The heterogeneous dynamics between growth and profits: the case of young firms

Juan S. Federico (corresponding author)

Entrepreneurial Development Programme (PRODEM)
Institute of Industry
UniversidadNacional de General Sarmiento
jfederic@ungs.edu.ar
J.M. Gutierrez 1150 (1663) Los Polvorines (Buenos Aires), Argentina
+54 11 4469-7564 (voice)
+54 11 4469-7581 (fax)

Joan-Lluis Capelleras

Department of Business
UniversitatAutònoma de Barcelona
08193, Bellaterra (Cerdanyola del Vallès), Spain
joanlluis.capelleras@uab.es
+34 93 581 4297 (voice)
+34 93 581 2555 (fax)

Abstract: While there is an increasing interest in the literature in the relationship between profits and business growth, the empirical evidence is mixed and inconclusive. This can be explained by the difficulty of fully addressing the complex nature of this relationship. Building on resource-based and evolutionary considerations, the present study investigates the dynamics between growth and profits of young firms by explicitly considering the endogeneity and heterogeneity aspects of the relationship. Data is based on a cohort of Spanish manufacturing firms> tracked during the period 1996-2010. The results indicate that young firm growth has a positive impact on profits. In contrast, the effect of profits on growth is not significant. Neither is there a significant correlation between past and current growth. Importantly, it is found that the results are strongly influenced by inter-firm heterogeneity. Implications from these findings are discussed.

Keywords: Young firms – Firm growth – Profits –System GMM – Endogeneity - Heterogeneity

JEL codes: L25, L26, M13

1. Introduction

The dynamics of growth rates and their interplay with other relevant measures of firm performance, such as productivity, profitability and survival is now at the heart of the debate among industrial economists and entrepreneurship scholars (Bottazzi, Coad, Jacoby, & Secchi, 2011; Bottazzi, Dosi, Jacoby, Secchi, & Tamagni, 2010; Coad & Broekel, 2012; Coad, Frankish, Roberts, & Storey, 2012; Coad, Rao, & Tamagni, 2011; Coad, 2007; Delmar, McKelvie, & Wennberg, 2013).

In particular, recent studies show a rather limited influence of profits on business growth (Bottazzi et al., 2010; Coad, 2007; Delmar et al., 2013), thus questioning some well-established theoretical expectations derived from the resource-based view (Barney, 1991)and the evolutionary perspective (Nelson & Winter, 1982; Nelson, 1995)about the relationship between these variables. These results also challenge earlier research that reported a positive association between profits and growth (e.g. Brush, Bromiley, & Hendrickx, 2000; Capon, Farley, & Hoenig, 1990; Cho & Pucik, 2005; Cowling, 2004).

These inconclusive results can be explained by the difficulty of fully addressing the complex nature of such relationship. Indeed, there are sound theoretical motivations to assume that this relationship is highly endogenous, where retained profits serve as prerequisite for a sustained growth trajectory and growth will reinforce firms' profits (e.g. Nelson & Winter, 1982; Penrose, 1959). As well, the link between profits and growth is likely to be influenced by inter-firm heterogeneity, which has been highlighted by evolutionary scholars as the '*regular state of affairs*' (e.g. Bottazzi et al., 2010; Nelson & Winter, 1982; Nelson, 1995) and constitutes a necessary and sufficient condition for the existence of resource-based competitive advantages (Barney, 1991; Peteraf & Barney, 2003). However, only few studies have considered the endogeneity and inter-firm heterogeneity aspects of the growth-profits relationship (Bottazzi et al., 2010; Coad, 2007; Cowling, 2004; Delmar et al., 2013; Roper, 1999).

The novelty of this study with respect to previous research stems from theoretical and methodological points of view. Theoretically, we examine the growth-profits nexus by explicitly considering both endogeneity and heterogeneity as key features of the relationship. Based on resource-based and evolutionary considerations, we suggest that profitable firms will be more likely to grow. At the same time, business growth can generate opportunities to earn profits by means of learning by doing effects and dynamic increasing returns. Hence, we first argue that there will be an endogenous relationship between them. Both, RBV and evolutionary economics, also consider firm heterogeneity as a structural feature of firms that derive from their particular resources and capabilities or from their specific organizational routines. Thus, we also argue that such heterogeneity will affect the way in which profits and growth are related, both at the firm and industry level.

Methodologically, we profit from recent advances in econometrics such as System GMM estimators (Blundell & Bond, 1998, 2000; Roodman, 2006) to account for endogenous regressors. Then, we introduce a novel approach which helps us to test for the presence of inter-firm heterogeneity in the profits-growth relationship (Dumitrescu & Hurlin, 2012; Hurlin, 2007).

Moreover, this paper is focused on the particular case of young firms by analysing a single cohort of Spanish manufacturing firms founded in 1996 and, following them throughout their first 14 years of life. While evidence suggest that the growth-profits relationship varies over time as the firm ages and evolves (Steffens, Davidsson, & Fitzsimmons, 2009), there is a scarcity of studies that have directly addressed this specific topic in the context of young firms (Delmar et al., 2013). In fact, there are several reasons to expect that this relationship may have unique features in the case of newly founded or young firms. First, some of these firms may decide to grow at the expense of profits, just for surviving reasons (Coad et al., 2012; Garnsey, 1998). Likewise, it could be expected that growth and profits are negatively related as a consequence of trial-and-error initial learning processes. Finally, it is also plausible that young firms may not be able to obtain sizeable profits without growing enough first in order to overcome cost disadvantages derived from the liability of newness (Bruderl & Schussler, 1990; Freeman, Carroll, & Hannan, 1983).

The study provides several contributions to the literature on young firm growth. First, in contrast to our theoretical expectations we do not find support for the evolutionary *growth of the fitter* postulate where profits positively affect the ability of firms to grow(Coad, 2007). On the contrary, it seems that in the case of young firms selection operates more on growth than on profits. Indeed, once we control for endogeneity, we find that firm growth has a positive impact on profits due to learning by doing gains. As well, we make a strong point on the relevance of intra-industry, firm-specific heterogeneity in such relationship. In accordance with our theoretical framework, firms may differ not only in terms of their growth prospectus due to firm-specific resources and capabilities, but fundamentally in how this growth could be translated (or not) into profits. Finally, we also contribute to the on-going debate on the randomness of growth rates in young firms (Geroski, 2005; Storey, 2011; Westhead & Wright, 2011) discussing the paradoxical situation where growth seems to be close to random but at the same time, it shows a strong impact on other non-random variables, such as profits.

In the next section, we present and discuss the theoretical arguments on the relationship between profits and growth and review the empirical evidence in this regard. We then examine the issues of endogenous regressors and inter-firm heterogeneity from both a theoretical and methodological point of view. The fourth section provides details on the data, variables and empirical models. We then turn to the results based upon System-GMM estimators and Hurlin's test of firm-specific heterogeneity in the relationship between profits and growth. In the sixth section, the main findings derived from our study are discussed in the light of our theoretical expectations and previous research. Finally, we conclude with some remarks, limitations and future research directions.

2. Theoretical background and related literature

2.1. The profits- growth relationship revisited

The relationship between profits and growth is at the heart of most theoretical perspectives from industrial economics and strategic management, which usually tend to affirm that the former drives the latter. However, these perspectives differ in their explanations of how and why these initial superior profits are achieved and translated into further growth.

Since its inception, the resource-based view (RBV) has been concerned with the explanation of sustained intra-industry performance differences, and more specifically, firms' sustained competitive advantage. Inspired by Penrose's (1959) ideas, RBV scholars argue that the more specific, complex, and difficult-to-imitate the resources are, the greater their contribution to creating sustained competitive advantages would be (Barney, 1991, 1997; Peteraf, 1993; Wernerfelt, 1984).

