Gazelles: Drivers of Exceptional Job Creation

A dynamic probit approach using Portuguese firm-level data

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Outline

Introduction - What are Gazelles and why are they relevant?

- Birch first noted that a **small group of high-growth firms (HGFs) generated most of the new net jobs** (D. L. Birch 1979). He named this special "breed" of firms as **Gazelles**.
  - **In the US it was found that 4% of ongoing firms created 60% of all new jobs** (D. L. Birch and Medoff 1994);
  - **In the UK it was found that 4% of firms created approximately 50% of jobs** (Storey 1994);
  - **In Sweden it was showed that 6% of the fastest growing firms contributed to 42% of jobs** in the 2005-2008 period (Daunfeldt, Halvarsson, Johansson, et al. 2012).
- Gazelles are particularly relevant, as firm growth rates have been shown to be heavy-tailed - **most firms do not grow.**

Introduction - Are Gazelles different?

- Related literature has been suggesting some distinctive characteristics of Gazelles:
  1. They tend to be **younger** but **not necessarily small** (Acs and Mueller 2008);
  2. They are found to **export more** than their slow-growth counterparts (Parsley and Halabisky 2008);
  3. They can be found throughout **all the sectors** in the economy, **not only in high-technology sectors**;
  4. They tend to **invest more in R&D** (Segarra and Teruel 2014).
  5. High-growth **is not persistent over time** (although high-growth persistence seems to depend on the choice of the growth measurement (Hölzl 2013))

Introduction - Questions addressed

- What makes a Gazelle?
  - We apply a **multivariate framework** in order to estimate the partial impact of an extended set of factors on the **probability of firms attaining fast-growth**.
- What is role of **credit access and human capital in determining high-growth events?**
  - These are particularly important in the Portuguese case.
- Are high-growth episodes **persistent?**
  - This result may be relevant in terms of policy.

Data

- Our empirical strategy relies on the use **firm-level data, for the 2006-2017 period**, provided by **Banco de Portugal (BdP)** through the **Central de Balanços (CB)** data set.
- The initial data set was submitted to several **consistency procedures:**
  - We required coherent reporting of fundamental figures (assets, liabilities, employment, labor expenses).
  - Only companies employing **at least five employees were considered**.

Data - Gazelle Criterion

- We based our Gazelle criterion on the seminal work of Birch (Birch 1987), which identifies **exceptional job creation performance as the most relevant economic characteristic of Gazelles.**
- We consider the Birch-Schreyer (BS) indicator (Schreyer 2000), **which accounts for bias towards smaller firms:**

$$BS_t = \frac{E_t}{E_{t-k}}(E_t - E_{t-k})$$

- E_t is the **employment level** at the end of period t and $k = 1$.
- **Gazelles are those whose growth indicator scores above the upper 10% of the BS indicator distribution.** (Almus 2002), (Lopez-Garcia and Puente 2012)

Table 1: Distribution of Gazelles by class size, region and sector

By Size			
	Gazelles	Rest	Total share of size class
Micro	13.8%	55.3%	52.2%
Small	65.1%	39.9%	41.8%
Medium	18.0%	4.3%	5.3%
Large	3.1%	0.5%	0.7%
By Region			
	Gazelles	Rest	Total share of region
North	34.3%	33.2%	33.3%
Centre	21.1%	23.5%	23.4%
Alentejo	6.0%	7.2%	7.0%
Algarve	6.2%	5.7%	5.7%
Lisbon	29.4%	27.3%	27.4%
Azores	1.3%	1.1%	1.1%
Madeira	1.7%	2.1%	2.1%
By Sector			
	Gazelles	Rest	Total share of sector
Manufacturing	25.9%	25.0%	25.1%
Construction	16.1%	14.6%	16.0%
Services	54.6%	55.7%	55.6%

Source: Central de Balanços - BdP and authors calculations

Empirical Approach - Identification Strategy

- We propose to model the probability of a given firm to become a Gazelle conditional on a set of *ex-ante* explanatory variables:

$$P(HGF_{i,t} = 1 | HGF_i, \mathbf{x}_i, e_i) = \Phi\left(\rho HGF_{i,t-1} + \beta \mathbf{x}'_{i,t-1} + e_i\right)$$

- where $\Phi(.)$ is the NCDF; $\mathbf{x}_i = (\mathbf{x}_{i,t-1}, ..., \mathbf{x}_{i,0})$, the covariates vector, for all t; and likewise, $HGF_i = (HGF_{i,t-1}, ..., HGF_{i,0})$.
- e_i captures firms' **unobserved heterogeneity** modelled as:

$$e_i = g(HGF_{i,0}, x_{i,0}, \bar{x}_i)$$

- The model is estimated with a parsimonious version of Wooldridge´s approach (Wooldridge 2005) based on Rabe-Hesketh and Skrondal 2013.

