WHAT MAKES A HIGH-GROWTH FIRM? A PROBIT ANALYSIS USING SPANISH FIRM-LEVEL DATA
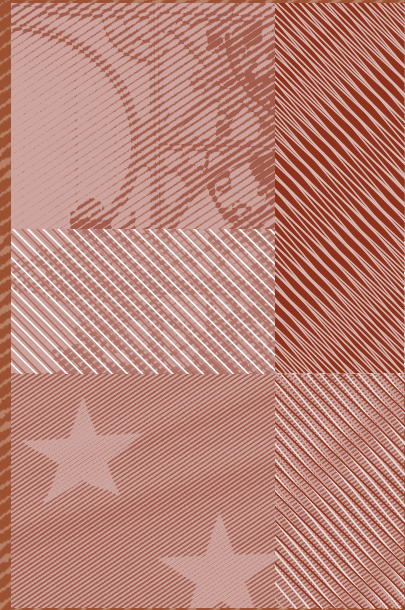
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BANCO DE ESPAÑA

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Abstract

Many studies have established that a small number of firms, known as fast-growth firms or Gazelles, create most of the new jobs. In spite of the importance of this topic from a policy-point of view, most of those studies are descriptive and limited to a comparison of the characteristics of the high-growth group with respect to a control group of firms. This paper, on the other hand, performs a multivariate analysis of the determinants of the fast growth of Spanish firms controlling for the possible endogeneity of some variables. We use for that purpose a firm-level database with information for about 200,000 Spanish firms per year between 1996 and 2003. We find that being a start-up increases the probability of fast growth by more than 30 percentage points, conditioned on having survived over the period. Firms with initial higher relative wages and debt ratio, up to a certain point, also experience higher chances of fast growth. Hence, as it was established elsewhere, better access to finance and to human capital are key to increase the number and growth of Gazelles. We also find that high-growth firm sustain their expansion with relatively more debt and fixed-term contracts than the rest of the firms in the sample.

Keywords: Gazelles, Job creation, Firm-level data.

JEL Classification: J23, L11, L25

1   Introduction

Over decades there has been much debate about whether small or large firms contribute the most to net employment creation[1]. There is, however, broad consensus about the fact that relatively few firms, be them small or large, known as high-growth firms or Gazelles[2], are responsible for the majority of jobs created. Birch and Medoff (1994), for example, estimate for the USA that during the 1988-1992 period, 4% of ongoing firms created about 60% of the jobs. Similarly, Storey (1994) reviews several studies for diverse countries and estimates than, in average, 4% of firms get to create about half of new jobs over a decade. Schreyer (2000) reviews the results from 6 OECD countries[3] and concludes that, in spite of the diverse data sources and methodologies, high-growth firms account for a disproportionately large part of net job creation in all countries analysed. Not only that, as Figure 1 below shows there is a strong correlation between the prevalence rate of Gazelles in different OECD countries and their corresponding aggregate employment variation rates.[4] Of course a simple bivariate scatterplot as the one shown in Figure 1 does not necessarily capture any causal relationship between Gazelles and aggregate employment creation rates, but taken together with the reported evidence on the important net job creation of high-growth firms, it constitutes a wake-up call for policy-makers.

GAZELLES VERSUS EMPLOYMENT VARIATION FOR SOME OECD COUNTRIES: 99-01; 00-02; 01-03   FIGURE 1
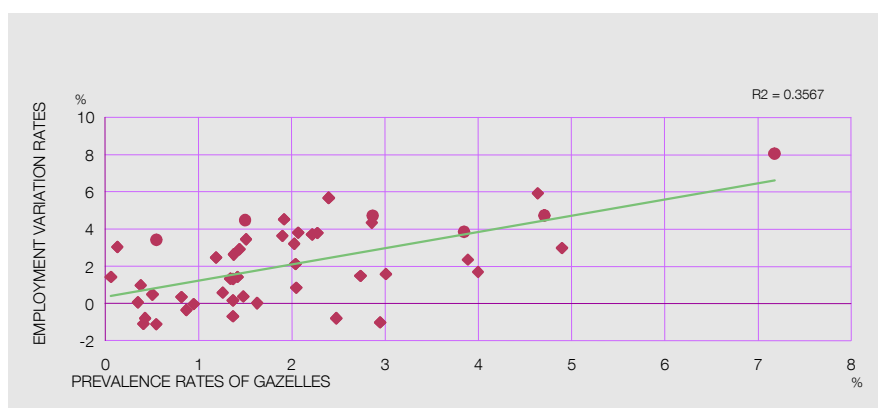
Sources: Bank of Spain Firm Demography Database and OECD STAN Database.

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1. Birch (1981) was the first to stress the importance of small firms in the job creation process of the USA. His work was criticised most notably by Davis et al. (1996). In the context of Spain, Lopez-Garcia, Puente and Gomez (2009) have analysed employment creation by firms of different size, sector and age.
2. Birch named the group of high-growth firms "Gazelles" in opposition to the group of small slow growers, "mice" and the group of large slow growers, "elephants" [see Henrekson and Johansson (2008) for a literature review]. Later, the OECD [Ahmad (2006)] proposed to use the term Gazelle exclusively to mark young high-growth firms, usually defined as having less than 5 years of operations. In this work we will use indistinctly the terms high-growth firms or Gazelles, independently on the age of the firms.
3. Germany, Netherlands, Italy, Spain, Sweden and the region of Quebec, in Canada.
4. The prevalence rates have been estimated by Hoffman and Junge (2006). They correspond to 17 OECD countries and 3 different two-year periods: 1999-2001, 2000-2002 and 2001-2003. The Figure shows the pooled rates against the corresponding two-year employment variation rates obtained from the OECD STAN database. The sectors considered are industry and services.

But what do we know about Gazelles? What do they look like? Where are they? What can governments do so there are more of them? In spite of different criteria used in the literature to classify a firm as a Gazelle, different data sources, time periods or methodologies, a number of results turn out to be quite robust. First, although high-growth firms can be of all sizes, small firms seem to be overrepresented. Moreover, among high-growth firms, small firms' job creation rates exceed those of large ones. Although there are large firms classified as well as Gazelles, their employment growth is mostly "acquired", that is, due to some kind of restructuring such as mergers or acquisitions. Second, high-growth firms tend to be younger than average. Overall it seems that newness is a more important factor for this group of firms than smallness. And third, there are high-growth firms in all industries not only, as it could be believed, in high-technology industries. If anything, there seems to be some overrepresentation in market services.[5]

Apart from size, sector and age, variables included in almost every single study on this topic, other dimensions of interest are analysed as well by a number of papers. For example, there is some consensus about the fact that high-growth firms are more technology intensive than average firms. EIM (2006) estimates that in the Netherlands about 40% of high-growth firms spend 10% of turnover or more in R&D whereas only 30% of slow growers devote such an effort to those activities. Schreyer (2000) finds a similar result in his review of the phenomenon in 6 OECD countries. In Spain, for example, he estimates that whereas about 50% of manufacturing firms undertake some R&D activity, the percentage increases to 70% when it comes to high-growth firms.[6]

The fact that Gazelles tend to be, to a certain extent, technology intensive young small firms explains the frequency with which they report having difficulties accessing to external financing. Indeed, there are at least four specific characteristics of R&D investment which might explain the existence of credit restrictions [see Hall (2002)]: First, the investment outcome is highly uncertain and, therefore, risky. Second, information asymmetries might be very important —and insurmountable— due to the secrecy around this type of activities to protect intellectual property. Third, the output of this investment is, broadly speaking, knowledge, an intangible asset which is very difficult to collateralize. And fourth, there is a long gap of time between the time of investment and the time of reaping the rewards from it. Hence, innovative firms might have a cash-flow shortage problem that could difficult even further their access to finance. Add to this equation the reported difficulties of young small firms to access finance —due to lack of track record or collateral[7]— and you have a probable case of underinvestment which might be reducing the number of high-growth firms.

Additionally, high-growth firms seem to spend more time and money in staff training and to hire more qualified workers than the average firm. EIM (2006), for example, estimates that Gazelles spend 70% more of time in staff training than slow growers. The information we have about this phenomenon stemming from interviews with entrepreneurs point in the same direction: Europe's 500[8], for example, shows that the key for success of the European most dynamic entrepreneurs during the 80s was human capital.

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5. See for example the literature review of Henreksson and Johansson (2008).
6. The Spanish case study of Schreyer (2000) is based on the "Encuesta sobre Estrategias Empresariales", a representative sample of manufacturing firms with more than 10 employees.
7. See Coluzzi et al. (2008).
8. Europe's 500 focus on the 500 most dynamic European entrepreneurs between 1979 and 1984.

