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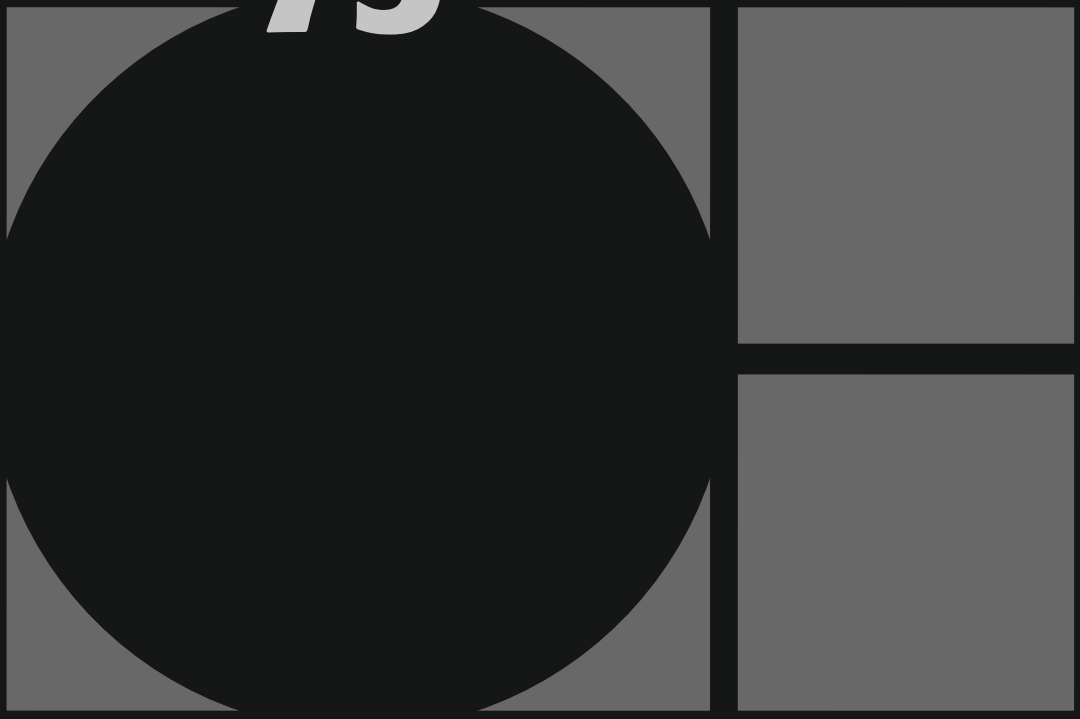

*Facultad de Ciencias Económicas*
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UNIVERSIDAD
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# ARTÍCULO

# DO PROFITABLE START-UP FIRMS GROW FASTER? EVIDENCE FROM COLOMBIA*

Yuji Honjo

**Honjo, Y. (2018). Do profitable start-up firms grow faster? Evidence from Colombia. *Cuadernos de Economía*, *37*(75), 727-754.**

This study explores the impact of profitability on the growth of start-up firms. Using data on start-up firms in Colombia, we examine the relationship between firm growth and profitability. We provide evidence that start-up firms with higher profitability increase their total assets. However, we find little evidence that profitability positively affects sales growth for start-up firms. In contrast, the results provide support for the notion that profitability is derived from sales growth. Furthermore, we find that firm growth depends heavily on firm age during the start-up stage.

**Keywords:** Growth; Profitability, Start-up.
**JEL:** L21; L26; M13.

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**Honjo, Y. (2018). ¿Las empresas emergentes rentables crecen más rápido? Evidencia de Colombia. *Cuadernos de Economía*, *37*(75), 727-754.**

Este estudio explora el impacto de la rentabilidad en el crecimiento de las empresas emergentes o *startups*. Empleando datos sobre empresas emergentes en Colombia, examinamos la relación entre el crecimiento empresarial y la rentabilidad. Proporcionamos evidencia de que las empresas emergentes con mayor rentabilidad incrementan sus activos totales. Sin embargo, encontramos poca evidencia de que la rentabilidad afecte positivamente el crecimiento de las ventas para las compañías emergentes. Por el contrario, los resultados apoyan la noción de que la rentabilidad se deriva del crecimiento de las ventas. Adicionalmente, encontramos que el crecimiento empresarial depende en gran medida de la edad de la empresa durante la etapa de emergencia de la misma.

**Palabras clave:** crecimiento, rentabilidad, empresa emergente (*startup*).
**JEL:** L21; L26; M13.

**Honjo, Y. (2018). Les entreprises émergentes rentables croissent-elles plus vite ? Exemple de la Colombie. *Cuadernos de Economía*, *37*(75), 727-754.**

Cette étude analyse l'impact de la rentabilité sur la croissance des entreprises émergentes ou *startups*. En utilisant des données sur les entreprises émergentes en Colombie, nous examinons la relation entre la croissance de l'entreprise et la rentabilité. Nous montrons que les entreprises émergentes les plus rentables augmentent le total de leurs actifs. Cependant, nous trouvons peu d'évidences de ce que la rentabilité augmente notablement les ventes des compagnies émergentes. Au contraire, les résultats montrent que la rentabilité provient de la croissance des ventes. En outre, nous observons que la croissance de l'entreprise dépend en grande mesure de l'âge de l'entreprise durant l'étape de son émergence.

**Mots-clés:** croissance, rentabilité, entreprise émergente (*startup*).
**JEL:** L21; L26; M13.

**Honjo, Y. (2018). As empresas emergentes lucrativas crescem mais rápido? Evidências da Colômbia. *Cuadernos de Economía*, *37*(75), 727-754.**

Este estudo explora o impacto da lucratividade no crescimento de empresas emergentes ou *startups*. Usando dados de empresas emergentes na Colômbia, examinamos a relação entre o crescimento dos negócios e a lucratividade. Fornecemos evidências de que empresas emergentes com maior lucratividade aumentam seus ativos totais. Porém, encontramos poucas evidências de que a lucratividade afeta positivamente o crescimento das vendas de empresas emergentes. Pelo contrário, os resultados apoiam a noção de que a lucratividade é derivada do crescimento das vendas. Além disso, descobrimos que o crescimento dos negócios depende em grande parte da idade da empresa durante a sua fase de emergência.

**Palavras-chave:** crescimento, rentabilidade, empresa emergente (*startup*).
**JEL:** L21; L26; M13.

# INTRODUCTION

To date, much attention has been paid to the growth of small and young firms in the literature (e.g., Acs, 1996; Coad, 2009). How high-growth (or fast-growing) start-ups—sometimes called "Gazelles"—contribute to the economy has often been debated (e.g., Acs & Mueller, 2008; Birch, 1981).[1] Despite their uncertain business prospects, the growth of start-up firms is an important vehicle for economic revitalization through job creation and innovation. High growth start-ups play a critical role in driving industry growth, and they presumably contribute to stimulating the stagnant economy. We expect the emergence of high growth start-ups to spur economic growth, not only in developed, but also developing economies.

When considering firm growth, some scholars emphasize the "growth of the fitter," which indicates that fitter firms survive and grow while less viable firms lose market share and exit (e.g., Coad, 2007). Put differently, growth is determined by the level of fitness in the market. Based on this perspective, it is plausible that firms with an ability to weather a turbulent environment are more likely to grow. Given that profitability represents the level of fitness in the market, we can state that firm growth is determined according to profitability. In this view, it is conceivable that profitable start-up firms are more likely to grow faster because they can adapt to the market environment. However, it remains unclear how firm growth is determined, especially for start-up firms in growing economies, because such firms are more vulnerable to turbulent economic conditions and market imperfections. Although previous studies have examined the impact on firm growth, their samples do not discriminate regarding firm age (e.g., Carpenter & Petersen, 2002; Fagiolo & Luzzi, 2006). Meanwhile, some empirical studies have provided supportive evidence on a negative relationship between firm age and growth (e.g., Evans, 1987a, 1987b). Further investigation is required to better understand the mechanism of firm growth.