Following a RBV logic, Davidsson, Steffens & Fitzsimmons (2009) develop a framework to analyse *profitable growth* trajectories, illustrated as configurations where firms show above-average growth rates and, at the same time, above-average profitability rates. Their starting point is that firms showing above-average profitability rates have demonstrated that they are capable of creating value for their customers, establishing a resource-based competitive advantage over their competitors. In addition, they have been able to appropriate the value created within the firm by building an adequate business model. So unless the potential for expansion in the current product market is exhausted, these firms are more likely to grow by penetrating this market, increasing their market shares. Moreover, since these firms have been able to generate superior profits, these gains could be reinvested, lowering the capital needed to finance expansion plans. All these ideas suggest that profitability should come first if a *profitable growth* trajectory is to be achieved, as Davidsson et al. (2009) and Brännback et al. (2009) have empirically proven.

In spite of the attractiveness of the configurational approach proposed by Davidsson et al. (2009), it would present a series of criticisms. First of all, this approach implicitly assumes that superior profits in one period are indeed the realisation of superior resource-based advantages, leaving aside the main question of *how* firms could generate the above-average profitability rates that in turn leads them to a growth path. However, these superior profits may be actually a *transient* result that derives from other circumstances that are external to the firm, rather than originated within it. Secondly, as Davidsson et al. (2009) pointed out the existence of such a relationship between profits and growth holds *if and only if* the growth trajectory is based on the kind of resources that gave rise to the initial superior profitability. However, firms may pursue other growth opportunities that may destroy rather than create value. Likewise, firms may enjoy superior profits and refuse to grow, disregarding opportunities for further value creation, as Garnsey (1998) and Wiklund, Davidsson & Delmar (2003) also mentioned.

Finally, young firms would have significant difficulties in establishing an initial competitive advantage that would enable them to enjoy an above-average profitability rate. Most young firms tend to face time compression diseconomies, making it difficult for them to accumulate a richer resource base in a short fixed period of time (Dierickx & Cool, 1989). Similarly, it is likely that most young firms will not be able to exhibit a superior performance in terms of profits without growing enough to overcome the liabilities of newness and cost disadvantages (Steffens et al., 2009). Moreover, some young and newly created firms may decide to grow at the expense of profits, simply to survive, since growth and survival are closely related (Coad et al., 2012).

Evolutionary economics (Nelson & Winter, 1982) also assumes that prior profits will drive subsequent growth, but from a different perspective. This approach assumes that firms operate in the context of a Schumpeterian economy, where they compete against each other in a turbulent and rapidly changing market environment. From the evolutionary perspective, firm performance would depend not only on what the firm does but also on what their competitors are doing, given the environmental conditions. So it is the environment, in principle, that determines the ‘rules of the game’. Selection, in this context, operates via differential growth, in the sense that the most viable firms will survive and grow. Specifically, Nelson & Winter (1982) establish that profitable firms will grow and unprofitable ones will contract, giving rise to the *growth of the fitter* principle. Therefore, initial profits would generate subsequent growth via a selection mechanism that will reinforce the firm’s relative position by producing additional profits which in turn will be re-invested again, generating a virtuous circle as long as expansion reinforces the firm’s set of effective routines. As a result of these ‘replicator dynamics’ (Coad, 2007), the economy would move towards a more efficient allocation of resources since the profitable firms (and their routines) would account for an increasing share of the market, and less viable firms would decline and eventually, close.

Although this *growth of the fitter* principle provides a sound theoretical explanation of industry dynamics, recent empirical evidence has failed to corroborated it as strongly as would be expected (Bottazzi et al., 2011; Coad, 2007). As Bottazzi et al. (2010, p. 1985)suggest, *'… the absence of any strong relationship between profitability and growth militates against the "naively Schumpeterian" or "classic" notion that profits feed growth (by plausibly feeding investments)…'*.

Additionally, it has been empirically proven that growth rates are not as autocorrelated as may be expected (Bottazzi et al., 2011; Coad & Broekel, 2012). Indeed, the recognition that *'…lagged growth is a poor signal of future growth'*(Coad et al., 2012, p. 3) and the fact that models aimed at identifying growth determinants account for a rather limited explanatory power have led some authors to argue that growth rates seem to follow a random walk(Geroski, 2005). This goes back to the Gibrat's Law main implications(Stam, 2010) and re-inaugurates an important debate in the literature (Storey, 2011; Westhead & Wright, 2011).

To account for this new evidence Coad et al. (2012) recently developed a new framework based on Gambler's Ruin theory (Wilcox, 1971). The departing point of this model is that new firm growth can be considered as a game of chance where each growth event depends only on the stock of accumulated resources, i.e. those derived from previous "wins" and /or those present at start-up. Accordingly, growth is close to random and, thus, sustained growth paths may be the exception rather than the rule. Although, some recent evidence appears to support this view, in that high-growth firms are not capable to sustain their rapid pace of growth for long periods of time (Garnsey, Stam, & Heffernan, 2006; Hölzl, 2014; Parker, Storey, & Witteloostuijn, 2010), it challenges previous theory and evidence on growth determinants.

In sum, it seems that the empirical evidence does not confirm the theoretical expectations regarding the positive relationship from profits to growth as strongly as would be expected, particularly in the case of young businesses. We subsequently argue that two major features of the profit-growth nexus, namely endogeneity and heterogeneity, may contribute to solve this inconsistency between theory and the empirical evidence.

2.2. Endogeneity and heterogeneity in the profits-growth relationship from a theoretical perspective

So far, we have argued for a close relationship between profits and growth according to resource-based and evolutionary considerations. However, it is also plausible that firm growth successively affects profits, leading us to the question of endogeneity (Cowling, 2004; Roper, 1999). Indeed, there are sound theoretical contributions supporting the endogenous nature of such relationship.

First, from a Ricardian perspective, comparative advantages imply that as long as firms grow, they are moving toward less profitable segments of the market. Although this expansion will continue to generate additional profits, it might also result in a decrease of profit rates if this movement towards less profitable market segments is not accompanied by the generation of scale economies (Steffens et al., 2009).

Second, according to Penrose's (1959) seminal book, growth makes managers more aware of the resources they control, the most profitable use of each, and the productive services that could be obtained from them. Hence, the knowledge generated through the growth process will enable entrepreneurs to conceive new resource combinations and develop new productive services(Lockett, Wiklund, Davidsson, &

Girma, 2011).As a result of this learning by doing process, resources and services are continuously released and combined in different ways in order to obtain the most profitable outcome of their unused resources.

However, these ‘economies of growth’ are by their very nature a transient phenomenon; they disappear as the firm become larger. In addition, like the same Penrose has proposed, the same internal process that fosters growth establishes its own limit, the well-known ‘Penrose curve’. As the firm grows, there is an increasing need to coordinate an extended amount of related activities which diverts managerial attention from operating costs, leading to a decrease in the profit rate. Moreover, entrepreneurs’ abilities to continuously combine resources to extract the most profitable usage of them are limited. The same is true for their abilities to perceive new growth opportunities (Lockett et al., 2011). This trade-off between profits and growth has been empirically proven in the case of Scottish young firms (Reid, 1995).

RBV scholars also recognize that growth positively affects profits as long as it reinforces firm’s resource advantages. Static increasing returns derived from specialization will operate in the same way, increasing firm profits as the firm grows. In addition, dynamic increasing returns as described by the Kaldor-Verdoorn principle would also predict growth to have a positive impact on profits as long as growing firms may invest in new technologies and/or learn about new methods which will lead to an increase in firm productivity and profits (Coad, 2007).