Finally, in Schreyer (2000) some country studies distinguish between independent firms and those that are partly or wholly owned by another firm. All of them conclude that dependent firms play a more than proportional part in the group of high-growth firms. They attribute this finding to three possible factors, also associated to reported constraints to growth: 1) dependent firms have easier access to finance; 2) dependent firms have better access to human capital whenever recruitment, training and mobility involve fixed costs and/or a minimum size; 3) dependent firms have easier access to information about markets, products and technologies.

In spite of the importance of this topic from a policy-point of view, most of the studies of Gazelles are descriptive and limited to a comparison of the characteristics of the high-growth group with respect to a control group of firms. However, a multivariate analysis of the determinants of the fast growth of firms would be required to disentangle the effect of the different variables reported to be important. That is precisely the first aim of this paper. Using firm-level data for Spanish firms, operating in all sectors of the economy, we run a probit regression to estimate the partial effect of each of the possible determinants of high-growth suggested by the literature reviewed above. Among those determinants we include sector of activity, age and region but also the capital structure of the firm and the relative qualification of the workforce at the beginning of the period. Given the fact that we have several years of information we are able to control for the fact that a firm marked as a gazelle in a certain period was also a high-growth firm in the previous period. Apart from controlling for some of the endogeneity issues which arise in this type of regressions, this procedure will allow us to study the growth inertia of this group of firms.

The second contribution of the paper is the analysis of the characteristics and determinants of Gazelles for the specific case of Spain. To the best of our knowledge, the only other paper addressing the phenomenon in Spain is Schreyer (2000), who summarises the results from 6 OECD country studies using a homogeneous methodology and treatment of the data so as to be as comparable as possible.[9] The Spanish study is based on the Encuesta sobre Estrategias Empresariales (ESEE) database, including firm-level information for about 1,200 manufacturing established firms for the period 1990 to 1994. The dataset includes a representative sample of firms with more than 10 but less than 200 employees and virtually all firms with more than 200 employees. Given the results elsewhere about the newness of high-growth firms as well as their overrepresentation in the service sector, the exclusion of entries and the focus of the Spanish study in the manufacturing sector could be affecting the results. Moreover, the study excludes all firms with less than 10 employees which, given the reduced average size of firms in Spain, could also be leaving out of the analysis a large number of potential fast growers.

The database used in this paper has been constructed at the Bank of Spain to overcome these problems. It contains firm-level information from the provincial firm registries and the National Institute of Statistics (INE) and offers at least four advantages with respect to other databases. First, there is little undersampling of small and young firms. Second, it includes all entries and exits. Third, it covers the whole market economy (but the financial sector). Fourth and last characteristic of our dataset is that the relatively long time span allows us to study different waves of high-growth firms so as to check the consistency of our findings as well as to control for possible endogeneity.

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9. Hoffman and Junge (2006) count the number of high-growth firms in Spain, in order to compare it with that in other countries, but they do not perform any further analysis about Gazelles´ characteristics or determinants.

The next section describes briefly the database and goes over the definition of high-growth firms used in this paper. Section 3 performs a descriptive analysis of Gazelles which includes an account of their importance in terms of employment in Spain. Section four performs a probit analysis in order to study the main determinants of fast employment growth. Section five looks at the growth process of this group of firms. The purpose is to learn what type of employees and finance use Gazelles in Spain to sustain their impressive growth. Finally, section six concludes.

2 Data and definitions

2.1 The database

The Bank of Spain Firm Demography Database (BSFDD) contains information on sector of activity (at 4 digits), legal form, employment and some entries of the balance sheet at firm-level for about 90,000-200,000 Spanish Limited Liability Societies and Corporations with one or more employees, operating in all sectors of the business economy (but the agricultural and financial sectors) each year between 1996 and 2003. Data come from two sources: the "Directorio Central de Empresas" (DIRCE), managed by the National Institute of Statistics (INE), and the "Central de Balances del Banco de España" (CB), which processes data from the firm registries. DIRCE covers the whole population of Spanish firms (including self-employed) since 1994. It works mainly with tax and social security records and provides annual information on the total number of active firms, entries and exits, by sector, region and employment strata. The CB receives sometime between August and December every year the financial statements deposited the previous year in the Firm Registries[10] by all societies (not self-employed) that have been active any moment during the previous year.

Although all societies are obliged by law since 1990 to deposit every year their financial accounts in the regional firm registries, provision of employment data is not compulsory. Furthermore, the cost of processing electronically the statements is quite high which means that only the readable and quality-printed financial statements are processed electronically every year by the "Centro de Procesos Estadísticos", dependent on the regional firm registries. Both circumstances imply that "only" the financial statements of about 60% of all active firms every year are sent to the "Central de Balances del Banco de España" (CB). The CB does not incorporate about 10% of the firms received from the firm registries to its database because either they belong to the financial sector, not covered by the CB, or because the firms are already collaborating on voluntary grounds with the CB. Firms that are received and processed by the CB pass several logical and arithmetic filters to detect statements with severe incoherencies in their balance sheets and employment figures (total assets should be equal to total liabilities, for example, and the employment figure provided should be in concordance with the reported labour expenses). Surprisingly, only about half of the financial statements received pass those, truly not too demanding, tests. The next table shows the number of firms dropped at each stage of the process. We end up with about one-third of all active societies each year.

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10. All regional firm registries send the statements to a central unit created in 1996 that processes electronically the information (the "Centro de Procesos Estadísticos" or CPE). It is the CPE who at the end of each year sends the electronic information to the CB.

CONSTRUCTION OF THE DATABASE   TABLE 1

Thousands

	Limited liability and corporations active in the population	Statements received by the CB from the firm registries	Statements processed by the CB1	Statements with coherent accounts	Statements with coherent accounts and employment figures
1996		311.6	279.4	173.3	109.0
1997		389.4	351.0	223.1	145.1
1998		446.8	401.5	238.1	154.9
1999	684.8	433.5	352.8	211.6	141.6
2000	734.7	427.7	361.5	231.7	167.0
2001	787.2	445.9	367.3	245.6	192.6
2002	832.9	609.3	489.5	320.0	295.0
2003	886.8	658.8	537.7	374.9	309.0

Source: Bank of Spain.

Amongst the firms that do present coherent financial statements at least one year, we find that many "disappear" from the registry to appear year/s later. We checked whether firms with no data in one specific year in their history were systematically different from those providing information that year, given both groups of firms had the same age and belonged to the same sector, by comparing their average employment and productivity when the information was provided. We found no systematic differences. We also looked for differences between firms whose financial accounts were never, during the period of analysis, processed by the firm registries, and those that did, at least one year, in terms of sector and employment at constitution year (information provided by DIRCE). We found that the proportion of firms in the construction and hotels and restaurants sectors belonging to the first group —those that never deposited their accounts or were not processed by the firms registries— was clearly larger than the proportion of firms in those two sectors that collaborated with the firm registries. The proportion of firms with no employees at birth was also higher within the first group.

Given the fact that the firm registry information is fairly incomplete due to the numerous gaps found in the history of some firms, we were unable to deduct the date of entry and exit of the firms solely from the presence or absence of data in the registry, as it is done in other countries. For that reason we had to resort to a second source of data. The Bank of Spain made a special request to "Directorio Central de Empresas" (DIRCE), run by the National Statistics Institute to get, under strict confidentiality clauses, the fiscal identification numbers, employment, sector and region of all Limited Liability Societies and Corporations that entered or exited the market between 1996 and 2003. DIRCE is, therefore, the main source of data to establish the entry and exit date of firms. It is important to stress that DIRCE records an entry whenever a new fiscal identification number is given to a firm. An exit is recorded when a fiscal identification number disappears. That means that any restructuring of firms (M&A) resulting in a new identification number will be recorded as an entry by DIRCE. Using information from large firms collaborating with the Bank of Spain we have estimated that around 5% of entries of firms with less than 20 employees and most of the entries recorded by DIRCE of firms with more than 100 employees could be the result of some kind of restructuring process or "false" entries. Moreover, we have no way to know whether observed employment growth of already established firms responds to an internal process of growth or, on the contrary, it is

"acquired" growth stemming from M&A.[11] Please keep these caveats in mind when interpreting the results of the paper.

We crossed the demographic information provided by DIRCE with the economic variables provided by the CB using the unique fiscal identification number of the societies in order to construct our database. Given the fact that firms in this literature are classified as fast growers on the basis of their employment or turnover growth over a period of several years, we construct five different 3-year datasets[12] and study the characteristics of high-growth firms in each of them. This procedure makes it possible to check the robustness of our results given that fast growers are not always the same across windows. Moreover, it allows us to look into the immediate past and future of the fast growers in a certain window to study their growth volatility as well as to control for possible endogeneity in the empirical analysis.

The selection of firms to be analysed in each of the 3-year windows was as follows: Firstly we selected all established and new firms in *t*, initial year of the period of analysis; those are the active firms in *t,* around 300,000 in average, as Table 2 shows. Then we chose among the active firms with one or more employee those that survived till the end of the period, *t+3*, and had complete employment data (both in *t* and *t+3*). That left us with about 100,000 firms in average every period. Lastly, according to the criteria provided in the next section, we marked the group of firms with high employment growth.