This study explores the impact of profitability on the growth of start-up firms. While previous studies tend to examine firm growth, regardless of firm age, in this study, we focus on start-up firms and examine the relationship between firm growth and profitability in order to clarify firm growth during the start-up sage. By doing so, we provide insights into the relationship between firm growth and profitability over time after founding. As a result, we provide evidence that start-up firms with higher profitability increase their total assets. However, we find little evidence that profitability positively affects sales growth. In contrast, the results provide support for the notion that profitability is derived from sales growth. Furthermore, we find that firm growth depends heavily on firm age during the start-up stage.

To date, the growth of start-up firms in developed economies has been highlighted in the literature.[2] However, start-up firms in developing economies may rather

[1] For instance, by using a meta-analysis of the empirical evidence regarding whether net employment growth rather is generated by a few rapidly growing firms, Henrekson and Johansson (2010) emphasized that Gazelles create all or a large share of new net jobs and they are outstanding job creators.

[2] For instance, Wagner (1994) examined the growth of start-up firms in West Germany, and Honjo (2004) did the same in Japan.

become driving forces to promote economic growth, and they presumably play a more important role in industry growth than those in developed economies. In this respect, much attention should be paid to the growth of start-up firms in developing economies.[3] In this study, we examine firm growth using data on start-up firms in Colombia, which was considered to have a stable developing economy in the 2000s. Not surprisingly, formal financial markets for start-up firms are not well developed in developing economies, and internal financing may play a critical role in investment for business expansion. Meanwhile, high growth start-ups have a higher demand for investment in developing economies, and they may not pursue their profits during the start-up stage. We shed light on the relationship between firm growth and profitability for start-up firms in Colombia, which provides insights into how profitability, including cash flow, induces the growth of start-up firms in developing economies.

The remainder of the paper is organized as follows. Section 2 provides the research background by reviewing the related literature. Section 3 explains the analytical framework. Section 4 describes the data used in the estimation model, and the estimation results are provided in Section 5. The final section makes some concluding remarks.

# RESEARCH BACKGROUND

## Start-up Firm Growth

The relationship between firm size and growth has long been examined in the literature (e.g., Mansfield, 1962).[4] Due to economies of scale, smaller firms are more likely to face cost disadvantages arising from insufficient firm size. Theoretical arguments indicate that, given that the long-term average cost curve is U-shaped or L-shaped, there is a minimum efficient sale (MES) level of output in an industry. Generally, start-up firms are smaller than incumbent firms, and they pursue MES level of output to overcome cost disadvantages. However, it is difficult for start-up firms to achieve MES level at founding because of capital market imperfections. Therefore, start-up firms are more likely to face cost disadvantages (e.g., Audretsch, 1995; Caves, Khalilzadeh-Shirazi, & Porter, 1975; Weiss, 1976). It is conceivable that the probability of firm exit increases as the gap between the firm's level of output and MES level of output increases.

To compete with incumbent firms, start-up firms pursue MES level of output after entering the market. Therefore, start-up firms have strong incentives to grow faster. In other words, growth is often a prerequisite for start-up firms to survive

[3] As one of few studies researching developing economies, Coad and Tamvada (2012) examined firm growth, including start-up firms, in India.

[4] According to Gibrat's law, firm growth is independent of size. However, many empirical studies have not provided evidence on the independence between firm size and growth; Gibrat's law did not hold in these studies. Their results may rather provide support for a negative relationship between firm size and growth (e.g., Evans, 1987a, 1987b; Hall, 1987).

in the market. For this reason, firm growth is considered to be related to firm age. Indeed, some studies empirically examined the relationship between firm age and growth, and they provided supportive evidence on the negative effect of firm size and age on growth (e.g., Evans 1987a, 1987b). Based on the empirical findings, the negative effect of firm size and age on growth seems to be accepted as a stylized fact in the literature.

According to firm selection theory, start-up firms discover their abilities, including how to become efficient, through a learning process (e.g., Audrestch, 1995; Jovanovic, 1982). More precisely, firms begin on a small scale and then expand as they discover their cost functions through the process of learning, even if they do not know what their functions are. Based on the premise that capital markets are imperfect, start-up firms are more susceptible to insufficient size, even if they have high growth potential, because they face difficulties raising the necessary funds from capital markets. Conversely, start-up firms that have insufficient firm size at founding have more opportunities to grow as they learn their businesses and establish their reputations in the markets. Such firms are more likely to achieve rapid growth. According to firm selection theory advocated by Jovanovic (1982), the negative relationship between firm age and growth suggests that start-up firms grow faster to survive in the market. However, the process of learning to achieve MES level of output differs across firms, and this growth potential is heterogeneous.

## Growth and Profitability Relationship

Several studies have focused on the relationship between firm growth and profitability. In a seminal work, Marris (1964) described a trade-off relationship between firm growth and profitability (or valuation). Cowling (2004) examined the short-run growth–profit trade-off of the type outlined by Marris, but the author found no evidence of this relationship. Moreover, Geroski, Machin, and Walters (1997) argued that current period firm growth rates reflect changes in current expectations about the long-run profitability of firms. Furthermore, Coad (2010) summarized the relationship between firm growth and profitability, including investment, by classifying three perspectives on firm growth: Tobin's q, imperfect market, and evolutionary theories.

To date, some studies have provided evidence on the growth and profitability relationship. For instance, Davidsson, Steffens, and Fitzsimmons (2009) showed that highly profitable and low growth firms are more likely to become highly profitable and high growth firms, and they emphasized that growth is often not a sign of sound development. Fagiolo and Luzzi (2006) found that cash flow has a positive, statistically significant effect on firm growth once they controlled for sheer size. However, Coad (2007) provided weak evidence of a positive relationship between firm growth and profitability. There is room for further research on the relationship between firm growth and profitability.

More importantly, although many empirical studies have examined firm growth, little attention has been paid to firm growth after founding. To achieve MES level of output, as discussed, start-up firms have strong incentives to grow faster. Some start-up firms have a priority to grow more rather than focus on profitability for business expansion, even if they do not obtain sufficient profits at founding. However, this priority to grow may diminish as the level of output increases over time. Therefore, it is plausible that the growth and profitability relationship varies over time, depending heavily on firm age. In this respect, research on start-up firm growth could provide critical insights into the relationship between growth and profitability.

As few exceptions, Delmar, McKelvie, and Wennberg (2013) examined the relationship between growth, profitability, and survival in new firms; they used a sample of start-up firms in Sweden. Their results showed a positive relationship between firm growth and profitability. Their findings suggest that profitable start-up firms are more likely to grow faster. However, the growth of start-up firms in developing economies may differ from that in developed economies since start-up firms have more opportunities for business expansion. Meanwhile, as Coad and Tamvada (2012) argued, formal financial markets are of limited use for start-up firms in developing economies. In this respect, start-up firms cannot necessarily rely on funds from capital markets to achieve firm growth in these economies.

