



# WHAT MAKES INNOVATIVE “GREEN” START-UPS DIFFERENT (IF ANYTHING)

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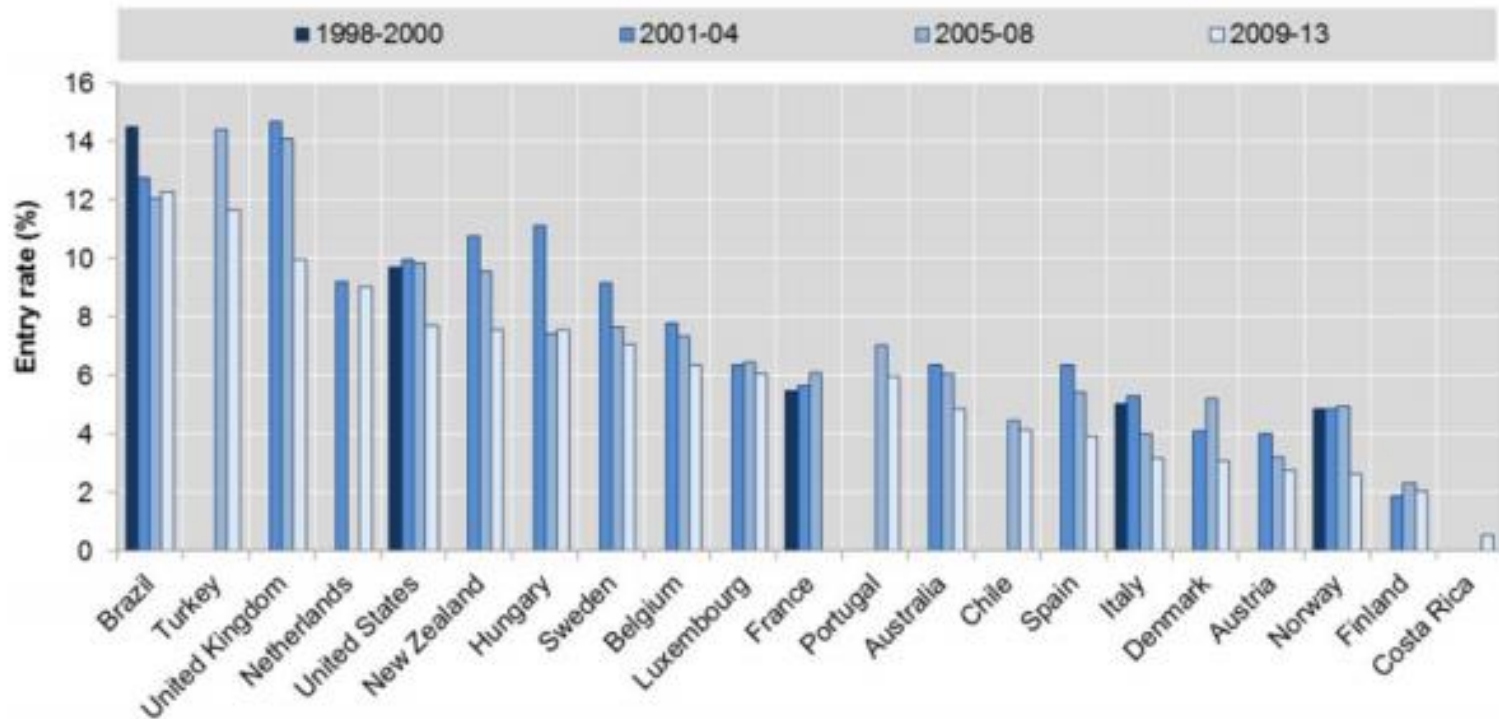
# Innovative start-ups & VC investments

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- Start-ups are a **policy priority**
  - Contribute disproportionately to **job creation** across OECD countries
  - Can help promote inclusiveness and social mobility – i.e. Aghion, et al.
  - Are instrumental to address “**grand challenges**” such as climate change
  
- **Can we learn more from VC data?**
- VC funds invest in only around **0.3% of new U.S. businesses**, but VC backed companies account for **43% of U.S. public companies** founded between 1979 and 2013, and **82%** of their total **R&D** exp. (Strebulaev & Gornall, 2015)



# Preamble (1): Falling Start-Up Rates across the OECD

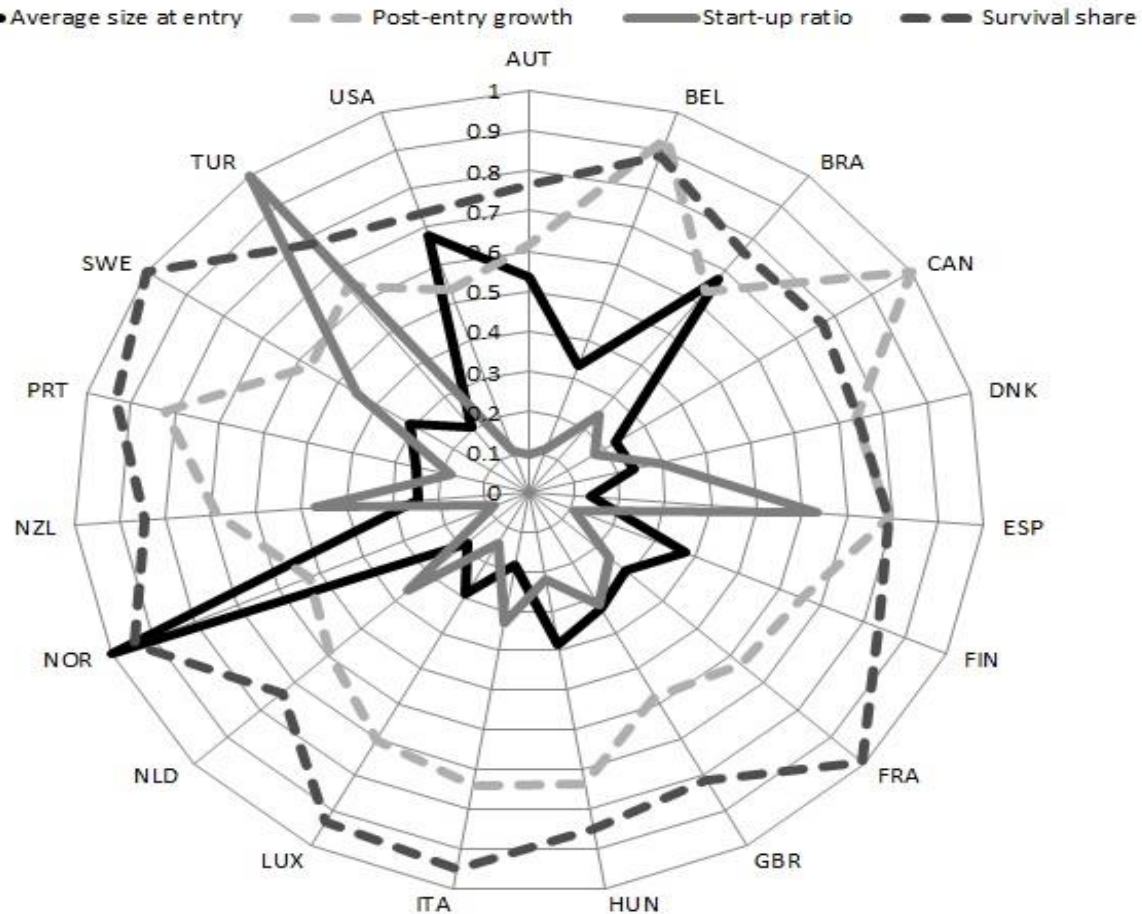


Note: The graph provides data on entry rates (calculated as the number of entrants with positive employment over the total number of units with positive employment). The figures report averages for the periods 1998-2000; 2001-04; 2005-08 and 2009-13 conditional on the availability of data. Sectors covered are: manufacturing, construction, and non-financial business services. The period between 2005 and 2008 has been excluded for the Netherlands due to a redesign of the business register in 2006. Figures for Chile are preliminary. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD DynEmp v.2 database, see <http://oe.cd/dynemp>.