NUMBER OF FIRMS IN SAMPLE   TABLE 2

	1996-1999	1997-2000	1998-2001	1999-2002	2000-2003
ACTIVE FIRMS IN *t*	283,463	310,856	338,798	364,620	388,054
Of which survive to *t+3*	260,982	283,073	307,652	329,522	352,793
Of which have employment data at *t* and $e_t >=1$	133,091	148,625	166,251	173,558	193,633
Of which have employment data at *t* and *t+3*	77,436	86,689	108,568	123,550	136,093
High-Growth Firms (Schreyer)	7,633	8,666	10,151	12,354	13,608
High-Growth Firms (OECD)	1,496	1,791	1,833	1,691	1,628

Source: Bank of Spain Firm Demography Database.

It is important to stress that the set of firms with complete data in each of the 3-year windows is representative of the total population, at least in terms of sector of activity, legal form and employment. In order to see that, we compare the distribution across sectors and employment of the total population of active firms in 1999 constituted as Corporations or Limited Liability in the business economy provided by the National Statistics Institute with that in our sample of active firms corresponding to the period 1999-2002. Table 3 below shows the result of the exercise. The results do not change if another 3-year window was chosen instead.

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11. This is important given that Davidsson and Delmar (2003) find that small firms grow organically to a larger extent while larger firms do so through M&A.
12. The datasets are: 1996-1999; 1997-2000; 1998-2001; 1999-2002; 2000-2003.

DISTRIBUTION OF FIRMS ACCORDING TO SIZE AND SECTOR: DATABASE VERSUS POPULATION   TABLE 3

| % | DIRCE | | | | BSFDD | | | |
| | By sector and size | | | | By sector and size | | | |
SIZE/SECTOR	<20	20-500	>500	TOTAL	<20	20-500	>500	TOTAL
Mining	78.8	20.4	0.8	0.3	80.0	18.5	1.5	0.4
Manufacturing	80.3	19.4	0.3	19.6	78.0	21.4	0.6	22.0
Utilities	82.8	15.3	1.9	0.2	72.2	22.9	4.9	0.3
Construction	88.9	11.0	0.1	16.5	89.4	10.5	0.2	15.2
Trade	93.9	6.1	0.1	32.4	93.0	6.8	0.2	33.4
Hotels and restaurants	91.1	8.8	0.1	7.2	88.6	11.2	0.2	6.3
Transport	91.1	8.7	0.2	5.6	89.7	9.9	0.5	5.1
Post and telecommunications	84.5	15.2	0.3	0.4	77.7	19.9	2.4	0.3
Other market services	93.4	6.4	0.2	17.8	92.9	6.7	0.4	17.0
TOTAL MARKET ECONOMY	89.8	10.0	0.2	100.0	88.5	11.1	0.3	100.0

Sources: DIRCE and Bank of Spain Firm Demography Database.

2.2 Definition of high-growth firms

There are several criteria to classify a firm as a Gazelle which combine in one manner or the other employment size and growth rate. Birch et al. (1995), for example, required a positive turnover growth every year and a doubling of turnover in a five-year window. Firms had to have a minimum initial turnover of $100,000. Hoffman and Junge (2006) require a two-year growth of at least 60% with a minimum of 20% growth per year. There is as well a requirement on initial employment of 15 employees. Schreyer (2000) proposes in his OECD study a combined measure of relative and absolute firm employment growth following earlier work of Birch (1987). The idea is that a growth measure meant to reflect successful management, innovation strategies etc. should not a priori favour any firm size class. The proportional rate of change of employment, a relative measure, would introduce a clear bias towards small firms. On the other hand, absolute employment growth, measured in employees, would introduce a bias towards large firms. The combined indicator proposed, which will be called the "Schreyer indicator" and is shown in (1) below, has been proven to give rise to the smallest bias towards any size class.

$$S = \left(X_{t+3} - X_t\right)\frac{X_{t+3}}{X_t} \tag{1}$$

where X_{t+3} and X_t denote employment at the end and at the beginning of the period respectively. High-growth firms will be then chosen as the 10% with the highest value of the indicator.

The OECD proposes a second indicator to classify firms as high-growth similar to that of Birch (1995) and of Hoffman and Junge (2006). It is based on average annualised employment growth —it should be greater than 20% per year in a 3-year window— but with a minimum initial employment size of 10 employees requirement in order to minimise the bias towards small firms.[13]

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13. See Ahman (2006).

Turnover measures of growth can give rise to comparability problems given the lack of consensus on how to deflate turnover as well as different criteria to measure service sector turnover. For that reason we prefer the employment growth criteria to classify firms as Gazelles,[14] although an indicator based on value added growth will eventually be used to check the robustness of the results. Unless otherwise specified, we will use the two OECD employment based high-growth indicators: the combined indicator labelled as Schreyer indicator and an annualised growth of 20% over a period of 3 years with a minimum initial size of 10 employees, which will be called the OECD indicator. Given that the average size of firms in Spain is much smaller than that in other OECD countries[15], we consider, however, the Schreyer indicator most appropriate for the Spanish analysis.

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14. In any case, Hoffman and Junge (2006) find a very high correlation (0.89) between the employment and turnover based prevalence rate of Gazelles.
15. Pagano and Schivardi (2003), for example, calculate that the average firm size in Spain is about 60% that in other European Union countries, even after controlling by sector of activity.

3 Some descriptive analysis

Are there more or less Gazelles in Spain than in other developed economies? Although cross-country studies are rare due to data comparability problems, Hoffman and Junge (2006) show prevalence rates of Gazelles for a number of OECD countries, including Spain. They use the Bureau van Dijk firm-level data to estimate the percentage of high-growth firms in the population of continuing firms with 15-200 employees. Gazelles are defined as firms (sole proprietors are not included) with an employment growth rate higher than 60% over two years (from t to t+2) with a minimum annual growth of 20%. Table 4 below shows the prevalence rates across OECD countries for the three 2-year windows analysed. Spain (1) refers to the percentage of high-growth firms in Spain estimated by Hoffman and Junge (2006) and Spain (2) to the prevalence rate estimated using our data but the selection criteria of Hoffman and Junge (2006). The purpose of the comparison is to check the general validity of our data, although the cross-country comparison should be done with the Hoffman and Junge data for internal consistency reasons.

HIGH-GROWTH FIRMS IN SPAIN AND OTHER OECD COUNTRIES   TABLE 4

%			
Country	1999-2001	2000-2002	2001-2003
Austria	0.1	0.1	0.5
Belgium	2.2	1.4	1.0
Denmark	2.1	1.5	1.4
Finland	2.9	1.5	1.4
France	1.9	1.2	1.0
Germany	0.6	0.4	0.4
Italy	3.9	2.3	2.0
Japan	0.4	0.4	0.6
Korea	7.2	4.6	4.9
Netherlands	1.5	1.4	0.8
Norway	1.3	1.3	0.9
Portugal	4.7	1.4	1.4
Spain (1)	2.4	2.1	1.9
Spain (2)	3.7	2.9	2.9
Sweden	2.9	2.0	1.6
Switzerland	3.8	1.7	1.2
UK	3.9	3.0	2.7
USA	4.0	3.0	2.5
EU	2.4	1.5	1.3

Sources: Hoffman and Junge (2006) and Bank of Spain Firm Demography Database.

Table 4 shows that, averaging over the three periods, the share of high-growth firms in the USA doubles that found in EU countries. Secondly, Spain's share of high-growth firms, according to the Bureau van Dijk data, is average within the European context, where Austria and Germany are at the bottom and UK and Portugal at the top of the ranking (considering all three periods).[16] Although the evolution of the prevalence rate of Gazelles in Spain using both the Bureau van Dijk and our data is very similar, the percentage of

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16. Italy shows high prevalence rates of Gazelles when employment growth is used as defining criterion and low prevalence rates when turnover is used instead. Hoffman and Junge (2006) attribute this fact to the poor quality of employment data of Italian firms in the Bureau van Dijk dataset.

high-growth firms in our database is larger. The reason could be that our sample includes only firms which have voluntarily deposited their accounts and employment information in the firm registries during the period of analysis. That is, there is a probable under-representation of firms going through difficulties. This possible self-selection problem should not affect, however, the results of the probit analysis since we study the relative characteristics of high-growth firms when compared to the characteristics of the slow growers in the group (of possibly self-selected firms). Furthermore, the fact that we count with a large number of firms in our sample ensures that those relative results are quite reliable.

