

Does gender matter for innovative and non-innovative firms' growth? An empirical analysis of Chilean managers

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Abstract:

Firm growth has been a focus of attention for a large number of studies. However, the influence of a firm's manager is still absent from many of these analyzes. Departing from the data of the Longitudinal Survey of Businesses from Chile, the aim of this article is to analyze the relationship between innovation and firm growth depending on the sex of the leader between 2007 and 2015. Applying econometric models of quantiles with fixed effects, the results reveal that there is a positive relationship between innovation, firms led by women and sales growth. In particular, male managers exert a negative impact on the firm growth. This impact is particularly more important for non-innovative firms. Finally, the growth rate increases if a female manager replaces to a male manager. Conversely, the growth rate decreases if a male manager replaces a female manager.

Keywords: firm growth, innovation, sex, gender, Chile, manager

JEL Codes: O30, L10, J16

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1. Introduction

In order to foster the innovation level of firms in emerging countries, it is necessary to design a strategy which succeeds in transforming the productive infrastructure, through the knowledge economy and, to a lesser extent, the development of commodities. In this process, emerging economies must involve in learning — and overcome difficulties in learning — in order to boost their innovative capability and competitiveness (Choi et al., 2011; Gu and Tse, 2010; Kim and Nelson, 2000; Nelson, 2004). However, emerging economies have different institutional characteristics and firm determinants in relation to firm growth (see Segarra, Teruel and Jové, 2016). Chile is an interesting case for different reasons. First, Chile appears in first position on the Ranking Global Entrepreneurship Index after the more developed economies (Acs et al., 2017). However, there is still a long way to push the Chilean technological frontier. Second, the intense access of women in the labour market (INE, I.D.E, 2015) may have facilitated the access of women to managerial positions. The access of women to leadership positions has potential economic benefits (Woetzel, 2015), which could double the contribution of women to global GDP growth.

Despite the potential positive externalities of the access of women to managerial positions, various studies in Latin America find that large firms are mainly led by men, while women present greater participation in smaller-sized firms (see for instance Solarte et al., 2012). Simultaneously, the empirical evidence indicates a lack of opportunities for companies led by women (Ilie et al., 2018; Adame and García, 2016; Powers and Magnoni, 2010; García and Moreno, 2010; Escandon and Arias S, 2011; Heller, 2010). All the above could cause, on the one hand, that female-led firms have a lower performance than male-led firms and, on the other hand, problems of inclusive innovation in Chile in line with previous evidence (Jiménez, 2018). Conversely, there is evidence which confirms that the leadership style of women improves firm performance, mainly in firms developing innovative strategies (Dezső and Ross, 2008).

Based on these previous arguments, we argue that the lower opportunities are directly related to firm and sector characteristics than to the managerial capacity of females. Hence, this study has two different aims: i) to analyse the impact of female leadership on firm growth in Chile; ii) to analyse whether there are differences between innovative and non-innovative firms. With these purposes, we use a database from the Longitudinal Survey of Businesses (Encuesta Longitudinal de Empresas), carried out in Chile between 2007 and 2015. The study applies fixed effect quantiles in order to analyze the role of women in the growth of

innovative and non-innovative firms. The innovative firms tend to have more workers, and tend to be firms with male managers. However, firms led by women have a greater propensity to hire women than firms led by men and tend to hire more female workers to occupy leadership positions. The data on participation of innovative firms by group, which indicate that 87% of firms which innovate are medium and big, these being mostly led by men. Our initial empirical data highlights the importance of controlling for firm characteristics. The econometric results show that when considering unobserved firm and sector characteristics firms that are innovative and those that are led by women have higher sales growth rates. Furthermore, when controlling for the change of the sex of the manager we observe that firms that change the sex of the manager from male to female obtain higher growth rates in the subsequent period. Conversely, the growth rate decreases if a male manager replaces a female manager.

Our research contributes to two aspects of the empirical literature. First, the analysis offers evidence about the firm growth for a panel of companies in an emerging Latin American country. Chile represents a paradoxical case within Latin America, due to its capacity for entrepreneurship and internationalization. Carrying out the study in Chile can therefore uncover some of the factors behind its greater capacity for growth. Second, the analysis of the impact of the leadership of women in firm growth for innovative and non-innovative firms will allow the definition of the role that women can play in emerging markets.

The structure of this study consists of five sections which are described below. The second section indicates the conceptual framework, developing a brief discussion of the literature related to firm growth, innovation and the sex of managers. The following section presents the database, from the compilation of the data (survey design and application), to the procedure used to filter the data collected. Furthermore, we present the variables used. The fourth section presents the methodological framework used for the development of the research. The following section develops the analysis of the results, together with their interpretation. Finally, the conclusions arising from the results obtained are developed.

2. Literature

2.1. The role of women on firm growth

There is a wide empirical and theoretical literature on firm growth (Coad, 2009). This has given rise to the analysis of the determinants of firm growth, such as innovation, firm age,

financial resources, among others (see, for instance, Coad et al., 2013, 2016; Bianchini et al., 2018). Despite this broad empirical knowledge on the determinants of firm growth, there are still some questions to be analyzed. In particular, in economies where there are limited resources, it is necessary to analyze the capacity of managers to maximize the potential growth (Bartz-Zuccala et al., 2018).

In this context, managerial capabilities become a crucial determinant to increase the efficiency of economic resources (Peng, 2001). Hence, capable managers are one of the prerequisites to increase firm growth due to the limited resources in these economies (Peng and Heath, 1996). This means that their skills, experience and background will be a key resource in order to enhance the capacity of firm performance. Hence, analyzing the characteristics of the managers is a relevant question. In this regard, there is broad literature arguing that the sex of the manager may have an impact on firm performance. Some authors consider that sex is a relevant factor among the demographic characteristics that influences performance. Some empirical studies report that men and women differ in their relational orientation (Riger and Gilligan, 1980; Cartwright and Gale 1995), market orientation (Davis et al., 2010), preference for risk, decision making, experience, among others (Hudgens and Fatkin, 1985; Johnson and Powell, 1994; Levin et al., 1988; Sexton and Bowman-Upton, 1990; Booth and Katic, 2013).

