EIEF WORKING PAPER SERIES

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EINAUDI INSTITUTE FOR ECONOMICS AND FINANCE

EIEF Working Paper 19/10

December 2010

Understanding the Size and Profitability of Firms: The Role of a Biological Factor

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Understanding the size and profitability of firms: The role of a biological factor*

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First draft: August 2010;
this draft: December 22, 2010

Abstract

We collect information on prenatal testosterone in a large sample of entrepreneurs by measuring the length of their 2th to 4th fingers in face to face interviews. Entrepreneurs with higher exposure to prenatal testosterone (lower second to fourth digit ratio) manage larger firms, are matched with larger firms when acquire control and experience faster average growth over the years they manage the firm. We also find that prenatal testosterone is correlated with elicited measures of entrepreneurial skills such as ability to stand work, and the latter are correlated with firm size. This evidence suggests entrepreneurial skills have a biological component and is consistent with models of the size distribution of firms based on entrepreneurial ability. However, firms run by high-testosterone entrepreneurs have lower profitability as measured by return on assets. We offer evidence that this is because the same biological factor that enhances entrepreneurial skills also induces empire building preferences, which leads high-testosterone entrepreneurs to target a firm size that exceeds the profit maximizing value.

JEL Classification: L26, L21, L25, D22

Keywords: Firm size distribution, Entrepreneurial success, Digit ratio

*We thank for helpful comments Fabiano Schivardi and seminar participants at the European University Institute,the Einaudi Institute for Economics and Finance, University of California Los Angeles, University College London, the conference New directions in applied microeconomics, NYU-Villa la Pietra. Aldo Rustichini acknowledges financial support of the ESRC grant RES-062-23-1385

1 Introduction

Firms in a market economy vary widely in size, profitability, and survival. What are the factors determining these observed variables, and how they operate, has been active topic of research in industrial organization and more generally in economic theory (Sutton, 1997; Luttmer, 2010, survey some of the main theories and findings in this area.). It is known that the distribution of the firms' size is highly skewed to the right (Quandt, 1966) and follows approximately a power law (Gabaix, 2009): the number of firms with n or more employees is approximately $1/n$ to some power a little larger than 1. This distribution is stable, and is very different from the prediction of an approximately unique firm size that can be derived from u-shaped average cost curves (Viner, 1932, Hymer et al., 1962). One possible explanation is an underlying stable factor inducing this distribution. This is the strategy pursued by Lucas (1978) (see also Prescott & Visscher 1980, and Rosen, 1982). What is this factor?

In Lucas' model it is a managerial skill or talent each agent in a population is endowed with, which is drawn from a probability distribution. Given their talent agents choose the type of employment: become workers, earning equilibrium wage, or being a manager/entrepreneur, earning profit of the firm they manage. A firm consists of a manager and units of capital and labor employed. The production function is linearly homogenous. Returns to scale in the control of the firm are decreasing, so the effective output of the firm is a decreasing function of the total potential output. The skill of the manager/entrepreneur multiplies this output. A type of firm is identified by the skill of the manager.

The equilibrium of this model[1] has a simple characterization: agents with skill larger than threshold become managers, the other workers. At equilibrium, marginal products of both factors are equal across firms, and so is capital labor ratio. By the previous result, firm size can be measured equivalently by capital or labor or output, and is increasing in the skill factor. Total profits are larger at larger firms but profitability (profits per unit of capital) is the same if firms face the same cost of capital.

The theory provides a link between the distribution of the managerial skill and, for a given technology of production and control, observed variables, such as profits, size and managerial skill. A test of the theory should presumably be a test of this link. However, whereas wages, profits, allocation of capital and labor are all observable, the managerial skill can only be observed indirectly, through its effects on the type of employment of the agent and, if he is a manager, on size, profitability and duration of the firm. Thus, a direct test is impossible, unless one is willing to conjecture possible measurements, independent of firm's performance of this skill. This is what we plan to do here.

[1]Equilibrium is an allocation of population to managers and workers, an allocation of capital and labor to each type of firm, and wage and rental price of capital which satisfies standard conditions. First, the allocation is feasible (total capital is less or equal to the amount available, and total labor is less or equal to the total population of workers), and second, the individual optimality conditions must be satisfied: for every level of skill, the choice of employment is optimal, and for each firm the capital and lobar used are profit maximizing.

There are additional important questions that the theory is forced to leave unanswered, and that we address. The first is what precisely is the mechanism through which the managerial skill affects the economic life of a firm? In Lucas' model, managerial skill is equivalent to a total productivity factor, multiplying the production function after the decreasing returns due to the constraints of span of control are taken into account. Other ways in which the skill operates are possible. Knight (1921) identified the skill with the ability to deal with uncertain, as opposed to risky, choices. If we do introduce uncertainty (or ambiguity), the attitude to risk might be an important factor in explaining an entrepreneur's career choice, and his success in the business: an entrepreneur has, among other qualities, a willingness to take risks. This would make however a poor explanation: being reckless is hardly a sufficient condition for success in business, since at least the ability to identify profitable opportunities among the many risky ones is also required. Hence perhaps a combination of willingness to take risks and good cognitive skills is required. Since these characteristics are in some measure correlated (Burks et al., 2009), this is a plausible conjecture, and we provide some evidence below.

So far we have identified managerial qualities with skills, in a model where profit maximization is the only criterion managers want to maximize. A different view proposes that the distinguishing feature of a manager is the preferences he has: these preferences explain both his decision to be a manager in the first place and his subsequent decisions as leader of the firm. For example Baumol (1959) suggests that for larger oligopolistic firms, managers may have a different set of objectives than profit maximization, like maximizing sales (or total revenue) subject to a profit constraint. Other examples of this literature, that deals with managers of large firms, are Schumpeter (1911-1934) and the idea of managers as empire-builders, Marris (1964) and Baumol (1962), with the idea that managers may have growth instead of profit maximization and, along the same line, Williamson (1974). The free cash flow theory (Jensen (1986)) predicts specifically that managers may have incentives, and the means to satisfy them, to cause their firms to grow beyond their optimal size. As we noted, this literature analyzes incentives and behavior of corporate managers and in particular the conflict of interest with shareholders, presumably because for small firms the constraint of competition is stricter: but the motivations like desire for power, status and prestige already emphasied by Baumol (1962) and Williamson (1963) among others, is likely to be present in managers of small firms too, as it is in the general population. So the second question we address is in what measure are the individual characteristics that make a manager, and predict his choices, skills or preferences? [2]

[2]A third set of important questions is whether managerial ability is a trait that is only acquired culturally, or has deeper roots, perhaps given at birth, or even genetic ones. This is a theme that has received less attention in the economic literature (much more in psychology and neuroeconomics: see for example Zhang et al., (2009), Nicolau et al. (2009)), but it has of course important policy implications. Our paper bears on this debate by highlighting the role of a non-cultural factor without however denying the existence and importance of learned abilities. More generally, cultural factors may interact with genetically acquired abil-

In our search for an answer we explore the hypothesis that direct measurement of a biological marker can provide evidence of the managerial skill explanation of the size distribution of firms. The marker we use is the ratio between the lengths of the 2nd (index) and 4th (ring) finger of the manager's hand(s) - 2D:4D for brevity. The 2D:4D measure has found extensive application in psychology, behavioral endocrinology, personality theory and, recently, even in economics. To provide a rationale for the effect of a physical measure that seems so remote from economic variables and appreciate its role, in Section 2 we discuss why it may be relevant. We implement the idea using a sample of Italian entrepreneurs that, as part of a face-to-face interview in a survey, have agreed to have their fingers measured and for whom a wealth of other information on their traits and characteristics was collected together with survey-based and administrative data on the firm they manage.