We turn now to the importance in terms of employment of Gazelles in Spain. Figure 2 below shows the share of fast growers in the total number of firms, 10% by construction when the Schreyer indicator is used to classify firms as fast or slow growers, and 1.5% when the OECD criterion is used instead. We show it for the total sample of surviving firms as well as for the sample of small firms, those with less than 20 employees at the beginning of the period. In all cases, the employment share of Gazelles the first year of analysis (we show the average of the different windows studied) exceeds their share in the number of firms. That is, the average size of fast-growers is larger than that of the rest of surviving firms.[17] The third bar in the Figure gives an idea of how much faster Gazelles grow when compared with the rest of surviving firms. Indeed, at the end of the period, surviving firms expanded in average their personnel in 2 employees over a 3-year period, vis-à-vis an expansion of 36 employees of Schreyer high-growth firms and more than 80 in OECD high-growth firms. Overall the 10% (1.5%) of firms classified as fast growers according to the Schreyer indicator (OECD indicator) were responsible for the creation of more than 500,000 (250,000) net jobs, in average, over a period of only three years, which is more than 100% of the total employment created in the period. That is, high-growth firms are a non-trivial source of employment in Spain.

If we restrict the sample to small firms it seems that the average initial size of fast growers is only slightly larger than that of non-growers. But three years later, the average size of small fast growers is 18 employees whereas that of the sample of small surviving firms is 6. The result is that 7.7% of firms marked as fast-growers in the group of small firms account for about 80% of net employment creation over a three-year period of all firms classified as small.

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17. The average size of active firms in *t* which survive up to *t+3* and provide data is, in average, 13 employees versus 50 and 52 employees for Schreyer and OECD high-growth firms respectively.

HIGH-GROWTH FIRMS AND EMPLOYMENT   FIGURE 2

Source: Bank of Spain Firm Demography Database.

Gazelles are therefore important job creators. What else do we know about them? We proceed first to do a descriptive analysis similar to that in other studies on this same topic. We compare the distribution of firms according to size, sector, status and region in the high-growth group with the distribution in the control group (active firms in t that survived to t+3, present data in both years and are not classified as fast growers). Other studies [Birch and Medoff (1994), for example] show only the characteristics of the Gazelles, without comparing them with any control group, which, in our modest opinion, can be misleading. We show results for the group of high-growth firms according to the Schreyer definition. Results are very similar if we used the OECD criterion instead to classify firms as Gazelles.

%

Average	Gazelles	Rest
BY SIZE		
Small (<20)	68.5	91.5
Medium (20-250)	27.5	8.2
Large >250	4.0	0.4
BY SECTOR		
Manufacturing	27.4	22.3
Construction	20.2	14.3
Market services	52.4	63.4
ICT-producing manufacturing	0.6	0.3
ICT-producing services	2.5	1.1
ICT-using manufacturing	8.2	7.5
ICT-using services	26.3	35.1
non-ICT manufacturing	19.1	15.0
non-ICT services	22.0	25.8
non-ICT others	21.2	15.1
BORN AT t	24.5	13.5
BY REGION		
Andalucía	12.4	11.7
Aragón	4.5	5.4
Asturias	2.0	2.1
Baleares	1.5	1.3
Canarias	1.8	1.2
Cantabria	0.4	0.2
Castilla la Mancha	3.3	4.0
Castilla y León	4.2	5.3
Cataluña	24.4	25.2
Comunidad Valenciana	17.1	18.6
Extremadura	1.1	1.3
Galicia	2.8	2.5
La Rioja	0.6	0.8
Madrid	15.6	12.8
Murcia	1.6	1.1
Navarra	1.5	1.4
País Vasco	4.5	4.4
Ceuta y Melilla	0.1	0.1

Source: Bank of Spain Firm Demography Database.

Almost 70% of Gazelles start from small bases (less than 20 employees in the first year of the period of analysis). Hence, as it has been established in other studies, a majority of Gazelles are small. However, if we compare with the control group, small firms are actually underrepresented. Instead, medium-sized firms and large firms play a more than proportional part in the group of Gazelles.[18] Similarly, although there are high-growth firms across all sectors they tend to be concentrated in the market service sector, although to a lesser extent than slow growers. Hence, manufacturing and, above all, construction firms are overrepresented in the Gazelle group.[19] If we grouped industries according to their technology intensity, as in van Ark et al. (2003), we could see that Gazelles are more concentrated in all manufacturing industries, independently on their technology degree, when compared to slow growers. There are differences, however, across service industries of different technology intensity. Table 5 shows that there is relatively more high-growth firms in ICT-producing services, basically telecommunications and computer services, whereas there are less, if compared to the concentration across industries of slow growers, in ICT-using services (retail) and non-ICT services (hotels and restaurants, for example). The high weight of the two latter groups of industries within the service sector

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18. Recall, however, that we cannot disentangle internal from acquired growth.
19. According to the Spanish National Accounts, employment in construction increased by 50% between 1996 and 2003, which can help explaining the high prevalence of fast-growth firms in that sector over the period of analysis.

explains that, in the aggregate, the concentration of fast growers in services is actually smaller than the concentration of slow growers in that sector.

A quarter of high-growth firms are start-ups —that is, they entered the market in t— vis-à-vis 13% of slow growers. Moreover, 20% of all new firms in t that survive over to $t+3$ grow so much as to be defined a Gazelle. Newness then seems to be quite important to explain high-growth. Lastly, the distribution of Gazelles across regions is very similar to that of slow growers, maybe with the exception of the Madrid region were the concentration is slightly higher. Hence, the region where the firm operates seems to be the least important of all high-growth determinants.

This first approach to the analysis of the characteristics of the Gazelles in Spain shows that there are high-growth firms across all sizes, sectors and regions. Although there is a high percentage of small Gazelles and of high-growth firms in the service sector, as it was expected given the results elsewhere, those percentages are actually smaller than the ones found in the control group of slow growers. The only clear result in Table 3 is the relatively larger presence of young firms amongst fast growers compared to that in the control group. However, in order to disentangle the impact of age or any other characteristic on the probability of growth from that of other variables one has to resort to a multivariate analysis. That is what we do in the next section.

4 Determinants of firms' growth: A probit analysis

In order to disentangle the partial effects of the different variables considered in the previous section on the probability of being a high growth firm, and to assess their significance, we need to estimate a multivariate equation. The bulk of the analysis of this section assumes that the dependent variable is a categorical variable, adopting the value of 1 for high-growth firms according to the definitions accepted in the literature and introduced in the previous section, and 0 for the rest of firms. However the employment growth thresholds above which a firm is defined as a Gazelle are arbitrary and do not respond to any break in the growth distribution of firms. For that reason, and in spite of the fact that the main purpose of this paper is to explore the determinants and characteristics of a very specific group of firms, we include as well in this section a regression where the dependent variable is firm growth with no particular minimum threshold, defined as the (continuous) value of the Schreyer indicator. The results of this latter regression will shed light on the issue of whether the included explanatory variables are important to determine not only whether a firm belongs or not to the high-growth group, but also its position within each of the groups.

We take all regressors at their value in the first year of the period considered, to ensure that they are, at least, predetermined with respect to actual growth process. For reasons explained below we will concentrate our analysis in two windows of three years: 1999-2002 and 2000-2003. However, we will also perform the analysis using pooled data for all the five 3-year windows.

As it was mentioned in the introduction, apart from age, sector and the region of activity of the firm there are other firm-specific characteristics that might affect the probability of high growth. Among them, human capital and access to finance are two of the most frequently mentioned. Please note that some of these variables could bear some endogeneity problems. For example, the financial possibilities-high growth channel could also operate the other way around: a firm with a high growth history could be more attractive to lenders. A similar problem can be found regarding the effect of average human capital. Our strategy to tackle this potential endogeneity problem is twofold. First, given that we have data from 1996 to 2003 we are in a position to control for the fact that firms marked as Gazelles in one period experienced also fast growth in the previous period.[20] We can do this exercise for two 3-year windows, namely, 1999-2002 and 2000-2003. Controlling for past growth, not only reduces the importance of endogeneity issues, but also allows us to estimate the growth inertia, if any. The second strategy to tackle a possible endogeneity problem is to instrument for the two possible endogenous regressors, financial structure and human capital, using as instruments the lagged values of the variables.[21] It is true that using lagged values of the explanatory variables as instruments is not a good solution to possible endogeneity issues when firms choose the value of those variables anticipating a certain growth path. In this case the lagged values would not be exogenous determinants of growth and we could only talk

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20. More concretely, we analyse high-growth firms in the period 1999-2002 controlling for past growth in the adjacent period 1996-1999. Similarly, we analyse Gazelles in 2000-2003 controlling for the fact that they were, or not, Gazelles in 1997-2000.