In sum, based on the existence of learning by doing effects, Penrose’s transient “economies of growth” and dynamic increasing returns, we would expect a positive effect from current growth to profits. This expectation, together with our previous reasoning about the profit-to-growth relationship, suggests an endogenous relationship between these two variables where lagged profits positively influence current growth and, at the same time, current growth increases subsequent profits.

Inter-firm heterogeneity is also an important issue to be addressed in the relationship between growth and profits. From a theoretical point of view, both RBV and evolutionary economics make a strong stand on the heterogeneous nature of firms. According to Penrose (1959) the ground of the uniqueness of each individual firm lies in the distinction between resources and the productive services derived from them. Although Penrose recognizes that resources could be heterogeneous, she emphasizes that precisely the way in which these resources are exploited by each firm gives them its unique character. Heterogeneity is also at the heart of the notion of resource-based competitive advantages popularized by RBV scholars, since these are derived from resources and capabilities which should be *by definition* valuable, rare, hard-to-copy, and non-substitutable, in the sense that there cannot be strategically equivalent substitutes for them (Barney, 1991; Peteraf & Barney, 2003; Peteraf, 1993).

In the same way, within the evolutionary thinking, heterogeneity constitutes a structural feature of firms which is rooted in the notion of organizational routines. Routines are persistent and regular features of the firm in the sense that they indicate 'what a firm does' and 'how productively'(Nelson, 1995). Routines are also heritable in the sense that they are conceived as the organizational memory (Nelson & Winter, 1982; Nelson, 1991). This firm-specific knowledge base is accumulated throughout the organizational life as a result of an endogenous, experience-based learning process. Consequently, the evolutionary theory conceives firms as structurally heterogeneous entities. Nelson (1991) adds that heterogeneity may also arise as a reflection of differences in three strongly related firm features: strategy, structure and core capabilities. Accordingly, market selection would imply that different industries may require different strategies, structures and capabilities; thus heterogeneity may also be translated from the firm level to the industry level. In fact, as (Bottazzi et al., 2010, p. 1954) affirms *"…heterogeneity is ubiquitous across sectors and applies irrespectively of the degrees of statistical disaggregation of industries".*

Empirically, a number of studies have suggested the existence of cross-firm variability in both growth rates and profitability (Bottazzi et al., 2010; Bottazzi, Secchi, & Tamagni, 2007; Delmar, Davidsson, & Gartner, 2003; Goddard, Tavakoli, & Wilson, 2009; Peneder, 2007). These studies show that growth rates as well as profits tend to reveal large and sustained heterogeneity across firms and industries which does not diminish as a consequence of the competition process. In other terms, heterogeneity seems to be *'the name of the game'*(Bottazzi et al., 2010). Interestingly, new empirical studies show that intra-industry (i.e. firm specific) heterogeneity tends to explain a greater portion of the variation in performance than inter-industry differences (Goddard et al., 2009; Short, Ketchen Jr, Palmer, & Hult, 2007; Srholec & Verspagen, 2012).

Overall, therefore, in the light of the previous theoretical and empirical considerations we suggest that the relationship between profits and growth is highly heterogeneous in nature, reflecting the presence of firm-specific attributes or idiosyncratic characteristics that mould such interplay not only at the firm level but also between industries.

3. Estimation methods to account for endogeneity and heterogeneity

3.1. The System GMM method

From a technical point of view, endogeneity appears when a bi-directional relationship is identified between two variables. In this context, OLS methods yield biased and inconsistent estimators, because endogeneity affects the orthogonality of the variables to the residual errors. One method to solve this problem is to introduce dynamic panel data models, i.e. models in which lagged values of the dependent variable are included as explanatory variables. As Bond (2002, p. 142) suggests, *'…even when coefficients on lagged dependent variables are not of direct interest, allowing for dynamics in the underlying process may be crucial for recovering consistent estimates of other parameters…'*.

However, dynamic panel data models introduces a further complexity since the lagged values of the dependent variable are correlated with the individual-specific fixed effects included in the error term, originating the 'dynamic panel' or 'Nickell bias' (Nickell, 1981). Importantly, this bias is not eliminated by using Fixed Effects (FE) estimators since the regressors and the error term continue to be correlated after such transformation (Bond, 2002; Roodman, 2006). This correlation between the transformed error and the transformed lagged dependent variable, though, does not diminish as the number of individuals in the sample increases, so the FE estimators remain inconsistent. Moreover, panel methods in general, and FE estimators in particular, can in turn be asymptotically biased (downwards) in panels where *T* is small (Bond, 2002).

In this context, Arellano & Bond (1991) proposed a GMM estimator for panel data which may deal with potentially endogenous regressors in dynamic panel data models. Regression equations are expressed in terms of their first differences, and endogenous variables are instrumented using lags of their own levels. This approach - which is known as 'Difference GMM' - has drawbacks of its own, however, as lagged levels may be weakly correlated with first differences. This may be the case when the lagged levels used as instruments are highly persistent. In our case, several studies affirm that firms' profits tend to be highly correlated (e.g. Bottazzi et al., 2006; Dosi, 2005).

To solve these problems, Arellano & Bover (1995) developed an improved estimator in which regressions are expressed in levels, and endogenous instruments in terms of their lagged differences. Blundell & Bond (1998) combined both approaches to construct a system of equations known as 'System GMM', which includes both differences and levels to instrument endogenous variables. Hence, System GMM has better asymptotic and finite sample properties than Difference GMM estimators (Arellano & Bond, 1991). Finally, System GMM has been proposed as a suitable estimation method when the number of available time periods, *T*, is small, and the number of cross-sectional units, *N*, quite large, as in our case (Roodman, 2006)[1].

Nevertheless, the System GMM method has its own shortcomings. First of all, it requires additional moment conditions to be satisfied. It also requires orthogonality between the differences of the errors and the lagged levels of the variables used as instruments, and at the same time, orthogonality between firm-specific effects and the lagged differences of the variables used as instruments. As a consequence, it is necessary to report specification tests on overidentifying restrictions to check the validity of the additional instruments. As well, System GMM requires that no second order serial correlation in the error terms is present. Finally, this type of GMM estimation could be harmed by employing too many instruments. This has been highlighted and analysed by Roodman (2009). Therefore, some attention should be taken when estimating such models since too many requirements must be in place to assure the desirable asymptotic properties of System GMM in finite samples.

[1]For a deeper discussion of the properties of System and Difference GMM estimators, see Bond (2002) and Roodman (2006, 2009).

3.2. The Hurlin test

Concerning the influence of firm-specific heterogeneity, we have already established that FE estimators are able to account for these unobserved firm-specific and time-invariant factors (i.e. persistent inter-firm heterogeneity). However, these estimators would lead to the aforementioned dynamic panel or Nickell bias when endogenous regressors are present, as in our case. System GMM, in turn, uses differences equations to instrument endogenous regressors so they are also able to deal with time-invariant firm-specific attributes, i.e. heterogeneity. As a consequence, System GMM estimators are suitable for this exercise not only because of their ability to deal with both endogeneity and heterogeneity.