When observing the sex of managers, the empirical evidence shows that managerial activity is a traditionally male occupation where women obtain less valued returns. For instance, female managers are paid less than male managers and their probability of promotion in comparison with male managers is lower (Clark, 1997; Gorman and Kmec, 2009; Metz and Tharenou, 2001; Kunze and Miller, 2014). Finally, female managers have shorter career ladders that tend to place them in less influential positions (Baron et al., 1986; DiPrete and Soule, 1988). Hence, the evidence shows that women do not have the same capacity to occupy managerial positions, and those who do achieve this may have more difficulties.

However, once they occupy a managerial position, the evidence also fails to support their performance. The underlying assumption in this literature is that men and women tend to have different experiences and skills resulting in different knowledge and different sources of information. For instance, men and women tend to use different evaluative criteria on assessing alternatives (Crow et al., 1991; Park, 1996).

This performance gap between sexes has been attributed to different reasons which may influence firm growth. First, women may show a lower risk appetite compared to men (Harris

and Jenkins, 2006). The fact that women are more cautious may diminish their propensity to invest in high—profitable risks but with high risks. Consequently, this may explain a lower profitability of female companies. Second, female managers are interested in different goals compared to men. For instance, they have a wider set of goals, such as achieving a work-life balance and employees' well-being, in addition to traditional firm performance indicators (Justo et al., 2015). Third, other authors have pointed out to the limited resources of businesses run by women are mainly due to the insufficient previous professional experience of the founders (Fairlie and Robb, 2009) and a greater difficulty in accessing capital and social networks (Aldrich, 1989). The latter are particularly important in emerging economies, where interpersonal networks serve as informal substitutes for formal institutional support. For instance, managers' interpersonal ties may facilitate growth during institutional transitions for incumbent firms and start-ups.

Furthermore, we argue that female managers are usually in smaller firms and in less technological sectors. These sectoral and firm characteristics may influence per se the firm growth rate which will affect more to female-led firms. Consequently, on average, firms managed by women will have less capacity to grow. Therefore, we aim to control for these variables in order to disentangle these differences.

2.2. The role of women in innovation

While there is wide literature related on the positive impact of the involvement of women in the innovation process, there is a great concern in order to increase the presence of female in the generation of knowledge and innovation. According to Burk (2011), there are three different dimensions of knowledge that women may contribute: technological practice, scientific knowledge and situated knowledge. Firstly, arguments exist that women are less affected by the dominant societal paradigm and they may have a more unique view of the world (technological practice). Secondly, several other arguments are noteworthy, and which state that science excludes knowledge or ways of understanding that have been assigned to individuals who fulfil a specific, subordinated social role (scientific knowledge). Thirdly, other arguments state that assumptions on which scientific knowledge is based may be also biased (situated knowledge).

All of this has given rise to a growing interest of scholars to define the incidence of women on the innovation development. Traditionally sex attributes have been signalled as having an

incidence on the innovation. Previous literature has suggested several channels through which sex of managers may affect innovation. First, it innovation is a risky activity; since on average women tend to be more risk-averse than men (Booth and Katic, 2013) they will be more cautious in the participation in innovation projects. Barua et al. (2010) point out that firms with female managers present financial decisions which are less risky. Second, innovation entails costs that may require access to finance, and women may have reduced access to finance compared to men (Muravyev et al., 2009). Third, most firms managed or solely owned by women are young and small and have more difficulty obtaining credit (Amin, 2010). Forth, women may self-select in routine sectors with lower mean productivity (Bardasi et al., 2011).

The previous arguments consider that women have traits that difficult their involvement in innovation projects, selection of innovation projects and also their capacity to develop innovation projects. However, there also alternative explanations about the lower participation of women in R&D and innovation. First, there is a lower number of women interested in studying STEM hence it diminishes their capacity to be present in the innovation projects. This will be a pure statistical problem. Second, other reasons may impede the participation of women in innovation careers such as their preference or even their obliged secondary role in innovation projects. As a consequence, if innovations are usually generated by male, this will cause a bias against women (Burk, 2011).

Here, we consider that innovations as the development of new products and new processes (technological innovations) and marketing and organization (non-technological innovations). Social innovations may also be included in these definitions since they may have involve a modification of the characteristics of a product to respond to needs of particular segments with special needs, we may develop less polluting production processes and so on. Consequently, we may also consider not-only economic impacts but also non-economic goals which at the end may have economic consequences at firm level since they may increase the reputation of the company and increase their sales.

However, we argue that sectoral and firm characteristics may influence the access to innovation resources. Controlling for these characteristics, female-led firms may have a two opposite effects due to their different managerial capabilities. On the one hand, female-led firms may have more difficulties to exploit innovative opportunities due to their different goals or skills. On the other hand, in a context in which managers have to manage

with limited resources, women may have skills which will facilitate a better management of scarce resources.

2.3. The Chilean context

In the context of Chilean firms, the empirical evidence shows that firms that innovate have a higher survival rate when they have a diversified portfolio (Fernandes and Paunov, 2015). Furthermore, Chilean firms suffer from severe financial obstacles for innovation. These barriers are particularly important for SMEs and are specific to innovation-related investments (Álvarez and Crespi, 2015). Barrera and Bisama (2016) show that R&D and innovation activities are positively influenced by male managers and their education level, while firm age and experience are not significant. While Barker and Mueller (2002) find that those firms that invest in R&D have younger managers and their educational level has no influence. Concerning access to public support for innovation, it is also necessary to understand that, in the programme to promote start-ups (CTIE, 2016), only 12.8% of participants were women.