21. Given that the maximum likelihood estimation does not lead to convergence we use the Newey's two-step estimator which allows fitting a probit model with multiple endogenous regressors. However, this methodology tests whether the estimated coefficient of the endogenous regressor is significantly different from zero, but it cannot be used for postestimation analyses such as calculating marginal effects. Hence the probit results will be shown as a robustness check but the marginal effect of the variables will be computed for the model controlling for past growth of firms (our first strategy to tackle the endogeneity problem).

properly about the existence of correlation between the variables but not about causality. We are currently working to find better instruments but consider that results obtained so far are interesting enough to be reported.

4.1 Explanatory variables

What follows is a short description of the explanatory variables and controls included in the analysis.

4.1.1 CAPITAL STRUCTURE OF THE FIRM

Firms' expansion requires financing. If due to information asymmetries, moral hazard, lack of tangible collateral or cash-flow problems some firms face financing constraints that hamper their growth, their financial structure will affect the probability of growth. In order to estimate this effect, we include as a regressor the share of total debt (long and short term) over total liabilities of a firm (we also try using only the share of long-term debt over total liabilities). The reasoning behind the use of this variable is that all the problems stated before should have a stronger effect on debt than on equity.[22] If this is the case, a higher debt ratio could be a proxy for lower financing constraints. However, a very high gearing could increase the risk of a firm to find financing difficulties, or reflect past profitability or solvency problems. In order to capture possible non monotonic effects of the variable we included also among the explanatory variables a quadratic debt term.

4.1.2 HUMAN CAPITAL

Gazelles have been reported to spend more time and resources in staff training and to employ, in average, more qualified staff than slow growers. To estimate the quantitative impact of a firm's human capital upon its growth probability we include as a regressor two possible proxies for human capital: average salary and the salary premium paid by the firm. The first human capital proxy, the average wage, is computed simply as the ratio of total wage bill over total employment. The second proxy, the wage premium, is calculated as the ratio of the average wage paid in the firm to that paid in other firms of the same 2-digit sector.

4.1.3 AGE

The estimation of the effect of age deserves special attention. Ideally, one should estimate the effect of each possible age on the probability of high growth. Unfortunately, our dataset does not have this information; we know the birth year of a firm only if it was created between 1996 and 2003. Moreover, the fact that we control for past growth of the firms marked as Gazelles in a given period implies that those high-growth firms had to be active over the previous period. For these two reasons we can only control for the fact that firms entered the market, or were already operating in it, at *t-3*. That is, when we analyse for example the determinants of firms marked as Gazelles during the period 1999-2002 we control for the fact that they were, or not, fast growers over the previous period, 1996-1999. That means that we can only mark firms that entered the market in 1996, the first year of the previous period. Consequently, our analysis of the effect of firm's age is limited to a dummy variable indicating if the firm is relatively younger (has three years of operations) than the rest.

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22. Hall (2002) reviews a number of papers testing the existence of financing restrictions to innovative firms and concludes that debt is a disfavoured source of finance for R&D investment.

If we did not control for past growth, that is, if there was no requirement for the firm to be active over the previous 3-year period, then we could control for the fact that the firm is a start-up. We do so in the pooled estimation of a probit model, where information on Gazelles in every 3-year window (five in total) is included.

4.1.4 CONTROLS

Given the results of table 2 and of other studies we include as controls the region and sector of activity of the firm. In the case of sector of activity, we try with five sector dummies grouping manufacturing and service industries according to their technology intensity, with 9 dummies for lower level sector aggregations as well as with 45 2-digit sector dummies.[23] As it has already been explained, we also include as a control a dummy capturing whether the firm was classified as a Gazelle in the previous adjacent period. Finally, in all the pooled data estimations we include a time dummy to control for the business cycle.

It is worth noting that size is not among the explanatory variables. The reason is that both definitions of high growth presented above combine in some way two elements: growth rate and size.[24] Hence size cannot be one of the regressors. In spite of that, and to check the robustness of the results, as it is explained below we include in Annex a regression controlling for the fact that the firm is small (<20 employees), medium-sized (between 20 and 250 employees) or large (>250 employees).

Table 6 below provides the basic descriptive statistics and definitions of the explanatory variables for the group of Gazelles (according to the Schreyer indicator) and for the rest of firms.

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23. The 5 sectors differing in technology intensity are: ICT producing and using manufacturing which are grouped under ICT manufacturing, non-ICT manufacturing, ICT services, non-ICT services and non-ICT others (basically, construction, utilities and mining). For a detailed account of these sectors, please refer to Annex 2. The 9 lower level sector aggregations are: Mining, manufacturing, utilities, construction, retail, hotels and restaurants, transports, telecommunications and other services.

24. This is obvious for the OECD definition. Regarding the Schreyer indicator, simple algebra reveals that it is the product of a quadratic growth term and a size term.

Average		High growth firms	Rest
DEBT RATIO			
	Mean	0.6	0.6
TOTAL DEBT OVER LIABILITIES AT t	Median	0.7	0.6
	Standard dev.	0.2	0.2
LONG- TERM DEBT RATIO			
	Mean	0.1	0.1
LONG-TERM DEBT OVER LIABILITIES AT t	Median	0.0	0.0
	Standard dev.	0.1	0.2
AVERAGE WAGE (Annual thousands of euros per employee)			
	Mean	22.1	17.0
TOTAL WAGE PAYMENT DIVIDED BY TOTAL EMPLOYMENT AT t	Median	18.9	15.0
	Standard dev.	15.2	9.2
WAGE PREMIUM			
AVERAGE WAGE AT THE FIRM OVER	Mean	1.1	0.9
AVERAGE	Median	0.9	0.8
WAGE PAID IN THE 2-DIGIT SECTOR AT t	Standard dev.	0.7	0.5
% BORN AT t		24.5	13.5
% GAZELLES IN PREVIOUS PERIOD (a)		35.0	7.8

Source: Bank of Spain Firm Demography Database.

a. Average refers to periods 1999-2002 and 2000-2003.

4.2 Results

Table 7 shows the result for six different models. Since we are estimating a probit model, the quantitative effect of the determinants on the probability of being a Gazelle vary with the value of the rest of covariates. Hence those effects will be reported separately in table 8.[25] Models 1 to 4 show the estimation of the probit model for windows 1999-2002 and 2000-2003, being 1996-1999 and 1997-2000 the two respective adjacent previous windows used to control for the past growth of firms. Models 5 and 6, on the other hand, show the results of the pooled data estimations. Model 1 includes all the variables presented above, including the dummy for the past growth of firms and it is our benchmark model. Model 2 shows the interaction of the dummy for past growth with eight sector dummies. Model 3 is like model 1, but excluding the dummy capturing the growth inertia.[26] Model 4 uses as instruments for the debt and wage their lagged values. The purpose of model 3 and 4 is to check, by means of comparing their estimation results with those of models 1 and 2, whether the possible endogeneity of some determinants is actually distorting their impact upon firm growth. If that was not the case we could exclude the past growth dummy and use the observations of the five windows in our sample. In that case we could replace the age variable by a dummy reflecting the fact that a firm is a real start-up, i.e. it entered the market exactly at the beginning of the window. This is done in models 5 and 6. Since the age dummy is now closer to a real start-up, we include in model 5 the interaction of the new firm dummy with the financial variables. The purpose is to see if financial constraints have a stronger effect for new firms. Please note that we cannot include fixed effects in the pooled data estimations due to the lack of degrees of freedom given that we only have between one and five observations for each firm (three in average). Hence we cannot control for heterogeneity at a firm level. Nevertheless, what we can do is to control for differences between sectors at a very low aggregation level. This is done in model 6, where we replaced the previous five

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25. Marginal effects will be calculated for Model 1, our benchmark model, where past growth is controlled for and human capital is proxied by the relative wage paid in the firm.
26. Both estimations have been done using the same set of observations.

sectors by 45 two-digit sectors hoping to capture in this way some of the firm-level idiosyncrasies that could also be affecting the probability of growth of the firm.