In addition, we profit from a recent development in econometrics that helps us identify and test for the presence of inter-firm heterogeneity in the relationship between two variables: the Hurlin test. Rooted in Granger causality literature, Hurlin (2007) and Dumitrescu & Hurlin (2012) propose an approach for evaluating causal relationships in heterogeneous panels that is increasingly used by the literature (Erdil & Yetkiner, 2009; Hood III, Kidd & Morris, 2008; Hurlin & Venet, 2008). This approach suggests that, in the context of heterogeneous panel data, four different hypotheses could be established as regards causality. The first, homogenous non-causality (HNC) implies that no individual causality exists from *x* to *y*. Conversely, homogeneous causality (HC) occurs when there is the same causal relationship from *x* to *y* for all the individuals. The other two cases correspond to heterogeneous processes. Firstly, there is heterogeneous causality (HEC), which implies that for all the individuals in the sample one could find a causal relationship from *x* to *y*, but that this relationship is unique for any individual. Finally, the heterogeneous non-causality hypothesis(HENC) posits that there is a subgroup of individuals for which there is a causal relationship from *x* to *y*, while at the same time there is another subgroup of individuals for which *x* does not cause *y* (Dumitrescu & Hurlin, 2012; Hurlin, 2007).

The proposed test starts from a linear model such as the following:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t}$$

where *y* and *x* are two stationary variables observed on *T* periods and on *N* individuals. For simplicity, individual effects α_i are assumed to be fixed. In addition, lag orders *K* are assumed to be identical for all cross-sections units of the panel, and the panel is balanced. Finally, parameters $\gamma_i^{(k)}$ and $\beta_i^{(k)}$ are different across individuals but constant, i.e. it is a fixed coefficient model with fixed individual effects.

The Hurlin test compares the null hypothesis of HNC against the alternative HENC. If the null hypothesis (HNC) is accepted, the variable *x* does not Granger-cause the variable *y* for all the cross-sectional units. Under the alternative hypothesis (HENC), we allow for some $N_1 < N$ individual processes with no causality from *x* to *y*.

$$H_1 \begin{cases} \beta_i = 0 & \forall_i = 1,...N_1 \\ \beta_i \neq 0 & \forall_i = N_1 + 1, N_1 + 2...N \end{cases}$$

where N_1 is unknown but satisfies $0 \leq N_1/N < 1$.

In other words, if HNC is rejected and if $N_1 = 0$, we can confirm that the variable *x* Granger-causes *y* for all the individuals in the panel. In these cases, we also get a homogeneous result in terms of the causal relationship. Finally, if HNC is rejected and $N_1 > 0$, the causal relationship may be heterogeneous and differs according to the cross-sectional units in question[2].

This test is based on a new statistic which results from averaging individual Wald statistics, like the unit root test for heterogeneous panels widely used by the

[2] Although we recognize that the whole idea of Granger causality that underlies Hurlin's approach may be criticisable, we consider this test to be of particular importance for testing the existence of inter-firm heterogeneity in the profit-growth relationship.

literature (Im, Pesaran, & Schin, 2003). In non-technical terms, this test computes *N* individual regressions, one for each cross-sectional unit, estimating the individual Wald statistic for the explanatory variable of interest. Then it averages the *N* individual Wald tests to obtain the standardized average Wald statistic – the *Z-tild* value - and finally compares this value with the corresponding critical value for a given level of confidence. Hurlin (2007) demonstrates that the standardized average Wald statistic – *Z-tild* – converges to a normal distribution as long as $T > 5+2K$ where K is the number of lags. In addition, for the moment conditions to hold, series are assumed to be cross-sectionally independent and panels must be strongly balanced. A full detailed discussion of the asymptotic properties of the average Wald statistic for fixed T samples can be seen in Hurlin (2007) and Dumitrescu & Hurlin (2012).

In sum, endogeneity and heterogeneity are key aspects of the profits-growth relationship from a theoretical perspective. At the same time, both pose important technical issues that need to be properly addressed. In this vein, our empirical analysis is based on new estimation methods that allow us to explicitly take into account these features of the profit-growth link.

4. Data, variables and empirical models

4.1. Data and sample

Data for this study are taken from the SABI© (*Sistema de Análisis de Balances Ibéricos*) database, collected and provided by Bureau Van Dijk and based on the Official Registry of Spanish Companies. This database has been increasingly used by researchers in the small business economics literature (Hernández-Cánovas & Martínez-Solano, 2008; López-Gracia & Sogorb-Mira, 2008; Nunes, Gonçalves, & Serrasqueiro, 2011; Teruel-Carrizosa, 2008).

This paper is based on a single cohort of young Spanish manufacturing firms (i.e., NACE Rev. 2 2-digit Classification codes 10 to 33). All firms which were created from January 1 to December 31 1996 and were followed over a 14-year period, from 1997 to 2010. Since we are interested in young firm growth we focus in 'organic' (i.e. internal) growth. Internal growth is not only the most common path of growth followed by young firms (Delmar et al., 2003) but it also reflects to a greater extent our theoretical framework. Consequently, those firms which control other firms and those controlled by another firm were removed from an initial list extracted from the SABI© database, leaving only those which are fully independent in the panel.

We started with an initial list of 2,446 firms from which we removed those firms without values in sales, results, added value and/or employment in the first two years (1997-98) i.e. firms with less than 2 consecutive years of data (or at least one year of growth).As a result, we had to eliminate 1,251 firms, leading to a list of 1,195 firms. From this list, we then eliminated those firms with interrupted spells in the series, which were 269, arriving ~~to~~ at a final sample of 926 firms. The initial list and this final sample were compared in terms of industry sector and region and the results showed no statistically significant differences at the 5% level, except for four industries (out of 23) and one region (out of seventeen). Importantly, it should also be noted that our sample not only reflects to a great extent the industry and geographical composition of the Spanish manufacturing firms, but also it presents the same industry and regional composition than the original data drawn from the SABI© registers[3].

[3] In order to check for the external an internal validity of this sample we estimate several tests for proportions (z-test) comparing this sample with the initial population drawn from the SABI© registers, the Spanish National Firms Registry *(Directorio Central de Empresas)*and other comparable statistics on the manufacturing sectors in other EU countries and the US. In all these cases, only few significant differences were found. These tests and tables are not reported here but they are available from the authors under request.

Survival (or attrition) bias has been pointed out as a major shortcoming in growth studies (Davidsson, Delmar, & Wiklund, 2006; Garnsey et al., 2006; Geroski, 1998). In order to avoid this, we use an unbalanced panel which starts with 926 manufacturing firms in 1997 of which 689 still exist in 2010. Although it is recognized that exit may result from different factors than failure, given the fact that this panel only comprises data from seemingly independent firms, it is more likely that those firms which cease to provide SABI© with information may constitute real failure-based 'exiters'. However, as SABI© includes mostly limited liability and public companies, there could be a certain underestimation of firm exit.

4.2. Variables and summary statistics

A variety of measures of firm growth have been used in the literature (e.g. Shepherd & Wiklund 2009; Weinzimmer et al. 1998). To facilitate comparability with other research (Bottazzi et al., 2011, 2006; Coad & Broekel, 2012; Coad, 2007), we have adopted the following definition of growth, based on the differences in the logarithms of size.

$$GROWTH_{it} = \log(SIZE_{it}) - \log(SIZE_{it-1})$$

Where $SIZE_{it}$ is measured by sales for firm i at time t. In addition to ensure comparability with previous studies about the profit-growth relationship (Bottazzi et al., 2010; Coad, 2007; Delmar et al., 2013), we decide to employ sales growth as our Where $SIZE_{it}$ is measured by sales for firm i at time t. In addition to ensure comparability with previous studies about the profit-growth relationship (Bottazzi et al., 2010; Coad, 2007; Delmar et al., 2013), we decide to employ sales growth as our measure of young firm growth mainly for theoretical reasons. Since our conceptual framework is mainly based on the evolutionary perspective and the market selection mechanism, we choose sales growth because it better reflects firms' market activity and their capacity to sell their products. In effect, sales growth provides an indication of the acceptance of the new firm's products or services in the market (Gilbert, McDougall, & Audretsch, 2006). Therefore, it is the preferred indicator for founders and owner-managers of new and young firms, whereas other indicators such as employment growth are not seen by them as a goal in itself (Achtenhagen, Naldi, & Melin, 2010).