# Preamble (2): Variation in Business Dynamism Across Countries

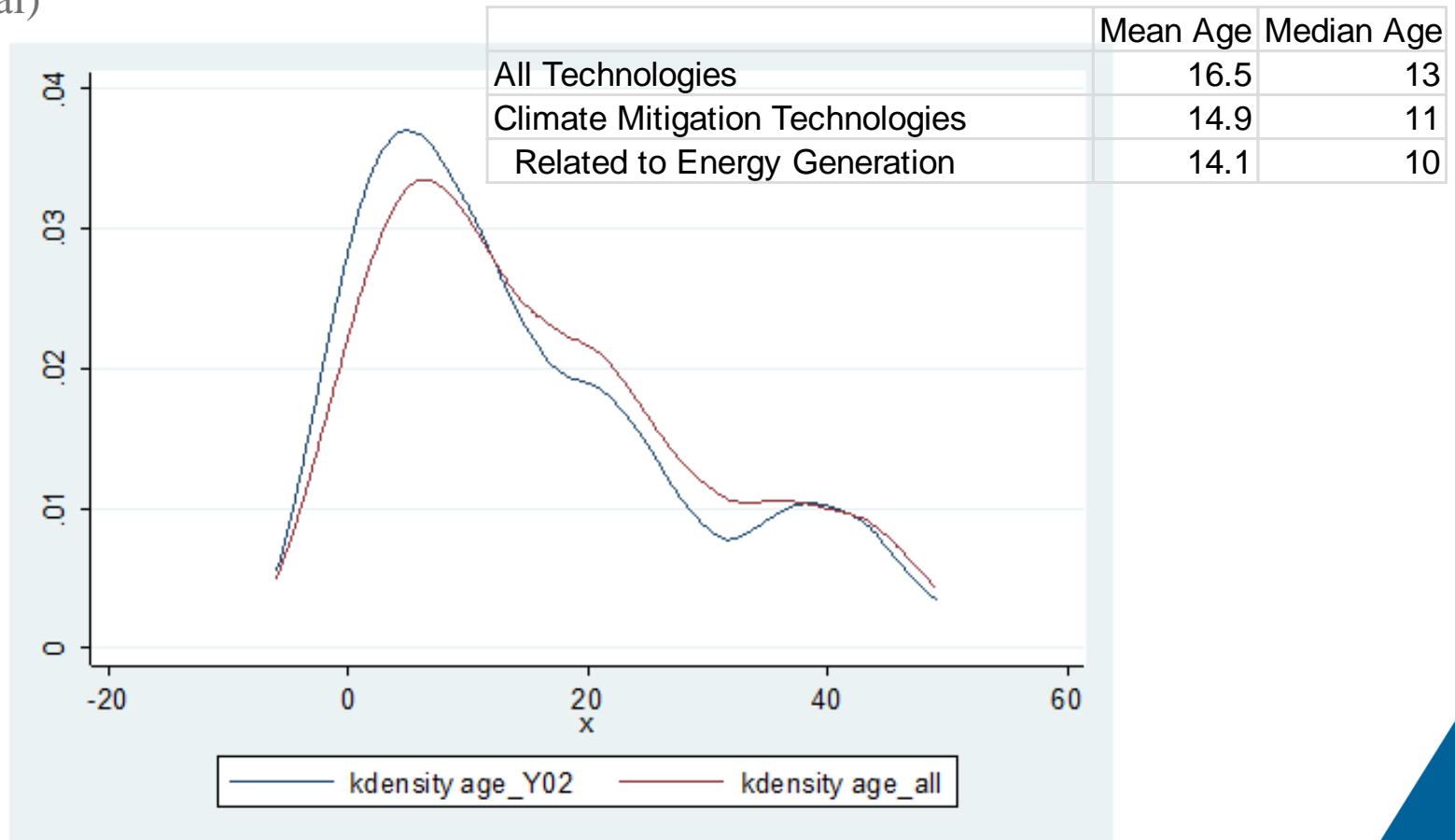


*Note:* the graph illustrates the four components of the growth decomposition normalized over the maximum value across all countries included in the sample. *Source:* Calvino, Criscuolo, and Menon (2015) and OECD DynEmp v.2 database, see <http://oe.cd/dynemp>.



# Preamble (3): The importance of “start ups” for “green” innovation

Firm Age of Patenting Firms for Climate Mitigation Technologies (Y02) and Technologies in General)





## What this “paper” does

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- Compares “innovative” Green Start-Ups with start-ups in general – particularly with respect to the characteristics of the founders (experience, education, demographics)
  - Looks at the characteristics of “innovative” green start-ups receiving VC in general and government VC in particular (directly or indirectly)
  - Looks at the characteristics of green start-ups exiting “successfully” (i.e. IPO or acquisition)
  - Compares these factors with those of start-ups in general
- => Better understand if and how public policies (and money) can be used foster a dynamic green start-up community



## Data sources

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- **Crunchbase** “the premier data asset on the tech/startup world” (Kauffman)
- 490k entities located in 199 countries; 580k people; 230k VC deals, 11k IPOs, and 34k acquisitions.
- Benchmarking with OECD Entrepreneurship Financing Database (and PwC for US) at country/year level show comparable patterns and levels
- Double match (people & companies) with patent data in house
- Two companion STI working papers:
  - Dalle, den Besten, & Menon (2017): using Crunchbase for Economic and Managerial Research
  - Tarasconi & Menon (2017) matching Crunchbase with patent data
- Information on founders complemented and cross-validated with data from Breschi et al. (2017)
- Caveats: sample selection & self-reported information
- “Smart” data mining



## Identifying Green Start-Ups

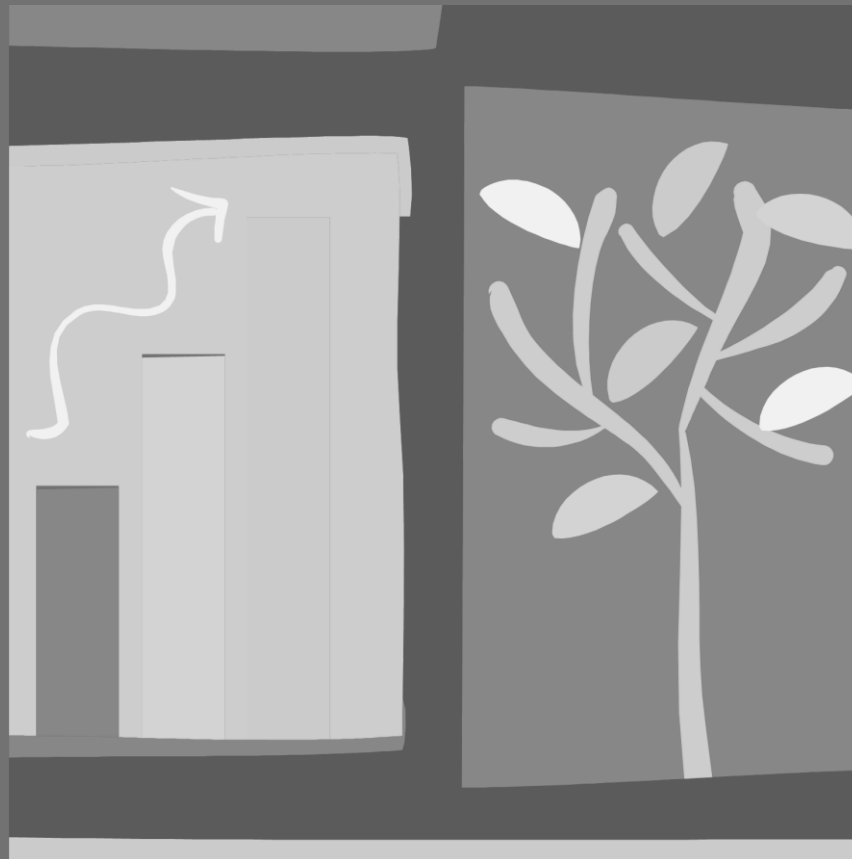
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- Crunchbase has 45 tags for different economic activities (e.g. information technology, health care, financial services) one of which is “green”/”sustainability”
- Can have multiple classifications – estimation based on primary or subsidiary (up to 5) classifications
- This has been complemented by “matching” Crunchbase with PATSTAT and linking tags for green patents (Hascic et al.) with start-ups with such patents.
- Efforts at doing text searches using “smart” data mining – thus far too many false positives, but have succeeded in other areas (e.g. AI)