We find that the digit ratio is systematically correlated with the size of the firm. Firms managed by entrepreneurs with a lower digit ratio - and thus a higher exposure to prenatal testosterone - have more employees, higher sales and higher value, both currently and at time the entrepreneur acquired control. Furthermore, firms managed by low digit-ratio entrepreneurs grow 1/2 of a percentage point a year faster on average over the years the entrepreneur was in control. Consistent with prenatal testosterone shaping skills, we document that the digit ratio is correlated with such traits as willingness to stand effort, cognitive ability and optimism which appear to be valuable in entrepreneurial occupations (e.g. Judge et al., 2002; Horton, 1992) and which are in turn correlated with the size of the firm. This evidence lends support to models of firm size based on a distribution of entrepreneurial skills, as in Lucas (1978), part of which, according to our results, are biologically determined. But we also find that firms run by high testosterone entrepreneurs make more profits in levels but attain lower profitability on average as measured either by the return on assets or by the return on sales. Since prenatal testosterone is also likely to shape people preferences, a model that allows entrepreneurs to obtain utility not only from the profits they are able to generate but also from the size of the firm they manage as in the managerial models of the firm, can account for the pattern of correlations that we find in the data.

In sum, our estimates point out that a biological factor of the entrepreneur - prenatal testosterone - affects firm outcomes. It does so both because the factor shapes several skills that are valuable for an entrepreneur and because it seems to distort preferences away from pure profit maximization. Needless to say, the idea that entrepreneurs have also non-pecuniary motives besides enjoying profits is hardly new and has instead a long tradition in economics.[3] What we add to it is that the same biological factor that makes a good entrepreneur may be responsible for the strength of these motives.

We organize the rest of the paper as follows. In Section 3 we illustrate a

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ities in facilitating or contrasting the allocation of entrepreneurial talents to entrepreneurial occupations (Guiso and Rustichini, 2010a).

[3] Besides the cited paper, see also Simon (1961), Gordon (1961), Barnard (1962) and Williamson (1963).

simple model of the firm that allows for the mentioned two channels of influence - skills and preferences - and derive some implications. Section 4 describes our data sources and Section 5 presents preliminary data analysis and diagnostics. Section 6 discusses the results of the estimates of the effect of the digit ratio on firm size, growth and profitability. Section 7 weights this evidence in light of various channels of influence, discusses and rejects that our results are driven by differential survival probabilities induced by correlation of digit ratio with risk preferences, and shows that failure of low digit ratio entrepreneurs to maximize profits does not results in lower survival. Conclusions follow.

2 The digit ratio

There are two key links in the chain linking the digit ratio to behavior. First, the digit ratio is considered a reliable marker of the exposure to testosterone in the fetal period, with a lower ratio index associated with a higher level of androgens. Second, such exposure is considered to have an organizing effect of the brain during that period, shaping in a permanent way future individual behavior. There is considerable evidence supporting both hypotheses.

Evidence supporting the hypothesis that high level of androgens before birth results in lower digit ratio is found in women with congenital adrenal hyperplasia (CAH), which results in elevated androgen levels at fetal stage, and have lower digit ratio (Brown et al. 2002; Okten et al. 2002; Ciumas et al. 2009). Additional evidence comes from amniocentesis samples, where the ratio of testosterone to estradiol has been shown to correlate negatively with subsequent digit ratio (Lutchmaya et al., 2004).

The idea of the organizing effects on the brain, and so on future behavior, of exposure to hormones during fetal period was introduced in Phoenix et al., (1959), a paper that contributed substantially to the foundation of the field of behavioral neuro-endocrinology. The authors report the result of an experimental study where a group of guinea pigs were born from mothers that had been injected androgens (Testosterone propionate) during much of the gestation. The young born had no additional treatment after birth. Genetic females born after such treatment had the capacity to display feminine sexual behavior permanently suppressed (feminization); instead, the display of masculine sexual behavior was significantly enhanced (masculinization). Androgens had permanently modified and organized the developing nervous system during gestation; also they had done so in their natural direction. The paper originated what became the Organizational/Activational hypothesis of sexual differentiation, and more generally it is now widely accepted that perinatal exposure to specific hormones affects permanently the way in which the adult individual responds to circulating hormones and hence his behavior.

In light of these facts, the digit ratio can constitute a potentially relevant index of managerial skill that can be observed and measured independently of firm's performance. In this paper we provide a first test of this hypothesis.

2.1 Explanatory power of digit ratio

Even if one is not entirely convinced by the two mechanisms reported so far, a direct test of the correlation between the digit ratio and individual characteristics may be enough to prove that the digit ratio is a reliable marker of important stable features of behavior. By its very nature, correlation of a behavior with this marker also implies a specific causal direction. It is known that the digit ratio is approximately fixed at birth: so whatever this marker signals, it is something that precedes and is stably determined at the beginning of life. Education, cognitive skills, even attitude to risks or ability to control a large group of individuals may be associated with economic success as entrepreneur, but because they are produced by it, rather than explaining it. Pinning down the direction of causation is difficult and controversial: no such difficulty arises with the evidence for the link between whatever it is that digit ratio signals and behavior.

A complete survey of results on the correlation between digit ratio and behavior until 2002 is in Manning (2002). Digit ratio is associated with better performance in competitive sports (Manning and Taylor, 2001 for soccer, Manning 2002 for skiing). Digit ratio affects personality traits and cognitive abilities: a low digit ratio has been associated with physical aggression in men (not in women, Bailey and Hurd, 2005). Luxen and Buunk (2005) find that a low 2D:4D is associated with low verbal intelligence, high numerical intelligence, and low Agreeableness, the Big Five factor that measures positive attitude to others. In a surprising result, higher scores are found to correlate with higher marks in Romano, Leoni and Saino (2006). Sluming and Manning (2000) find that professional musicians (British Symphony Orchestra) have lower digit ratio than controls.

Turning to the still limited research closer to economics, a low digit ratio has been found to be associated with high earnings and better ability to remain in a competitive job in the City of London (Coates, Gurnell, Rustichini, 2009). Sapienza, Zingales, Maestripieri (2009) find a weak effect of low digit ratio reducing risk aversion (mostly for women).

There are potential alternative measures that might be used as proxies for managerial skill. For example, a natural candidate is some combination of personal attitudes, like those to risk and ambiguity, with measures of cognitive skills. Since we do have in our data information on such characteristics, we will also be able to compare the relative importance of these factors.

3 Digit ratio and firm performance

3.1 Hypotheses

In our analysis of firms' performance we focus on two main groups of variables: the first describes size (and its growth), the second firms' profitability. Our leading hypothesis is that digit ratio affects both significantly; we have now to specify the likely direction of the effect. It is useful to recall in the following discussion that digit ratio is negatively correlated with early exposure to androgens.

Since the digit ratio has already been shown to correlate negatively and significantly with success in several fields, including economic success, we conjecture that it might be a proxy for the managerial skill in the models of Lucas (1978) and Rosen (1982). A possible channel of the effect on economic success might be a combination of cognitive skills and motivation, characteristics which are consistent with the general idea of managerial skill. Our prediction on size is consistent with those models: lower digit ratio should be associated with larger size. If one extends these models to a dynamic environment, and links entrepreneurial ability with growth of the size of the firm, lower digit ratio should also be associated with higher growth rate of the size, measured by the number of employees, or value of sales, as asset values.

As for profitability, a first working hypothesis is that digit ratio has the same effect as on size, of negative correlation. But the ratio has also been shown to affect preferences: for example, it is correlated with assertiveness and aggression, and is likely to be negatively related to social dominance. So when we consider profitability of the firm, we should also consider the trade-off between higher profits and the achievement of some other objective that has been the focus of the literature on managers preferences and their choices; for example, the empire building motivation or the "amenity potential" characterization of entrepreneurs preferences (Demsetz and Lehn, 1985). This literature has pointed out that choices which maximize profit are not necessarily the same that maximize size: and if managers have a specific preference for size (or growth) - a proxy for the amenity potential - then choices might reflect this, and favor size even if this reduces in some measure profitability. If we consider this possibility, then the prediction on firms' profitability may even be reversed: if managerial skills are in some measure correlated with the strength of preferences for size, then the effect of our proxy for managerial skill would still be clear for size (because in this case both preferences and skill move in the same direction); the effect on profitability could be ambiguous, because now skill and preferences may move in opposite direction, and the preference for size might determine the final effect, inducing a positive effect from digit ratio to profitability (lower digit ratios, lower profits).

3.2 A simple model

To cast these intuitions in a formal framework, we present a highly stylized model which will help the presentation of the predictions we test later. The model allows for the two potential motivations affecting the choices of the manager - profits and size - appropriately weighted, and derive individually optimal values. These values will indicate how they depend on the weight describing the relative importance of the profit motivation in the utility function of the manager.