In the same way, our choice of a profit measure is consistent with our focus on the market selection mechanism and how it works in the case of young firms. We therefore are interested in evaluating the commercial viability of young firms in its basic form, as an indicator of the degree of fitness between firms' activities and the market. Hence, we choose firms' gross operating surplus (GOS) as our profit measure. In particular, we have adopted the same profit ratio as Coad (2007b) where GOS is divided by value added. Specifically, gross operating surplus at *t* is divided by value added at *t-1* to '*avoid spurious results associated with the regression fallacy'* (Coad, 2007, p. 375).

Table 1 shows a set of descriptive statistics for selected years, which offer the reader a first approach to the variables used in this research. Growth rates as well as the inter-firm variation of these tend to diminish as firms age, even in the case of young businesses like those included in this study, supporting previous research (e.g. Stam, 2010; Sutton, 1997). Likewise, profits – measured by our GOS/value added ratio – also diminish. Finally, it is worth noting that both growth and profit rates tend to be negative (on average) at the end of the period under study as a potential result of the downturn in macroeconomic conditions derived from the global financial crisis.

- Insert Table 1 around here -

The lower section of Table 1 shows the contemporaneous correlation between sales growth and profitability. As in previous research (Coad & Broekel, 2012; Coad et al., 2011), sales growth and profits appear to be contemporaneously correlated but this positive correlation is far from perfect. This result could also reflect the existence of industry-specific as well as individual attributes that affect the relationship between growth and profitability. Table 2 shows the correlation coefficients between growth and profits according to the industry sector.

- Insert Table 2 around here -

As can be seen, although almost all the coefficients are positive and highly significant, there is an important inter-industry heterogeneity. The largest correlation coefficient (Spearman's rho) is 0.50, while the lowest is 0.18.

4.3. Empirical models

In order to analyse the proposed relationship between profits and growth, we estimate the following equations:

$$(1) \quad GROWTH_{it} = \alpha + \sum_{k=1}^{2} \beta_k GROWTH_{it-k} + \sum_{k=1}^{2} \delta_k PROFITS_{it-k} + \\ + \gamma SIZE_{it-1} + \sum \lambda_t YEAR_t + \sum \varphi_i INDUSTRY_i + \sum \rho_i REGION_i + \varepsilon_{it}$$

$$(2) \quad PROFITS_{it} = \alpha + \sum_{k=1}^{2} \beta_k PROFITS_{it-k} + \sum_{k=0}^{2} \delta_k GROWTH_{it-k} + \\ + \gamma SIZE_{it-1} + \sum \lambda_t YEAR_t + \sum \varphi_i INDUSTRY_i + \sum \rho_i REGION_i + \varepsilon_{it}$$

where $GROWTH_i$ refers to the sales growth rate for each firm and $PROFITS_i$ our profit ratio for each firm, measured by the GOS/value added. For comparison purposes, our model specifications resemble those used by Coad (2007b). Equation (1) represents our GROWTH model, where current growth is estimated using a set of lagged values of profits - more explicitly form *t-1*to *t-2* - to account for the importance of retained profits in explaining firm growth, as the main reviewed literature states. Equation (2), in turn, corresponds to our PROFIT equation, which not only includes lagged values of sales growth (*t-1* and *t-2*) but also includes the contemporaneous term of growth ($growth_{it}$) to test our theoretical expectation about a positive simultaneous effect of growth on profits derived from learning-by-doing gains and dynamic increased returns verified *as long as* firms grow.

In addition, lagged values of the dependent variables are introduced in each Equation to account for possible omitted variables, to attenuate any autocorrelation in the residuals and to improve the efficiency of the estimators in the presence of endogenous variables. In particular, following Bottazzi et al. (2011) suggestion we introduce two lags of the dependent variable as control variables. Adding further lags will reduce critically the number of observations and may not imply an improvement in the explanatory power of the model.

Lagged firm SIZE, measured by the number of employees, is also included in both Equations to account for other firm-specific factors. TIME DUMMIES were incorporated to take cyclical macroeconomic influences into account. Since we are dealing with a single cohort of firms, TIME DUMMIES would also capture the effect of FIRM AGE. Finally, INDUSTRY and REGIONAL DUMMIES are also included.

As we established in the previous section, we estimate equations (1) and (2) using first Fixed Effects and then using System GMM method to properly account for the presence not only of firm-specific heterogeneity but also of endogenous regressors.

Finally, to calculate Hurlin's test of heterogeneity we estimate the following equations:

$$(3)\quad GROWTH_{i,t} = \alpha_i + \sum_{k=1}^{2} \beta_k GROWTH_{i,t-k} + \sum_{k=1}^{3} \gamma_k PROFITS_{i,t-k} + \delta SIZE_{i,t-1} + \phi AGE_t + \varepsilon_{i,t}$$

$$(4)\quad PROFITS_{i,t} = \alpha_i + \sum_{k=1}^{2} \beta_k PROFITS_{i,t-k} + \sum_{k=0}^{2} \gamma_k GROWTH_{i,t-k} + \delta SIZE_{i,t-1} + \phi AGE_t + \varepsilon_{i,t}$$

where $GROWTH_i$ and $PROFITS_i$ are the same variables explained before. We also add the SIZE of the firm (measured by employment) and FIRM AGE to avoid the risk of spurious causality. Since the Hurlin test requires balanced panels, we only ran this test for those firms that survived the 14 years considered by this study and recognizing that this fact may introduce some bias in the data. The next sections describe and discuss the main results obtained from these estimations.

5. Main results

5.1. The dynamics between growth and profits

Tables 3 and 4 show the results for the GROWTH and PROFITS equations, respectively. In the first column of each Table, we report the Fixed Effects estimators. These results confirm that growth affects profits, while at the same time retained profits have a significant impact on current growth. Interestingly, the first column of Table 3 shows that previous profits have a negative influence on subsequent growth, which is in contrast with our theoretical expectations. These results, though, should be taken with caution since the magnitude of the coefficients is empirically negligible (around -0.01). Overall, the FE specification, suggests the presence of an endogenous relationship between profits and growth.

However, as we describe in section 3.1, FE regressions do not provide suitable estimators in the presence of endogenous and dynamic relationships. For this reason, we present in the second column of Tables 3 and 4, the estimation using the System-GMM approach, which is appropriate for dynamic panel data models in which some regressors are assumed to be endogenous, as in our case.

- Insert Table 3 and 4 around here -

The results presented in the second column of Table 3 indicate that, after controlling for endogeneity and dynamic panel bias, previous profits do not exert a statistically significant influence on sales growth. Additionally, under the System-GMM specification none of the lagged values of growth shows an empirically relevant or statistically significant relationship with current growth. This provides evidence in favour of to the growth-as-a random-walk perspective.

Conversely, as the second column of Table 4 shows, firm growth positively affects current profits once we have controlled for endogeneity and dynamic panel bias. In fact, under the System-GMM estimation an increase in the growth rate of sales of 1% over the period t−1: t leads *ceteris paribus* to an increase in the profit rate at time t of about 0.26%. However, the relevance of this influence decreases as we move towards the past, suggesting that this effect is for the most part immediate. In sum, our results suggest that dynamic panel (or Nickell) bias and endogeneity among regressors may lead to ambiguous results when examining the profit-growth relationship. Actually, after accounting for endogeneity and dynamic panel bias, we find that sales growth may affect profits but not the other way round. In addition, our results indicate a positive and statistically significant effect only for the one-year lagged value of profits on current profits. This shows that although profits may have certain persistence – fundamentally in the short run – this is greater than business growth.