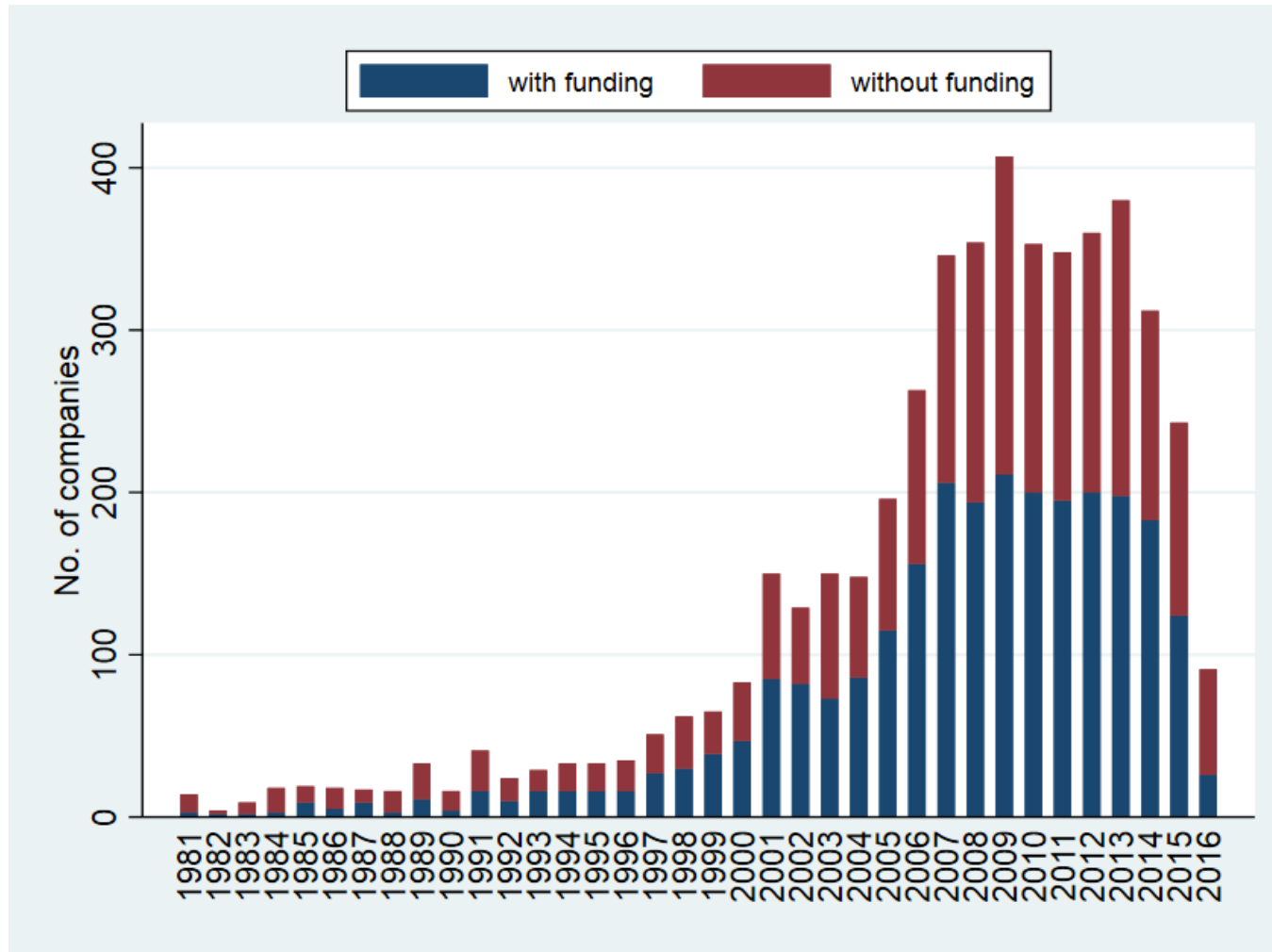


# DESCRIPTIVE EVIDENCE





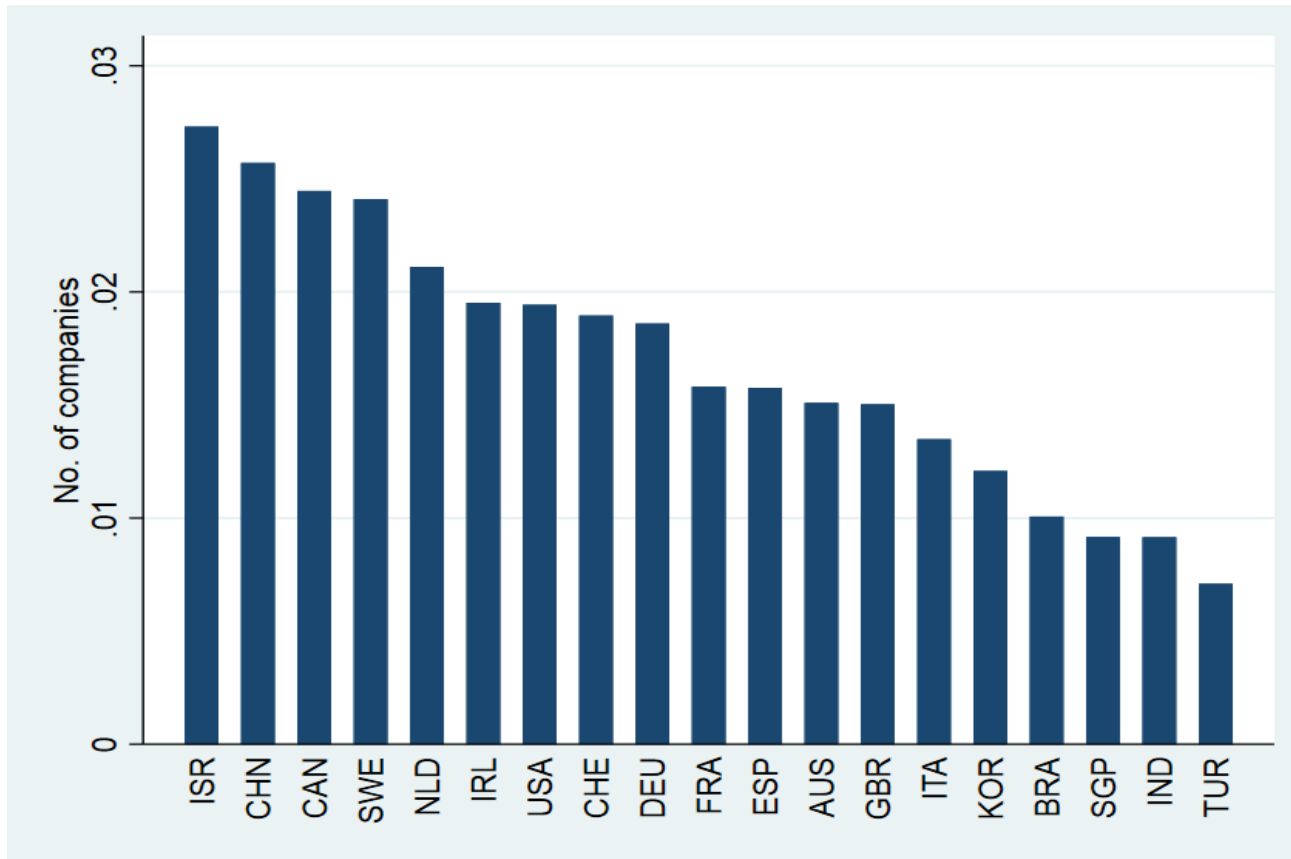
# How Many Start-Ups are “Green”?



Using a narrow definition - 1.7% of Total



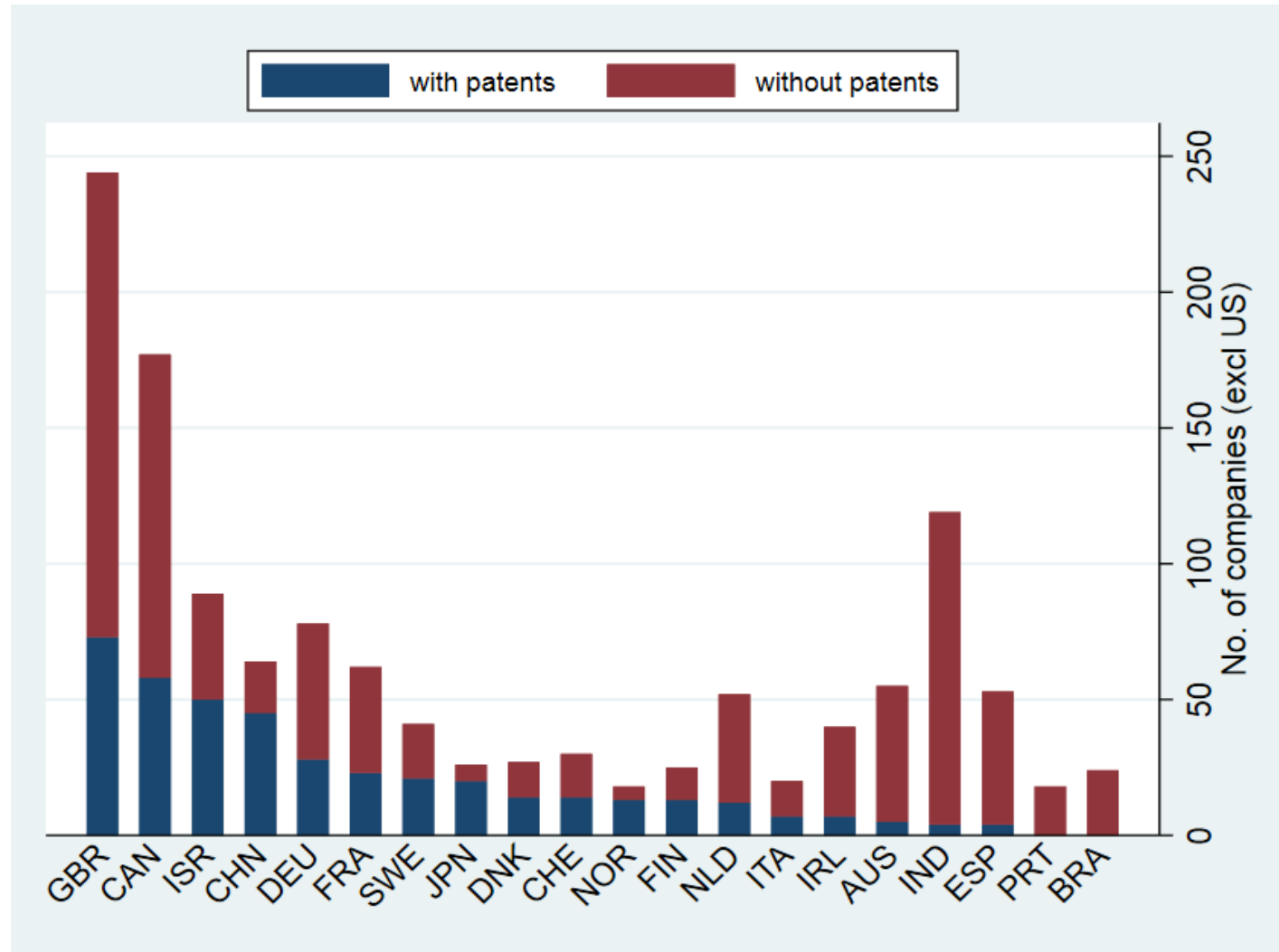
# How Many Start-Ups are “Green”?