In this study, we examine the relationship between firm growth and profitability using a sample of start-up firms in Colombia. As discussed later, the Colombian economy has experienced stable and rapid growth, and there is a high level of entrepreneurship in the country. Because of more opportunities for business expansion, profitability in such economies may be less important for firm growth than in developed economies, and, therefore, the reverse relationship —firm growth generating profits— may exist between firm growth and profitability.

## Financing of Start-up Firms

While the effects of firm size and age on growth have been examined in the literature, other factors are considered to be more important for growth than firm size and age. Some scholars have emphasized the role of human capital—specifically entrepreneurial human capital—in the post-entry performance of firms (e.g., Cressy, 1996).[5] In addition to human capital, financial capital is of paramount importance for the growth of start-up firms: firms require financial capital to start and sustain their businesses. Without financial capital, start-up firms would not be able to invest in firm growth.

[5] It is likely that start-up firms managed by entrepreneurs with higher ability outperform those managed by entrepreneurs who have lower ability. Indeed, some studies have found the vital role of entrepreneurial human capital on the growth of start-up firms (e.g., Colombo & Grilli, 2010; Honjo, 2004). For a survey on the role of entrepreneurial human capital, see Storey and Greene (2010). However, we could not obtain information on entrepreneurs from the database used in the analysis. As such, further investigation is warranted.

To better understand the mechanism of firm growth through investment, many scholars have highlighted how investment is sensitive to internal financing, which is often measured by cash flow or operating profits (e.g., Fazzari, Hubbard, Petersen, Blinder, & Poterba,1988; Fazzari, Hubbard, & Petersen, 2000). Some scholars emphasized that profitable firms are more likely to grow because such firms can avoid financial constraints (e.g., Carpenter & Petersen, 2002; Fagiolo & Luzzi, 2006). Not surprisingly, high growth start-ups require more capital due to the growing demand for investment. In this respect, how firms finance themselves during the start-up stage will have an influence on their longevity and growth.

Many, but not all, start-up firms require funds from external capital markets when starting their businesses. For business longevity and growth, firms prefer to use internal finance stemming from cash flow because, in general, the cost of internal financing is lower than that of external financing, such as bank loans. However, it takes most firms a certain period of time after founding to gain a positive cash flow that can be used as the source of internal finance; that is, it is not easy to secure internal finance soon after founding. Despite limited internal finance, start-up firms that have high demand for growth do require large capital.

Based on the premise of capital market perfections, external finance is equivalent to internal finance; hence, internal and external finances are perfect substitutes. In this case, firms with growth potential can raise funds, regardless of internal or external finance. However, in reality, capital markets are imperfect. Despite start-up firms' growth potential, generally, external suppliers of capital, such as banks, cannot always assess growth potential, because they do not always have the knowledge and skill to assess the business. Moreover, information asymmetry between start-up firms and external suppliers of capital often arises due to the lack of start-up firms' business history and credit record. Start-up firms' performance is so uncertain that external suppliers of capital cannot accurately predict outcomes. Therefore, external suppliers of capital, such as banks, hesitate to provide funds to start-up firms because of uncertainty and information asymmetry associated with the lack of business history and credit record.

As Carpenter and Petersen (2002) argued, the principal source of the wedge of the cost of financing is due to asymmetric information between firms and potential suppliers of external capital. Such information issues often generate transaction and monitoring costs for external financing, and lead to adverse selection and moral hazard problems in capital markets, which result in agency costs associated with an increase in the cost of external financing. The cost of external financing, particularly for start-up firms, is higher than that of internal financing because of the lack of business history and credit record. In this respect, start-up firms tend to face financial constraints. Accordingly, start-up firms cannot use external finance in the same way as internal finance due to capital market imperfections.

During the start-up stage, internal finance is considered to play a critical role in firm growth. Start-up firms that can make positive profits have more financing

advantages because they face fewer financial constraints and can secure funds with lower capital costs. As such, it is conceivable that profitable start-up firms are more likely to grow faster. However, even if start-up firms face cost disadvantages for financing due to information asymmetry, such disadvantages may be mitigated when the economy is expanding. In growing economies, the role of internal finance seems to be limited for firm growth. In such economies, the emergence of start-up firms with growth potential is so attractive that external suppliers of capital can provide funds to start-up firms because of anticipated future growth. In addition, already operating firms may not easily sustain competitive advantages. Conversely, start-up firms may prefer to obtain profits by expanding their businesses and securing internal funds. By investigating start-up firms in Colombia, we provide evidence on the relationship between growth and profitability.

# ANALYTICAL FRAMEWORK

Some scholars have framed firm growth based on an evolutionary economics perspective (e.g., Dosi & Nelson, 1994). Coad (2007, 2009) for example emphasized the firm selection mechanism and proposed an evolutionary model of firm growth based on the concept of replicator dynamics. Following these arguments, we consider the relationship between firm size and its variation. Let $x$ denote firm size, and $\dot{x}$ represent the variation of firm size in a time interval. According to the perspective of evolutionary economics, we can write $\dot{x}$ as follows:

$$\dot{x} = \alpha x\left(F - \overline{F}\right) \tag{1}$$

where $F$ is the level of fitness of the firm, $\overline{F}$ is the average level of fitness of firms in the market, and $\alpha$ is a parameter.

Meanwhile, other scholars have emphasized the impact of financial constraints on the post-entry performance of firms (e.g., Evans & Jovanovic, 1989). According to the perspective of financial constraints, firms prefer to use internal financing because the cost of internal financing is lower than that of external financing; this is due to information asymmetry between firms and external suppliers of capital. Following this perspective, Carpenter and Petersen (2002) proposed a model of firm growth associated with cash flow. In their model, firm growth is subject to the financial constraints that the firm faces and the variation of assets $\dot{x}_A$ in a time interval depends on the amount of cash flow, $CF$. Following Carpenter and Petersen's argument, we can write the derivative relationship as follows:

$$\frac{d\dot{x}_A}{dCF} = \kappa \tag{2}$$

where $\kappa$ is a leverage effect of internal finance, measured by cash flow, on increase in assets. In Equation (2), the variation of assets has a linear relationship with cash flow. Dividing this relationship by the size of assets, we can consider that the growth rate of assets is a function of the ratio of cash flow to assets.

Assuming that the firm's level of fitness in Equation (1) is measured by profitability—more precisely, the ratio of cash flow to firm size—we can write the growth rate as a function of the cash flow ratio. In this case, as Coad (2009, 2010) suggested, the financial constraints perspective seems to be similar to that taken by evolutionary economics. In practice, Equation (1) is almost equivalent to Equation (2) where $\dot{x}$ is measured by assets, $F$ is defined as $CF/x$, and $\alpha = \kappa$ in Equations (1) and (2).

Furthermore, we consider an estimation model of firm growth, following the evolutionary economics and financial constraints perspectives. Let $GROW_{it}\left(=\dot{x}/x\right)$ denote firm $i$'s growth for the period $t-1$ and $t$. It is important to note that $t$ indicates firm age in this study. Suppose that profitability reflects the level of firm $i$'s fitness, which is measured by the ratio of cash flow to total assets $\left(CF/A\right)_{it}$. To identify the relationship between firm growth and the level of fitness for start-up firms, we can write the empirical model as follows:

$$GROW_{it} = \beta_0 + \beta_1 \frac{CF_{it-1}}{A_{it-1}} + \beta_2 Z_{it-1} + u_i + \nu_t + \epsilon_{it} \tag{3}$$

where $\beta_0, \beta_1$, and $\beta_2$ are the parameters to be estimated, and $Z_{it-1}$ is a vector of controls.[6] The terms $u_i$ and $\nu_t$ are firm-specific and age-specific terms, respectively, and $\epsilon_{it}$ is an error term. To avoid reverse causality, we use the lagged variable for profitability, measured by the cash flow ratio, and the vector of controls. More importantly, start-up firms have heterogeneous demands for business expansion. Using the firm-specific term $u_i$, we control for the heterogeneity in the demand for firm growth. Additionally, the demand for growth varies over time, and firm growth may depend on firm lifecycle associated with firm age. Thus, we control for change in the demand over time by using the age-specific term $\nu_t$.

