TO START OR NOT TO START A BUSINESS

Are Historical Averages or Reference Groups Useful Information for Entrepreneurial Entry?

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Motivation

There is no doubt that personality matters when individuals decide to start a business and to maintain it successfully. But, there is a controversial discussion in entrepreneurship research whether these empirical results are useful for practical advice. Most psychological and economic research in this field compares average values of personality traits of individuals being in wage employment or of unsuccessful entrepreneurs with the traits of entrepreneurs who are at the time of the survey in the market (an approximation for successful entrepreneurs). Results of these comparisons are then often used to create a profile of a prototype of a successful entrepreneur; thus, basically revealing information about average scores in inventories such as the Big Five—to be called 'historical average'—are transformed to benchmark values about successful entrepreneurs entering the data base of this industry. A minority argues for a different approach by employing role models where information about the personality of a reference group close to the potential entrepreneur is used to enter as benchmark value in the further process—to be called 'reference group'. This leads to the crucial question of what kind of information should be used as benchmark value.

General Setup

- Two questions
  1. Are reference groups or historical averages better (according to intuitive criteria)?
  2. Which approach properties are responsible for the answer to the first question?
- General method: numerical experiment, *i.e.*, simulations
- Two main variables
  - Entrepreneurial fitness $\varphi \in \mathbb{R}$ (monetary entrepreneurial income in relation to the monetary income from some alternative such that entrepreneurial income is weakly better than alternative income if $\varphi \geqslant 0$)
  - Individual attribute $\tau \in \mathbb{R}$ (traits)
- Main variables jointly-normal
- Variables to fix (objective) distribution
  - Correlation between fitness and traits ρ, standard deviation of fitness σ_φ, standard deviation of attributes σ_τ, mean fitness μ_φ, and attributes' mean μ_τ

General Problem

- Individual i requests an advice ($i \in \mathbf{C}$ and $|\mathbf{C}| = N_{\mathbf{C}}$)
  - Adviser with historical data $\mathbf{H}$ where $|\mathbf{H}| = N_{\mathbf{H}}$
  - Historical data: (φ_j, τ_j) for all $j \in \mathbf{H}$ such that there are $2 \times N_{\mathbf{H}}$ historical data points
  - Entrepreneurial fitness of client $(\varphi_i$ for all $i \in \mathbf{C})$ not observable
  - Client attributes τ_i (for all $i \in \mathbf{C}$) observable
  - Subjective fitness cut-off $\lambda \in \mathbb{R}_0^+$ (if $\varphi_i \geqslant \lambda$ for some individual i, i is considered an entrepreneur)
  - (Subjective) share of entrepreneurs in population negative in λ ("natural" cut-off: $\lambda = 0$)
  - Task of adviser: recommendation for or against entrepreneurship for each $i \in \mathbf{C}$ after observing τ_i for each $i \in \mathbf{C}$ and (φ_j, τ_j) for all $j \in \mathbf{H}$
- Construction of performance criteria by comparing advisers' outcome to self-selection outcome (client knows her φ)
  - Overall performance Ω
  - Performance of recommendations for entrepreneurship Δ

(Theoretical) Experimental Setting

Decomposition of $\mathbf{H}$ into two groups

- Historical entrepreneurs $\mathbf{E}_H = \{i \in \mathbf{H} | \varphi_i \geqslant \lambda\}$
- Historical non-entrepreneurs $\mathbf{A}_H = \{i \in \mathbf{H} | \varphi_i < \lambda\}$

Historical averages (HA)

- Historical average: $\hat{\tau}_{\mathbf{E}} = \left(\sum_{i \in \mathbf{E}_H} \tau_i\right) / |\mathbf{E}_H|$
- If $d(\tau_i, \hat{\tau}_{\mathbf{E}}) < \varepsilon$, recommend entrepreneurship

Reference groups (RG)