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



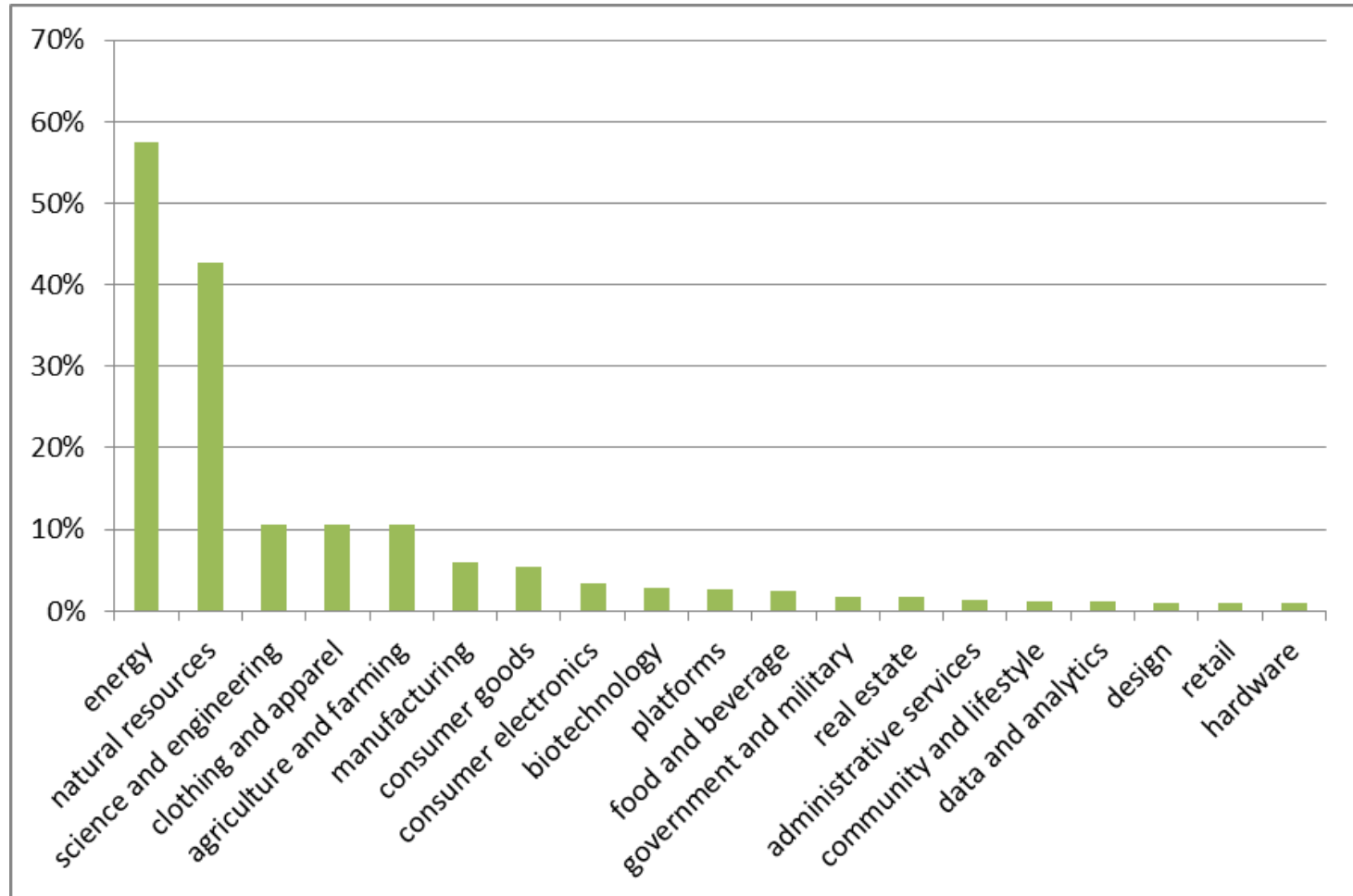
# How Innovative are Green Start-Ups?



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



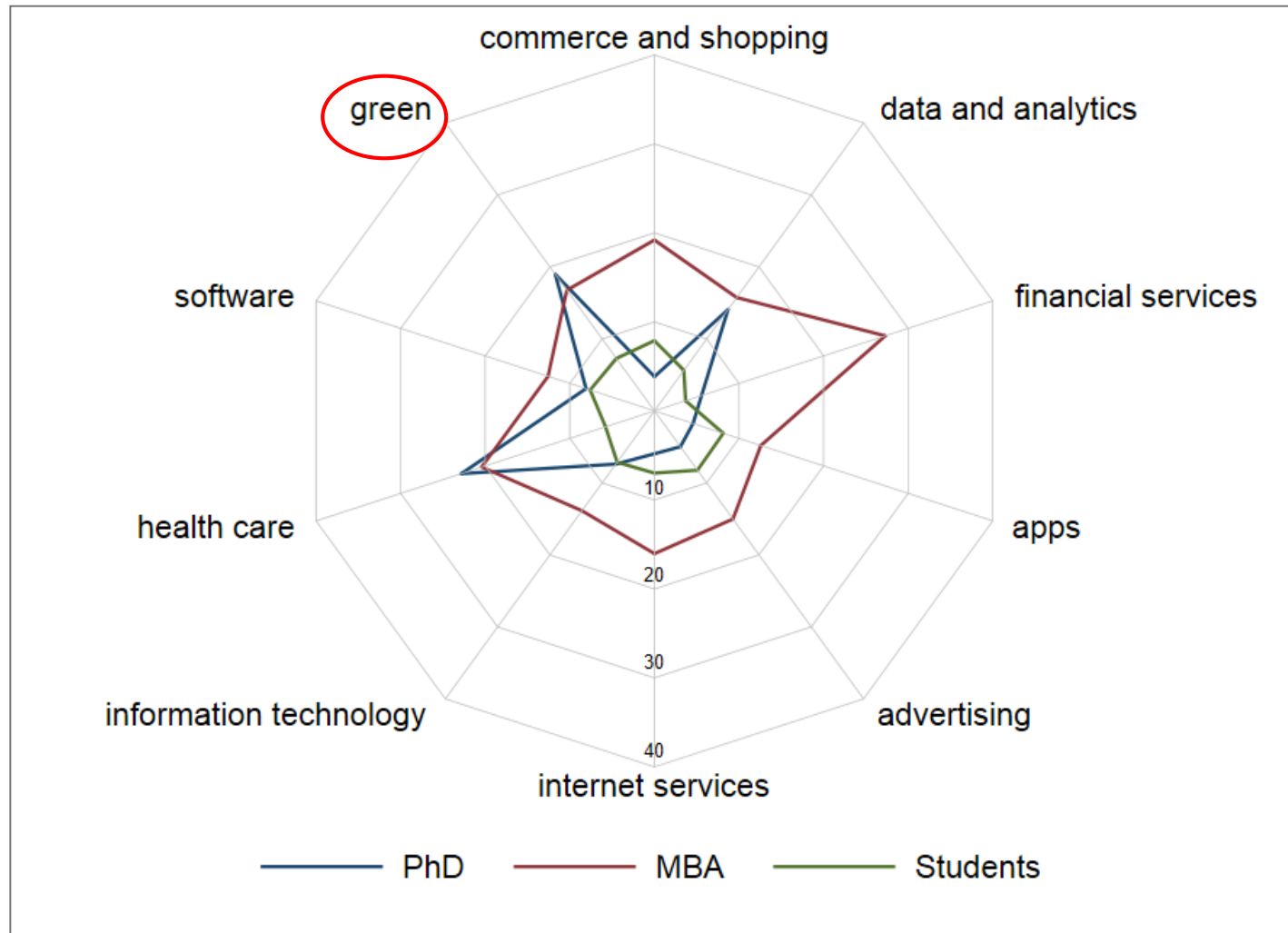
# In What Complementary Fields are Green Start-Ups Active?



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



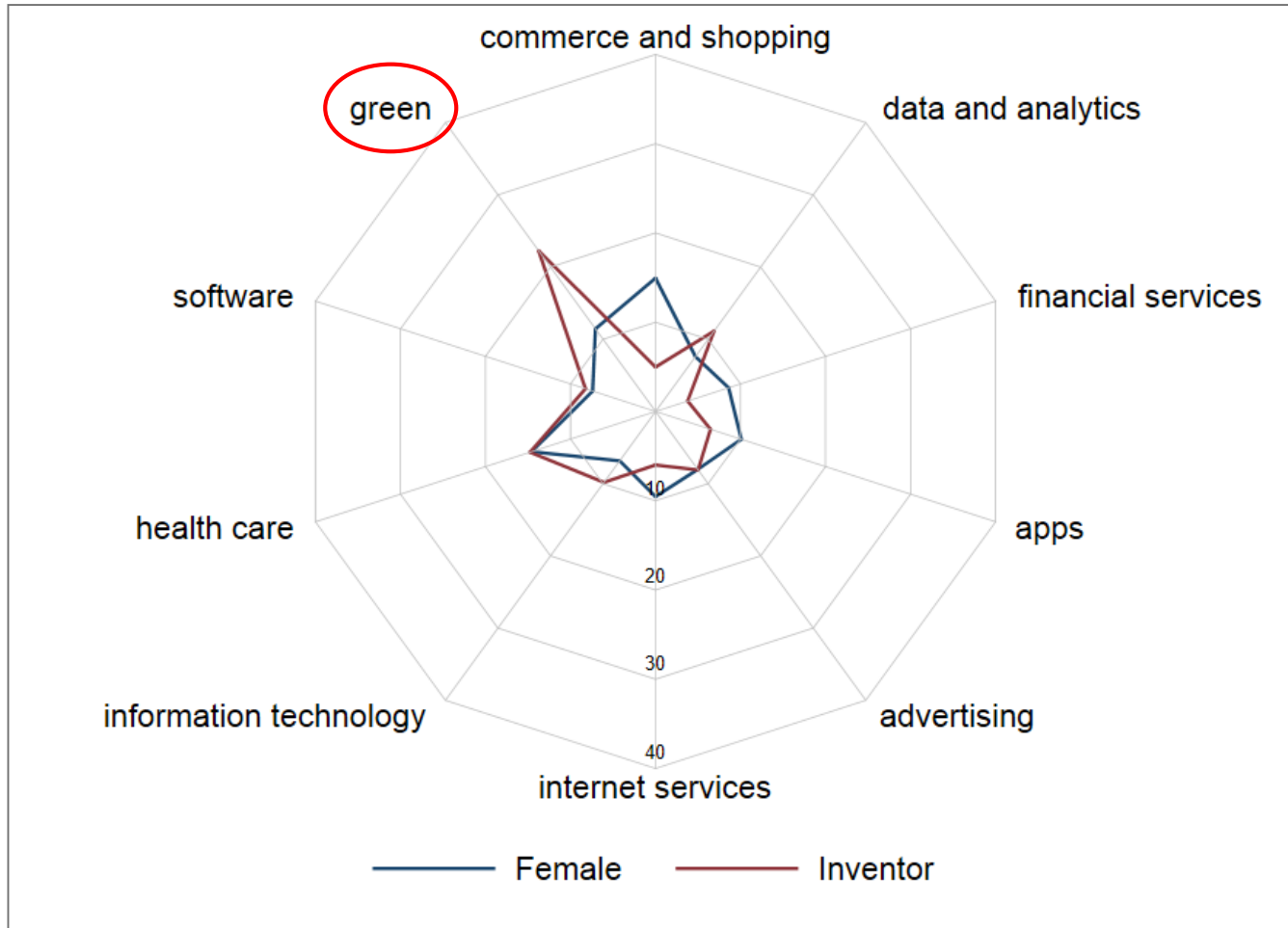
# Are the Founders of Green Start-Ups Different (1)?