5.2. Assessing firm-specific heterogeneity in the relationship between growth and profits

In the previous section the question of firm-specific heterogeneity has been examined by using FE and System-GMM regressions, which introduce first-differences to eliminate time-invariant and firm-specific attributes in the estimation. In this section, we present the main results derived from Hurlin's (2007) approach to identify the relative importance of inter-firm heterogeneity in the profits-growth nexus. Table 5 shows the results for the Hurlin test, presenting averaged Wald statistics and the standardized *Z-tild* values. In this case, HNC is significantly rejected by both the PROFITS and GROWTH equations. In other terms, we can affirm that the relationship between profits and growth – in either direction – is significantly influenced by individual-specific heterogeneity. The same is observed when a second order lag is introduced.

- Insert Table 5 around here -

However, the previous results could be affected by cross-sectional dependence. Moreover, a large *N* – as in this case – may generate a bias towards large *Z-tild* values, leading us to easily reject the H_0 of HNC. In order to check the robustness of the results presented in the previous paragraph, we developed the following strategy.[4] Instead of using firm-level observations, we moved on to the industry level. We calculated the median for each year and industry sector as an indicator of the average firm in each case. Then we ran the Hurlin test on the medians. By doing so, we were also able to separate inter- and intra-industry heterogeneity. As a general rule of thumb, if we are able to reject HNC in this narrower context, we can reject it more confidently in the general context. Table 6 shows the results of the Hurlin test at the industry level.

- Insert Table 6 around here -

As can be seen in the table, HNC could only be significantly rejected in the PROFITS equation. Consequently, we can be confident in supporting the existence of a heterogeneous relationship only from firm growth to profits but not vice-versa. In addition, this exercise reveals that the heterogeneity in the growth-profits relationship derives from both inter- and intra-industry differences. As such, different possible routes can be said to be relevant to achieving superior profits at both the industry and firm levels. In contrast, our results show that the profit-to-growth nexus would be affected chiefly by intra-industry (i.e. firm specific) heterogeneity.

6. Discussion

[4] This idea was suggested by Dr. Walter Sosa Escudero. However, mistakes and omissions remain our responsibility.

This paper has investigated the profits-growth relationship in the context of young firms by explicitly considering both endogeneity and heterogeneity issues. The main findings that emerge from our study are now presented and discussed.

6.1. The effect of profits on growth

First, while both resource-based and evolutionary perspectives suggest that past profits will enhance subsequent growth, we have argued that this may not always necessarily be the case. Our results indeed show that, once we account for endogeneity, previous profits do not exert a significant influence on subsequent business growth. This finding contrasts with earlier evidence that showed a positive effect of profits on growth but did not account for endogeneity (e.g. Brush, Bromiley, & Hendrickx, 2000; Cho & Pucik, 2005; Cowling, 2004).However, this is in line with recent longitudinal studies controlling for endogenous regressors that found that past profits do not have a significant impact on firm growth rates(Bottazzi et al., 2010; Coad et al., 2011; Coad, 2007; Delmar et al., 2013).

Our finding has a number of implications for theory. While previous research based on the RBV (Davidsson et al., 2009)affirm that above-average profitability is a prerequisite for achieving subsequent growth, we suggest two plausible arguments for why this could not be the case for young firms. Firstly, initial superior profits could be derived from firm strategic decisions undertaken in response to external (environmental) shocks rather than from superior resource-based differences in efficiency coming from within the firm. This is in consonance with the view that differential profits between firms may stem from the firm-specific responses to economy-wide shocks (Alessi, Barigozzi, & Capasso, 2013). As a result, these superior profits cannot be treated as sources of *sustained* competitive advantages. In fact, our results tend to support the volatility of such initial profits given the relatively low –but statistically significant-persistence observed in this variable over time.

Secondly, most young firms would have some difficulties to create an initial resource-based competitive advantage because of time compression diseconomies (Dierickx & Cool, 1989). Similarly, it is likely that young firms will not be able to exhibit a superior performance in terms of profits without growing enough to overcome the liabilities of newness and cost disadvantages (Steffens et al., 2009).

The lack of any significant effect of previous profits upon growth would also mean that the evolutionary 'growth of the fitter' principle does not hold for young firms (Coad, 2007). The theoretical implication here is that market selection may operate on diverse degrees of efficiencies (fitness) and profits – in principle – could only provide a rather limited criterion for selection (Coad, 2007; Srholec & Verspagen, 2012). In particular, we argue that for young firms market selection would operate initially on firm growth and survival rather than on profits. For entrepreneurs, this would explain why many of them tend to pursue growth-strategies in their earlier stages, because this constitutes a way of attracting angel investors and external capital (Mason & Stark, 2004). Also, they may be affected by the perception that growth is proof of a working business model and will eventually lead to profitability(Brännback, Kiviluoto, Carsrud, & Östermark, 2010).

6.2. The effect of growth on profits

The second main finding that can be derived from our empirical analysis is that growth has a positive impact on profits. This result contrasts with those from Lee (2014) and Steffens et al. (2009) who conclude that young firms pursuing high-growth strategies early on their lives may perform poorly in terms of profits. On the contrary, our results are consistent with those reported by a number of recent studies which show that the influence of growth on subsequent profits is more important than the effect of retained profits on firm growth (Coad et al., 2011; Coad, 2007; Delmar et al., 2013). Therefore, once we properly account for endogeneity, it seems that the positive outcomes of growth in terms of profits tend to prevail over the assumed effect of retained profits on growth.

From a theoretical point of view this finding confirms our expectation that learning-by-doing effects may be at play for young firms. By growing, entrepreneurs may learn how to produce and organize activities more efficiently, releasing and combining resources in different ways to obtain the most profitable outcome from them(Penrose, 1959). These learning- and experience-based effects take on a critical role in the case of young and newly founded firms, since they do not have well-established organizational routines nor sustained resource-based competitive advantages.

Learning gains are not only circumscribed to internal resources and capabilities. It could be also the case that, unlike the Ricardian postulate, new firms do not start out in the most profitable segments of the market, rather they learn about their market and their product-market fit while they start to operate and grow. Hence, the growth of the firm may involve changing the use of existing resources to exploit new market opportunities and thus increasing the chances to earn additional profits(Lockett et al., 2011).

However, our results also indicate that the positive effect of growth on profits is fairly immediate (i.e. only current growth affects positively profits) supporting the transient nature of these Penrosean ‘economies of growth’. In effect, as Lockett et al. (2011) showed, firms which have grown in the past will find it more difficult to grow in the future due to the time and effort required to coordinate an increasing amount of activities within the firm and the abilities of entrepreneurs to perceive new growth opportunities, which in turn, are restricted and may not last for long periods of time.

For entrepreneurs, this result may imply that growth itself is not sufficient to secure profits. Our judgement is that growth should be accompanied by a suitable and flexible business model in order to capture the most profitable outcome of firm resources and capabilities as well to fully exploit potential market opportunities. Moreover, the continuous development and renewal of such resources and capabilities is key to assure a translation of growth into successive profits.

6.3. Heterogeneity in the profits-growth relationship

Our third main finding is that the relationship between growth and profits and vice versa is highly influenced by inter-firm heterogeneity. This result confirms our previous theoretical expectation and is in consonance with the results found by Bottazzi et al. (2010) who suggest that the growth-profits nexus depends on specific attributes of the firm. As Delmar et al. (2003)claim, it is almost impossible to refer to a 'typical growth firm'. Rather, firms could follow different patterns or modes of growth with diverse implications in terms of profits.