Specifically, in our model we assume that the utility function of the manager is a linear combination of profit and size, with weights a and $1-a$ respectively.

We also keep the assumption, as in the Lucas (1978), that total factor productivity depends on personal characteristics (skill) of the manager; this is modeled by the parameter A. Let the production function be $y = Ak^\beta$ where y denotes output and k the stock of capital (we consider a single factor of production; allowing for labor is trivial). Lucas span of control hypothesis requires $0 < \beta < 1$. Firm profit is $\Pi = Ak^\beta - rk$ where r is the rental cost of capital and thus manager utility is

$$U(k) = a\left(Ak^\beta - rk\right) + (1-a)Ak^\beta.$$

If the manager maximizes over capital the utility function, the optimal capital stock is

$$k = \left(\frac{A\beta}{ar}\right)^{\frac{1}{1-\beta}}$$

The total sales are

$$y = A\left(\frac{A\beta}{ar}\right)^{\frac{\beta}{1-\beta}}$$

and the value of the firm

$$U = (\beta A)^{1/(1-\beta)}(ar)^{-\beta/(1-\beta)}$$

The return on assets (ROA) and the return on sales (ROS) are:

$$ROA \equiv \text{ profit over capital } = r\left(\frac{a-\beta}{\beta}\right)$$

$$ROS \equiv \text{ profit over sales } = 1 - \frac{\beta}{a}$$

The model predicts that, under the assumption that (1) the factor A decreases with the digit ratio; (2) the factor a increases with the digit ratio:

1. Size (measured by k or output y or firm value U) decreases with the digit ratio both because the digit ratio affects manager ability A and because it may induce a preference for size;

2. ROA and ROS increase with the digit ratio but only if the digit ratio affects manager preferences.[4]

[4] Notice that in this simple model in the absence of a preference for size effect ($a = 1$) profitability would be independent of entrepreneurial ability. Another possibility is that the digit ratio affects manager ability to raise cheap capital. This could be captured by letting the rental cost of capital depend on the digit ratio. In this case, ROA too would be affected by manager ability, but not ROS. We discuss this possibility in Section 7.2 and find no evidence in support.

4 Data collection

Our data consist of detailed information on firms and their top CEO. The data set is the outcome of a survey conducted by ANIA (the Italian National Association of Insurance Companies), covering 2,295 private Italian firms with up to 250 employees. [5]

The survey was conducted between October 2008 and June 2009. Table 1 part A, presents summary statistics on the firms in the sample. Consistent with the geographical distribution of business in Italy, a large fraction (44.7 per cent) was located in the North, 30.5 per cent in the Center and the rest in the South. The appendix describes the survey design in greater detail and provides a precise description of the variables used in this study.

4.1 Questionnaires

The survey consisted of two distinct questionnaires. The first collected general information on the firm, and was filled by the firm officials on a paper form. The focus of this first questionnaire was on the type of firm-related insurance contracts that the firm had or was considering. But the questionnaire also collected general information on the firm (such as ownership structure, size and current performance) and its demographic characteristics.

Insert Table 1, Panel A here

The second questionnaire collected information on the entrepreneur or the top CEO, and was filled in face to face CAPI interviews by a professional interviewer of a specialized company. Several broad groups of data were collected. First, information on a number of traits, abilities and preferences such as the entrepreneur will power, optimism, ability to stand effort, attitudes to risk and ambiguity of the subject, elicited with hypothetical choices and/or direct questions; second, information on his own personal wealth holdings or those of his/her family; finally, information on physical traits, family background and demographics (see Table 1, B).

Insert Table 1, Panel B here

[5] Identification of the effect of entrepreneurial ability on firm performance is easier in a sample of small businesses. In small businesses, owned by the entrepreneurs, the link between the biological marker of the CEO/entrepreneur and the performance of the firm is more clear. In large managerial corporations we may even find a large effect of CEO exposure to markers of testosterone on firm size, but this could be both because high testosterone may cause a higher firm size through the effect it may have on CEO ability and preferences, but also because high-talent managers tend to match with firms that offer steeper incentives and the latter can push in the direction of increasing size (Bandiera et. al 2010). If one cannot control for incentives they would be picked up by the digit ratio.

On the other hand, if exposure to markers of testosterone does indeed results in a larger firm size only through its effects on entrepreneurs ability and preference, focusing on small business implies that any effect we find is presumably a lower bound.

4.2 Collection of digit ratio

At the end of the personal interview, the interviewer asked each participant in the survey whether he or she was willing to have the length of the fingers measured. They were first informed that some recent research has established a link between choice of employment and success and some physical characteristics of a person. No mention was made of the direction of this link.[6] If the participant accepted, the four measurements (second and fourth fingers of both hands) were collected with an electronic caliper, with small measurement error (0.02 mm). Each interviewer has his own tool; each was given a written protocol on how to execute the measurement and pre-trained by the company. As part of the procedure they asked the CEOs to keep the hand as straight as possible; fingers on the right were measured first, and then those on the left. The length measured was from the middle of the bottom crease at the base of the finger to its tip.

In summary, we collected a combination of information on the firm, and its most important performance variables, the manager and many personal characteristics: demographics, economic preferences and some physical characteristics, as well as of his or her family. To the best of our knowledge, this is a unique data set.

4.3 Balance sheet data

In the data analysis below we also rely on detailed balance sheet information of a large subset of the firms that were part of the survey. Data were provided by the Cerved Group, a business information agency operating in Italy. The data from the two sources were matched using a uniquely identifying id number. Data on balance sheets were available for the period 1993 (or later, if the firm was founded in a later year) to 2007; we have been able to match 633 firms for which the digit ratio measure is available (summary statistics in Table 1, Panel A).

5 Preliminary data analysis and diagnostics

Out of 2,295 entrepreneurs interviewed 1,346 agreed to have the fingers length measured.[7] Table 2 examines possible explanation of the willingness to participate in the digit ratio data collection. Participation in the measurement is correlated with some of the observed variables: it is lower among male entrepreneurs

[6]The measurement of the digit ratio was done at the very end of the interview. Hence answers to all previous questions were not affected by the measurement, which could have created spurious correlations if respondents had in mind some desirable pattern of answers. Since the measurement of the fingers was done by the interviewers, the respondent had no room to report a fingers length "consistent" with previous answers. Hence, any correlation that we find between the digit ratio and traits measured in the interviews cannot be the consequence of respondents answering strategically.

[7]We disregard 33 observations because either the length of one the digits was missing or because was a clear mistake. Thus the final sample contains 1,313 observations.

and increasing with age and the height of the interviewed. Education instead has no predictive power as much as the age of the firm and the number of years the entrepreneur has been in control of the company.

Insert Table 2 here

This features may create a potential for selection bias when estimating the effect of the digit ratio on firm performance due to non random missing observations. We account for this by noticing that the main driver of the willingness of the entrepreneurs to let the interviewer measure his/her fingers is an index of affinity between the two as reported by the interviewer at the end of the interview (Table 2, second column). Specifically, we use the answers to the question: "On a scale between 0 and 10 what do you think is your affinity with the person interviewed?" that the interviewer had to answer at the end of each interview. Since affinity reflects the answers of the interviewer there is no reason why it should be correlated with the residual in equations of firms size and profitability. Hence, it can provide an exclusion restriction for the probit regression used to compute the Mill's ratio to account for possible selection (Wooldridge, 2002 Chp. 17).[8]

For the sample of participants in measurement the distribution of the digit ratio of the right hand (the one typically used in these studies; the distribution is similar for the left hand) has both mean and median centered around 1 and is fairly symmetric, but departs from normality because it appears leptokurtic (Kurtosis= 5.13).

Insert Figure 1 here

Correlation between 2D:4D in right and left hand is high (0.65) and similar to figures obtained in comparable studies (e.g. Manning, 2002). Interestingly, there is considerable sample variation (interquartile range 0.15 and standard deviation 0.053; see Table 1, Panel C).

Insert Table 1, Panel C here

Table 3 reports regressions of the digit ratio on classical determinants (for the right and left hand respectively): we find that first born have a lower digit ratio which is typical (Manning, 2002); also taller entrepreneurs have a significantly lower digit ratio, a finding previously reported by Manning, 2002.