- Construction of reference group: $\mathbf{R}_i = \{j \in \mathbf{H} | d(\tau_i, \tau_j) < \eta\} \subseteq \mathbf{H}$ for each $i \in \mathbf{C}$
- Simple reference-group fitness (SRG): $\hat{\varphi}_{\mathbf{R}_1, i} = \left(\sum_{j \in \mathbf{R}_i} \varphi_j\right) / |\mathbf{R}_i|$
- Weighted reference-group fitness (WRG): $\hat{\varphi}_{\mathbf{R}_2, i} = \sum_{j \in \mathbf{R}_i} \omega_j \varphi_j$
- If $\hat{\varphi}_{\mathbf{R}, i} \geqslant \lambda$, recommend entrepreneurship

- d some distance function
- Weight ω normalized and negative in attribute distance
- Similarity criterion η = exogenous search budget
- Similarity criterion ε endogenous
- Three possibilities to handle ε
  1. $\eta = \varepsilon$ (HA and RG compete on equal terms)
  2. Optimal ε determined by experience and η exogenous
  3. Optimal ε computed under perfect information and η exogenous
- Minimal fitness requirement λ exogenous (if endogenous, simple strategy: set extremely unrealistic minimal fitness and do not recommend entrepreneurship)
- All data drawn from same bivariate normal distribution
- All parameters allowed to vary (given certain limits)

Results I: Performance

- Lower performance boundary derived from toss of unbiased coin
- Two moments (empirical mean and standard deviation) of the distributions of Ω and Δ
- Unmodified reference groups compete against
  - Unmodified (uncoordinated) HA
  - HA where advisers are allowed to gain (limited) experience with data generating distribution (coordinated HA)
  - HA where advisers are provided perfect information on joint distribution
- Main results
  1. Competition on equal terms: RG-approaches clearly dominate, instances where HA is not much better than coin
  2. Optimized HA: under most conditions, RG-approaches either superior or able to compete with HA

Historical Averages versus Uncoordinated Reference Groups and the Coin (Relative Difference in Percent)

Condition		Ω-PERFORMANCE HA vs. SRG	HA vs. WRG	HA vs. COIN	Δ-PERFORMANCE HA vs. SRG	HA vs. WRG	HA vs. COIN
λ	0.01	63.48^{-+}	63.56^{-+}	10.22^{+}	26.70^{-}	23.49^{-}	7.70^{+}
	0.15	25.33^{-}	25.45^{-+}	25.07^{+}	41.95^{-}	40.67^{-}	12.21^{+}
$\varepsilon = \eta$	0.01	46.45^{-+}	46.31^{-+}	15.99^{+}	13.78^{-}	13.19^{-}	11.97^{+}
	0.15	39.13^{-+}	39.45^{-+}	20.51^{+}	59.81^{-}	54.20^{-}	7.04^{+}
$\hat{\rho}$	0.00	52.48^{-+}	52.38^{-+}	11.04^{+}	22.94^{-}	20.87^{-}	0.65^{-}
	0.20	50.15^{-+}	50.08^{-+}	12.53^{+}	30.66^{-}	25.89^{-}	1.19^{+}
	0.40	44.02^{-+}	44.04^{-+}	16.74^{+}	34.61^{-}	31.31^{-}	5.23^{+}
	0.60	37.48^{-+}	37.64^{-+}	21.90^{+}	38.68^{-}	37.85^{-}	12.44^{+}
	0.80	32.16^{-+}	32.57^{-+}	27.12^{+}	35.67^{-}	34.29^{-}	24.30^{+}
Unconditional		42.69^{-+}	42.79^{-+}	18.31^{+}	34.17^{-}	31.65^{-}	9.58^{+}

"$-$" signifies a loss of HA and "$+$" a win over the competitor. Numbers are percentage differences with HA as basis. For instance: 10^{-} tells us that HA has to increase its average performance by 10 percent to be on par with the opponent; 10^{+} tells us that, to be on par with the competitor, HA has to decrease its average performance by 10 percent. "$-+$" signifies that even in the best situation for HA, where HA is above the (conditional) mean by twice the HA (conditional) standard deviation and the competitor is below its (conditional) mean by twice its (conditional) standard deviation, HA loses.