Therefore, our finding offers support to evolutionary and resource-based theorizing where it is argued that firms have heterogeneous internal resources and organizational routines and, as a consequence, differ in terms of performance. Indeed, this result suggests that young firms tend to adopt differing strategies, even in the same sector or country, because they start from different resource bases and tend to interpret the environment differently (Srholec & Verspagen, 2012).

Moreover, we have found that inter-industry heterogeneity plays a relevant role in the studied relationship, particularly in the growth to profits association. Such finding is consistent with studies which suggest that the link between growth and profits varies according to the industry, either in the case of manufacturing industries (Nakano & Kim, 2011) or in sectors with distinct technological regimes (Peneder, 2007). In effect, we have found that there are sectors in which growth may actually lead to higher profits, whereas this might not be the case for other industries. In particular, in the most innovative sectors increasing (dynamic) returns would imply a positive translation of growth into productivity gains and, ultimately, profits.

Interestingly, our results also show that firm-level heterogeneity tends to prevail over industry-level heterogeneity, particularly in the case of profits. This result is in line with some variance decomposition analyses which affirm that firm-specific attributes are more important in explaining differences in performance than industry-specific features (Goddard et al., 2009; Short et al., 2007). From an evolutionary perspective, we could conjecture that in complex markets where many local niches are present, selection pressures are less important(Srholec & Verspagen, 2012). So, individual firm level choices, resources and capabilities and their performance implications could be still different even within the same industry sector. Overall, our study shows that heterogeneity matters, not only at the industry level, but fundamentally at the firm level, to explain the growth-profits relationship.

6.4. The effect of past growth on current growth

Finally, our results are also interesting regarding the impact that previous growth have on current growth. In addition to profits, our empirical model has included past growth as a potential determinant of subsequent growth. The finding here is that lagged growth rates do not significantly affect current growth, which is in line with recent empirical evidence that point to a relatively small (or even negative) degree of autocorrelation among firm growth rates through time (Bottazzi et al., 2011; Coad and Broekel, 2012; Coad et al., 2012). This can be illustrated with the case of gazelles (fast growing firms) which tend to have difficulties in sustaining their rapid pace of growth (Garnsey et al., 2006; Parker et al., 2010). In other words, gazelle-like growth does not persist for relatively long periods of time.

This result is related to the ongoing discussion in the literature about the randomness of growth rates (Coad et al, 2012; Geroski, 2005; Storey, 2011; Westhead and Wright, 2011). The fact that random effects are dominant in the explanation of young firm growth is assumed in Gibrat's Law, since it implies that firm growth is not correlated over time. While we agree that this fact does not necessarily constitute a *'negative state of affairs'*(Coad et al., 2012:12), we find it necessary to reconcile this new perspective on young firm growth with the accumulated literature on the determinants of business growth (Westhead & Wright, 2011). As noted by Stam (2010), a reappraisal of randomness beyond the Gibrat interpretations would contribute to a better understanding of the antecedents of young firm growth.

Reaching a better understanding of the randomness of growth is particularly important since young business growth has a significant impact on other relevant firm outcomes which are considered non-random variables. While others have shown that new firm growth has an impact on the survival chances of newly founded firms (Coad et al., 2012), here we have confirmed our expectation that growth affects positively profits. This coincides with entrepreneurs' judgements where growth is not viewed as a final outcome but rather as a means for achieving some ulterior purposes such as profitability or survival (Achtenhagen et al., 2010).

7. Conclusion, limitations and further research

This paper has examined the profits-growth nexus in the case of young firms by taking into account the heterogeneous and endogenous nature of this relationship. To guide our analysis, we have used resource-based and evolutionary considerations to explain the link between the two concepts. The results confirm our expectation that young firm growth has a positive impact on profits. In contrast, we have found that the effect of profits on growth is not significant in this context of young firms. Neither did we find a statistically significant correlation between past growth and current growth. Last, but not least, we have confirmed that the identified relationships are not uniform but depend on the heterogeneous attributes of the firm and, to a lesser extent, of the industry.

The present study is not free of limitations. However, it also opens interesting avenues for future research. First, while we have provided insights into the heterogeneous relationship between profits and growth of young firms, our research does not include specific resources and capabilities of such firms. Access to resources is a key factor in explaining the growth and development of this type of firms (e.g. Capelleras & Rabetino, 2008; Gilbert et al., 2006). Future studies might focus their attention not only on the presence of heterogeneity, but also on examining *what* specific firm-level variables affect the growth-profits relationship. In other words, our results point in the direction of research questions focused on the sources of inter-firm heterogeneity within particular environments.

The identification of industry variables that may act as moderators of this relationship also constitutes a promising line for future research (Delmar et al., 2013). Hence, it would be interesting to explore the moderating role of specific firm and industry variables in the profits-growth relationship. Such an analysis will also be of relevance in order to further test the validity of the growth-as-random perspective.

Second, our analysis only comprises manufacturing firms, thus it is valid only for this subset of firms. However, in recent years there is an increased interest on services firms, in particular in the case of newly founded and young firms. The different competitive pressures, market structures and sources of dynamic competitive advantages in the service sector *vis a vis* manufacturing, would imply that the growth-profits nexus may be different. For instance, Jang & Park (2011) found that in the restaurant industry profit positively affects growth but growth impedes profitability. As well, Audretsch, Klomp, Santarelli, & Thurik (2004) showed that among services firms growth is not as crucial to overcome costs disadvantages as in manufacturing sectors and that Gibrat´s Law provides a useful benchmark to understanding growth among services firms.

Third, it should be noted that our measures for young firm growth and profits are based on theoretical reasons and comparability with other studies. However, our study should be complemented in future research by adding other measures, particularly employment growth, as this measure is highly relevant from a policy point of view (Davidsson et al, 2006; Gilbert et al, 2006).

Fourth, there is a need to advance in our understanding of entrepreneurs' view of the growth processes in young firms and their relationship with profits (Achtenhagen et al., 2010; Garnsey et al., 2006; Garnsey, 1998). This calls for future research that explores such processes combining quantitative data with a longitudinal case study approach.

Finally, we have examined the association between growth and profits and its dynamics by explicitly considering both endogeneity and heterogeneity issues, but without implying any definition about the causal relationship between the two variables. We acknowledge that the question of causality implies a much more complex kind of relationship (Atukeren, 2008; Granger, 2003) and calls for more complex approaches, such as structural equation models (Pearl, 2009).

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Table 1. Summary Statistics

	Mean	SD	10%	25%	Median	75%	90%	Obs.
1998								
Sales (in 000 Euros)	1,031.73	12,214.14	81,0	142,0	292.3	550,5	1108,0	926
Sales Growth	1.08	1.17	-0.11	0.25	0.93	1.86	2.56	926
Gross Operating Surplus (in 000 Euros)	64.29	860.75	-5.0	3.0	10.0	31.0	78.0	926
Profit Ratio	0.25	1.47	-0.10	0.06	0.17	0.34	0.60	718
Employment	8.18	35.17	2.0	3.0	5.0	8.0	12.0	921
2003								
Sales (in 000 Euros)	1,642.75	19,610.66	125.0	234.0	460.0	876.0	1,873.0	882
Sales Growth	0.04	0.25	-0.22	-0.07	0.03	0.16	0.31	882
Gross Operating Surplus (in 000 Euros)	96.49	1,422.19	-5.0	4.0	15.0	42.0	102.0	884
Profit Ratio	0.13	0.26	-0.06	0.03	0.11	0.20	0.35	884
Employment	11.26	39.44	2.0	4.0	6.0	11.0	20.0	881
2010								
Sales (in 000 Euros)	1,883.54	21,532.84	92.0	190.0	406.0	867.0	3.206,0	689
Sales Growth	-0.06	0.40	-0.40	-0.18	-0.02	0.11	0.28	689
Gross Operating Surplus (in 000 Euros)	79.42	1,647.68	-49.0	-8.50	8.0	30.0	93.0	696
Profit Ratio	-0.03	1.48	-0.41	-0.09	0.06	0.15	0.28	696
Employment	10.01	35.01	2.0	3.0	5.0	10.0	17.0	699
Pairwise Correlation	0.044							
(p-value)	(0.000)							
Spearman's rho	0.3482							
(p-value)	(0.000)							

Note: Following Coad et al. (2011), Spearman's rank coefficient is included since this is more robust to the presence of outliers and fat-tails.
Source: Own elaboration based on SABI©.