Insert Table 3 here

But differently from all other studies (Manning, 2002), where the digit ratio is sexually dimorphic, and significantly higher in women, we find that in our sample males have a higher ratio; the difference is relatively small but it is significantly different from zero in almost all specification reported in Table 3,

[8] An alternative is to use as exclusion restrictions some characteristics of the interviewer. Following this strategy and using interviewer age, gender and height as exclusion restrictions produces results that are very similar to the ones reported. But these variables have lower explanatory power than affinity in the probit for participation in fingers measurement.

including the one in the last column where estimates are adjusted for selection using a Heckman two step estimator.

In a separate paper (Guiso and Rustichini, 2010a) we argue that what is overturning the sign of the gender difference in the digit ratio in our sample compared to population-representative samples is the existence of gender-specific barriers to entrepreneurship. If women face stronger obstacles to enter into entrepreneurial jobs - a feature that is consistent with the much lower presence of women in managerial positions - only those with above average ability will self-select into these jobs. If digit ratio is correlated with entrepreneurial skills, only women with strong testosterone markers (i.e. low digit ratio) will show up as entrepreneurs, hence the result. Guiso and Rustichini (2010a) support this interpretation with three types of evidence: first, they document a lower incidence of women in entrepreneurship; in the ANIA sample 34% of the entrepreneurs are women (see Table 1, Panel B). Second, using differences across regions of Italy in an index of women emancipation, they show that the ratio of women to men among entrepreneurs is higher in regions with higher values of the emancipation index.[9] Third, they show that the effect of a male dummy on the digit ratio in regressions similar to those in Table 3 is smaller in regions with a higher value of the women emancipation index. That is, an interaction between the male dummy and the women emancipation index has a negative and statistically significant effect on the digit ratio. In the region with the highest value of the women emancipation index it turns out that women entrepreneurs have a larger digit ratio than men entrepreneurs, consistent with the existence of culture-driven barriers to entrepreneurship which affect women occupational choice.

6 Digit ratio and firms economic performance

6.1 Measurements

We measure firm size using three indicators that are available in the survey. First, the firm reports the current number of employees; second, entrepreneurs were asked to report current firm sales and finally they were also asked to report the value of the firm. Since the vast majority of the firms in the sample are not listed, firm value is obtained by asking the entrepreneur how much he/she could make from selling the firm in the market. To obtain measures of firm growth entrepreneurs were also asked to report the number of employees, value of sales and value of the firm (using the above definition) at the time they acquired control - that is when they started managing the firm. This allows us to test the effect of the digit ratio on the growth of the firm over the period the manager was actually running it. In principle these indicators offer equivalent

[9]The women emancipation index is constructed from answers to questions in the 2005 World Values Survey eliciting individuals' beliefs about the role of women in society. For instance, one such question asks how much the respondent agrees with the statement "men make better business executive than women".

measures of size; in practice some of them are likely to be better proxies. First, sales are likely to be more subject to transitory shocks to demand and thus be more volatile than employment as a measure of firm size. This volatility acts as a measurement error which may boost standard errors of estimated coefficients, unless one averages sales over time. Second, firm value has the advantage that it reflects future profits and size; but it is a subjective assessment of the entrepreneur rather than a price quoted by potential buyers. As such this measure too is likely measured with error. Third, both sales and (particularly) firm value are very likely to be subject to recall bias when entrepreneurs are asked to report their value in the year they acquired control. This problem is obviously more severe for those who acquired control far in the past. Since the average number of years in control is 15 (Table 1), recall bias may indeed be an issue. Recall bias is likely to be much less severe for the employment figures: arguably, entrepreneurs are more likely to remember how many employees the firm had when they started managing it than to remember its value or its sales. This is consistent with the fact that while almost all entrepreneurs report firm current employment and 83% report also employment at acquisition of control, only 869 (out of 2,265 interviewed) report the value of the firm and of these only 724 recall its value at acquisition. Many more report current sales but only half of them also report sales at acquisition. Because of this, in our regressions on firm size and growth we will focus on employment but we will also report estimates using firm value and sales.

6.2 Effect of digit ratio on firm size

The first measure of size we consider is the natural log of the number of employees. Results are shown in Table 4.

Insert Table 4 here

In all specifications we insert industry dummies using a seven industry classification and a full set of regional dummies to account for systematic differences in average firm size due to industry composition and geographical or institutional effects. The first column shows a simple regression with only these dummies and the entrepreneur digit ratio. The latter has a negative and highly significant effect on firm size, which is consistent with the idea that exposure to markers of testosterone may enhance entrepreneurial skills. This effect is unchanged when controlling for gender: though males seem to manage larger firms, the effect of the digit ratio persists and, if anything is even larger. The next column adds controls for other characteristics of the entrepreneur (its height, age, being first born, its education and number of years in control) and the age of the firm. Interestingly, the effect of the male dummy vanishes while the negative effect of the digit ratio, its significance and size remain unchanged. A decrease of one standard deviation of the digit ratio produces a 7.3 per cent increase in the number of firm's employees, or slightly more than two employees for the average size of 32. It is worth noticing that since the digit ratio is approximately normally distributed in the sample, it induces a normal distribution in the log of employment and thus tends to generate a right-skewed distribution of employment level which is a distinctive feature of the size distribution of firms. Finally, the last two columns report estimates of firm size adjusting for selection; this is done adding the Mill's ratio from a probit regression for the entrepreneur's willingness to participate in the measurement of his/her fingers on all controls that appear in the size equation and in addition the measure of the interviewer perceived affinity with the entrepreneur. As can be seen, the effect of the digit ratio is unaffected; the Mill's ratio is statistically insignificant signalling that sample selection is unlikely to be an issue. This comprehensive specification is further expanded in the last column to include a measure of the entrepreneur risk tolerance obtained from answers to a question asking which combination of risk/return the entrepreneur would choose (see the Appendix for exact wording). One issue is in fact that the digit ratio may reflect entrepreneurs preferences for risk rather than his/her ability to manage larger quantities of inputs. We will discuss this and other issues related to risk preferences and firm size in greater detail in Section 7. For now it suffices to notice that according to our measure, risk tolerance has no effect on firm size while controlling for it does not change the effect of the digit ratio. [10]

Table 5 shows results using firm (log) sales and firm (log) value as measures of size. We report the specification with all the controls, accounting and not for selection.

Insert Table 5 here

As expected the number of observations drops, particularly when using the value of the firm. In all cases the digit ratio has a negative effect on firm size and it is statistically significant when firm value is used; the estimated coefficient is large but not precisely estimated when sales are used, a reflection of the high volatility of firm sales. For the value of the firm, a one standard deviation decrease in the digit ratio results in an increase in firm value by 24% - around 55,000 euros at the sample mean value of 227,749 euros. The effect on firm sales is smaller at around 4%, similar in magnitude to the economic effect on employment. In these estimates too there is no evidence of selection bias, as documented by the lack of significance of the Mill's ratio.

The skills of an entrepreneur may contribute to firm size in the obvious way, by affecting the growth rate of the firm during the manager's career at the firm - a channel we look at in the next section. A correlation may also occur because individuals with higher ability match from the start of their tenure with larger firms. Our data show that both ways are likely. In Table 6 we report regressions of the initial size of the firm on digit ratio and several control variables.

Insert Table 6 here

The initial size is measured in number of employees, value of the firm, and total sales. The effect of digit ratio is significant in all three cases, with p-value

[10] Inserting dummies for the quartiles of the digit ratio in order to capture non-linear effects shows that often most of the explanatory power comes from the lowest quartile, though, depending on the variables also the other quartiles matter.

< 0.006 for employees and values, and p-value $= 0.093$ for sales. The effect on size is between 7 and 11 per cent in standardized variables.

6.3 Effect of digit ratio on firm growth

If entrepreneurial ability contributes causally to increase the size of the firm we would expect that the digit ratio has an effect on growth during the period the entrepreneur is in charge of the management of the firm. To test this implication we compute the average annual growth rate of the firm, over the period control was in the hands of the manager. As before we focus first on employment growth. Table 7 shows the results; the specification is the same as in Table 4 except that we now control for initial (log) size, to take into account any dependence of growth on size.