# DATA

## Colombia's Economy

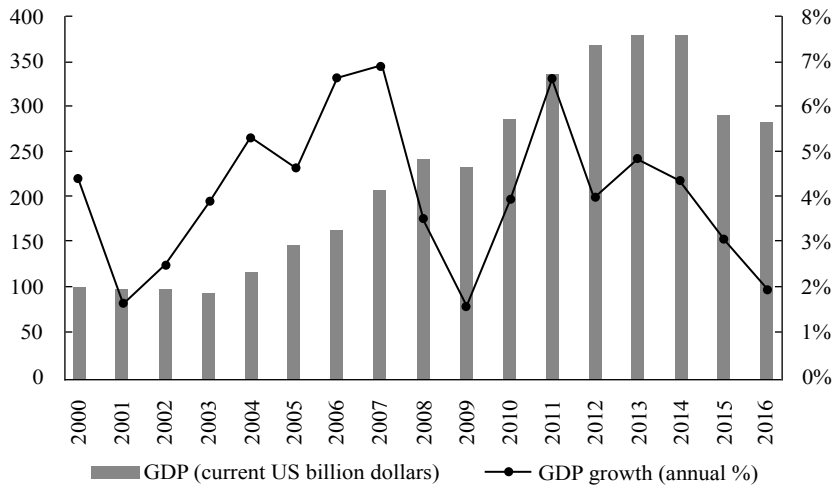
In this study, we investigate start-up firms in Colombia. Figure 1 shows Colombia's gross domestic product (GDP) as well as its annual growth rate. While

[6] Coad (2007) used multiple lagged variables for profitability in his estimation model. However, we did not, mainly because the observation period is limited in our sample.

the Colombian economy faced long-term high inflation rates until the 1990s, it achieved rapid growth around the early 2000s. The Colombian economy experienced sustained growth until the mid-2000s, but it then faced a recession after the Lehman Brothers collapse. However, while South American economies, including Brazil and Chile, recorded negative GDP growth in 2009, the Colombian economy experienced positive GDP growth. The Colombian GDP in 2011 was over 300 billion US dollars (current value), which was three times larger than that in 2000. However, the economy was sluggish in 2015 because of the decline in crude oil prices. Meanwhile, the average consumer price index has been under 10% since 2000, and inflation has recently abated.[7] Overall, the Colombian economy has recently experienced strong and sustained growth.

In Colombia, the level of entrepreneurship, which is significantly linked to the emergence of start-up firms, is higher than in most other countries. According to the Global Entrepreneurship Monitor Global Report, total early-stage entrepreneurial activity (TEA), which is often used as an index for a country's entrepreneurship level, is 22.7% in Colombia, which was ranked eighth out of sixty countries in 2015 (Kelley, Singer, & Herrington, 2016). In addition, entrepreneurial intentions are 48.2%, which puts Colombia in fourth position in the same ranking. While the entrepreneurship level is very low in some developed economies, such as Germany

**Figure 1.**
GDP and Annual GDP Growth in Colombia




Source: The World Bank Data.
https://data.worldbank.org/country/colombia

[7] For more details and data for Colombia and other countries, see, for example, the IMF, OECD, and World Bank websites. http://www.imf.org/external/datamapper/datasets/WEO [Accessed on November 20, 2017] http://www.oecd.org/eco/surveys/economic-survey-colombia.htm [Accessed on November 20, 2017] https://data.worldbank.org/country/colombia [Accessed on November 1, 2017]

(TEA: 4.7%), Italy (TEA: 4.9%), Spain (TEA: 5.7%), and Sweden (TEA: 7.2%), the TEA in Colombia is much higher than in these countries.[8] Further economic growth that depends on high entrepreneurship level is expected in Colombia as there are many high growth start-ups that stimulate the economy.

## Sample

The data on start-up firms are from the Orbis database, which is provided by Bureau van Dijk Electronic Publishing and contains information on over 200 million privately held firms globally. Using Orbis, we obtained financial statements from 2006 to 2015. Orbis generally provides up to ten years' history of firms, and our sample includes financial statements from 2006 to 2015. In this study, we highlight firm growth during the start-up stage and target start-up firms founded in Colombia.[9] While data on firms founded in 2006 can be obtained for up to ten years, those founded in 2014 can be obtained for one or two years. In other words, the observation periods depend on when the firm was founded. To observe firm growth from founding, we target firms whose financial statements from the first accounting year are available on Orbis, and then we construct a panel data set of start-up firms for the years after they were founded. However, the longer the observation window, the smaller the number of firms. Accordingly, to secure a sufficient sample size, we measure firm growth for five years after founding, which is regarded as start-up stage in this study. As a result, our sample for start-up firms consists of panel data that contain the financial statements of firms for five years after founding (during 2006–2010).

Following Nomenclature of Economic Activities, Rev.2 (hereafter, NACE), we selected firms classified in the following industries: manufacturing (NACE code: C), construction (NACE code: F), wholesale and retail trade (NACE code: G), transportation and storage (NACE code: H), accommodation and food service activities (NACE code: I), information and communication (NACE code: J), real estate activities (NACE code: L), professional, scientific, and technical activities (NACE code: M), administrative and support service activities (NACE code: N), arts, entertainment, and recreation (NACE code: R), and other service activities (NACE code: S). However, we do not include firms classified as finance and insurance (NACE code: K) because financial statements in this industry differ from those in non-financial industries. In addition, firms classified in industries, such as agriculture, forestry, and fishing (NACE code: A), electricity, gas, steam, and air conditioning supply (NACE code: D), public administration and defence (NACE code: O), education (NACE code: P), and human health and social work activities (NACE code: Q) are not included because there are special regulations for these

[8] In general, TEA tends to be lower in developed economies, such as the European countries and Japan.

[9] The number of observations in Orbis considerably differs between countries. In practice, Orbis does not sufficiently cover start-up firms in North, Central, and South American countries, including the United States. From these countries, we obtained sufficient data on start-up firms in Colombia. This is one of the reasons why we examine firm growth focusing on start-up firms in Colombia.

industries to be incorporated. Moreover, activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (NACE code: T), and activities of extraterritorial organizations and bodies (NACE code: U) are not included in the sample.

The sample contains some firms that should be considered as outliers. First, there are some ways to legally constitute a company that is possible in the country. In this study, we only focus on public and private limited companies, mainly because these are the standard company form in most countries. Second, extremely large firms are excluded from the sample. More precisely, firms whose equity finance is no less than 20 billion pesos at founding are regarded as outliers.[10] Third, only a few firms have extremely low or high cash flow ratios, and, therefore, the variable for the cash flow ratio is winsorized at 1% and 99%. Fourth, we construct balanced panel data for five years after founding to identify the growth process over time. Therefore, firms whose financial statements are not available for five years are excluded from the sample.[11] Furthermore, several firms are not independent, and they appear to be subsidiaries and affiliated firms. Such firms have different growth strategies from independent firms. Therefore, in the estimation, we control for the impact of firm-specific characteristics on firm growth using firm-specific terms. To check robustness, we also estimate the determinants of firm growth by excluding non-independent firms from the sample.