Table 2. Contemporaneous Correlation Matrix by Industry Sector

Industry Sector (NACE Rev. 2)	**Pairwise correlation**	**Spearman's rho**	**Obs.**	**Industry Sector (NACE Rev. 2)**	**Pairwise correlation**	**Spearman's rho**	**Obs.**
10	0.0458	**0.2840**	1200	23	**0.2240**	**0.4145**	725
11	0.0593	**0.3281**	173	24	**-0.3660**	**0.1803**	177
13	0.0841	**0.3278**	369	25	**0.2426**	**0.3870**	1797
14	**0.2497**	**0.2966**	311	26	**0.4164**	**0.5009**	166
15	**0.2080**	**0.3463**	302	27	**0.1844**	**0.4069**	155
16	**0.2320**	**0.3446**	726	28	0.0144	**0.4221**	647
17	**0.2297**	**0.4171**	181	29	**0.2962**	**0.3238**	133
18	0.0187	**0.3399**	1258	31	**0.1915**	**0.3526**	702
20	0.0969	**0.2603**	366	32	**0.3123**	**0.3282**	347
22	**0.2325**	**0.3350**	458	33	**0.0986**	**0.3895**	537

Note: Cells in bold are statistically significant at 95%. Following Coad et al. (2011), Spearman's rank coefficients are included since these are more robust to the presence of outliers and fat-tails.
Source: Own elaboration based on SABI©.

Table 3. Regression Results: Profits on GROWTH (Robust standard errors are reported in parentheses)

Dependent variable: $GROWTH_{it}$	**Fixed Effects**	**SYS-GMM**
$GROWTH_{it-1}$	-0.1086*** (0.0120)	0.0267 (0.0347)
$GROWTH_{it-2}$	-0.0464*** (0.0079)	-0.0012 (0.0097)
$PROFITS_{it-1}$	-0.0206*** (0.0060)	-0.0018 (0.0081)
$PROFITS_{it-2}$	-0.0063* (0.0035)	0.0037 (0.0028)
$SIZE_{it-1}$	-0.0032*** (0.0006)	0.0011 (0.0021)
TIME DUMMIES	YES	YES
INDUSTRY DUMMIES	NO	YES
REGIONAL DUMMIES	NO	YES
Constant	0.2329*** (0.0162)	0.1213** (0.0492)
Wald Chi (p-value)		974.71 (0.000)
F test (p-value)	78.85 (0.000)	
AR(1) z-test (p-value)		-10.59 (0.000)
AR(2) z-test (p-value)		0.13 (0.899)
Number of instruments		63
Hansen test (p-value)		8.90 (0.632)
Difference-in-Hansen test for GMM instruments (p-value)		4.01 (0.675)
Number of Observations	8,871	8,871
Number of Groups	912	912

Note:*, **, and *** denote coefficients which are statistically significant at 10%, 5%, and 1%, respectively. Robust standard report Windmeijer (2005) small-sample correction for the two-step standard errors. Following Roodman (2009)suggestions, we limited the lag length used as instruments to 3 years and we collapsed the instrument matrix. The corresponding tests of instrument validity used are also reported in each table. We report the Hansen J test instead of the more common Sargan test because it is more robust to heteroskedasticity and autocorrelation.
TIME DUMMIES are included in both specifications, INDUSTRY and REGIONAL dummies are only introduced in the System GMM because they are time invariant and do not make sense to include them in the FE estimation.

Table 4. Regression Results: Growth on PROFITS (Robust standard errors are reported in parentheses)

Dependent variable: $PROFIT_{it}$	**Fixed Effects**	**SYS-GMM**
$GROWTH_{it}$	0.2303*** (0.0679)	0.2565*** (0.0558)
$GROWTH_{it-1}$	0.0411 (0.0727)	0.0550 (0.0455)
$GROWTH_{it-2}$	-0.0100 (0.0479)	0.0153 (0.0125)
$PROFITS_{it-1}$	0.0569 (0.0366)	0.1174*** (0.0378)
$PROFITS_{it-2}$	0.0061 (0.0210)	-.0020 (0.0092)
$SIZE_{it-1}$	-0.0005 (0.0035)	0.0032 (0.0028)
TIME DUMMIES	YES	YES
INDUSTRY DUMMIES	NO	YES
REGIONAL DUMMIES	NO	YES
Constant	0.1159 (0.0993)	0.0430 (0.0897)
Wald Chi (p-value)		293.84 (0.000)
F-test (p-value)	3.11 (0.000)	
AR(1) z-test (p-value)		-1.54 (0.124)
AR(2) z-test (p-value)		0.45 (0.651)
Number of instruments		64
Hansen test (p-value)		13.21 (0.354)
Difference-in-Hansen test for GMM instruments (p-value)		7.22 (0.301)
Number of Observations	8,871	8,871
Number of Groups	912	912

Note:*, **, and *** denote coefficients which are statistically significant at 10%, 5%, and 1%, respectively. Robust standard report Windmeijer (2005) small-sample correction for the two-step standard errors. Following Roodman (2009)suggestions, we limited the lag length used as instruments to 3 years and we collapsed the instrument matrix. The corresponding tests of instrument validity used are also reported in each table. We report the Hansen J test instead of the more common Sargan test because it is more robust to heteroskedasticity and autocorrelation.
TIME DUMMIES are included in both specifications, INDUSTRY and REGIONAL dummies are only introduced in the System GMM because they are time invariant and do not make sense to include them in the FE estimation.

Table 5. Hurlin Test

From Growth to PROFITS	**1-Lag**	**2-Lag**
Average Wald statistic (W_{HNC})	4.8284	4.5155
Standardized Average Wald statistic (Z_{HNC})	40.4317***	15.2331***
From Profits to GROWTH	**1-Lag**	**2-Lag**
Average Wald statistic (W_{HNC})	2.2786	2.9021
Standardized Average Wald statistic (Z_{HNC})	11.3315***	7.0828***

Note:*, **, and *** denote coefficients which are statistically significant at 10%, 5%, and 1%, respectively. Z_{HNC} values are estimated according to Hurlin's (2007) specifications.

Table 6. Hurlin Test (using industry averages)

From Growth to PROFITABILITY	**1-Lag**	**2-Lag**
Average Wald statistic (W_{HNC})	4.1281	3.0999
Standardized Average Wald statistic (Z_{HNC})	5.5268***	1.3769
From Profitability to GROWTH	**1-Lag**	**2-Lag**
Average Wald statistic (W_{HNC})	1.3350	3.1825
Standardized Average Wald statistic (Z_{HNC})	0.0958	1.4481

Note:*, **, and *** denote coefficients which are statistically significant at 10%, 5%, and 1%, respectively. Z_{HNC} values are estimated according to Hurlin's (2007) specifications.