Insert Table 7 here

We note that initial size is negatively correlated with subsequent growth and the effect is highly significant (p-value < 0.0005). In the first column when only industry and geographical controls are inserted the digit ratio has a negative effect on employment growth but the coefficient is not statistically significant. However, adding entrepreneurs characteristics and controlling for firm age raises somewhat the (absolute value of the) estimated coefficient of the digit ratio which becomes significant at the 10% level. The result is invariant to accounting for selection (last column) and controlling for the entrepreneurs risk tolerance. Needless to say, measurement error in initial size and thus in the growth rate tends to exaggerate the standard errors of estimated coefficients. However the economic effect of the digit ratio on firm growth is consistent with its effect on the cross sectional distribution of firm size. Lowering the digit ratio by one standard deviation increases average annual employment growth by 0.59%. Capitalizing this effect over the average number of years in control results in an estimated effect on firm size of around 9 per cent which compares well with the estimated effect of 7.3% in Table 4.

Table 8 shows the results when using the growth rate of firm value and sales growth respectively as left hand side variables.

Insert Table 8 here

Because many fail to recall initial value and sales the number of observations drops to around 400. The effect of the digit ratio is negative also in these specification and the size of the point estimate economically relevant. Yet, though in some cases the coefficient is borderline significant, inference is more problematic when using value and sales growth because of the smaller sample size and the severity of measurement error in initial size.

6.4 Firm profitability

The model in Section 3.2 predicts that the digit ratio can affect firm profitability if it affects people's preferences leading entrepreneurs to value firm's size in itself.

To check this possibility we use measures of return on capital and return on sales. As shown in Section 3.2, if the digit ratio affects preferences for size than both the return on sales and the return on assets should increase with the digit ratio because a lower digit ratio results in an excessively (from the perspective of pure profit maximization) large firm size, and thus a lower profitability. To obtain measures of profitability we merge the survey data with accounting data from the CERVED panel. Since firms have some discretion on what to report as profit, to minimize its impact we report results using four measures: gross operating profit (GOP), gross profit before interest (GPBI), gross profit after interest (GPAI), net profit after interest (GNAI); discretion should less relevant for the first, broader measures than for the latter. We scale these measures with beginning of period total assets (book value) and current sales, respectively. In all our estimates we insert industry dummies, regional dummies and year dummies in order to account for systematic differences in profitability across industries, location and over the business cycle. In addition we insert controls for the entrepreneur characteristics and for the age and size of the firm. We account for firm clustering when computing standard errors. Table 9 shows the result for the return on assets.

Insert Table 9 here

For all the measures of profits the digit ratio has a positive and highly statistically significant effect on the return on assets (p-values range between 0.001 and 0.02). The result is not affected when accounting for selection as shown in the last column. A one standard deviation increase in the digit ratio increases the return on assets by about 0.9 percentage points - around 8% of the sample mean using GOP as the numerator and by 20% using GPAI. Table 10 reports the estimates using measures of return on sales.

Insert Table 10 here

In this case too the digit ratio has always a positive and precisely estimated effect on firm profitability. Interestingly, the digit ratio is the only characteristic of the entrepreneur that significantly affects all measures of profitability: for comparison, the coefficient of education (once standardized) is much smaller and often not significant.

In conclusion, we have found statistically significant and economically important effects of digit ratio, after controlling for a large set of variables, on both size and profitability. The effects go in opposite direction: a lower digit ratio (higher exposure to testosterone prior to birth) is associated with larger size and with lower profitability.

7 An exploration of plausible channels

Now that we have established significant correlations between the entrepreneur digit ratio and firms' outcomes, we can conjecture and test directly some plausible channels for these effects in our data set. One interpretation of the opposite correlation of the digit ratio with the size and profitability of the firm is that it affects both entrepreneurial skills and entrepreneurs preferences for size. However, another interpretation of our findings is possible: that the digit ratio has no effect on skills and only boost people appetite for size: entrepreneurs with stronger exposure to prenatal testosterone attach a larger weight to size and thus build firms that depart more from the profit maximizing size.

To sort out these alternative and quite different explanations we follow two strategies: first, we look at the effect of digit ratio on the *level* of profits when we partial out its effect on total profits through its effect on size and when we do not (Section 7.1). Second we rely on direct measures of entrepreneurial qualities. If the entrepreneur digit ratio affects firm size because it affects skills we should find that it predicts measured qualities and that the latter are correlated with firm size; on the other hand, if these indicators measure skills and not preferences, they should be uncorrelated with firm profitability (Section 7.2 below). We then explore whether alternative channels based on ability to raise capital (Section 7.3) and on preferences for risk (Section 7.4) may explain the evidence.

7.1 Effect of digit ratio on profit levels

In the model of Section 3.2, total profits are given by

$$\Pi = rk\frac{(a-\beta)}{\beta} = r(\frac{\beta A}{ar})^{\frac{1}{1-\beta}}\frac{(a-\beta)}{\beta}$$

We assume that the entrepreneur attaches enough weight to profit to stay in business, i.e. $a - \beta > 0$. Let $A_{DR} < 0$ and $a_{DR} > 0$ denote the effect of the digit ratio on ability and preference for profits, respectively. The effect of the digit ratio on total profits, Π_{DR} , can be decomposed into the sum of its effect via the stock of capital, k_{DR} , and its effect via preference for profit:

$$\Pi_{DR} = r\frac{(a-\beta)}{\beta}k_{DR} + \frac{rk}{\beta}a_{DR}$$

Since (as shown in Section 3.2) $k_{DR} < 0$ and $a_{DR} > 0$ the total effect of digit ratio on profit level is ambiguous. But if the ability effect A_{DR} is strong enough that the size effect dominates the preference effect, then the effect of the digit ratio on total profits should be negative - an implication that can be tested in a regression of the digit ratio without controlling for the size of the firm. [11] On the other hand, if we hold firm size constant, the effect of the digit ratio on total profit is $rka_{DR} > 0$. Thus, if testosterone at birth affects entrepreneurs preferences for size, in a regression of the profit level that controls for firm assets the effect of the digit ratio should be positive. Put differently,

[11] the overall derivative of profits with respect to the digit ratio is
$\Pi_{DR} = \frac{\Pi}{1-\beta}[\frac{A_{DR}}{A} + \frac{\beta(1-a)}{(a-\beta)}\frac{a_{DR}}{a}]$
The first term in brackets is negative and the second positive. Thus, the correlation between total profits and the digit ratio can be negative only if the ability effect is strong enough.

a regression of profit level on the digit ratio *without controlling* for size allows to test the existence of a (strong) ability effect; if this effect is present the digit ratio should be negatively correlated with the level of profit. A regression of profit level on the digit ratio *controlling* for size allows to test the existence of a preference effect. If the latter effect is present the coefficient of the digit ratio should flip sign when size is added as a control.

We test these implications in Table 11 using a broad measures of profits: gross operating profits; results are similar using other measures.

Insert Table 11 here

When no control for firm assets is introduced (columns 1 and 3) the digit ratio is negatively correlated with the profit level; the standard errors of the estimates are very large because of the inherent volatility of profits but the point estimate points to a large effect (a one standard deviation decrease in the digit ratio raises the value of gross operating profits by 40% of its sample mean). When we add firm assets as control the effect of the digit ratio on total profits flips signs (and becomes significant) - consistent with testosterone inducing a preference for size.

7.2 Effort cost, cognitive skills and optimism

We have measures of three qualities that are potentially relevant for manager's success: willingness to work, cognitive skills, optimism. Willingness to work effort is measured by the number of hours the entrepreneur said he was willing to work before feeling the desire to change activity. An approximate measure of cognitive skills is the grade obtained at the end of the high school (typically at age 18, the equivalent of grade 12 in the USA). The measure of optimism is the answer to a question determining expectation on future good and bad outcomes (left unspecified; see data appendix for exact wording). We consider how these measures are related to digit ratio, and how they correlate with size and profitability. Results of controlled regressions are shown in Table 12 below.