Regarding the performance of start-up firms, we capture firm growth over time. As discussed, we measure firm growth for five years after founding. To control for the difference in inflation rates over time, we use GDP deflators when calculating firm growth.[12] The variables for financial statements, except for ratio measures, are normalized by GDP deflators based on 2006 values.

The sample consists of 3264 firms founded during 2006-2010. The data on financial statements for five years after founding are available. In the Appendix, Table A1 describes the distribution of start-up firms by industry. The proportion of start-up firms in wholesale and retail trade (NACE code: G) is over 30%, while the proportion of start-up firms in manufacturing (NACE code: C) accounts for 17%. The mean sales are approximately 6 billion pesos, and the median sales are approximately 0.3 billion pesos in the first accounting year. Moreover, the mean total assets are approximately 4 billion pesos, and the median total assets are approximately 0.2 billion pesos in the first accounting year in the sample.

[10]According to annual exchange rates reported in OECD, 1 US dollar equaled 2361.139 Colombia pesos in 2006. 20 billion pesos had a value of approximately 9 million US dollars based on this exchange rate. See exchange rates (indicator) by OECD. doi: 10.1787/037ed317-en [accessed on October 31, 2017]

[11]In this study, we do not examine firm exit among start-up firms. Further investigation is required to better understand the survival and exit of start-up firms in Colombia.

[12]We obtained GDP deflators for Colombia from the World Bank website. https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?locations=CO [accessed on September 30, 2017]

## Variables

In this study, we measure firm growth using the annual growth rates of sales and total assets. Firm growth is defined as the differences in the logarithms of sales or total assets between two consecutive years.[13] Table 1 describes the descriptive statistics of firm growth by firm age. Table 1 reveals that the mean and median growth rates of sales and total assets are always positive for five years after founding. We find that, on average, start-up firms are more likely to grow after founding. In particular, the mean growth rate of sales is over 50% from the first to the second accounting year. However, the mean growth rate, regardless of sales or total assets, gradually decreases with firm age. The mean comparison test and Wilcoxon singed-rank test indicate that the growth rates significantly decrease in comparison to those in the previous years.

**Table 1.**
Sales Growth and Asset Growth of Start-up Firms

| **Sales growth** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Age** | **Mean** | **SD** | **5%** | **Median** | **95%** | \|*t*\| | \|*z*\| | *N* |
| 1 => 2 | 0.506 | 1.096 | –0.814 | 0.343 | 2.404 | ----- | ----- | 3264 |
| 2 => 3 | 0.145 | 0.894 | –1.016 | 0.116 | 1.320 | 13.205*** | 18.196*** | 3264 |
| 3 => 4 | 0.105 | 0.777 | –0.921 | 0.087 | 1.239 | 1.734* | 4.454*** | 3264 |
| 4 => 5 | 0.061 | 0.750 | –0.987 | 0.064 | 0.989 | 2.090** | 4.634*** | 3264 |
| All | 0.204 | 0.907 | –0.951 | 0.128 | 1.600 | | | 13056 |
| **Asset growth** | | | | | | | | |
| **Age** | **Mean** | **SD** | **5%** | **Median** | **95%** | \|*t*\| | \|*z*\| | *N* |
| 1 => 2 | 0.320 | 0.683 | –0.478 | 0.228 | 1.428 | ----- | ----- | 3264 |
| 2 => 3 | 0.174 | 0.594 | –0.577 | 0.115 | 1.119 | 8.631*** | 10.466*** | 3264 |
| 3 => 4 | 0.153 | 0.523 | –0.541 | 0.106 | 0.950 | 1.425 | 2.555** | 3264 |
| 4 => 5 | 0.113 | 0.504 | –0.568 | 0.073 | 0.859 | 2.972*** | 4.063*** | 3264 |
| All | 0.190 | 0.586 | –0.541 | 0.123 | 1.134 | | | 13506 |

Notes: SD indicates the standard deviation. |*t*| indicates statistics for paired mean comparison test with the previous year's values. |*z*| indicates statistics for the Wilcoxon singed-rank test with the previous year's values. *N* indicates the number of firms.

Source: Author's own elaboration based on Orbis database.

[13]Many studies have measured employment growth (Evans, 1987a, 1987b). However, we did not use this growth measurement, because we did not obtain data on the number of employees from Orbis.

The definitions of variables used in the estimation model are shown in Table 2. While the growth rates of sales and total assets are used as dependent variables, the cash flow ratio and firm age are used as major independent variables in the estimation model. Table 3 provides the descriptive statistics of cash flow ratios by firm age. We find that the mean and median cash flow ratios are always positive in Table 3. While the mean cash flow ratio is the highest in the second accounting year, it subsequently decreases.

Considering other variables, we control for differences in asset structure, including tangibility, across start-up firms, and include the fixed asset ratio variable in the estimation model, following previous studies (e.g., Claessens, Erik Feijen, & Laeven, 2008; Frank & Goyal, 2003). In addition, following Coad (2007), we control for firm size. Moreover, we use GDP growth to control for macroeconomic conditions because start-up firms may be vulnerable to economic growth and, as shown in Figure 1, the economic growth in Colombia does differ during the observation period. It is important to note that *t* indicates firm age in this study. While

**Table 2.**
Definitions of Variables

| Variable | Symbol | Definition |
|---|---|---|
| Sales growth | *GROW_S* | Difference in the logarithm of net sales between two subsequent years |
| Asset growth | *GROW_A* | Difference in the logarithm of total assets between two subsequent years |
| Cash flow ratio | *CF/A* | Operating profits plus financial profits minus tax, divided by total assets |
| Fixed asset ratio | *FA/A* | Total amount (after depreciation) of non-current assets (Sum of intangible assets, tangible assets, and other fixed assets), divided by total assets |
| Sales size | *SIZE_S* | Logarithm of net sales |
| Asset size | *SIZE_A* | Logarithm of total assets |
| GDP growth | *GDP* | Annual growth rate of GDP |
| Firm age | *AGE*2 | Dummy for the second accounting year (reference category) |
| | *AGE*3 | Dummy for the third accounting year |
| | *AGE*4 | Dummy for the fourth accounting year |
| | *AGE*5 | Dummy for the fifth accounting year |

Notes: All data on financial statements are measured in the local currency (millions of Colombian pesos) normalized by GDP deflators.

Source: Author's own elaboration.

**Table 3.**
Start-up Firms' Cash Flow Ratio

| **Cash flow ratio** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Age** | **Mean** | **SD** | **5%** | **Median** | **95%** | \|*t*\| | \|*z*\| | *N* |
| 1 | 0.141 | 0.274 | –0.136 | 0.081 | 0.583 | ----- | ----- | 3264 |
| 2 | 0.145 | 0.271 | –0.108 | 0.090 | 0.571 | 0.607 | 1.708* | 3264 |
| 3 | 0.133 | 0.250 | –0.107 | 0.083 | 0.532 | 2.202** | 2.299** | 3264 |
| 4 | 0.127 | 0.236 | –0.116 | 0.083 | 0.500 | 1.339 | 2.206** | 3264 |
| 5 | 0.122 | 0.224 | –0.095 | 0.077 | 0.480 | 1.105 | 1.909* | 3264 |
| All | 0.133 | 0.252 | –0.111 | 0.083 | 0.530 | | | 16320 |

Notes: SD indicates the standard deviation. |*t*| indicates statistics for paired mean comparison test with the previous year's values. |*z*| indicates statistics for Wilcoxon singed-rank test with the previous year's values. *N* indicates the number of firms.
Source: Author's own elaboration based on Orbis database.