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)

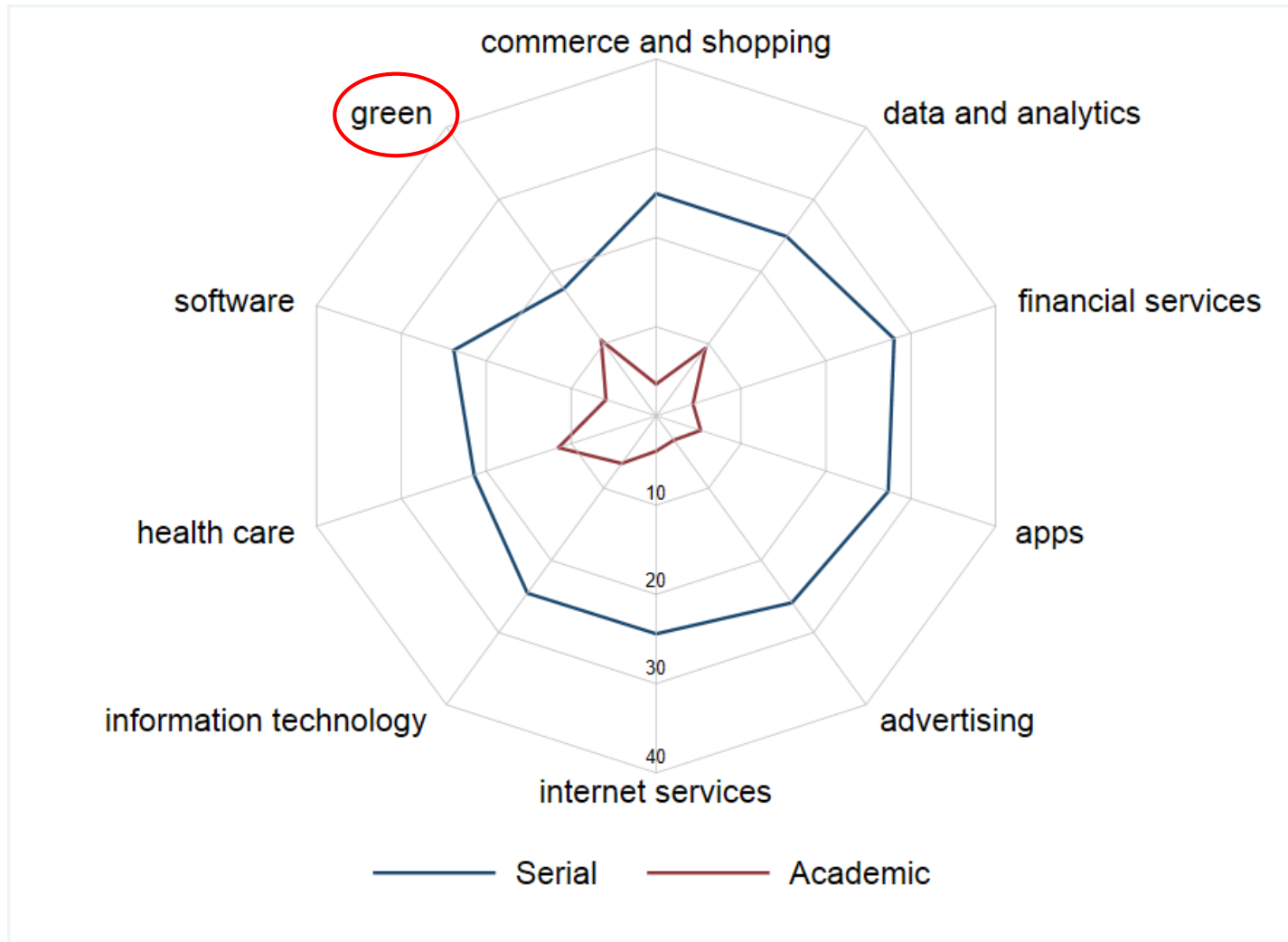


# Are the Founders of Green Start-Ups Different (2)?





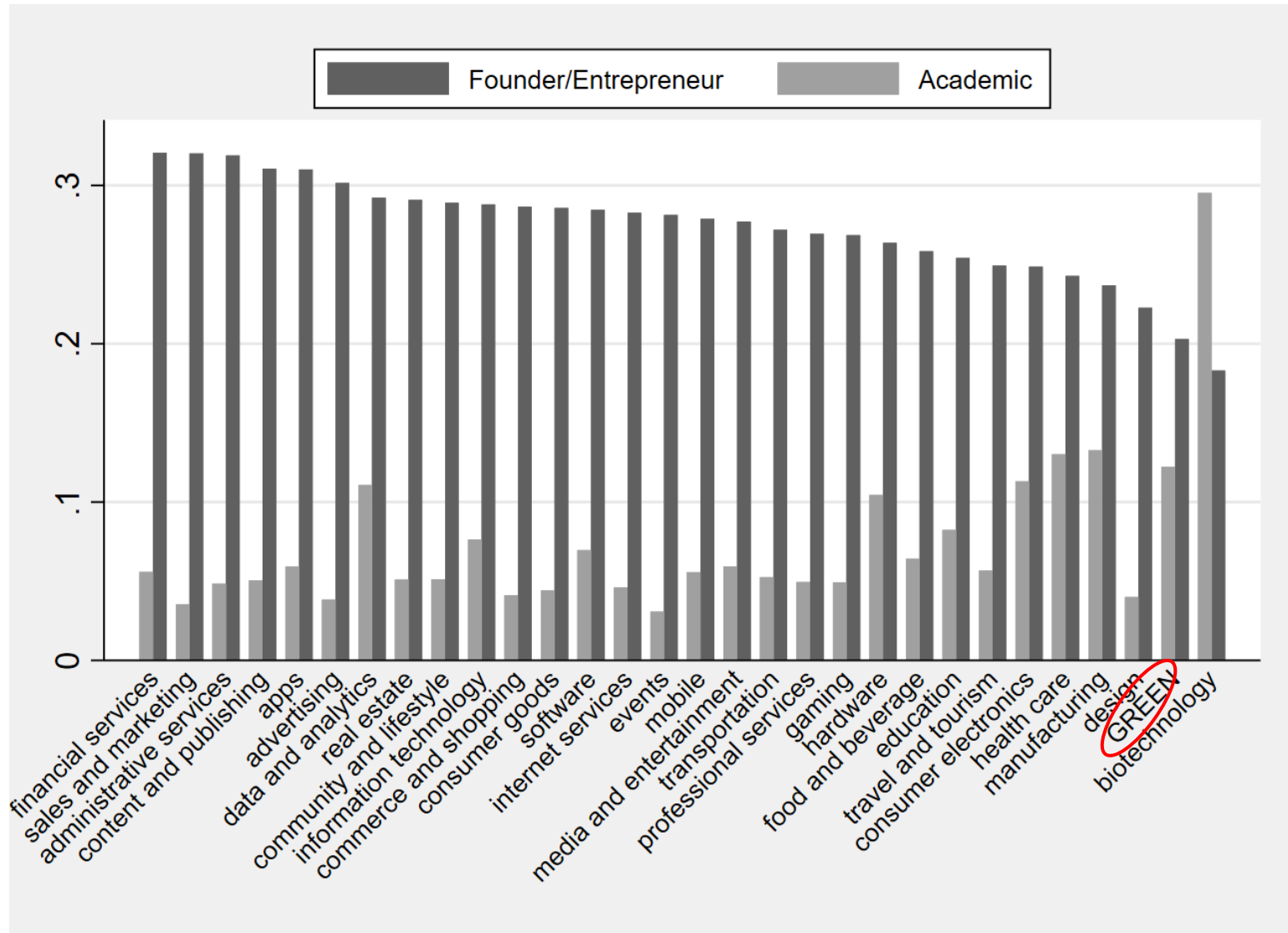
# Are the Founders of Green Start-Ups Different (3)?