Insert Table 12 here

The direction of effects concurs in all cases. All three measures are negatively correlated with digit ratio, with significance between 5 and 10 per cent and results do not depend on selection (see estimates that include the Mill's ratio). Furthermore, as shown in Table 13 all three measures of ability correlate positively with size (measured by the log of the number of employees), effort and optimism at better than 5 per cent significance level.

Insert Table 13 here

The standardized coefficient of willingness to work is 0.06, (p-value $= 0.001$), so an increase of one standard deviation produces a 6 percentage point increase in the natural log of firm's employees, or approximately two employees for the average size of 32. The standardized coefficient of optimism is similar in size (0.054, p-value $= 0.01$), and so the approximate effect is the same. Finally, the school grade has a slightly smaller standardized coefficient, with lower significance (0.048, p-value = 0.082).

However, no significant effect from any of these measures is found on profitability, measured either as returns on assets or on sales. On ROA and ROS respectively the p-values are 0.11 and 0.69 for willingness to work, 0.19 and 0.79 for cognitive skills, 0.94 and 0.37 for optimism (see Table 14).

Insert Table 14 here

In conclusion, we have determined that plausible potential channels of the effect from characteristics marked by digit ratio on firm's size are given by a few ability measures. Those same measures do not seem to affect profitability. A reasonable explanation of this finding, in line with the model of Section 3, might be that those measures affect in a non ambiguous way the size of the firm, but in an ambiguous way its profitability, because of the opposite effects of profit motivation and size motivation.

7.3 Ability to raise cheap capital

An alternative explanation for the negative effect of the digit ratio on firm size and positive effect on profitability is that digit ratio, besides affecting the above ability measures also affects size because it affects an entrepreneur ability to raise cheap capital. If so, high digit ratio entrepreneurs would pay a higher cost of capital; because of this they would invest less and as a result they would run smaller firms with a higher marginal product of capital and thus a higher return on assets. The positive effect of digit ratio on ROA would reflect this channel not an effect on preference for size. This explanation can be ruled out two ways. First, if true the digit ratio should only affect ROA but not ROS, since the latter is independent of the cost of capital (see Section 3). However, we find that digit ratio also affects ROS. Second and more directly in Table 15 we show regressions of digit ratio on a measure of the interest firms pay on their loans, a measure of credit rationing and a measure of collateral requirements when borrowing.

Insert Table 15 here

The digit ratio has no effect on either of these variables, ruling out this channel of influence.

7.4 Attitude to risk and selection

A possible alternative way to explain the effect of digit ratio on size of the firm is to reduce it to a side effect of the differences in risk attitudes. According to this view, entrepreneurs with lower digit ratio are more willing to take risks, a hypothesis which is consistent with several findings in the literature (and explicitly mentioned for instance in Coates, Gurnell, Rustichini 2009). Thus, those entrepreneurs are more inclined to select on the frontier of projects those with higher mean returns and higher variance. In the long run, these choices produce higher profitability and higher growth but also higher variance and hence an increase in the probability of failure and exit from business activity. Since firms which exit are not in the sample, we would more likely to observe in the lower digit ratio category those entrepreneurs who have been lucky enough to survive.

This explanation finds several difficulties. A first one is the fact that, as we have just seen, there is a *positive* correlation between digit ratio and profitability. So to make the theory fit the data we also need to assume that low digit ratio entrepreneurs choose projects with higher variance but not higher returns. This may happen if they are risk lovers, or if they are less able than the higher ratio ones to select good projects. The first assumption is extreme; the second is in disagreement with existing findings on the effect of digit ratios. We have in addition a way to test directly the explanation by considering information on experimental risk aversion determined in the questionnaires, as well as the information we can derive from portfolio choices of the entrepreneurs. A detailed analysis of the attitude to risk of entrepreneurs is in Guiso and Rustichini (2010b). The conclusions suggest that lower digit ratio is associated in hypothetical choices among lotteries with higher risk aversion, higher ambiguity aversion and stronger regret. When we consider the financial portfolio of the individuals in the sample, lower digit ratio are associated with reduced diversification. In conclusion, we do not find reliable evidence that, in the sample we are considering, a lower digit ratio is associated with stronger willingness to take risks.

A second and more substantial difficulty is the connection between digit ratio and survival, which we now discuss in detail. Our results suggest that low digit ratio entrepreneurs make more profits but, because higher exposure to testosterone induces a preference for size they fail to make even more. This failure of profit maximization implies that high digit ratio entrepreneurs make more profit in levels but achieve lower profitability. There is a commonly stated view dating back to Friedman (1953) that economic theory predicts that traders who do not maximize profits do not survive. This prediction is based on a model of selection of behavior, or ability (people who do not maximize profits have either other objectives or are unable or misinformed) and has been recently formally re-examined by Blume and Easley (2006). Does this prediction holds in our data?

To answer this question we look at the cross sectional relation between the digit ratio and the number of years an entrepreneurs has been managing the firm. One realistic characterization of firm entry is that in every period there is a roughly constant inflow of new firms and a (roughly) constant outflow of existing firms. If firms managed by high testosterone entrepreneurs (low digit ratio) are less likely to survive because they depart from profit maximization we should see a higher digit ratio among entrepreneurs that are in the early years of their tenure with the firm and have not yet been selected out and a lower digit ratio among entrepreneurs that have been managing the firm for several years but have survived long because they are more likely to follow profit maximization. That is the relation between digit ratio and the number of years in control should be upward sloping. Figure 2 plots this relation and as can be seen the opposite is true: the digit ratio of long-lived entrepreneurs is lower than that of beginners suggesting that low digit ratio entrepreneurs have better chances of surviving.

Insert Figure 2 here

Table 16 reports the result of the regressions, where we control for age which is naturally correlated with the number of years in control. Other controls in the regression are entrepreneur gender, height and being first born, firm initial size and firm and regional dummies. The coefficient on the number of years in control has a size effect (β coefficient) of 7.9 per cent and p-value = 0.048.

Insert Table 16 here

This result is not consistent with a model where traders with low digit ratio are more risk takers, have higher variance of returns and hence are more likely to be selected out. And it is inconsistent with the prediction that traders that have a preference for size in addition to profits do not survive. Indeed in our data the opposite is true: low digit ratio entrepreneurs are more long lived. Interestingly, this is the same finding as Coates, Gurnell and Rustichini (2009) who document that financial traders with longer seniority as traders have lower digit ratios than traders with shorter experiences. Reaching the same conclusion in two very different data sets, independent contexts and type of activity is quite remarkable. As far as we know this is one of the few non-speculative results on selection.

8 Conclusions

We have shown that a biological marker, the 2D4D ratio, can predict significantly, and in sizeable proportion, some important measures of the performance of a firm, like size, growth, and profitability. This marker may be considered as a reliable proxy for at least some important components of the otherwise unobservable variable called managerial skill or talent.

Our first contribution is to the method of the analysis: by expanding the set of variables our understanding of economic phenomena can only improve, but in some cases this extension is substantial. Introducing this additional variable allows us to begin addressing the issue of an independent measurement of managerial skill. We are not claiming this is an exhaustive description: but we think we have identified an important component. Testing theories of size distribution in firms can now be done, although, as we mention later, there is a substantial amount of additional research necessary.

Our second contribution is to the specific understanding of the effect of managerial skill on firms' size distribution and profitability. In theories like Lucas (1978), the role of managerial skill is modeled in a very simplified way, and it is equivalent to a firm-specific scaling of the production function, after the effects of the span of controls have been taken into account. It could not be otherwise, since no specific information is available in the model on what the managerial skill is, for example whether it is a cognitive skill or leadership ability. Neither is it clear how it can be measured independently of the observed effects on the firm. The additional information and control variables (personality, education, economic preferences) allow us to formulate and test more specific hypotheses on the way in which these effects operate. In particular we have tested alternative theories of the role of the entrepreneur/manager. One theory views his contribution as effectively implementing profit maximization, hence his effect is primarily on (the scaling of) the production function. The other theory claims that, within the constraints of a market economy, managers bring into their decisions their own preferences on firms' outcomes, which include size in addition to profit. We have found that the most plausible explanation of the data is a combination of the two.

A more challenging research lying ahead is now a more direct test of the theories of firms' size. This test will require appropriate data that were only in part available to us. An essential element in this research will be gathering a data set that includes data on entrepreneurs and the general population, to identify what is specific to the managers' population. This data set should include information on cognitive skills, personality traits, socio-economic variables, and biological variables like the digit ratio we considered here. Our results show that this research is promising.