GDP growth depends on the year, founding years differs for each firm. Therefore, the GDP growth variable depends not only on age *t*, but also on firm *i*. Furthermore, dummies for firm age are included to control for differences in firm growth according to firm lifecycle. Table 4 provides the descriptive statistics of variables used in the estimation model.

# ESTIMATION RESULTS

## Sales Growth

Table 5 presents the estimation results for sales growth. In Table 5, we use fixed-effects estimation for panel data to consider heterogeneity across firms and estimate the determinants of firm growth. We show the estimation results in column (i) of Table 5 when the variables for the cash flow ratio, fixed-assets ratio, GDP growth, and firm age are included. We also show the estimation results in column (ii) when including the lagged sales size instead of the dummies for firm age. Several firms are not independent and appear to be subsidiaries and affiliated firms. In addition, firms in the construction and real estate industries may be significantly associated with the economic growth cycle. Therefore, we show the estimation results in columns (iii) when non-independent firms and those classified as these industries are excluded from the sample. Moreover, to check for robustness, columns (iv) and (v) present the estimation results when alternative estimation methods are employed. While the ordinary least squares method is applied to estimate coefficients in columns (iv), instrumental variables and the two-stage least squares method for panel data is applied to the estimation in columns (v) because of the

**Table 4.**
Descriptive Statistics of Variables

| Symbol | Mean | SD | 5% | Median | 95% | *NT* |
|---|---|---|---|---|---|---|
| *GROW_S* | 0.204 | 0.907 | –0.951 | 0.128 | 1.600 | 13056 |
| *GROW_A* | 0.190 | 0.586 | –0.541 | 0.123 | 1.134 | 13056 |
| *CF/A* | 0.136 | 0.258 | –0.115 | 0.084 | 0.549 | 13056 |
| *FA/A* | 0.284 | 0.290 | 0.000 | 0.181 | 0.892 | 13056 |
| *SIZE_S* | 6.046 | 1.864 | 3.129 | 5.958 | 9.285 | 13056 |
| *SIZE_A* | 5.696 | 1.954 | 2.711 | 5.598 | 9.173 | 13056 |
| *GDP* | 0.042 | 0.018 | 0.017 | 0.040 | 0.069 | 13056 |

Notes: SD indicates the standard deviation. *NT* indicates the number of observations. The descriptive statistics of *GROW_S*, *GROW_A*, and *GDP* are measured during the period between 2 to 5 years of firm operation. The descriptive statistics of *CF/A*, *FA/A*, *SIZE_S*, and *SIZE_A* are measured during the period between 1 to 4 years of firm operation
Source: Author's own elaboration based on Orbis database.

endogeneity issue of the cash flow ratio.[14] In column (v), the cash flow ratio is regarded as endogenous, and a one-year lagged variable for the cash flow ratio is used as an instrumental variable.

With respect to the growth and profitability relationship, the coefficients of the cash flow ratio are negative and significant for sales growth in columns (i)–(iv) of Table 5. The results do not show that the cash flow ratio has a positive effect on sales growth.[15] We find no evidence on cash flow sensitivity for the sales growth of start-up firms. The results indicate that less profitable start-up firms are more likely to increase their sales, suggesting that profitability measured by the current cash flow, although it is the source of shareholder's equity increase, does not reflect the firm's level of fitness. Even though start-up firms have more cash flow, they do not always increase their sales. While the negative relationship between firm growth and profitability is not consistent with Delmar et al.'s (2013) findings, this relationship is in part consistent with Coad's (2007) findings, which suggest that cash flow plays a limited role in sales growth in growing economies, such as Colombia. Start-up firms with few profits may rather increase their sales, presumably because they have growth opportunities and incur higher investment costs.

Regarding other variables, the fixed asset ratio has a positive effect on sales growth, and its coefficients are significant in Table 5. The results indicate that start-up firms

[14]Coad (2007) used two and three-year lagged variables for profitability. This study does not use these, however, to ensure sufficient sample size because our sample covers variables only for five years.

[15]Instead of fixed-effects estimation, we employ random-effects estimation for panel data. As a result, we find support for a positive relationship between asset growth and profitability, and a negative relationship between sales growth and profitability.

**Table 5.**
Estimation Results for Sales Growth ($GROW\_S_{it}$)

| Variable | (i) | (ii) | (iii) | (iv) | (v) |
|---|---|---|---|---|---|
| | **FE** | **FE** | **FE** | **OLS** | **IV** |
| $(CF/A)_{it-1}$ | –0.457*** | –0.067* | –0.464*** | –0.295*** | 0.048 |
| | (0.054) | (0.036) | (0.071) | (0.034) | (0.109) |
| $(FA/A)_{it-1}$ | 0.262*** | 0.012 | 0.372*** | 0.094*** | 0.112*** |
| | (0.065) | (0.049) | (0.081) | (0.031) | (0.028) |
| $SIZE\_S_{it-1}$ | | –0.842*** | | | |
| | | (0.015) | | | |
| $GDP_{it-1}$ | 1.746*** | 2.217*** | 2.196*** | 1.757*** | 1.887*** |
| | (0.572) | (0.386) | (0.712) | (0.539) | (0.608) |
| $AGE3_{it-1}$ | –0.364*** | | –0.361*** | –0.365*** | |
| | (0.027) | | (0.033) | (0.024) | |
| $AGE4_{it-1}$ | –0.422*** | | –0.376*** | –0.420*** | –0.052** |
| | (0.024) | | (0.029) | (0.024) | (0.023) |
| $AGE5_{it-1}$ | –0.475*** | | –0.447*** | –0.471*** | –0.102*** |
| | (0.023) | | (0.028) | (0.023) | (0.021) |
| Industry dummies | No | No | No | Yes | No |
| Number of observations | 13056 | 13056 | 8056 | 13056 | 9792 |
| Number of firms | 3264 | 3264 | 2014 | 3264 | 3264 |
| *F* statistics | 87.4*** | 788.5*** | 50.9*** | 31.3*** | |
| Wald statistics | | | | | 47.3*** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. OLS indicates pooled-OLS estimation. IV indicates instrumental variables and two-stage least squares method when $(CF/TA)_{it-1}$ is endogenous and its lagged variable is used as an instrumental variable. In column (iii), non-independent firms and firms classified as construction or real estate activities are excluded from the sample. For firm age, $AGE2_t$ is the reference category in columns (i)–(iv), and $AGE3_t$ is the reference category in columns (v). Industry dummies are dummies measured by the NACE codes shown in Figure 1.

Source: Author's own elaboration based on Orbis database.

with a higher fixed asset ratio are more likely to increase their sales. In addition, firm size has a negative effect on sales growth, which is consistent with Gibrat's law. More importantly, the coefficients of GDP growth are positive, and GDP growth has a positive effect on sales growth. The results reveal that start-up firms

tend to increase their sales during the economic boom period.[16] Furthermore, the dummies for firm age are negative and significant for sales growth in Table 5. Table 1 showed that the mean and median growth rates of sales and total assets are positive during the observation period, and Table 5 presents empirical evidence on the effect of firm age on sales growth. In the regression model, we find that firm growth depends heavily on firm age during the start-up stage, which is consistent with the trends of firm growth shown in Table 1. The results reveal that firm growth varies over time after founding, depending on firm lifecycle. More specifically, the estimation results indicate that firm growth decreases with firm age, partly because younger firms tend to have stronger incentives to grow faster; this provides support for the learning process discussed in the literature (e.g., Audrestch, 1995; Jovanovic, 1982).