Despite the potential positive externalities of the access of women to managerial positions, various studies in Latin America find that large firms are mainly led by men, while women present greater participation in smaller-sized firms (see for instance Solarte et al., 2012). Simultaneously, the empirical evidence indicates a lack of opportunities for companies led by women (Ilie et al., 2018; Adame and García, 2016; Powers and Magnoni, 2010; García and Moreno, 2010; Escandon and Arias S, 2011; Heller, 2010). All the above could cause that female-led firms have a lower performance than male-led ones and the problems of inclusive innovation in Chile in line with previous evidence (Jiménez, 2018). Conversely, there is evidence which confirms that the leadership style of women improves firm performance, mainly in firms developing innovative strategies (Dezsó and Ross, 2008).

All the above sections point out to the fact that women have lower returns despite their different managerial style. The traditional approach in the empirical literature considers the sex as a proxy of the traits and profiles that affect the managerial capabilities. Attitudes and perceptions such as risk aversion, growth ambitions, or self-efficacy are usually captured in the variable of sex (e.g., Sexton & Bowman-Upton 1990). The measurement of these traits is not straightforward in common statistics and hence this is a proxy used in the literature. However, we argue that part of the results are due to sectoral and firm characteristics that

will affect their performance. Hence, our research draws on this debate and aims to analyse two aspects: first, the impact of female leadership on firm growth in Chile; second, the analysis of the differences between innovative and non-innovative firms. Considering the merciless speed of technological, social, and cultural changes, we wonder whether the performance gap mentioned above is still more relevant for firms in an emerging economy such as Chile and whether there are differences between innovative and non-innovative firms

3. Database and variables

3.1. Database and variables

The database used in this study corresponds to the Longitudinal Survey of Businesses (ELE, Encuesta Longitudinal de Empresas) carried out in Chile in the years 2007, 2009, 2012 and 2015, developed by the Ministry of Economy, Development and Tourism together with the Internal Taxation Service. The aim of this survey is to characterize firms in national territory with sales levels higher than 800.01 Unidades de Fomento (UF), according to their economic activity and sales size, identifying determinants of business development.

The panel has a total of 32,626 observations. The total number of firms are 21,823 firms, of which 15,354 firms participated only once in the surveys. For the econometric analyses, we select firms which participated in two or more surveys, obtaining a total number of 17,272 observations belonging to 6,469 firms.

The sex of the manager is our main explanatory variable of interest. Following previous empirical studies (Barbero et al., 2011; Coad and Hölzl, 2012; Serrasqueiro et al., 2010; Becchetti and Trovato, 2002; Olivares Contreras and Vaillant, 2013), we include other variables related to firm characteristic, characteristics of manager, and their innovation profile. Our explanatory variables are the following:

- **Sales growth:** this corresponds to the firm growth, a variable created starting from the sales data between two consecutive years of the company. The sales growth has not been deflated since we ignore the product composition. Hence, the variable not only will capture the growth in terms of the amount but also in price.
- **Sex:** this corresponds to the sex of the manager. This is a categorical variable which has a value of 1 when it is a man and 0 when it is a woman.

- **Size:** the size is defined as the annual sales level of the firms in four categories (micro-enterprise, small, medium and big enterprise).
- **Firm age:** this variable measures the number of years for which the company has existed. This is measured from the date of establishment, considering the number of years for which the firm has operated up to the year on which the survey was carried out.
- **Manager age:** This corresponds to the age of the manager.
- **Experience:** This variable measures the years of experience that the manager has in the company.
- **Number of workers:** this variable indicates the number of workers, considering both men and women.
- **Innovative firms:** for this study, an innovative firm is defined as one which has at least one of these three categories: i) it has received a CORFO (Corporation for Production Development – Corporación de Fomento de la Producción) fund; ii) it has a R&D department and personnel; iii) it has invested in R&D.
- **Export firms:** Dummy variable which takes a value equal to 1 when the firm exports and 0 when it does not.
- **Sector:** this variable corresponds to the economic activities carried out by the firms. In this study, the firms are classified in 11 categories, which are defined in the Internal Taxation Service. The following sectors are included: Agriculture, livestock, fishing, forestry and hunting; mining and quarrying; manufacturing industries; electricity, gas and water supplies; construction; wholesale and retail trade, repair of automotive vehicles, motorcycles, personal effects and household goods; hotels and restaurants; transport, storage and communication; financial intermediation; property, business and rental activities; other activities.

3.2 Statistical descriptive

In emerging economies, such as Chile, the institutional context has given rise to the appearance of dynamic economic sectors, which have facilitated the growth of firms. Furthermore, the development of a set of innovative policy tools endeavours to foster firm growth and the innovation propensity of firms such as incumbents and start-ups. The aim of this subsection is to show firm growth according to the sex of the manager.

Table 1 shows that there is a higher prevalence of men leading firms and a low participation of women in management positions. One interesting result is that the firms led by women have a higher percentage of women working for them both in general terms and in management positions, compared with the firms which have male managers and which present low percentages of recruitment of the opposite sex. This is an interesting result since previous results have shown that the impact of female leadership on firm performance increases with the share of female workers (Flabbi et al., 2019; Nakagawa et al., 2014).

Moreover, firms led by women have a smaller size and a lower propensity for internationalization and innovation. This is an interesting result since it shows that there are differences in the natures and the sector of the firm.