9 Appendix: Information on Data

The ANIA survey

The ANIA Survey for Small Business Companies collects data on a sample of 2,295 Italian firms and their top manager. The survey was conducted on a sample of small Italian firms, having up to a maximum of 250 employees, extracted from the total number of companies registered with CERVED - a business information agency operating in Italy which collects companies balance sheet data. The survey was conducted between October 2008 and July 2009.

Compared to the initial target set at the completion of 2,300 interviews, the investigation closed with 2,295 completed interviews. Participation in the survey entails the willingness to provide information on the use of insurance markets and details regarding the firm as well as the willingness of the top CEO/owner of the company to take part in a face to face interview with a professional interviewer. The first type of data was collected through a questionnaire filled out by each company, while the second type was obtained through an interview using the Computer Assisted Personal Interviewing) method. Partly because the survey took place during the financial crisis and partly because interviews targeted the CEO of the firm, the drop out rate was relatively high particularly among firms in the larger size categories lengthening. To account for this the survey design was slightly reviewed to include a larger number of smaller firms (with less than 20 employees) which were easier targets. This has caused the sample to be somewhat biased towards smaller firms than the population of businesses with up to 250 employees.

In the final sample of 2,295 firms, 98.5% are private, located in 59% of cases in north Italy, 19% in central Italy and 22% in the south and islands. In 85% of cases these are controlled by an individual within a family and a remaining 10% by a group of people without family ties.

Variables definitions

Here we provide a detailed description of the variables used in the paper whose definition is not obvious.

Affinity: index obtained from thye answers to the question "On a scale between 0 and 10 what do you think is your affinity with the person interviewed?" that the interviewer had to answer at the end of each interview.

Age of entrepreneur: in years.

Collateral requirements: value of collateral as a fraction of the value of the stock of outstanding loans; reported in the firms general survey questionnaire. Answer to the question: With reference to outstanding bank loans can you tell what is the value of the goods offered as collateral as a fraction of these loans?

Cost of work effort: obtained from the following question to the entrepreneur

"When you work, after how many hours do you start feeling like stopping and do something else?".

Education: Number of years of schooling of the entrepreneur.

Firm age: Years since firm foundation

First born: Indicator equal to 1 if entrepreneur is the first born child.

Grade at secondary school: Grade obtained at the end of secondary school, when students have to pass an exam and obtain a secondary school diploma. Grades are on a 0 to 100 scale.

Height: Entrepreneur's height in centimeters

Interest rate: Interest rate charged to the firm by the main bank lender on credit lines.

Initial size: Measured as either the number of employees, the value of the firm, in the year the entrepreneur acquired control of the firm. Initial sales and firm value were reported in prices of that year. We have expressed them in 2008 prices using the GDP deflator.

Male: Indicator equal to 1 if entrepreneur is a male.

Optimism: answers to the question borrowed from a standard Life Orientation Test (Scheier et al., 1994) " How much do you agree with the statement: overall I expect more good things than bad things to happen to me". Answers are on a 0 to 10 scale, and are increasing in optimism.

Risk tolerance: Indicator obtained using the answers to the question "If the investment strategy of the firm depends only on you, among the following alternative strategies which one would you pick up? One that yields a) Low profits but no risk of losses; b) Decent profits and rare losses; c) Good profits with some chances of incurring losses; d) Very high profits with a high risk of significant losses. The indicator is coded between 1 and 4, increasing in risk tolerance.

Rationing: Indicator equal to 1 if the firms has been turned down for credit over the 5 years before the interview. Obtained from the questions: Over the past 5 years, has the firm applied to a bank to increase the size of existing loans or to obtain a new loan? (Answers: yes, no). if so, did it occurred to you that the application was turned down? (Answers: Yes once, yes more than once, non never). Rationing is set to 1 if the firm has been turned down one or more times.

Return on assets and return on sales: Four measures of accounting profits are used: Gross operating margin; Gross profit before interest; Gross profits after interest; Net profits after interest. Each of these measures is scaled with the book value of total assets to obtain a measure of ROA and with firm sales to obtain a measure of ROS

Total assets: Book value of firm total assets.

Years in control: Number of years since the entrepreneur has acquired the responsibility of the management of the firm.

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Tables and Figures

In all tables below, robust p-values are reported in parenthesis. *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table 1: **Summary statistics for firms, entrepreneurs and digit ratios.** See the appendix for variables definitions; firm value and sales are in millions of 2008 euros.

variable	Mean	Median	Standard Deviation
Panel A: Firms			
Size: employment	31.631	20	40.126
Size: firm value	239.603	2.50	1648.289
Size: firm sales	14.378	2.50	49.184
Growth: employment	0.0675	0.035	0.181
Growth: firm value	0.164	0.073	0.391
Growth: firm sales	0.14	0.049	0.346
GOP/assets	0.115	0.099	0.119
GPBI/assets	0.060	0.053	0.076
GPAI/ assets	0.042	0.031	0.079
NPAI/ assets	0.014	0.007	0.054
GOP/sales	0.092	0.082	0.112
GPBI/sales	0.042	0.042	0.032
GPAI/ sales	0.028	0.023	0.080
NPAI/ sales	0.006	0.008	0.059
Firm age	25.820	21	23.03
Located North East	0.131	0	0.338
Located North West	0.316	0	0.465
Located Center	0.305	0	0.460
Panel B: Entrepreneurs			
Male (share)	0.662	1	0.4737
Age	47.46	47	10.3
Education (years)	13.23	13	2.717
Height (cm)	172.49	172	8.251
First born	0.571	1	0.495
Years in control	15.21	12	11.746
Risk Profile	2.29	2	0.705
Work effort	8.81	9	2.588
Optimism	7.24	7	1.768
Affinity	7.12	8	2.04
Panel C: Digit ratios			
Right hand: whole sample	1.001	1,0	0.0522
Right hand: male	1.002	1,0	0.0528
Right hand: female	0.9995	0.9997	0.0509
Left hand: whole sample	0.9998	0.9999	0.0496
Left hand: male	1.002	1,0	0.0494
Left hand: female	0.9977	0.9951	0.0497

Table 2: **Probit regression on participation to digit ratio collection**. Probit of the agreement of the entrepreneurs to have their fingers measured. Marginal effects evaluated at the variable mean. Affinity is an index between 0 and 10 measuring affinity between the entrepreneur and the interviewer as reported by the latter at the end of the interview. See the data appendix for wording of question.

	(1)	(2)
	b/p	b/p
Male	–0.034	–0.067**
	(0.247)	(0.023)
Age	–0.001	0.002**
	(0.615)	(0.042)
Education	0.011***	0.005
	(0.004)	(0.176)
Height	0.001	0.004***
	(0.426)	(0.009)
First born	–0.016	0.018
	(0.447)	(0.402)
Age of firm		–0.001
		(0.128)
Years in control		–0.001
		(0.303)
Affinity		0.041***
		(0.000)
N	2265	1964

Table 3: **Classical determinants of digit ratio.** The dependent variable is the ratio of second to fourth digit of the right hand (Panel A) and left hand (Panel B).

	(1)	(2)	(3)	Selection Adjusted
Panel A: Right Hand				
Male	0.003	0.007*	0.007*	0.007
	(0.396)	(0.070)	(0.090)	(0.121)
Height		–0.000*	–0.000*	–0.000*
		(0.050)	(0.066)	(0.075)
First born		–0.008***	–0.007**	–0.007**
		(0.009)	(0.016)	(0.024)
North West			–0.005	–0.003
			(0.406)	(0.669)
North East			0.000	0.004
			(0.920)	(0.355)
Center			–0.002	0.001
			(0.505)	(0.828)
Mills ratio				–0.006
				(0.338)
r2	0.001	0.008	0.009	0.010
N	1313	1313	1313	1167
Panel B. Left Hand				
Male	0.007**	0.013***	0.014***	0.012***
	(0.013)	(0.001)	(0.000)	(0.005)
Height		–0.001***	–0.001***	–0.001**
		(0.008)	(0.006)	(0.030)
First born		–0.008***	–0.009***	–0.008***
		(0.003)	(0.002)	(0.007)
North West			0.003	–0.001
			(0.581)	(0.942)
North East			0.003	0.005
			(0.366)	(0.171)
Center			0.005	0.007*
			(0.159)	(0.068)
Mills ratio				–0.013**
				(0.015)
r2	0.005	0.017	0.018	0.023
N	1313	1313	1313	1167

Table 4: **Effect of digit ratio on firm size: employment**. The dependent variable is log of the number of the firm employees. β coefficients.