As a result, our findings do not support the positive effect of profitability on sales growth for start-up firms in Colombia. However, start-up firms may generate more cash flow through the growth process, and, therefore, the reverse relationship may occur in sales growth. Following Coad (2007), we examine the reverse relationship between firm growth and profitability. The cash flow ratio is used as the dependent variable, and sales growth is used as the independent variable. The variable for GDP growth and dummies for firm age are also included in the estimation model. Table 6 provides the estimation results for profitability. We show the estimation results when the variables for sales growth, GDP growth, and the dummies for firm age are included in column (i) of Table 6. Non-independent firms and those classified as construction and real estate activities are excluded from the sample in column (ii).

As shown in Table 6, the coefficients of sales growth are positive and significant, indicating that sales growth induces profitability. We find a positive relationship between sales growth and profitability when estimating the regression model for profitability, which is consistent with the findings of Coad (2007) and Cowling (2004). The results indicate that start-up firms that achieve rapid sales growth tend to yield more profits, suggesting that profitability is derived from sales growth. This may imply that financial constraints can be mitigated through the learning process associated with sales expansion.

## Asset Growth

In addition to sales growth, we estimate the growth and profitability relationship when measuring firm growth by the growth rate of total assets. Similar to Table 5, Table 7 presents the estimation results for asset growth. In Table 7, the positive

[16] As GDP growth has a positive effect on sales growth, the growth and profitability relationship may depend on economic growth cycle, such as booms and recessions. Therefore, we estimate the determinants of firm growth when dividing the sample by founding year. The estimation results for sales growth and asset growth are provided in Tables A2 and A3 of the Appendix, respectively. As a result, we find that the sales growth and profitability relationship tends to be weak for firms founded in 2009 and 2010.

**Table 6.**
Estimation Results for the Effects of Sales Growth on Profitability ($(CF / A)_{it-1}$)

| Variable | (i) | (ii) |
|---|---|---|
| | **FE** | **FE** |
| $GROW\_S_{it}$ | 0.024*** | 0.027*** |
| | (0.002) | (0.004) |
| $GDP_{it}$ | 0.142 | 0.259 |
| | (0.131) | (0.173) |
| $AGE3_t$ | –0.003 | –0.004 |
| | (0.005) | (0.007) |
| $AGE4_t$ | –0.009* | –0.014** |
| | (0.006) | (0.007) |
| $AGE5_t$ | –0.014** | –0.013* |
| | (0.006) | (0.007) |
| Number of observations | 13056 | 8056 |
| Number of firms | 3264 | 2014 |
| *F* statistics | 23.1*** | 13.4*** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. In column (ii), non-independent firms and firms classified as construction or real estate activities are excluded from the sample. For firm age, $AGE2_t$ is the reference category in all columns.
Source: Author's own elaboration based on Orbis database.

relationship between asset growth and profitability is supported even when alternative estimation methods are employed. We find that the cash flow ratio has a positive effect on asset growth, while it has a negative effect on sales growth, as shown in Table 5. The results reveal that start-up firms with higher profitability are more likely to increase their assets in Colombia, partly because retained earnings together with profitability results in an equity increase for shareholders. The findings about the positive effect of profitability on asset growth are consistent with Carpenter and Petersen's (2002) findings, although the impact (coefficient) of profitability is much smaller than their estimated impact. This may imply that start-up firms tend to increase capital by means other than retaining earnings.

Regarding other variables, the coefficients of the fixed asset ratio are, in part, positive, which are consistent with those shown in Table 5. The results indicate that start-up firms with a higher fixed asset ratio are more likely to increase their total assets. Moreover, we find that GDP growth has a significant effect on asset growth, whereas the coefficients of GDP growth for asset growth tend to be lower than those for sales growth. Furthermore, the dummies for firm age are negative and significant for asset growth, which are consistent with those shown in Table 5.

**Table 7.**
Estimation Results for Asset Growth ($GROW\_A_{it}$)

| Variable | (i) | (ii) | (iii) | (iv) | (v) |
|---|---|---|---|---|---|
| | **FE** | **FE** | **FE** | **OLS** | **IV** |
| $(CF/A)_{it-1}$ | 0.216*** | 0.073*** | 0.198*** | 0.191*** | 0.360*** |
| | (0.037) | (0.028) | (0.043) | (0.025) | (0.069) |
| $(FA/A)_{it-1}$ | 0.090* | 0.034 | 0.149*** | –0.023 | 0.007 |
| | (0.050) | (0.033) | (0.056) | (0.020) | (0.020) |
| $SIZE\_A_{it-1}$ | | –0.657*** | | | |
| | | (0.016) | | | |
| $GDP_{it}$ | 0.713*** | 1.887*** | 0.758* | 1.013*** | 1.033*** |
| | (0.355) | (0.270) | (0.438) | (0.346) | (0.398) |
| $AGE3_t$ | –0.148*** | | –0.146*** | –0.149*** | |
| | (0.017) | | (0.021) | (0.016) | |
| $AGE4_t$ | –0.172*** | | –0.169*** | –0.174*** | –0.024 |
| | (0.015) | | (0.018) | (0.015) | (0.015) |
| $AGE5_t$ | –0.212*** | | –0.204*** | –0.215*** | –0.064*** |
| | (0.015) | | (0.019) | (0.015) | (0.014) |
| Industry dummies | No | No | No | Yes | No |
| Number of observations | 13056 | 13056 | 8056 | 13056 | 9792 |
| Number of firms | 3264 | 3264 | 2014 | 3264 | 3264 |
| *F* statistics | 43.8*** | 409.4*** | 28.5*** | 20.2*** | |
| Wald statistics | | | | | 55.6*** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. OLS indicates pooled-OLS estimation. IV indicates instrumental variables and two-stage least squares method when $(CF/TA)_{it-1}$ is endogenous and its lagged variable is used as an instrumental variable. In column (iii), non-independent firms and firms classified as construction or real estate activities are excluded from the sample. For firm age, $AGE2_t$ is the reference category in columns (i)–(iv), and $AGE3_t$ is the reference category in columns (v). Industry dummies are dummies measured by the NACE codes shown in Figure 1.

Source: Author's own elaboration based on Orbis database.

As shown in Table 8, the coefficients of asset growth are negative, indicating that start-up firms that achieve higher asset growth are less likely to create profits. While internal financing in accordance with profitability increases assets, as shown in Table 7, asset growth does not exert an influence on profitability. The findings

imply that investment does not necessarily lead to profitability for start-up firms. In this respect, the importance of financial constraints associated with investment seems to be exaggerated for start-up firms, although financial constraints may essentially impede business start-ups. However, in our analysis, we focus on the short-run growth-profit trade-off —more precisely, asset growth in the five years after founding— and it may take start-up firms a longer period to secure profits by investment. Further investigation, including long-term profits, would be required to elucidate the asset growth and profitability relationship.

# CONCLUSIONS

This study has explored the impact of profitability on the growth of start-up firms. Using data on start-up firms in Colombia, we examined the relationship between firm growth and profitability measured by the cash flow ratio. We provided evidence that

**Table 8.**
Estimation Results for the Effects of Asset Growth on Profitability ( $(CF/A)_{it-1}$ )

| Variable | (i) | (ii) |
|---|---|---|
| | FE | FE |
| $GROW\_A_{it}$ | –0.012** | –0.008 |
| | (0.005) | (0.006) |
| $GDP_{it}$ | 0.194 | 0.324* |
| | (0.132) | (0.173) |
| $AGE3_t$ | –0.014*** | –0.015** |
| | (0.005) | (0.007) |
| $AGE4_t$ | –0.022*** | –0.025*** |
| | (0.006) | (0.007) |
| $AGE5_t$ | –0.028*** | –0.026*** |
| | (0.006) | (0.008) |
| Number of observations | 13056 | 8056 |
| Number of firms | 3264 | 2014 |
| *F* statistics | 5.0*** | 3.0** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. In column (ii), non-independent firms and firms classified as construction or real estate activities are excluded from the sample. For firm age, $AGE2_t$ is the reference category in all columns.