Historical Averages versus Coordinated (CD) and Perfect-Information (PI) Reference Groups and the Coin (Relative Difference in Percent)

Condition			Ω-PERFORMANCE HA vs. SRG	HA vs. WRG	HA vs. COIN	Δ-PERFORMANCE HA vs. SRG	HA vs. WRG	HA vs. COIN
λ	0.01	CD	1.70^{-} (77.96^{-+})	1.75^{-} (78.03^{-+})	44.15^{+} (2.28^{+})	23.21^{-} (26.40^{-})	20.96^{-} (24.10^{-})	9.56^{+} (7.21^{+})
		PI	0.05^{-} (78.70^{-+})	0.09^{-} (78.77^{-+})	45.07^{+} (1.89^{+})	7.15^{-} (1.02^{+})	6.93^{-} (1.20^{+})	20.27^{+} (26.33^{+})
	0.15	CD	2.24^{-} (28.67^{-})	2.35^{-} (28.80^{-})	38.89^{+} (23.10^{+})	37.61^{-} (46.47^{-})	37.13^{-} (45.96^{-})	15.02^{+} (9.55^{+})
		PI	1.06^{-} (30.53^{-+})	1.16^{-} (30.66^{-+})	39.59^{+} (21.98^{+})	19.34^{-} (2.25^{+})	18.88^{-} (1.17^{+})	27.93^{+} (38.25^{+})
η	0.01	CD	1.74^{-} (51.40^{-+})	1.65^{-} (51.27^{-+})	41.64^{+} (13.16^{+})	15.17^{-} (19.95^{-})	14.48^{-} (19.23^{-})	11.83^{+} (8.17^{+})
		PI	0.31^{-} (51.56^{-+})	0.22^{-} (51.42^{-+})	42.46^{+} (13.07^{+})	8.90^{-} (7.10^{+})	8.25^{-} (7.65^{+})	17.66^{+} (29.76^{+})
	0.15	CD	2.18^{-} (49.37^{-+})	2.42^{-} (49.71^{-+})	41.64^{+} (14.69^{+})	48.50^{-} (54.72^{-})	43.61^{-} (51.71^{-})	11.86^{+} (8.17^{+})
		PI	0.75^{-} (52.17^{-+})	0.98^{-} (52.53^{-+})	42.46^{+} (13.08^{+})	38.18^{-} (31.86^{-})	15.44^{-} (9.26^{+})	30.27^{+} (34.08^{+})
$\hat{\rho}$	0.00	CD	1.95^{-} (65.09^{-+})	1.89^{-} (63.00^{-+})	40.32^{+} (4.85^{+})	25.68^{-} (25.80^{-})	25.36^{-} (25.49^{-})	0.88^{+} (0.08^{+})
		PI	0.45^{-} (63.74^{-+})	0.51^{-} (63.63^{-+})	41.94^{+} (4.50^{+})	28.85^{-} (5.57^{+})	26.49^{-} (7.30^{+})	0.00 (26.71^{+})
	0.20	CD	1.84^{-} (49.29^{-+})	1.80^{-} (49.22^{-+})	40.64^{+} (12.99^{+})	29.49^{-} (30.76^{-})	27.15^{-} (28.41^{-})	1.41^{+} (0.45^{+})
		PI	0.30^{-} (45.90^{-+})	0.34^{-} (45.84^{-+})	41.91^{+} (15.00^{+})	38.15^{-} (4.36^{+})	33.64^{-} (7.48^{+})	1.11^{+} (30.00^{+})
	0.40	CD	1.88^{-} (49.62^{-+})	1.90^{-} (49.65^{-+})	41.15^{+} (13.58^{+})	28.69^{-} (33.11^{-})	26.12^{-} (30.45^{-})	6.07^{+} (2.85^{+})
		PI	0.32^{-} (47.15^{-+})	0.34^{-} (47.17^{-+})	42.03^{+} (14.97^{+})	12.01^{-} (2.80^{+})	11.57^{-} (3.31^{+})	36.08^{+} (25.32^{+})
	0.60	CD	2.00^{-} (44.74^{-+})	2.13^{-} (44.92^{-+})	42.10^{+} (17.83^{+})	53.71^{-} (44.98^{-})	53.75^{-} (42.02^{-})	14.75^{+} (9.48^{+})
		PI	1.14^{-} (49.69^{-+})	1.27^{-} (49.87^{-+})	42.35^{+} (14.98^{+})	16.39^{-} (3.82^{+})	16.85^{-} (3.13^{+})	45.95^{+} (32.89^{+})
	0.80	CD	2.15^{-} (46.85^{-+})	2.44^{-} (47.28^{-+})	43.68^{+} (19.02^{+})	27.79^{-} (38.80^{-})	26.08^{-} (36.86^{-})	29.41^{+} (23.39^{+})
		PI	1.88^{-} (54.16^{-+})	2.19^{-} (54.64^{-+})	43.83^{+} (15.00^{+})	4.72^{-} (2.30^{+})	5.69^{-} (1.26^{+})	47.43^{+} (43.56^{+})
Unconditional		CD	1.96^{-} (50.38^{-+})	2.04^{-} (50.49^{-+})	41.64^{+} (13.95^{+})	30.31^{-} (35.75^{-})	28.81^{-} (34.18^{-})	11.84^{+} (8.17^{+})
		PI	0.53^{-} (51.87^{-+})	0.60^{-} (51.97^{-+})	42.46^{+} (13.08^{+})	12.66^{-} (1.60^{+})	11.19^{-} (0.28^{+})	24.48^{+} (31.89^{+})