Insert Table 1

In relation to firm age, the average age of firms led by women is 15 years while for those led by men it is 17 years. If we compare this with the innovative firms, the firm age increases to 16 years for those led by women, while for those led by men it is 20 years. This first approximation shows that women are in charge of companies with less experience in the market. When we differentiate by the innovative activity, we observe that non-innovative firms present a higher percentage of women leading firms and the difference between the sex of the leaders increases more in innovative firms. Finally, we should highlight that the percentage of exporting firms is higher among the firms which are innovative, as is the average number of workers in this type of firm.

Insert Table 2

As suggested by table 2, firms led by men represent 83.2%, while only 16.82% are led by women. If we analyze innovative firms with less than 10 years of existence, those led by women represent 13.18% compared with 86.82% led by men. Meanwhile, if we analyze innovative firms with more than 10 years of existence, those led by women represent 7.53% compared with 92.47% led by men. This indicates a very low participation of women in management positions of organizations which decreases over time.

Table 3 presents a detail analysis of the workers variable, but considering innovative firms with less and more than 10 years of existence, contrasting with the sex of the manager variable. The data shows the differences existing between the share of female workers depending on the sex of the manager. Thus, no difference is observed between the firms run by the same sex on considering whether or not they are innovative. Conversely, there are

significant differences of the share of female workers for each sex of the leader. Hence, female leaders manage firms where there is a higher presence of female workers.

Insert Table 3

Figure 1 analyzes shows the percentage of firms with female managers, according to the firm size and the innovation behaviour. The results show that the highest percentage of participation is 31% in small enterprises, with 21% in micro-enterprises, while the lowest percentages of participation are 17% for big enterprises and 14% for medium enterprises. However, if we analyze only the innovative firms led by women, the data shows a considerable increase in participation in large enterprises. On the contrary, for micro-enterprises, the share of women decreases when only innovative firms are selected. Hence, when we consider the whole distribution of firms, females are more concentrated in micro and small firms, while once we consider innovative firms we observe that females are leading large companies. This may point out to the different nature and abilities of female managers.

Insert Figure 1

Below we present the share of sales growth between two years, differentiating by sex (Figure 2). In order to construct these distributions, we use a non-parametric estimation of density functions by means of the kernel method. This method allows the density function of sales growth to be viewed considering the sex of the manager.

Insert Figure 2

Figure 2a) does not show significant differences between the sales growth obtained according to sex. Conversely, differences are observed when an analysis is performed between innovative and non-innovative firms (Figure 2b). It is thus observed that innovative firms present higher rates of growth than those which are not innovative.

Furthermore, if we perform a breakdown by sex for innovative firms (Figure 3), the above analysis is performed but differentiating innovative and non-innovative firms. The figures only show changes for innovative firms. In this case when a firm is innovative there are differences between sales growth, and these differences are positive when the manager is male.

Insert Figure 3

4. Econometric methodology

Our main equation departs from a production function in which the different input resources affect firm performance (*GrlnSales*). We distinguish between firms that have devoted efforts in innovation and those that do not and between firms led by males. The following econometric method is developed to solve the relationship between sex of the firm leader and firm growth:

$$GrlnSales_{it} = \beta_0 + \beta_1 Sex_{it-1} + \beta_2 Inno_{it-1} + X_{it-1}\beta_3 + \varepsilon_{1it} \quad [1]$$

Where β_i are the coefficients and ε_{it} is the usual error term of firm i at time t . In this analysis, the dependent variable is the logarithmic growth of sales (*GrlnSales*). We focus on the explanatory variables *Sex* and *Inno* in order to capture the impact of male managers and innovation on firm growth. *Sex* identifies the male managers, while *Inno* identifies a firm that has devoted effort on innovation activities. In this case, our innovation variables will include input innovation variables. We consider innovation inputs since in this way we can analyse the impact on sales growth regardless the firms has been able to develop successfully the innovation. Hence, we will capture not only the direct impact via improvement of products, processes, organizations and social innovations, but also some indirect impacts related to the learning processes. X is a set of explanatory variables which follow from previous work on the determinants of firm growth. Hence, we include the logarithmic firm age, the logarithmic years of manager's experience, the logarithmic number of workers, and a dummy identifying whether the firm exports. Finally, we include time and sector dummies to control for time periods. All the explanatory variables are in lags in order to control for potential endogeneity.

In this paper, we apply quantile regression in order to see the impact of these variables on growth. The quantile regression estimator was originally designed for the analysis of cross-sectional datasets (Koenker and Bassett, 1978). In view of the high heterogeneity of the firm growth distribution, characterized by heavy tails (see previous Figure 2), this is the most convenient econometric technique (Coad, 2009). However, recently, some works have applied this technique in a panel context in order to control time-invariant, firm-specific effects (Powell, 2016; Canay, 2011; Galvao, 2011; Koenker, 2004). We write the formula in a more general form:

$$Y_{it} = X_{it}\beta + \varepsilon_{it}$$

Hence, quantile regressions with fixed effects allows us to control for time and sector unobserved invariant characteristics. In order to obtain more precision in our inference, we report bootstrapped standard errors (with 100 bootstrap replications). The results of these regressions are given in the following section, where we present results for the $\theta = 0.10, 0.25, 0.50, 0.75$ and 0.90 quantiles.

5. Results

In order to be able to determine and compare results, we proceed to develop the quantile regression with fixed effects econometric model. The model proposes a generalization of the linear quantile regression model to accommodate possibilities afforded by panel data (Graham et al., 2015). The aim is to identify the variables which have a significant influence, in addition to their impact on sales growth of firms, considering the impact of the previous periods of the study. Table 4 shows the results obtained by the econometric model explained above.