TABLE 7

PROBIT COEFFICIENTS

DEPENDENT VARIABLE: PROBABILITY OF BEING A GAZELLE	MODEL 1 Benchmark		MODEL 2 Sector interactions		MODEL 3 Without past growth		MODEL 4 Instrumental variables		MODEL 5 Debt interactions	MODEL 6 With 45 sector dummies
	1999-2002	2000-2003	1999-2002	2000-2003	1999-2002	2000-2003	1999-2002	2000-2003	Pooled data	Pooled data
HGF in previous period (t-3/t)	0.828***	0.822***	0.367***	0.413***						
	(0.042)	(0.042)	(0.122)	(0.125)						
HGF(-1)*mining			-0.356	0.51						
HGF(-1)*manufacturing			0.318***	0.366***						
HGF(-1)*utilities			0.919***	0.304						
HGF(-1)*retail			0.793***	0.559***						
HGF(-1)*hotels			0.215	0.033						
HGF(-1)*transport			0.777***	0.63***						
HGF(-1)*telecomm			0.89	-0.075						
HGF(-1)*other services			0.696***	0.619***						
Born in t									0.815***	0.584***
									(0.260)	(0.066)
Born in t-3	-0.068	0.153	-0.070	0.123	0.183*	0.310***	0.285	0.166		
	(0.113)	(0.113)	(0.112)	(0.111)	(0.109)	(0.110)	(0.247)	(0.225)		
Debt	1.620***	1.467***	1.616***	1.443***	2.169***	2.026***	4.860**	3.051***	1.999***	1.850***
	(0.401)	(0.419)	(0.402)	(0.419)	(0.389)	(0.404)	(1.984)	(1.106)	(0.151)	(0.153)
Debt^2	-1.239***	-1.060***	-1.218***	-1.018***	-1.505***	-1.351***	-4.179**	-2.409**	-1.278***	-1.162***
	(0.364)	(0.378)	(0.365)	(0.378)	(0.354)	(0.366)	(1.965)	(1.087)	(0.135)	(0.135)
log(wage premium)	0.293***	0.256***	0,336***	0.294***	0.231***	0.227***	0.284***	0.237***	0.226***	0.234***
	(0.051)	(0.051)	(0.049)	(0.051)	(0.047)	(0.048)	(0.067)	(0.068)	(0.018)	(0.019)
ICT manufacturing	-0.192**	-0.288***			-0.266***	-0.330***	-0.319***	-0.357***	-0.223***	
	(0.079)	(0.082)			(0.077)	(0.080)	(0.093)	(0.091)	(0.030)	
ICT services	-0.115*	-0.112			-0.210***	-0.205***	-0.274***	-0.320	-0.259***	
	(0.069)	(0.070)			(0.067)	(0.068)	(0.078)	(0.077)	(0.026)	
Non-ICT manufacturing	-0.082	-0.078			-0.164**	-0.142**	-0.208**	-0.172**	-0.165***	
	(0.069)	(0.071)			(0.066)	(0.068)	(0.086)	(0.079)	(0.026)	
Non-ICT services	-0.015	-0.088			-0.066	-0.118*	-0.140*	-0.148*	-0.169***	
	(0.072)	(0.073)			(0.070)	(0.071)	(0.080)	(0.081)	(0.027)	
Debt*Born									-1.159	
									(1.013)	
Debt^2*Born									1.023	
									(0.883)	
Region dummies	included	included	included	included	included	included	included	included	included	included
9 sector dummies			included	included						
45 2-digit sector dummies										included
Period dummies									included	included

Source: Bank of Spain Firm Demography Database.
****, ** and *: significant at 1%, 5% and 10%, respectively.

The past growth of Gazelles is a highly significant predictor for current growth. In spite of this fact the coefficients of debt, wage and sector are very similar across models 1, 2, 3 and 4. This suggests that the possible existence of endogeneity is not affecting their estimation. This finding is important because it allows us to pool all the observations, from the five 3-year windows, and re-run the probit with alternative controls and specifications.

The observed growth inertia could be capturing the fact that the period of analysis, 1996 to 2003, is characterised by sustained and, in some sectors like construction, explosive employment growth. To check this possibility we take advantage of the fact that not all sectors grew during the overall period of analysis, especially during the dotcom crisis of the earlier 2000s. If past growth in those laggard sectors did not increase the probability of being a Gazelle then we could conclude that the observed growth inertia is solely a result of the expansive moment of the cycle. Model 2 includes in the regression interaction terms between the past growth dummy and 8 sector dummies, being construction our omitted sector.[27] We find that the past growth dummy is positive and significant in all sectors. Hence firms' growth inertia, or the fact that past growth is an important determinant of current growth, seems not to be responding solely to the expansive moment of the cycle but to be rather a more structural phenomenon in Spain.

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27. The eight sectors are mining, manufacturing, utilities, retail, hotels and restaurants, telecommunications, transport and other services.

Even controlling for past growth, which as it has been mentioned is positive and very significant, other variables seem to be important for growth. The effect of the debt ratio of the firm has an inverted U-shape. That is, it is positive up to a certain point; beyond that point further increments of debt will reduce the probability of growth. The fact that the capital structure of a firm has a significant effect upon its probability of growth could reflect the presence of market failures. Our results seem to point in the same direction as the rest of the literature: those firms with better access to credit, a higher debt ratio, have higher chances to grow fast. The fact that the impact of debt is non-linear is consistent with the theory of optimal capital structure of the firm [Jensen (1986)] which states that there is a mix of debt-equity which maximises the value of a firm. According to our estimations the maximum probability of growth is achieved when the debt ratio is almost 70%.[28] This is also consistent with Lopez-Garcia and Puente (2007) where it was found that the effect of debt on the probability of survival of a firm was also non-linear, with a maximum probability of survival between 50 and 75% debt ratio. We provide in the annex 1 (model A1) an estimation replacing total debt by long term debt as a robustness check. The results are very similar although the estimation of the debt effect loses some accuracy.

The effect of wages paid in the firm relative to the average wage in the 2-digit sector of activity —a proxy for the firm's human capital—, is extremely robust, positive and significant. In Annex 1 (model A2) we show the coefficients of the regression when the firm's average wage instead of the relative wage is included as a proxy of human capital. Results are almost identical. We have also included a quadratic term of the firm's average wage to study possible non-monotonicities, finding that the effect of the variable is always positive but marginally decreasing. The estimation using the log of the relative wage has this property and provides a better fit, hence it is the one shown in Table 5.

The variable used to proxy human capital, relative wages, could be capturing the effect on growth of other related factors such as firm size or the existence of a firm-level collective agreement. To rule out the possibility that the impact of wages on growth is reflecting a pure size effect, we have included size dummies in a pooled data regression shown in Annex 1 (model A4).[29] The only purpose of the exercise is to check whether, after controlling for firm size, the results for the rest of the variables change or not dramatically. We go no further due to the fact that firm size is part of the definition of the dependent variable, as it was explained previously. But even so, the results are very similar to those in models 5 and 6 of Table 5, the only difference being that the magnitude of the relative wage coefficient is somehow smaller. On the other hand, firms subject to a firm-level collective agreement are in a better position to adjust to short-term market conditions. This fact alone could be increasing their probability of growth when compared to that of other similar firms in terms of size etc., but subject to sector collective agreements. To control for this possibility model A3 in Annex 1 includes a dummy variable that takes the value 1 if the firm had a firm-level collective agreement at the beginning of the period and 0 otherwise. Apart from a slight reduction in the quantitative effect of the relative wage on growth, results do not change much.

The regression includes a dummy capturing the age of the firm. However, for reasons explained previously, in models 1 and 2 we only can control for the fact that a

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28. The estimation uses the coefficients of Model 1. In the first window the maximum is achieved at 65% and in the second window at 69%.

29. Dummies are defined for firms with less than 20 employees, between 20 and 250 employees and more than 250 employees. The reference is small firms (less than 20 employees).

firm marked as a Gazelle entered the market three years before the beginning of the period of analysis or, alternatively, was already an established firm at that time. We find that, when controlling for past growth, those relatively younger firms do not have a significantly higher probability of being Gazelles than the rest of the firms in the sample. Also in models 3 and 4, where past growth of the Gazelles is not controlled for, we find a very weak effect of the age dummy. This suggests that having entered the market several years before has little impact on the probability of high growth. But the story changes if one controls for the fact that the firm is a real start-up, that is, it has entered the market right at the beginning of the period of analysis. That is clearly revealed in models 5 and 6, which use pooled data and show that actual start-ups (firms born in *t)* have a significantly higher probability of becoming Gazelles between *t* and *t+3*. The marginal effect at the mean is large: New firms have 32 percentage points more probability of being Gazelles.

The pooled estimations are also useful to study whether the effect of debt is different for new firms. To do so, we have also included in model 5 the interaction between the two debt variables and the start-up dummy. It seems however that this differential effect of debt is not significative. The reason is that the standard errors of those interactions are very large given the fact that the variance of debt is not enough for this particular group of firms.

Among the sector dummies we find that, *ceteris paribus*, firms operating in construction, services and non-ICT manufacturing have a higher probability of experiencing fast growth when compared to firms operating in ICT-manufacturing. The difference is significative at 5% confidence level in both windows. The result with respect to the service sector —it is the same for ICT and non-ICT services— is not surprising given the results found elsewhere in the literature. Maybe it seems a bit more surprising the fact that firms operating in the construction sector have higher chances of fast growth. This could be explained, however, by the construction boom experienced by the Spanish economy precisely during this period.

Finally, model 6 substitutes those aggregate sector dummies by 45 2-digit sector dummies. The purpose is to control as far as the dataset allows us for other firm-level characteristics that might be affecting the probability of growth, like sector riskiness, sector concentration etc. Results, however, do not change. Hence they seem to be quite robust.