Results II: Properties

- HA properties *without* interventions
  - Moderate trade-off between overall recommendation performance (Ω) and performance of pro-entrepreneurship recommendations (Δ)
  - Weak reflection of movements in population share of entrepreneurs
  - Tendency to underestimate population share of entrepreneurs
  - Highly dependent on similarity measure ε
- SRG and WRG properties
  - Low trade-off between overall recommendation performance (Ω) and performance of pro-entrepreneurship recommendations (Δ)
  - Good reflection of movements in population share of entrepreneurs
  - Tendency to overestimate population share of entrepreneurs
  - Robust against variations in measure of similarity η
- HA properties *with* interventions
  - HA properties converge towards properties of SRG and WRG, *i.e.*, trade-off becomes weaker, HA better follows movements in population share of entrepreneurs, ...

Results III: Robustness

- Competition on equal terms
- Observations errors
  - Instead of τ_i, observation of $\tau_i + e_i$ where e_i i.i.d. normally distributed observation error
  - Observation errors systematic if $\mathbb{E}\{e\} \neq 0$ and unsystematic if $\mathbb{E}\{e\} = 0$
  - $\mathrm{Var}(e) \neq 0$ always
  - Results: negative general effect on HA performance; SRG/WRG performance more volatile, such that, losses and gains
  - Comparative: HA and SRG/WRG relative positions almost the same
- Relevance of non-trait conditions (NTCs)
  - Assumption: accounting for NTCs decreases fitness variance
  - Results: unconditional HA performance increases, HA always better than coin; unconditional SRG/WRG performance increases
  - Comparative: no change in relative performance position
- Additional tests?

Summary

Personality traits are one important factor for becoming an entrepreneur. However, is such information also useful for advice? Most academic researchers employ a construct based on the average scores of successful entrepreneurs (historical averages) and advice is then made by comparing the average with the specific scores in traits of a potential entrepreneur. A minority argues that role models (reference groups) are a benchmark to be used instead. This paper theoretically analyzes both approaches. Given two straightforward performance criteria and based on a multitude of simulations, we demonstrate that the role model approach is superior. Compared to historical averages, approaches using reference groups have better and more stable intrinsic properties and their performance depends less on the behavior of the adviser. Furthermore, we show that under some conditions, associated with a small correlation between traits and the answer to the question whether an individual should become an entrepreneur, there is not much difference between the performance of historical averages and the performance of an unbiased coin.