Insert Table 4

On the basis of our results, there are seven variables that have statistically significant values. A negative effect is observed in relation to the variables of interest when the manager of the firm is male. On the other hand, the second variable of interest positively affects sales growth when the firm is an innovative firm. Conversely, female-led firms show a higher growth rate. Hence, our results confirm that controlling for our explanatory variables and also unobserved characteristics, female managers will affect a positive impact on the firm growth. Hence, the fact that female-led firms have a lower mean growth rate is not the cause of their managerial abilities but to some characteristics of the firms where they develop their tasks.

Concerning to variables related with the learning process at individual and firm level, it should be mentioned that older managers and more years of existence of the firm will positively affect sales growth across the distribution. Hence, the previous contacts and career experience of the manager reverts positively on the firm growth. Furthermore, already established firms will have an advantage in comparison with younger firms. Conversely, the

experience of the manager in the firms negatively affects growth. Hence, the results point out to the importance of a certain turnover among the managers.

Finally, the amount of workers and the export activity present negative coefficients. Hence, larger firms show lower firm growth measured in terms of sales in line with previous empirical evidence (see Coad et al., 2013; Coad et al., 2016) and those firms that enter into foreign markets do not have such a large amount of foreign markets.

However, the impact that our key variable may be sensitive to the innovative context of the company. Table 5 shows that male managers have a negative impact on the sales growth regardless the firm shows an innovative or non-innovative behaviour. However, the firm shows an interesting result. For innovative firms, we observe that the sex shows negative impact but with a less negative impact, while for non-innovative firms the coefficient shows an inverted-U shape.

Insert Table 5

For the low-growth firms located in the quantiles 10% and 25%, male managers have a more negative impact for innovative than non-innovative firms, while this pattern reverts once we take into account the patterns for high-growth firms (firms located in the quantiles 75% and 90%). Hence, in comparison with male-led firms, females managing innovative firms will perform better. However, the advantage is particularly larger for non-innovative firms.

However, the manager's sex variable is incorporated into the previous results as a dummy variable identifying the sex of manager. If we analyse the change in the sex of managers we observe that 6.2% of observations the manager leading the company changed from man to woman, while 3.2% change the sex of the manager from woman to man. However, we may consider the change of manager between two periods. Therefore, we generate two new explanatory variables. The first considers value 1 if the company changes from male to female manager and 0 if there was no change ($SexMW$), and the second variable is value 1 if the company changes from female manager to male and 0 if there were no changes ($SexWM$)¹.

Table 6 show the results obtained when replace the variable sex with the new two variable mentioned before

Insert Table 6

¹ During the revision process, one of our referees suggested us this analysis. We thank her/him for the idea.

The results are similar, but our new explanatory variables indicate statistically significant values for high-growth firms with growth rates in the 50%, 75% and 90% quantiles. First, our results show that regardless the change of the sex, the firm performance will increase. Second, when comparing the results according to the sex, we observe that when firms change from man to woman manager, the impact is larger than when the change of manager is from woman to man. Hence, the results confirm that controlling for all the explanatory variables, the change will have a positive benefit on firm growth.

5.2. Robustness checks

In order to be able to determine and compare results, we proceed to develop an econometric model with quantile regressions (Table 7). Quantile regressions will not control for time-invariant unobserved characteristics, consequently, the results may hide some internal firm characteristics. Therefore, we will see the effect of these controls. In comparison with our previous results (Table 4), a negative effect on sales growth is observed in relation to the variables of interest when the manager of the firm is male, for the first two quartiles, but there is a positive effect in the last quartile. The second variable of interest concerning innovative firms is not significant for this model.

Insert Table 7

In relation to firm age, it can be mentioned that an older age of the manager will positively affect the firm's sales growth for the second quartile, while the fourth quartile has the opposite effect, the results for the rest of the quartiles not being significant. In turn, a higher number of years of existence of a firm will have a negative effect on growth. On analyzing the experience of the manager in the activity, this also negatively affects the growth.

Finally, the number of workers positively affects growth for the first three quartiles, while for the last two quartiles an increase in the number of workers has a negative impact on growth. The export variable is significant and positive only for the first quartile.

6. Conclusions

Managerial capabilities has rised the attention to scholars due to their impact on the firm performance in particular in less developed countries. Capable managers are one of the prerequisites to increase firm growth due to the limited resources in these economies. In this

framework, the sex of the manager has been also one of the characteristics that may explain the different productive capacity of firms. Firm performance, and particularly innovation, is closely related to the risk preference of managers, the goals set up by the manager and the skills to manage limited to resources. In this regard, the different skills, experience and preferences of female leaders may have an influence on firm growth.

One of the main objectives of this study is to analyze the impact of the sex of the manager and innovation on firm growth for Chilean firms controlling for time-invariant variables which may affect the firm performance. This technical point is important since we must consider the effect of our key variables given a particular environment.

Our main results show that female leaders present a positive relationship when firm growth is analyzed and innovative firms also contribute to firm growth. Furthermore, our results show that female-led firms in non-innovative firms will exert a still higher positive impact in comparison with innovative firms. Hence, females contributions on firm growth is higher for firms in non-innovative firms in comparison with their contribution to innovative firms. Despite this, female managers will have a higher performance in innovative firms than their male counterparts.

Furthermore, our evidence shows that innovative firms tend to have more workers, and tend to be firms with male managers. However, one important point is that firms led by women have a greater propensity to hire women than firms led by men, for which the figures do not reach 30% of female workers. A more encouraging figure is that women tend to hire more female workers to occupy leadership positions, representing approximately 50%. All in all, sectoral and firm characteristics affect the firm growth. Hence, the evaluation of the firm performance by sexes must take into account the contextual factors.

In relation to the evidence which shows a low percentage of women running innovative firms, it is relevant to analyze the sociological phenomena which may be affecting the disproportion and the lack of participation of women in this type of firm. This may be influenced by the fact that women run smaller firms, which in turn are less innovative, this information being corroborated by the data on participation of innovative firms by group, which indicate that 87% of firms which innovate are medium and big, these being mostly led by men.