To further check the robustness of the results, we have tried to run the regression using alternative measures of growth. Model A6 in Annex 1 shows the probit results using the OECD indicator defined above to mark high-growth firms. The accuracy of the estimators is lower, because the number of high growth firms is now smaller. Nevertheless, most of the estimators still have a significant effect, with the exception of the quadratic debt term, which is now not significant. We have also tried to define Gazelles on the basis of value added growth (model A4 in Annex 1), instead of employment growth. For this alternative definition, the results concerning debt are less strong, and the ranking of sectors changes: all service sectors now have less probability of high growth, compared to the other three. This result is not surprising, since services have traditionally lower productivity and higher employment growth rates, compared to manufacturing. Finally, we include a regression where the dependent variable is the continuous Schreyer indicator, as defined in section 2 (model A7) instead of a dummy variable taking the value of 1 if the firm has an indicator value in the top 10%. The purpose is to check whether the explanatory variables determine not only whether a firm is amongst the fast growers or not but also its ranking within each of those two groups.

Results are very similar to the ones reported elsewhere in this section with the exception of the effect of the debt ratio which is now not significant. Hence the initial debt ratio of a firm is not a significant determinant of firm growth, taken as a continuous variable. It can determine, however, whether the firm grows a lot (is among the Gazelle group) or not.

Note that so far we have studied the impact of several variables on the probability of being a Gazelle versus the probability of not being a Gazelle. That latter possibility includes being a firm with negative employment growth during the period of analysis as well as being a firm with positive but low employment growth. However, the transitions from negative growth to slow growth and from slow growth to fast growth, or gazelle, do not necessarily have to respond to the same factors. Hence, one final robustness check, interesting in itself, is to study whether the variables analysed so far affect in the same way these two margins. To do so we have run a multinomial logit[30] in which the dependent variable takes a different value for each of the groups of firms mentioned previously: firms with negative employment growth over the period of analysis, firms with positive but slow growth and firms with fast employment growth. The result of the exercise is that the explanatory variables analysed affect the two transitions, from negative to slow growth and from slow to fast growth, in a similar way. The only difference is that the significance of all variables is somehow larger for the second transition.

We proceed now to show the quantitative impact on the probability of growth of the group of variables found to be significant for the Model 1 of Table 7. Table 8 below reports the effects of a change in one explanatory variable for a hypothetical firm which has all other variables equal to their means.[31]

EFFECT ON THE PROBABILITY OF HIGH GROWTH FOR DIFFERENT CHANGES IN THE COVARIATES   TABLE 8

Change in Probability	1999-2002	2000-2003
From non-HGF to HGF in previous period	0.298	0.285
From 25th percentile debt ratio to 50th percentile	0.022	0.022
From 50th percentile debt ratio to 75th percentile	-0.007	-0.002
From 25th percentile relative wage to 50th percentile	0.026	0.021
From 50th percentile. relative wage to 75th percentile	0.027	0.024
From ICT manufacturing to non-ICT others	0.065	0.092

Source: Bank of Spain Firm Demography Database.

The determinants of growth are past growth, human capital, sector of activity and access to finance. Indeed, the probability of growth increases by almost 30 percentage points if a firm has had fast growth in the previous period. That is, it seems that there is large growth inertia among Spanish firms. As explained before, when we remove this variable we are able to estimate the effect of newness on the probability of growth pooling all five windows. We find a large marginal effect: A start-up who survives up to *t+3* has a probability of fast growth 32 percentage points (pp) higher than an established (surviving) firm.

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30. Results of the multinomial logit are available from the authors at request.
31. In the case of debt, we compute first the mean debt ratio, and then set the quadratic variable equal to this mean squared.

Even after controlling for past growth, that is, ruling out a possible endogeneity problem, we find that increasing the relative salary paid the first year of the first period of analysis (results for the period 2000-2003 are very similar) in the firm from 0.78 to 1.03 times the average wage paid in the 2-digit sector (from the 25th percentile to the 50th) increases the probability of being a Gazelle 2.6 pp. Increasing the salary further to 1.34 times the average salary of the sector (to the 75th percentile) augments that probability an additional 2.7 pp. Hence, as it was shown in Table 7, the relative salary, our proxy for firm's human capital, has an important and positive effect on the probability of fast growth, although that effect is marginally decreasing. Similarly, increasing the initial debt ratio from 42% to 62% (from the 25th percentile to the 50th) increases the probability of fast growth in 2.2 pp. However, and this is different from the average wage effect, further increases of the initial debt ratio reduces the probability of growth. Lastly, the probability of fast growth of a firm operating in the ICT manufacturing sector is more than 6 pp lower than that of a firm operating in the construction sector (construction is the main element of the sector labelled as "other non-ICT sectors").

5   The growth process of Gazelles

Do Gazelles finance their fast growth with debt or equity? Is the debt structure of the firm changing after three years of fast growth? Is the expansion of this type of firms based on temporary or indefinite contracts? Is the mix between employees with indefinite and fixed-term contracts changing along the expansion path? The first purpose of this section aims to answer these relevant questions to better understand the growth process of firms in Spain. We do so by comparing the employment and capital structure at the beginning and at the end of the period of analysis of Gazelles with those of slow growers on the one hand and with the value of the variables of those firms that decreased employment over the period on the other hand. Considering the possibility that firms operating in sectors with different technology intensity could grow differently, we perform the analysis separately for producing and using ICT industries and for non-ICT industries. Another dimension worth analysing, above all in the Spanish case, is whether the growth of Gazelles is a quality-based growth, that is, whether it is based on high productivity and/or high wages. The comparison of the quality of growth of Gazelles with that of other types of firms is the second purpose of this section.

Table 9 shows the results of this exercise. The first column corresponds to Gazelles, the second one to firms that increased their size over the period, but not enough to be considered a fast-growth firm (slow growers), and the third one to firms that decreased their employment over the period. The value of the variables at *t* is the average value of the corresponding variable at the beginning of each window of analysis (five in total). The value at *t+3* is the average at the end of the period of analysis. The five variables analyzed are the share of employees with a permanent contract over total employment, the share of long and short term debt over total liabilities, labour productivity of the firm over average productivity of all firms operating in the same 2-digit sector, and average wage, also as a fraction of the average wage in the sector. We have performed a test to assess whether pairwise differences in initial and final values of the variables for each group of firms are statistically different.

GROWTH PATTERNS OF DIFFERENT TYPES OF FIRMS (a)   TABLE 9

%	High growth		Slow growth		Negative growth	
Variable:	t	t+3	t	t+3	t	t+3
FIRMS IN ICT INDUSTRIES:						
Share of permanent contracts	62.5 $^{(=)}$	62.9	64.4	68.3	62.7 $^{(=)}$	71.6
Long term debt ratio	9.5	10.7	8.5 $^{(=)}$	8.7 $^{(=)}$	8.7 $^{(=)}$	9.0 $^{(=)}$
Short term debt ratio	52.8	53.1	51.1 $^{(=)}$	49.4	50.2 $^{(=)}$	46.5
Productivity	134.5	100.9	101.9	95.7	85.4	109.6
Average wage	124.5	99.3	100.4	95.3	91.7	111.2
FIRMS IN NON-ICT INDUSTRIES:						
Share of permanent contracts	54.0	52.0	59.1	61.8	56.4	64.4
Long term debt ratio	12.1 $^{(=)}$	12.7	13.3	13.7	11.9 $^{(=)}$	11.9
Short term debt ratio	49.4	50.0	41.6	40.0 $^{(=)}$	43.4	40.2 $^{(=)}$
Productivity	136.7	102.9	103.1	96.8	84.9	110.2
Average wage	127.7	101.4	101.2	96.0	91.4	111.8

Source: Bank of Spain Firm Demography Database.

a. All diferences are significative (at 1%) for a given variable, moment and industry group, except those marked with an (=) sign.

We start analyzing changes in the employment composition of ICT firms. The first thing to notice is that the share of employees with permanent contracts increases in firms which are reducing employment over the period. This is the result of the fact that these firms are dismissing many more employees with temporary contracts than workers with permanent contracts (-29% versus -4% respectively). This is the consequence of the difference in firing costs between temporary and indefinite contracts in Spain, which pushes firms to adjust their personnel through changes in the amount of temporary employees. The share of permanent contracts also increases in the case of slow growers, but to a lesser extent. These firms are increasing both types of employment, but fixed-term contracts grow at a slightly lower rate. Gazelles, on the other hand, have a very stable mix of both types of jobs. As a consequence, their share of permanent contracts, which is similar to the other two types of firms at the beginning of the period, ends up several percentage points below the other firms. This result reflects that: 1) Gazelles use evenly both types of jobs when growing; 2) Gazelles resort more to fixed-term contracts compared to other firms.

Although results are very similar for non-ICT firms, there are some differences worth stressing. First, non-ICT firms have more fixed-term employees, compared with ICT firms. Second, this is especially the case for non-ICT fast-growth firms. And third, Gazelles increase fixed-term jobs slightly more than permanent jobs, which results in a small decrease in the share of permanent jobs at the end of the period.