Empirical Approach - Baseline covariates

- All explanatory variables used in the model are taken **at the beginning of the growth period.**
  - **HGF**$_{(t-1/t-2)}$: past instances of the "Gazelle" status are used to access **growth persistency**.
  - **Wage premium**: used to *proxy* **human capital** and defined as the ratio of average hourly wage over the average of this figure for the same 2-digit sector.
  - **Share of full-time employees**: used to eliminate the effect of contract mix on wage premium.
  - **Age**: number of years since foundation.
  - **Debt Ratio**: used to *proxy* **credit access** and defined as the ratio of total outstanding debt over liabilities. A quadratic term is included to allow for **non-linear effects**.
  - **Financial Autonomy**: the degree of capitalization, given by equity over total assets.

Empirical Approach - Extensions and controls

- We extend our baseline estimation by adding further covariates:
  - **Workers and management Human Capital**: Using the wage bill for board members and non-board members, we **disentangle** the effect of human capital.
  - **R&D Emp. Share**: measure of **R&D intensity** identified as the share of employees allocated to R&D activities on total employment.
  - **Exporter Status**: measure of **internationalization** interacted with firm age.
- We control for **time invariant factors** such as **sector** and **region**, and also allow for **year** fixed effects.

Table 2: Summary statistics of covariates by group

	HGF $_{(t/t-1)}$	Remaining Firms
HGF $_{(t-1/t-2)}$	17.8%	6.3%
Wage Premium $_{t-1}$	1.07	0.98
Share of Full Time Emp $_{t-1}$	97.1%	97.7%
Age $_{t-1}$	14.7	17.4
Debt Ratio $_{t-1}$	33.8%	33.3%
Financial Autonomy $_{t-1}$	28.9%	30.7%
R&D Emp. Share $_{t-1}$	1.0%	0.6%
Exporter $_{t-1}$	35.7%	26.2%

Source: Central de Balanços - BdP and authors calculations

Table 3: Results - Firm Unobserved Heterogeneity

Covariates	Simple Probit	Model 2
HGF $_{(t-1/t-2)}$	**0.006 *** **	**-0.0355 *** **
Ln (Wage Premium) $_{t-1}$	0.015 ***	0.0094 ***
Share of full time employees $_{t-1}$	-0.0129	0.0206
Age $_{t-1}$	-0.0016 ***	-0.0071 ***
Debt Ratio $_{t-1}$	**0.0738 *** **	**-0.0193**
Debt Ratio Sq $_{t-1}$	**-0.0876 *** **	**0.0057**
Financial Autonomy $_{t-1}$	**0.0038**	**0.0245 *** **
Sector dummies	yes	yes
Region dummies	yes	yes
Year dummies	yes	yes
Firm heterogeneity	**no**	**yes**
Number of observations	186,741	186,741

*** p<0.01, ** p<0.05, * p<0.1

Firm Unobserved Heterogeneity

- **Dynamic process:** Unlikely to persist as exceptional job creator. (*"One-hit wonders"?*)
- **Financial Debt:** Access to credit has an insignificant role. Suggesting lack of access to credit did not hinder episodes of exceptional growth.
- **Financial Autonomy:** More capitalized firms are more likely to excel in job creation.

Human Capital

How to disentangle HC of workers and board-members?

- **The issue:** hours of work are not disaggregated. Average wage for both groups is unavailable.
- Overall wage bill of board and non-board members is sensitive to firm size.
- We thus consider the ***"wage bill premium"*** on same sized firms in the same 2-digit sector.

Table 4: Results - Human Capital

Covariates	Model 2	Model 3
HGF $_{(t-1/t-2)}$	-0.0355 ***	-0.0371 ***
Ln (Wage Premium) $_{t-1}$	**0.0094 *** **	
Share of full time employees $_{t-1}$	0.0206	0.0034
Age $_{t-1}$	-0.0071 ***	-0.0060 ***
Debt Ratio $_{t-1}$	-0.0193	-0.0210
Debt Ratio Sq $_{t-1}$	0.0057	0.0059
Financial Autonomy $_{t-1}$	0.0245 ***	0.0248 ***
Ln (Wage Bill Premium Workers) $_{t-1}$		**0.2695 *** **
Ln (Wage Bill Premium Board) $_{t-1}$		**0.0376 *** **
Sector dummies	yes	yes
Region dummies	yes	yes
Year dummies	yes	yes
Firm heterogeneity	yes	yes
Number of observations	152,392	152,392

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Results - Innovative Capacity