It is therefore recommended to generate conditions which facilitate innovation, research and development for smaller-sized companies. Although programmes focused on these areas

exist in Chile through the Corfo (Corporation for Production Development), the micro and small enterprise groups do not participate, whether due to lack of information, availability of resources, bureaucratic work or not having skilled personnel to implement the projects. It is therefore considered adequate to generate programmes exclusively for micro and small enterprises which are led by women, in addition to developing training programmes for female managers in order to foster innovation within organizations.

We acknowledge as limitations of the study not having greater diversity of data than those provided by the Longitudinal Survey of Businesses in relation to innovation. Furthermore, we are capturing behavioural performance of females just by their sex. Hence, future research lines should take into account to try to define some personality profiles more in depth. Additionally, in this investigation, we have not been able to differentiate between different types of innovations. However, future research lines could try to analyse the influence according to the type of innovations.

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Table 1. Descriptive analysis of the variables, considering the sex of the manager or innovative activity.

Análisis descriptivo de variables	2007		2010		2013		2015	
	Hombre	Mujer	Hombre	Mujer	Hombre	Mujer	Hombre	Mujer
Edad de la empresa	13	10	14	12	16	14	17	15
% Líderes por género	80	20	85	15	88	12	82	18
% Mujeres trabajadoras	26	45	25	46	27	42	28	40
% Mujeres en Cargos Directivos y/o Profesionales y Técnicos	21	55	19	61	16	50	16	41
Cantidad promedio de trabajadores	102	22	290	45	2588	104	2355	1805
% de empresas que exportan	7	3	12	5	18	11	17	14
% de empresas innovadoras	3	1	11	5	8	3	15	10

Análisis descriptivo de las variables considerando el año de realización de la encuesta y el género del líder de cada empresa

	2007		2010		2013		2015	
	Man	Woman	Man	Woman	Man	Woman	Man	Woman
Firm age	13	10	14	12	16	14	17	15
% Leaders by gender	80	20	85	15	88	12	82	18
% Female workers	26	45	25	46	27	42	28	40
% Women in Management and/or Professional and	21	55	19	61	16	50	16	41
Average number of work	48	11	87	32	271	188	274	213
% exporting firms	7	3	12	5	18	11	17	14
% innovative firms	3	1	11	5	8	3	15	10

Source: own elaboration from ELE.

Table 2. Number of firms according to sex of the manager.

	Non-innovative firms		Innovative firms				Total firms	
	Quantity	%	Equal or less than 10 years		More than 10 years		Quantity	%
Female	5,236	17.52	104	13.18	147	7.53	5,487	16.8%
Male	24,648	82.48	685	86.82	1,806	92.47	27,139	83.2%
Total	29,884		789		1,953		32,626	

Note: For innovative firms we differentiate between those which have 10 or fewer years of existence.

Source: own elaboration from ELE.

Table 3. Share of female workers according to sex of the manager and the innovative behaviour.

	Innovative firms with 10 or less years	Innovative firms with more than 10 years	Total
Female	44.3	40.4	43
Male	27.5	26.4	26.6

Source: own elaboration from ELE.

Table 4. Fixed effects quantile regression of Sales Growth ($GrlnSales_{it}$). Bootstrapping (100 reps).

	10%	25%	50%	75%	90%
Sex _{it-1}	-0.142*** (0.0154)	-0.151*** (0.0047)	-0.164*** (9.5x10 ⁻¹⁰)	-0.156*** (0.0040)	-0.137*** (0.0211)
lnManagAge _{it-1}	0.586*** (0.0334)	0.699*** (0.0114)	0.764*** (2.3x10 ⁻⁹)	0.696*** (0.0173)	0.604*** (0.0336)
lnAge _{it-1}	0.0511*** (0.0061)	0.0680*** (0.0016)	0.0731*** (4.0x10 ⁻¹⁰)	0.0890*** (0.0028)	0.107*** (0.0088)
Innov _{it-1}	0.112*** (0.0169)	0.120*** (0.0097)	0.181*** (5.2x10 ⁻⁹)	0.133*** (0.0055)	0.0897*** (0.0199)
lnExp _{it-1}	-0.0676*** (0.0098)	-0.0771*** (0.0037)	-0.0926*** (5.3x10 ⁻¹⁰)	-0.0836*** (0.0031)	-0.0712*** (0.0116)
lnWorkers _{it-1}	-0.0431*** (0.0030)	-0.0361*** (0.0007)	-0.0334*** (1.4x10 ⁻¹⁰)	-0.0263*** (0.0011)	-0.0248*** (0.0040)
Expo _{it-1}	-0.212*** (0.0133)	-0.247*** (0.0032)	-0.260*** (1.1x10 ⁻⁹)	-0.220*** (0.0119)	-0.206*** (0.0137)
Constant	-2.004*** (0.113)	-2.378*** (0.0348)	-2.585*** (7.9x10 ⁻⁹)	-2.384*** (0.0655)	-1.989*** (0.125)
Pseudo R ²	0.0597	0.1454	0.2045	0.1392	0.0599
Observations	9,218	9,218	9,218	9,218	9,218

Standard errors in parentheses

Time dummies are included.

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

Table 5. Fixed effects quantile regression of sales growth ($GrlnSales_{it}$). Bootstrapping (100 reps)

	10%	25%	50%	75%	90%
Innovative firms					
Sex _{it-1}	-0.155*** (0.0487)	-0.158*** (0.0146)	-0.164*** (0.0010)	-0.125*** (0.0194)	-0.0885*** (0.0333)
Non-innovative firms					
Sex _{it-1}	-0.134*** (0.0233)	-0.153*** (0.0055)	-0.164*** (9.2 x10 ⁻¹⁰)	-0.160*** (0.0047)	-0.145*** (0.0177)

All equations include the same control variables as in Table 8.

