (%GDP)	World Development Indicator, World Bank
INFRAST: Infrastructure	Internet user per 100 people	World Development Indicator, World Bank
HC: Human capital	Education expenditure (%GDP)	World Development Indicator, World Bank

Method: Variable definition & Data source

VARIABLE	DEFINITION	SOURCE
K: Physical capital	Gross fixed capital formation (%GDP)	World Development Indicator, World Bank
Y: Output per capita	GDP per capita, PPP, (2011USD)	World Development Indicator, World Bank
W: Wage	Average annual wage	OECD
L: Labor in industry (Excl Agri)	Employment in industry (% total employment)	World Development Indicator, World Bank
AGGL: Agglomeration	Large city population (%Urban population)	World Development Indicator, World Bank
INFRAST: Infrastructure	Internet user per 100 people	World Development Indicator, World Bank
HC: Human capital	Education expenditure (%GDP)	World Development Indicator, World Bank

Method: Simultaneous equation system

- Panel data
  - Year: 1996 - 2015
  - Nation: 35 nations of OCED
  - Observation: 331
- The econometric model consists of 2 equations. This system is estimated by Two-Stage Least Square
- Dummy variables are employed. Entrepreneurial economies take value of 1 and managed economies take value of 0
- Adding two interactions terms between the dummy variable and Log(y) in equation 1 as well as ENTRE in equation 2 to identify variation in coefficients of these two explanatory between managed and entrepreneurial economies.

Data analysis

Depdent variable Log(y)	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Intercept	4.3 | (0.00)	4.39 | (0.00)	4.39 | (0.00)	4.39 | (0.00)	4.16 | (0.00)*
A	0.08 | (0.00)	0.13 | (0.00)	0.13 | (0.00)	0.13 | (0.00)	0.18 | (0.00)*
INFRAST	0.001 | (0.00)	0.000 | (0.38)	0.000 | (0.38)	0.000 | (0.38)	0.00 | (0.44)
HC	0.01 | (0.01)	0.02 | (0.00)	0.02 | (0.00)	0.02 | (0.00)	0.014 | (0.02)**
K	0.00 | (0.72)	0.001 | (0.43)	0.001 | (0.43)	0.001 | (0.43)	0.00 | (0.73)
L	-0.006 | (0.00)	-0.007 | (0.00)	-0.007 | (0.00)	-0.007 | (0.00)	-0.00 | (0.02)**
AxENTRE	-0.002 | (0.64)	-0.02 | (0.06)	-0.02 | (0.06)	-0.02 | (0.06)	-0.03 | (0.00)*
AxAGGL	-0.001 |(0.00)	-0.000 | (0.24)	-0.000 | (0.24)	-0.000 | (0.24)	-0.00 | (0.00)*
ENTRE	0.0003 | (0.73)	0.036 | (0.07)	0.036 | (0.07)	0.036 | (0.07)	**0.05 | (0.00)***
AGGL		-0.003 | (0.054)	-0.003 | (0.054)	-0.003 | (0.054)	
ENTRExD					**0.03 | (0.00)***
Adj-Rsrq	0.54	0.44	0.44	0.44	0.53

Data analysis

Dependent variable Entre	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Intercept	-92.9 | (0.00)	118.7 | (0.00)	91.6 | (0.03)	-133 | (0.00)	-61.8 | (0.1)
A	-1.125 | (0.00)	-1.29 | (0.00)	-1.39 | (0.00)	-1.5 | (0.00)	-1.32 | (0.00)*
FDI	-0.00 | (0.97)	-0.019 | (0.37)	-0.01 | (0.47)	0.0009 | (0.68)	0.004 | (0.83)
GOV	-0.021 | (0.78)	0.045 | (0.53)	0.007 | (0.92)	-0.136 | (0.1)	-0.164 | (0.02)**
W	-0.00 | (0.09)	0.00 | (0.00)	0.000 | (0.02)	-0.00 | (0.00)	-0.00 | (0.64)
Logy	22.7 | (0.00)	-30.3 | (0.00)	-23.7 | (0.02)	32.11 | (0.00)	**14.22 | (0.10)*** **
PATENT	-0.00 | (0.24)	-0.00 | (0.00)	-0.00 | (0.06)	0.00 | (0.3)	-0.00 | (0.08)***
AGGL	0.1 |(0.00)	0.14 | (0.00)	0.133 | (0.00)	0.08 | (0.00)	
INFRAST		0.14 | (0.00)	0.13 | (0.00)		0.076 | (0.00)*
HC			0.37 | (0.16)	1.3 | (0.00)	1.33 | (0.00)*
LOGYxD					**-0.95 | (0.00)***
Adj-Rsrq	0.06	0.19	0.25	0.04	0.28

Conclusion

- Agglomeration play key role in enhancing entrepreneurship's contribution to growth while entrepreneurship insignificantly contributes to growth (See. Model 1 and 2)
- The coefficient of the interaction term between Entrepreneurship and Dummy is statistically significant (See. Model 6). As a result, entrepreneurship's importance to economic growth varies among stages of development
- Entrepreneurship has statistically significant positively contributes to long-run growth.

Conclusion (cont.)

- Human capital and infrastructure play integral role in facilitating entrepreneurship (see model 1 - 4)
- That fact that coefficients of both Log(y) and Log(y)xD are statistically significant implies that entrepreneurship considerably varies between various stages