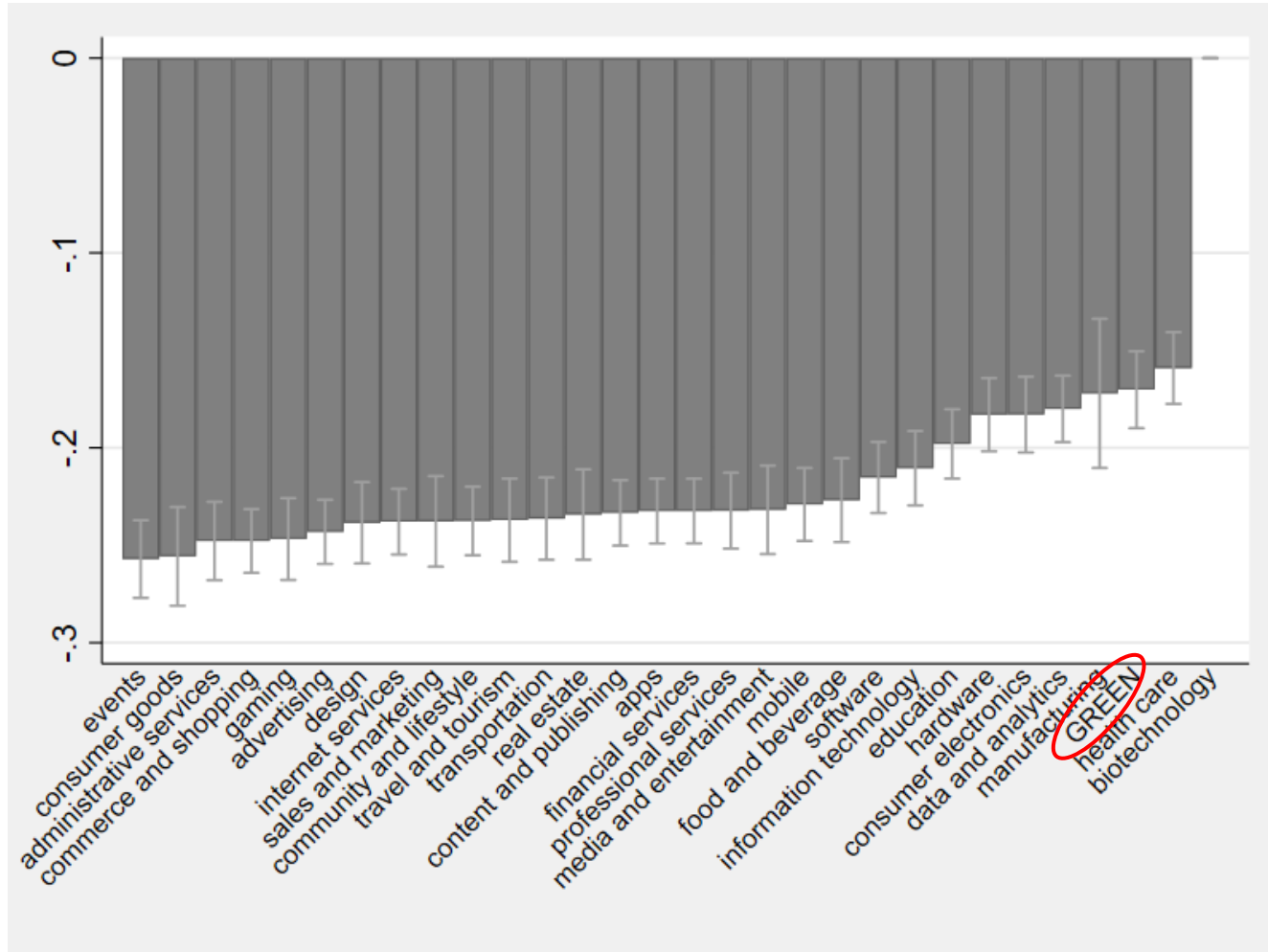


# Are the Founders of Green Start-Ups Different (4)?





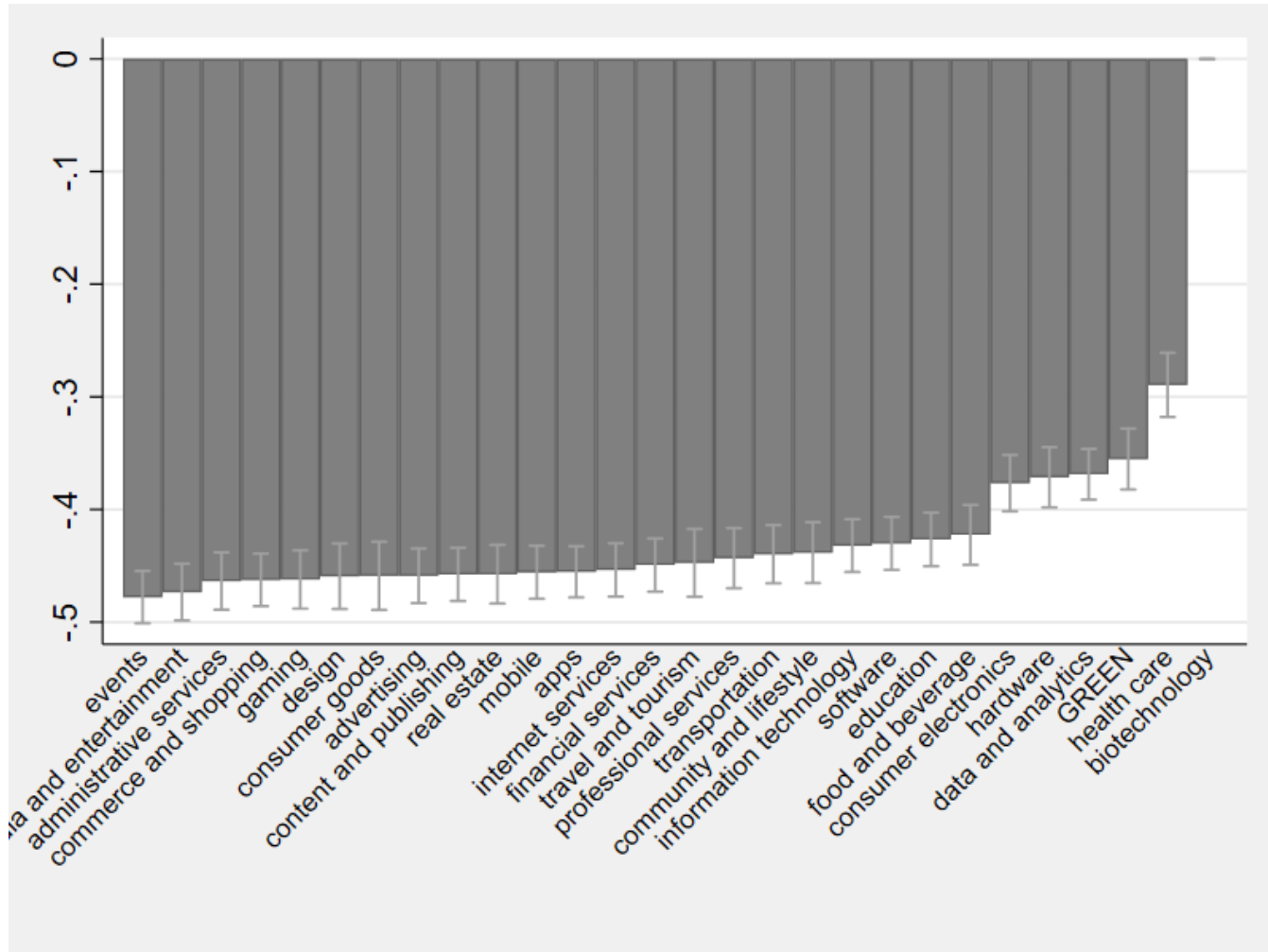
# Are the Founders of Green Start-Ups Different? [Academic]



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



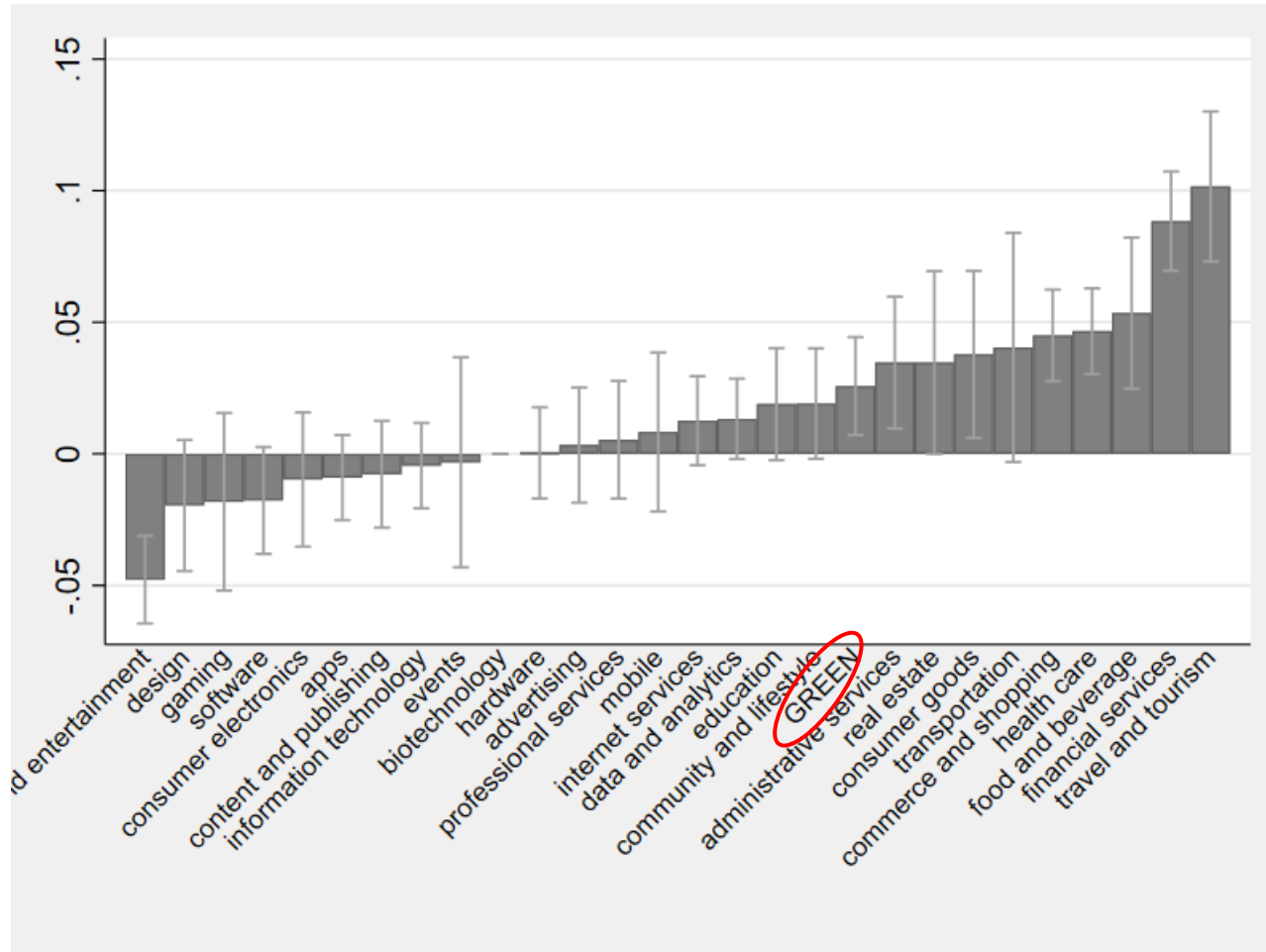
# Are the Founders of Green Start-Ups Different? [Ph.D.]