Standard errors in parentheses
Time dummies are included.
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Quantile regression of sales growth (GrlnSales_{it}). Bootstrapping (100 reps).

	10%	25%	50%	75%	90%
SexWM _{it-1}	-0.0534 (0.0839)	-0.0184 (0.0346)	0.0538* (0.0284)	0.106*** (0.0236)	0.126*** (0.0351)
SexMW _{it-1}	-0.130 (0.0916)	0.0181 (0.0395)	0.125*** (0.0180)	0.127*** (0.0093)	0.218** (0.0848)
lnManagAge _{it-1}	0.582*** (0.0314)	0.711*** (0.0134)	0.764*** (3.3 x10 ⁻⁹)	0.606*** (0.0123)	0.661*** (0.0315)
lnAge _{it-1}	0.0561*** (0.00912)	0.0690*** (0.0014)	0.0731*** (3.2x10 ⁻¹⁰)	0.0937*** (0.0034)	0.0959*** (0.0086)
Innov _{it-1}	0.107*** (0.0169)	0.115*** (0.0117)	0.181*** (4.3 x10 ⁻⁹)	0.116*** (0.0079)	0.102*** (0.0207)
lnWorkers _{it-1}	-0.0451*** (0.0042)	-0.0364*** (0.0006)	-0.0334*** (3.2x10 ⁻¹⁰)	-0.0365*** (0.0014)	-0.0285*** (0.0030)
lnExp _{it-1}	-0.0683*** (0.0010)	-0.0819*** (0.0033)	-0.0926*** (5.7x10 ⁻¹⁰)	-0.0854*** (0.00342)	-0.0795*** (0.0074)
Expo _{it-1}	-0.215*** (0.0155)	-0.249*** (0.0025)	-0.260*** (1.9x10 ⁻⁹)	-0.219*** (0.00712)	-0.220*** (0.0193)
Constant	-2.116*** (0.0933)	-2.557*** (0.0473)	-2.749*** (1.3x10 ⁻⁸)	-2.096*** (0.0466)	-2.254*** (0.124)
Observations	9,218	9,218	9,218	9,218	9,218

Standard errors in parentheses
Time dummies are included.
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Quantile regression of sales growth (GrlnSales_{it}). Bootstrapping (100 reps).

	10%	25%	50%	75%	90%
Sex _{it-1}	-0.0707*** (0.0245)	-0.0373*** (0.0123)	0.0044 (0.0062)	0.0262* (0.0142)	0.0795*** (0.0261)
lnAge _{it-1}	0.0278* (0.0156)	-0.0159*** (0.0051)	-0.0378*** (0.0046)	-0.0775*** (0.0050)	-0.165*** (0.0116)
Innov _{it-1}	0.0284 (0.0284)	-0.0051 (0.0163)	-0.0041 (0.00797)	-0.0106 (0.0097)	0.0420 (0.0294)
lnExp _{it-1}	-0.0321** (0.0135)	-0.0239*** (0.00531)	-0.0062** (0.0029)	-0.0047 (0.0051)	-0.0142 (0.0198)
lnWorkers _{it-1}	0.0264*** (0.0039)	0.0122*** (0.0018)	0.0041*** (0.0007)	-0.0045*** (0.0013)	-0.0199*** (0.0043)
lnManagAge _{it-1}	0.0768 (0.0545)	0.0482** (0.0226)	-0.0129 (0.0121)	-0.0423** (0.0171)	0.0055 (0.0514)
Expo _{it-1}	0.0528*** (0.0185)	0.0027 (0.0122)	-0.0013 (0.0085)	0.0011 (0.0074)	-0.0114 (0.0181)
Constant	-0.744*** (0.227)	-0.209** (0.0918)	0.201*** (0.0437)	0.588*** (0.0543)	0.929*** (0.166)
Pseudo R ²	0.0044	0.0023	0.0029	0.0101	0.0164

Observations 10,298 10,298 10,298 10,298 10,298

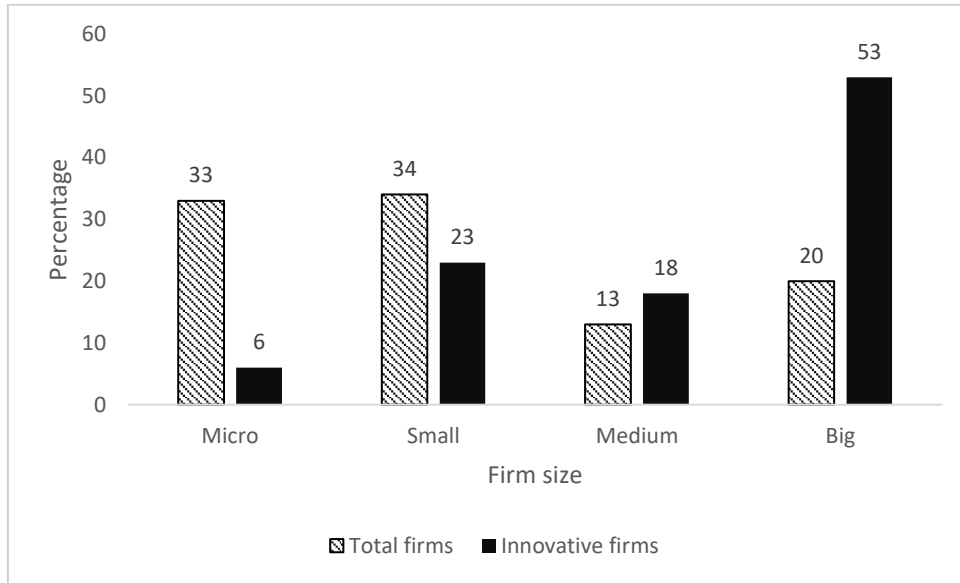
Standard errors in parentheses

Time dummies are included.