Regarding the changes in liabilities composition, ICT firms with slow or negative growth (differences in this respect between both types of firms are not significantly different) have a very stable long-term debt ratio, but a decreasing short-term debt ratio. This means that their liabilities composition is changing towards equity. On the contrary, Gazelles increase both types of debt, especially the long-term one. This happens in spite of the fact that they already had a higher debt ratio at the beginning of the three year period. Again, results are similar for non-ICT firms. Although all firms have more long term debt and less short term debt than in ICT sectors, maybe due to the fact that the construction sector is non-ICT, the pattern of increasing debt in Gazelles and increasing equity in other firms remain. In summary, Gazelles use more fixed-term contracts and more debt to support their growth, compared to other firms.

Now we start the second purpose of the section by looking at productivity and wages of Gazelles at the beginning and at the end of the period of analysis, compared to the other two types of firms. The first thing to notice is that at the beginning of each window, Gazelles have productivity levels well above other firms —more than 30% higher than the average in the sector— whereas the contrary happens to negative growth firms. This happens both in ICT and non-ICT industries. However, the productivity of Gazelles decreases after three years of fast employment growth. Note that, despite this fall, their productivity level is still above the average level of the sector of activity at the end of the period. Likewise fast-growth firms' wages at the beginning of the period are about 25% higher than average wages in the sector. After three years of fast growth their average wage, computed as wage payments over total employment in the firm, has been reduced although it is still over the economy average.

6   Conclusions and some policy implications

A number of studies have stressed the enormous impact of a small group of enterprises, known as Gazelles, in aggregate net job creation. In spite of the importance of this topic from a policy-point of view, most of the studies of Gazelles are descriptive and limited to a comparison of the characteristics of high-growth firms with respect to a control group of firms. This paper aims at filling this gap from two different points of view. First, we develop a multivariate analysis of the determinants of the fast growth of firms in order to disentangle the effect of the different variables reported to be important in the literature. And second, we analyze how Gazelles' important variables change along their strong growth path, compared to other firms.

We find a number of variables that are related to a higher probability of being a Gazelle. The most important one is precisely having been a Gazelle in the previous period, and this is true even at a lower level of sector aggregation. Hence, at least during the period of time analysed in this paper, there is strong growth inertia. However, even controlling for past growth, there are other variables that are also significantly related to the probability of fast growth. First of all, new firms (that survive over the period) have about 30 pp more of probability than established firms to be a Gazelle. Hence, the removal of entry barriers seems to be crucial to enhance the number of fast-growth firms and, therefore, employment creation. Secondly, a higher level of human capital, proxied by relative wages, increases the probability of fast-growth monotonically. The need to invest in education to improve the skill pool, to improve the connection between the university and the enterprises, to facilitate training on the job etc. has been established since a long time. However our analysis highlights the importance of all those policies from another perspective, namely, to foster firm growth.

We find as well that an initial higher debt ratio increases the probability of fast growth only up to some point. Beyond, further debt increases impact negatively on that probability. Hence better access to finance is indeed, as shown in other papers, facilitating the expansion of firms.

Regarding the growth pattern of Gazelles, we find that they resort more to fixed term employment and debt —especially long term debt— to sustain their growth, compared to other firms. They also start with a productivity level 30% higher than other firms, and in spite of their intense process of employment growth, they end up with a higher productivity level than other firms.

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Annex 1

DEPENDENT VARIABLE: PROBABILITY OF BEING A GAZELLE	MODEL A1		MODEL A2		MODEL A3		MODEL A4		MODEL A5	MODEL A6	MODEL A7
	Long-term debt		Average wage		Collective agreements		Value added		Size dummies	OECD	Schreyer indicator
	1999-2002	2000-2003	1999-2002	2000-2003	1999-2002	2000-2003	1999-2002	2000-2003	Pooled data	Pooled data	Pooled data (OLS)
HGF in previous period (t-3/t)	0.847***	0.846***	0.827***	0.823***	0.767***	0.782***	0.532***	0.512***			
	(0.041)	(0.041)	(0.042)	(0.042)	(0.039)	(0.040)	(0.041)	(0.041)			
Born in t									0.697***	0.7211***	8565.3***
									(0.071)	(0.085)	(798.4)
Born in t-3	-0,054	0.114***	-0,066	0,144	-0,07	0,04	-0,24	0,35			
	(0.110)	(0.112)	(0.112)	(0.113)	(0.111)	(0.110)	(0.230)	(0.268)			
Debt	0.976***	0.717**	1.600***	1.447***	2,910***	2.708***	1,039***	0,19	1.115***	0,917***	2131,6
	(0.338)	(0.337)	(0.401)	(0.418)	(0.392)	(0.410)	(0.408)	(0.402)	(0.160)	(0.243)	(1621.5)
Debt^2	-2.103***	-1.109*	-1.192***	-1.018***	-2,372	-2.243***	-0,468	0,17	-0.441***	-0,096	-2065,3
	(0.647)	(0.623)	(0.364)	(0.378)	(0.354)	(0.369)	(0.374)	(0.368)	(0.142)	(-0.209)	(1476.8)
log(wage premium)	0.293***	0.286***	0.308***	0.291***	0,197***	0,149***	0,209***	0,238***	0.140***	0,174***	655.4***
	(0.048)	(0.048)	(0.049)	(0.049)	(0.047)	(0.047)	(0.052)	(0.052)	(0.020)	(-0.027)	(208.3)
ICT manufacturing	-0.218***	-0.316***	-0.216***	-0.312***	-0,554***	-0,751***	-0,08	-0,07	-0.236***	-0,366***	-20,8
	(0.078)	(0.081)	(0.079)	(0.082)	(0.071)	(0.074)	(0.078)	(0.078)	(0.031)	(0.046)	(358.2)
ICT services	-0.127*	-0.105	-0.124*	-0.110	-0,410***	-0,481***	-0,249***	-0,218***	-0.114***	-0,139***	400,5
	(0.069)	(0.069)	(0.068)	(0.070)	(0.061)	(0.062)	(0.069)	(0.070)	(0.027)	(0.036)	(310.4)
Non-ICT manufacturing	0.141**	-0.132*	-0.122*	-0.112	-0,471***	-0,498***	-0,09	-0,08	-0.201***	-0,368***	-5,4
	(0.066)	(0.068)	(0.068)	(0.070)	(0.059)	(0.060)	(0.069)	(0.069)	(0.027)	(0.039)	(311.2)
Non-ICT services	-0,016	-0.098	0.010	-0.057	-0,235***	-0,347***	-0,243***	-0,152***	-0.069**	-0,201***	86,3
	(0.071)	(0.072)	(0.072)	(0.074)	(0.063)	(0.064)	(0.075)	(0.075)	(0.029)	(-0.038)	(323.7)
Medium size									0.702***		
									(0.020)		
Large size									1.296***		
									(0.030)		
Region dummies	included	included	included	included	included	included	included	included	included	included	included
Period dummies									included	included	included
Collective agreement dummies					included	included					

Source: Bank of Spain Firm Demography Database.

*** , ** and *: significant at 1%, 5% and 10%, respectively.

Annex 2: Industries by technology intensity [van Ark et al. (2003)]

ICT-Producing Manufacturing

30	Office, accounting and computing machinery
313	Insulated wire and cable
321	Semiconductors and other electronic components
322	Communication and broadcasting equipment
323	Radio and TV receivers
331	Medical and measuring equipment and industrial process control

ICT-Producing Services

64	Post and Telecommunications
72	Computer and related services

ICT-Using Manufacturing

18	Wearing apparel, dressing and dying fur
22	Printing and Publishing
29	Machinery and equipment
31 (not 313)	Electrical machinery and apparatus
33 (not 331)	Precision and optical instruments
351	Building and repairing of ships and boats
353	Aircraft and spacecraft
352+359	Railroad equipment and transport equipment
36-37	Miscellaneous

ICT-Using Services

51	Wholesale trade
52	Retail trade
71	Renting of machinery and equipment
73	Research and Development
741-743	Professional business services

Less-intensive ICT Manufacturing

15-16	Food products, beverages and tobacco
17	Textiles
19	Leather and footwear
20	Wood and cork
21	Pulp and paper
23	Coke, refined petroleum and nuclear fuel
24	Chemicals
25	Plastic and rubber products
26	Non-metallic mineral products
27	Basic metals
28	Fabricated metal products
34	Motor vehicles, trailers and semi-trailers

Less-intensive ICT Services

50	Repairs
55	Hotels and restaurants
60-63	Transport and storage
70	Real state activities
745-749	Other business services

Less-intensive ICT Other

10-14	Mining and quarrying
40-41	Electricity, gas and water supply
45	Construction

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