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



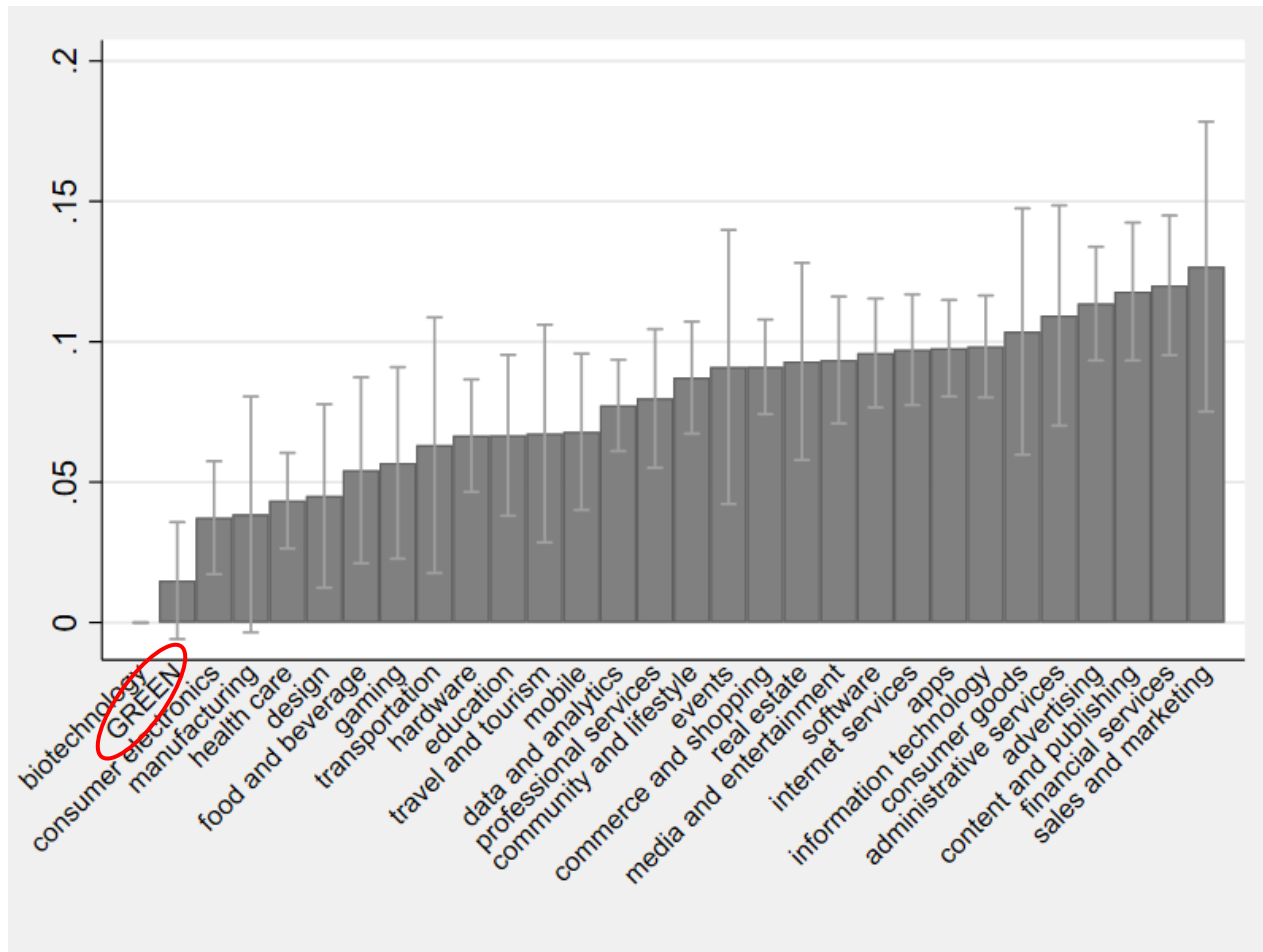
# Are the Founders of Green Start-Ups Different? [MBA]



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)



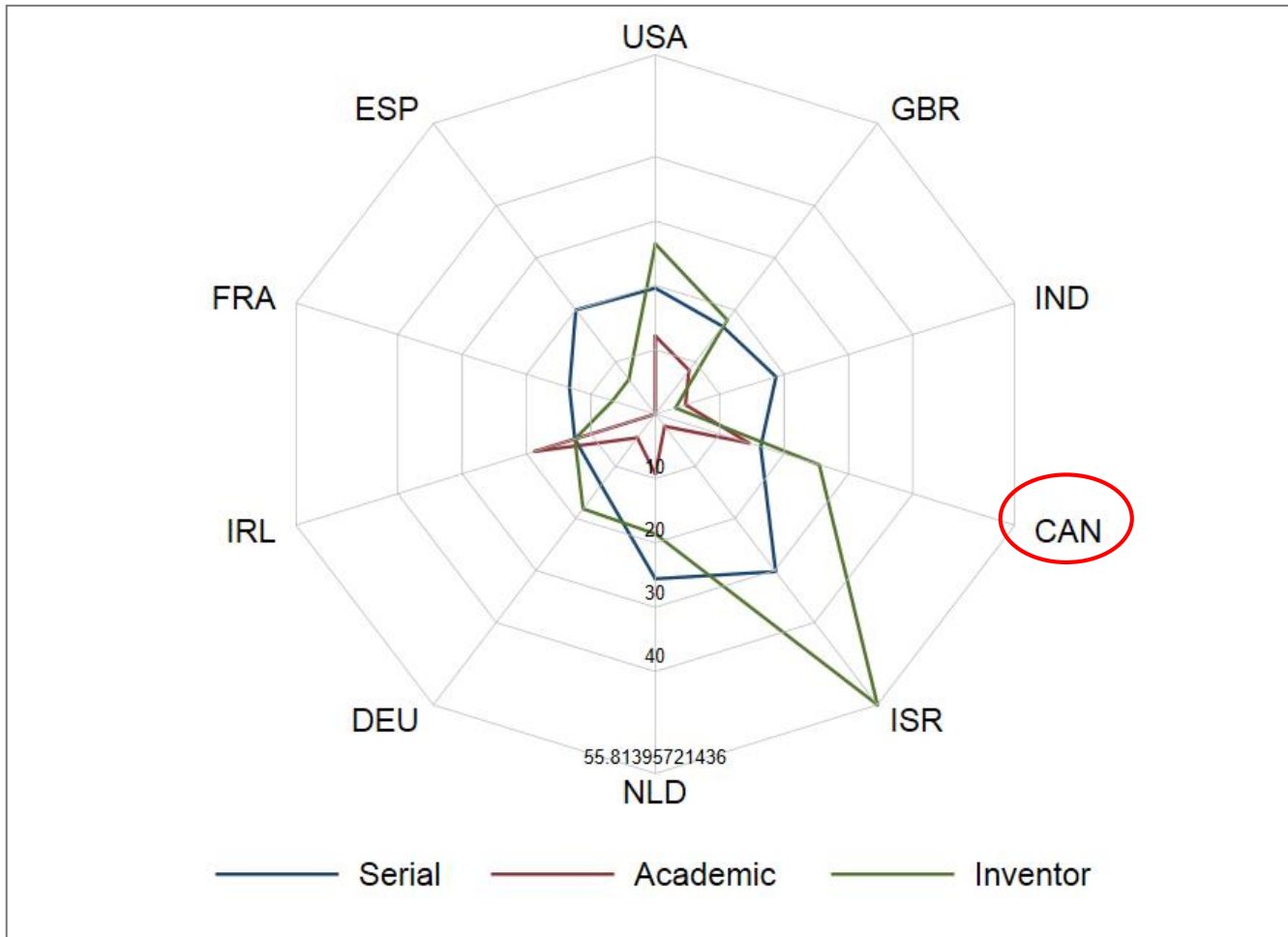
# Are the Founders of Green Start-Ups Different? [Serial Entrepreneur]



Source: Authors' elaboration on [www.crunchbase.com](http://www.crunchbase.com)