Source: Author's own elaboration based on Orbis database.

start-up firms with higher profitability increase their total assets. However, we found little evidence that profitability positively affects sales growth for start-up firms. In contrast, the results provided support for the notion that profitability is derived from sales growth. We also found that firm growth depends heavily on firm age during the start-up stage, suggesting that sales growth depends on firm lifecycle. Our findings imply that start-up firms expand their businesses without internal financing in growing economies such as Colombia, and that they can generate internal finance through their sales growth.

There are, however, limitations to this study. First, we did not identify whether the relationship between firm growth and profitability is derived from firm selection or financial constraints. Second, we prioritised tracing firm growth during the period from the first to the fifth accounting year, and we did not consider firm exit. Third, we did not examine the effects of market conditions and competition on firm growth and profitability, even though start-up firms would be susceptible to market conditions and competition. Fourth, we did not examine the growth of start-up firms in other countries, and a positive relationship between sales growth and profitability may be evident only in Colombia. Different findings may arise in stagnant economies, such as some European countries and Japan. Further investigation is required to better understand how the growth of start-up firms is determined in various developed and developing economies.

Despite the study's limitations, we provide some insights into firm growth during the start-up stage. Our findings provide supportive evidence that firm growth depends heavily on firm age. In particular, the findings of this study suggest that start-up firms do not increase their sales by means of profitability; they do, however, increase their assets through retained earnings in accordance with profitability. The findings also suggest that the mechanism of sales growth differs from that of asset growth for start-up firms. In addition, sales growth generates profitability for start-up firms. To sustain new businesses, as the findings of this study suggest, firms should seek sales growth during the start-up stage. Moreover, as economic growth is found to be related to the sales growth of start-up firms, potential entrepreneurs should pay more attention to macroeconomic conditions. Furthermore, we contribute by providing new evidence on the growth and profitability relationship in Colombia. Little previous attention has been paid to the growth of start-up firms in developing economies.

There are several implications as a result of the findings of this study. To date, policy support for potential entrepreneurs and small businesses has often been enacted for mitigating financial constraints in many countries. Essentially, some scholars have emphasized the existence of financial constraints (e.g., Carpenter and Petersen, 2002; Fazzari et al., 1988). However, as Coad (2009) argued, the issue of financial constrains impeding firm growth may be exaggerated. In practice, the results do not demonstrate that the cash flow ratio induces sales growth, even though business start-ups generally tend to be financially constrained. In Santarelli and Vivarelli's (2007) opinion, firms' post-entry performance, includ-

ing survival/failure and growth, should be seen as socially optimal rather than the result of either financial market imperfections or other market failures. Firms with higher capabilities may not only be able to increase their sales but also to secure internal finance. Our findings imply that sales growth depends on firm lifecycle rather than on the level of cash flow during the start-up stage. Paying attention to a firm's dynamic change over time would be more useful to understand the post-entry performance of firms in growing economies.

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# APPENDIX

Table A1 describes the distribution of start-up firms by industry. Tables A2 and A3 show the estimation results for sales growth and asset growth, respectively, when we divide the sample by founding year. It is important to note that columns (iv) include firms founded in 2009 and 2010 because the number of observations for 2010 is small (only 260).

**Table A1.**
Distribution of Start-up Firms by Industry

| NACE | Industry | *N* | (%) |
|---|---|---|---|
| C | Manufacturing | 549 | (16.8) |
| F | Construction | 325 | (10.0) |
| G | Wholesale and retail trade | 1026 | (31.4) |
| H | Transportation and storage | 142 | (4.4) |
| I | Accommodation and food service activities | 56 | (1.7) |
| J | Information and communication | 225 | (6.9) |
| L | Real estate activities | 165 | (5.1) |
| M | Professional, scientific, and technical activities | 537 | (16.5) |
| N | Administrative and support service activities | 187 | (5.7) |
| R | Arts, entertainment, and recreation | 16 | (0.5) |
| S | Other service activities | 36 | (1.1) |
| | Total | 3264 | (100.0) |

Notes: *N* indicates the number of firms. NACE indicates the NACE version 2 main section.
Source: Author's own elaboration based on Orbis database.

**Table A2.**
Estimation Results for Sales Growth by Founding Year ( $GROW\_S_{it}$ )

| Variable | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009–2010** |
| | **FE** | **FE** | **FE** | **FE** |
| $(CF/A)_{it-1}$ | –0.516*** | –0.563*** | –0.517*** | –0.173 |
| | (0.111) | (0.108) | (0.093) | (0.117) |
| $(FA/A)_{it-1}$ | 0.260** | 0.232 | 0.310*** | 0.241 |
| | (0.117) | (0.148) | (0.114) | (0.148) |
| $AGE3_t$ | –0.376*** | –0.320*** | –0.372*** | –0.373*** |
| | (0.047) | (0.051) | (0.061) | (0.055) |
| $AGE4_t$ | –0.423*** | –0.367*** | –0.425*** | –0.408*** |
| | (0.045) | (0.047) | (0.047) | (0.052) |
| $AGE5_t$ | –0.393*** | –0.463*** | –0.521*** | –0.425*** |
| | (0.042) | (0.045) | (0.046) | (0.053) |
| Number of observations | 3392 | 3476 | 3744 | 2444 |
| Number of firms | 848 | 869 | 936 | 611 |
| *F* statistics | 28.1*** | 27.7*** | 36.0*** | 18.3*** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. For firm age, $AGE2_t$ is the reference category.
Source: Author's own elaboration based on Orbis database.

**Table A3.**
Estimation Results for Asset Growth by Founding Year ($GROW\_A_{it}$)

| Variable | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009–2010** |
| | **FE** | **FE** | **FE** | **FE** |
| $(CF/A)_{it-1}$ | 0.179*** | 0.231*** | 0.182*** | 0.291*** |
| | (0.069) | (0.069) | (0.062) | (0.101) |
| $(FA/A)_{it-1}$ | 0.108 | 0.282** | 0.011 | –0.052 |
| | (0.097) | (0.120) | (0.075) | (0.109) |
| $AGE3_t$ | –0.154*** | –0.143*** | –0.135*** | –0.156*** |
| | (0.035) | (0.032) | (0.033) | (0.033) |
| $AGE4_t$ | –0.143*** | –0.167*** | –0.169*** | –0.194*** |
| | (0.029) | (0.029) | (0.028) | (0.033) |
| $AGE5_t$ | –0.178*** | –0.218*** | –0.201*** | –0.228*** |
| | (0.029) | (0.028) | (0.027) | (0.033) |
| Number of observations | 3392 | 3476 | 3744 | 2444 |
| Number of firms | 848 | 869 | 936 | 611 |
| *F* statistics | 9.5*** | 15.5*** | 14.6*** | 13.0*** |

Notes: Figures in parentheses are robust standard errors. ***, **, and * indicate the 1%, 5%, and 10% significance levels, respectively. FE indicates fixed-effects estimation. For firm age, $AGE2_t$ is the reference category.
Source: Author's own elaboration based on Orbis database.

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