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

Note: Compiled by authors starting from ELE.

Figure 1. Distribution of firms led by women according to firm size (%).

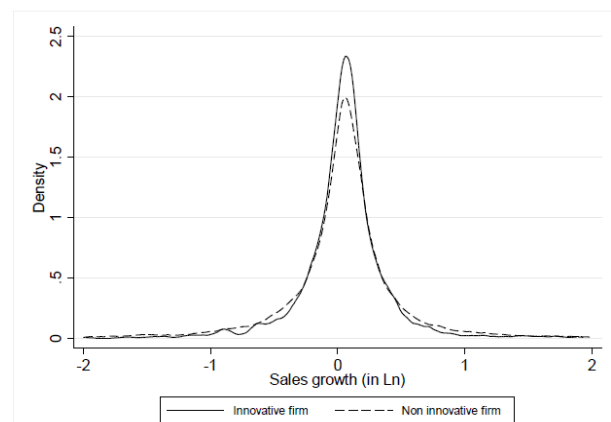
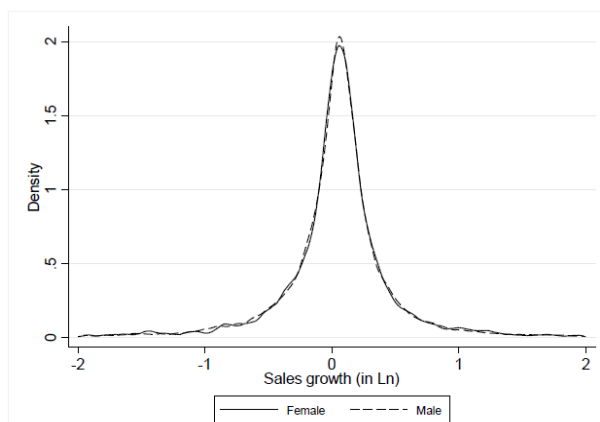


Source: own elaboration from ELE.

Figure 2. Kernel density of sales growth

a) According to sex of the manager
firm is

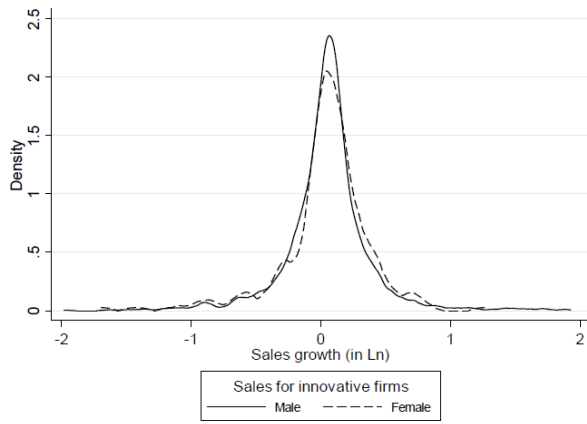
b) According to whether or not the
innovative



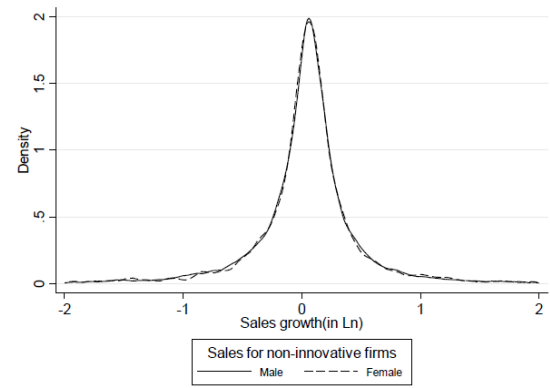
Source: Compiled by authors starting from ELE.

Figure 3. Kernel density of sales growth considering the sex of the manager

a) Innovative firms



b) Non-innovative firms



Source: own elaboration from data from ELE.

ANNEX

Table A-1. Description of the variables

Variables	Measurement
Sales growth (<i>GRlnSales</i>)	Sales growth between two years (in ln)
Sex (<i>gen</i>)	1= Male
Firm age (<i>lnAge</i>)	Firm age (in ln)
Age (<i>lnManagAge</i>)	Manager's age (in ln)
Innovative firm (<i>Inno</i>)	1 = Firm has innovative potential
Manager's experience (<i>lnExp</i>)	Years of experience (in ln)
Firm size (<i>lnWorkers</i>)	Number of workers (in ln)
Exports (<i>expo</i>)	1= if the company exports

Source: own elaboration from the data provided by ELE

Table A-2. Statistical descriptives and correlation of variables

	Mean	Std.Dev	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Sales growth(%)</i>	0.09	2.06	-23.74	35.21	1							
<i>Sex</i>	0.89	0.31	0	1	-0.0369	1						
<i>lnManagAge</i>	3.92	0.21	3.04	4.53	0.0928	0.0992	1					
<i>Firm Age</i>	2.54	0.80	0	5.07	0.0393	0.0607	0.2346	1				
<i>Inno</i>	0.10	0.29	0	1	0.0149	0.0582	-0.0458	0.0871	1			
<i>lnExp</i>	2.80	0.76	0	4.25	0.0245	0.1031	0.5868	0.1719	-0.0601	1		
<i>lnWorkers</i>	4.73	2.36	0	12.69	-0.0567	0.157	-0.0274	0.2398	0.1652	-0.0835	1	
<i>expo</i>	0.16	0.37	0	1	-0.0728	0.0579	-0.0376	0.1036	0.2121	-0.0328	0.1968	1

Source: own elaboration from the data provided by ELE