Covariates	Model 3	Model 4
HGF $_{(t-1/t-2)}$	-0.0371 ***	-0.0371 ***
Share of full time employees $_{t-1}$	0.0034	0.0036
Age $_{t-1}$	-0.0060 ***	-0.0060 ***
Debt Ratio $_{t-1}$	-0.0210	-0.0212
Debt Ratio Sq $_{t-1}$	0.0059	0.0061
Financial Autonomy $_{t-1}$	0.0248 ***	0.0247 ***
Ln (Wage Bill Premium Workers) $_{t-1}$	0.2695 ***	0.2691 ***
Ln (Wage Bill Premium Board)$_{t-1}$	0.0376 ***	0.0378 ***
R&D Emp. Share $_{t-1}$		**0.043 ** **
Sector dummies	yes	yes
Region dummies	yes	yes
Year dummies	yes	yes
Firm heterogeneity	yes	yes
Number of observations	152,392	152,392

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Results - Internationalization

Covariates	Model 3	Model 5
HGF $_{(t-1/t-2)}$	-0.0371 ***	-0.0369 ***
Share of full time employees $_{t-1}$	0.0034	0.0030
Age $_{t-1}$	**-0.0060 *** **	**-0.0051 *** **
Debt Ratio $_{t-1}$	-0.0210	-0.0208
Debt Ratio Sq $_{t-1}$	0.0059	0.0060
Financial Autonomy $_{t-1}$	0.0248 ***	0.0252 ***
Ln (Wage Bill Premium Workers) $_{t-1}$	0.2695 ***	0.2707 ***
Ln (Wage Bill Premium Board)$_{t-1}$	0.0376 ***	0.0379 **
Exporter $_{t-1}$		**-0.011 *** **
Exporter $_{t-1}$ **x Age**$_{t-1}$		**0.0004 ** **
Sector dummies	yes	yes
Region dummies	yes	yes
Year dummies	yes	yes
Firm heterogeneity	yes	yes
Number of observations	152,392	152,392

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Results - Full model

Covariates	HGF $_{(t/t-1)}$
HGF $_{(t-1/t-2)}$	-0.0369 ***
Share of full time employees $_{t-1}$	0.0032
Age $_{t-1}$	-0.0051 ***
Debt Ratio $_{t-1}$	-0.0210
Debt Ratio Sq $_{t-1}$	0.0062
Financial Autonomy $_{t-1}$	0.0251 ***
Ln (Wage Bill Premium Workers) $_{t-1}$	0.2702 ***
Ln (Wage Bill Premium Board)$_{t-1}$	0.0381 ***
R&D Emp. Share$_{t-1}$	0.042 **
Exporter $_{t-1}$	-0.011 ***
Exporter $_{t-1}$ x Age$_{t-1}$	0.0004 **
Sector dummies	yes
Region dummies	yes
Year dummies	yes
Firm heterogeneity	yes
Number of observations	152,392

*** p<0.01, ** p<0.05, * p<0.1

Full model

- **Innovative Capacity:** Although rare, R&D effort plays a significant role in explaining high growth.
- **Internationalization:** Exposure to foreign markets pertain betters odds to excel at job creation for more mature firms. The benefits seem to be linked to a learning-by-doing phenomenon.

Table 8: Results - Average Growth

Covariates	HGF $_{(t/t-1)}$	BS indicator
HGF $_{(t-1/t-2)}$	-0.0369 ***	0.0220
Share of full time employees $_{t-1}$	0.0032	16.6245 ***
Age $_{t-1}$	-0.0051 ***	-1.0558 ***
Debt Ratio $_{t-1}$	-0.0210	-1.6636
Debt Ratio Sq $_{t-1}$	0.0062	0.703
Financial Autonomy $_{t-1}$	**0.0251 *** **	**1.7163**
Ln (Wage Bill Premium Workers) $_{t-1}$	0.2702 ***	23.0860 ***
Ln (Wage Bill Premium Board)$_{t-1}$	0.0381 ***	17.3345 ***
R&D Emp. Share$_{t-1}$	**0.042 ** **	**0.7111**
Exporter $_{t-1}$	**-0.011 *** **	**0.4287**
Exporter $_{t-1}$ x Age$_{t-1}$	**0.0004 ** **	**0.0318**

*** p<0.01, ** p<0.05, * p<0.1

Conclusions

- High-growth is **unlikely to persist** for a given firm.
- **Human capital** is an important determinant for high-growth. Particularly so for **non-executive workers.**
- **Younger firms** are more likely to grow at the fastest pace.
- Once firm heterogeneity is accounted for, **restrictions to credit did not hinder** Gazelles from **full-filling their growth potential**.
- Evidence suggests that **innovative capacity is crucial** in outstanding job creation episodes.
- Benefits from **international exposure** take time to realize.
- Evidence also suggests **nonlinearities in the growth process** of firms (high-growth v.s. average growth).

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