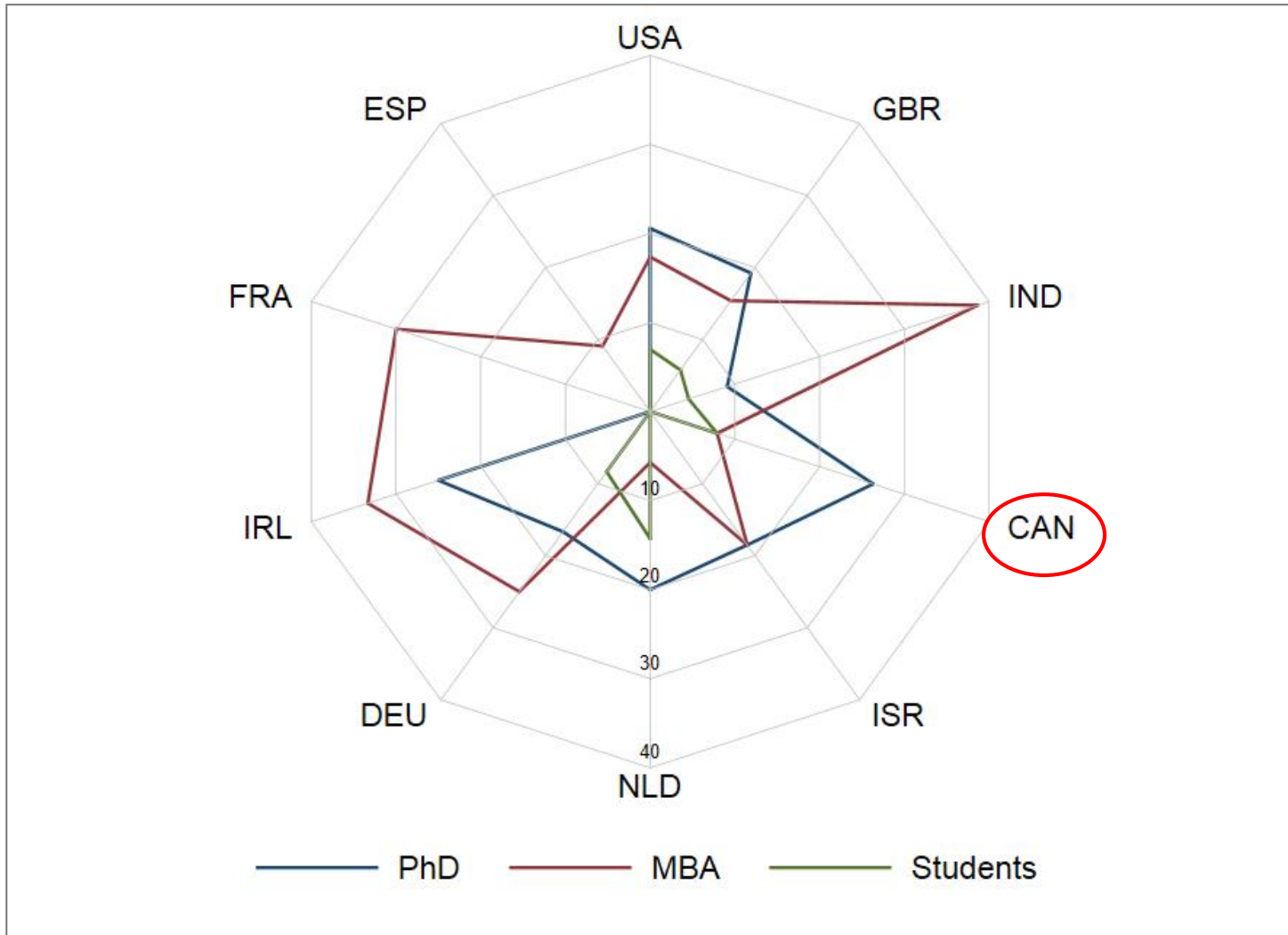


# Green Founders' in Canada and Elsewhere





# Green Founders' in Canada and Elsewhere



Source: [www.crunchbase.com](http://www.crunchbase.com)



# PRELIMINARY EMPIRICAL ANALYSIS







# Preliminary Results

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- OLS Estimation (generally with country and founding year fixed effects), and large variety of controls (e.g. demographics of founder, previous experience (academic, entrepreneurship, etc....), patent stock)
- Sample sizes vary from 400 (green sample with full demographics) to 20000 (full sample)
- Four questions:
  - Does being green attract VC?
  - Which green start-ups attract VC?
  - Does being green lead to successful exit?
  - Which green start-ups are most likely to exit successfully



# Does Being Green Attract VC (1)?

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- The short answer is “yes” => Based on sample of ~20,000 start-ups, and controlling for relevant attributes x being “green” has a positive impact on:
  - Likelihood of getting VC (in general)
  - Likelihood of getting Government VC (in particular) – mixed motives?
  - The amount of VC received (conditional upon getting a VC)



## Does Being Green Attract VC (2)?

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Interacting “green” with other relevant attributes of founders and firms:

A) generally negative impacts of firm patents and green:

- Inventors amongst founders
- Previous patent application by firm

B) generally positive effects of interaction between green:

- Mixed gender founders



# Which Green Start-Ups Attract VC(1)?

VARIABLES	Number of VC Rounds	Number of VC Rounds (>0)	Receiving > 0 GVC Round	Receiving > 0 GVC (VC>0)	Amount Raised	Amount Raised (VC>0)
> 0 founder is a patent holder	0.793***	0.768***	0.0307	0.0350	1.582	1.274
Founders are male and female	-0.0260	-0.255	0.0969***	0.107***	1.744**	0.838
Founders are all female	0.00930	0.310***	-0.0447**	-0.0258	-0.909	-0.287
> 0 founder is serial entrepreneur	0.366***	0.332***	-0.0618***	-0.0974***	1.521***	1.260***
> 0 founder has research experience	-0.331***	-0.303*	-0.0448	-0.0406	-0.527	0.297
> 0 founder has been self-employed	-0.365	-0.0901	-0.124**	-0.129*	1.752	4.358***
> 0 founder holds a PhD	0.166*	-0.0416	0.0339**	0.0306	1.527**	0.542
> 0 founder holds an MBA	0.0111	-0.170	0.00739	0.000196	1.792***	1.209**
> 0 founder holds an M.Sc	-0.125	-0.109	0.0241	0.0329	0.132	0.607
Founders are all older than 50	-0.617**	-0.798***	-0.0121	-0.0409	-0.553	-0.529
> 0 founder is young	0.187	0.242	0.114	0.168*	1.682*	2.849***
Co. Patent Application Prior	0.365	-0.437***	0.0410	0.0128	3.621***	0.701
Company Patent Granted Prior	-0.644***	-0.366*	-0.0488	-0.0391	-1.370	-0.624
Observations	420	329	420	329	420	329
R-squared	0.207	0.257	0.088	0.117	0.175	0.146
Country FE	No	No	No	No	No	No
Founding year FE	Yes	Yes	Yes	Yes	Yes	Yes



## Which Green Start-Ups Attract VC (2)?

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- Demonstrated innovation capacity in terms of patent portfolios
- Although more robust results for the founder having previously had a patent than for firm to have filed one
- Demonstrated academic credentials (Ph.D), but not engaged in research
- Previous entrepreneurship experience (except in case where government VC is involved)
- Diversity in the gender composition of founders, and at least one of the founders is young



# Does Being Green Lead to Successful Exit?

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## Green Sample

- Consistently “no” in terms of acquisition (although few)
- Consistently “yes” in terms of going public
- Consistently “yes” in terms of subsequent inventive activity

## Interaction with green in full sample

- All women – negative impact for all (and negative for mixed gender for acquisition)
- Inventors – negative for acquisition and positive for IPOs and subsequent patents
- VC has positive impact on acquisition, but government VC has negative impact



# Which Green Start-Ups Have higher Probability of Successful Exit (2)?

VARIABLES	acquired	ipo	patent filing
> 0 founder is a patent holder	-0.0547***	0.0804***	0.0315
Founders are male and female	0.0124	-0.0324**	0.00351
Founders are all female	-0.0622***	-0.000291	-0.0409
> 0 founder is serial entrepreneur	-0.000650	-0.0166	-0.0176
> 0 founder has research experience	0.0424*	-0.0150*	0.0449*
> 0 founder has been self-employed	-0.0517	-0.0238	-0.177
> 0 founder holds a PhD	-0.0310***	-0.00168	0.0233
> 0 founder holds an MBA	0.0509*	0.0313	0.0265
> 0 founder holds an M.Sc	0.0311**	0.00612	-0.00911
Founders are all older than 50	0.0198	-0.0219	0.115***
> 0 founder is young	0.174*	-0.0264	0.00837
Co. Patent Application Prior	0.0431*	-0.0668***	0.171***
Company Patent Granted Prior	0.0295	-0.0214***	0.263***
Company has received VC funding	0.0361*	0.00771	0.134***
Company has received public VC	-0.0345**	-0.0173*	-0.0348
Observations	413	398	420
R-squared	0.142	0.270	0.485
Country FE	No	No	No
Founding year FE	Yes	Yes	Yes



# Which Green Start-Ups Have higher Probability of Successful Exit (2)?

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Green Sample (400 to 1200)

- Having a M.Sc or MBA, but negative effect of Ph.D (acquisition)
- Receiving a VC (not surprisingly) unless the VC is government VC
- Young founders are involved and previous patent filings

Full Sample with Interactions (20,000) with green

- Negative impact for female founders (no impact of 2-gender)
- Mixed impact for inventors (neg. on acquisition and positive on IPO)
- Has received VC (but government VC not negative in this case)





# Further Work

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- Improving the identification of “green” (we apply a very narrow definition)
- Improved unbundling VC fund types (beyond government, private, mixed)
- The role of government VC and mixed motives of government support for VC
- Better understanding the superior performance of “mixed” (i.e. signalling and commitment)
- Crowding in and crowding out – taking advantage of data on the “rounds” of VC
- The role of public research efforts (PRIs and university grants) and resources in “green” start-up outcomes – direct and spatial
- Is there a start-up “drain” and if variation across countries – where and why?
- Most importantly, the link between green government VC and other complementary or substitute policy settings