	(1) beta/p	(2) beta/p	(3) beta/p	(4) beta/p	(5) beta/p
Digit ratio	–0.074***	–0.077***	–0.073***	–0.075***	–0.074***
	(0.006)	(0.004)	(0.007)	(0.006)	(0.007)
Male		0.081***	0.026	0.031	0.029
		(0.002)	(0.466)	(0.426)	(0.446)
Age			0.007	0.001	0.005
			(0.821)	(0.970)	(0.885)
Education			0.189***	0.191***	0.189***
			(0.000)	(0.000)	(0.000)
Height			0.040	0.035	0.035
			(0.288)	(0.386)	(0.386)
First born			0.022	0.017	0.015
			(0.436)	(0.550)	(0.601)
Age of firm			0.198***	0.198***	0.198***
			(0.000)	(0.000)	(0.000)
Years in control			–0.013	–0.009	–0.007
			(0.717)	(0.801)	(0.842)
Mills ratio				–0.002	–0.001
				(0.969)	(0.988)
Risk Profile					0.044
					(0.129)
r2	0.096	0.103	0.178	0.176	0.178
N	1313	1313	1186	1167	1167

Table 5: **Effect of digit ratio on firm size: value and sales**. In columns 1 and 2 the dependent variable is log of current firm value; in columns 3 and 4 the log of current firm sales. β coefficients.

	Log of Value		Log of Sales	
	(1)	(2)	(3)	(4)
	beta/p	beta/p	beta/p	beta/p
Digit ratio	–0.109**	–0.108**	–0.024	–0.023
	(0.024)	(0.028)	(0.543)	(0.570)
Male	0.100*	0.097*	0.067	0.064
	(0.085)	(0.096)	(0.212)	(0.233)
Age	0.054	0.059	0.046	0.049
	(0.312)	(0.269)	(0.274)	(0.246)
Education	0.139***	0.139***	0.160***	0.159***
	(0.003)	(0.003)	(0.000)	(0.000)
Height	–0.065	–0.062	0.047	0.050
	(0.266)	(0.291)	(0.400)	(0.381)
First born	0.007	0.004	0.065*	0.064*
	(0.877)	(0.919)	(0.075)	(0.079)
Age of firm	0.096**	0.095**	0.157***	0.157***
	(0.036)	(0.038)	(0.000)	(0.000)
Years in control	0.036	0.035	–0.035	–0.035
	(0.497)	(0.499)	(0.428)	(0.431)
Mills ratio	0.176**	0.176**	0.071	0.071
	(0.027)	(0.028)	(0.291)	(0.292)
Risk profile		0.036		0.027
		(0.434)		(0.450)
r2	0.168	0.169	0.171	0.172
N	542	542	753	753

Table 6: **Effect of digit ratio on initial firm size**. The dependent variable is the log of initial firm size at the time the entrepreneur acquired control measured by the log of employment (Employee), log of firm value (Value) and log of firm sales (Sales). β coefficients.

	Employee beta/p	Value beta/p	Sales beta/p
Digit ratio	–0.072***	–0.111***	–0.079*
	(0.006)	(0.003)	(0.093)
Male	0.020	–0.014	0.143**
	(0.594)	(0.816)	(0.013)
Age	0.068**	0.076	0.050
	(0.036)	(0.147)	(0.369)
Education	0.187***	0.143***	0.131***
	(0.000)	(0.001)	(0.006)
Height	–0.001	0.031	–0.047
	(0.985)	(0.605)	(0.394)
First born	0.023	0.049	0.059
	(0.417)	(0.213)	(0.195)
Age of firm	0.299***	0.256***	0.199***
	(0.000)	(0.000)	(0.008)
Years in control	–0.334***	–0.447***	–0.462***
	(0.000)	(0.000)	(0.000)
r2	0.224	0.311	0.299
N	1069	499	446

Table 7: **Effect of digit ratio on firm growth: employment**. The dependent variable is the annual average growth rate of employment over the years the entrepreneur was in control of the firm. β coefficients.

	(1)	(2)	(3)	(4)	(5)
	beta/p	beta/p	beta/p	beta/p	beta/p
Digit ratio	–0.028	–0.026	–0.035*	–0.036*	–0.035*
	(0.128)	(0.151)	(0.088)	(0.076)	(0.077)
Male		–0.037	–0.057	–0.046	–0.047
		(0.281)	(0.181)	(0.299)	(0.290)
Initial Size	–0.258***	–0.256***	–0.311***	–0.311***	–0.311***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age			–0.010	–0.017	–0.016
			(0.818)	(0.709)	(0.733)
Education			0.033	0.029	0.029
			(0.383)	(0.384)	(0.397)
Height			0.085**	0.074*	0.074*
			(0.010)	(0.061)	(0.060)
First born			0.033	0.030	0.030
			(0.286)	(0.325)	(0.337)
Age of firm			–0.041	–0.037	–0.037
			(0.105)	(0.127)	(0.125)
Years in control			–0.217***	–0.213***	–0.213***
			(0.000)	(0.000)	(0.000)
Mills ratio				0.041	0.041
				(0.455)	(0.450)
Risk Profile					0.014
					(0.554)
r2	0.103	0.105	0.151	0.148	0.148
N	1061	1061	1036	1018	1018

Table 8: **Effect of digit ratio on firm growth: value and sales**. In columns 1, 2 and 3 the dependent variable is the annual average growth rate of firm value over the years the entrepreneur was in control of the firm; in columns 4, 5 and 6 it is the average share of growth of firm sales. β coefficients.

	Value			Sales		
	(1)	(2)	(3)	(4)	(5)	(6)
	beta/p	beta/p	beta/p	beta/p	beta/p	beta/p
Digit ratio	–0.086*	–0.087	–0.085	–0.061	–0.072	–0.070
	(0.081)	(0.138)	(0.137)	(0.228)	(0.233)	(0.234)
Log of initial value	–0.456***	–0.461***	–0.463***			
	(0.000)	(0.000)	(0.000)			
Log of initial sales				–0.418***	–0.413***	–0.413***
				(0.000)	(0.000)	(0.000)
Male	0.036	0.032	0.030	–0.004	–0.033	–0.043
	(0.558)	(0.580)	(0.611)	(0.943)	(0.423)	(0.319)
Age	–0.059	–0.069	–0.061	–0.044	–0.021	–0.009
	(0.321)	(0.166)	(0.251)	(0.616)	(0.724)	(0.863)
Education	0.070	0.077	0.075	0.033	0.050	0.049
	(0.124)	(0.159)	(0.167)	(0.471)	(0.456)	(0.459)
Height	–0.006	–0.003	0.003	0.079*	0.121	0.133*
	(0.903)	(0.963)	(0.965)	(0.095)	(0.104)	(0.099)
First born	0.095*	0.095	0.093	0.042	0.054	0.053
	(0.081)	(0.150)	(0.149)	(0.566)	(0.535)	(0.536)
Age of firm	–0.002	–0.003	–0.003	0.014	–0.000	–0.004
	(0.955)	(0.954)	(0.956)	(0.712)	(0.996)	(0.932)
Years in control	–0.218***	–0.215***	–0.220***	–0.210***	–0.215***	–0.215***
	(0.000)	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)
Mills ratio		–0.009	–0.008		–0.148	–0.151
		(0.963)	(0.967)		(0.516)	(0.507)
Risk Profile			0.045			0.077
			(0.472)			(0.209)
r2	0.262	0.262	0.264	0.214	0.222	0.228
N	400	393	393	397	393	393

Table 9: **Effect of digit ratio on firm's profitability: returns on assets**. The left hand side is a measure of return on assets computed using a measure of profits and scaling by the firm book value of assets. Profits are measured using four indicators from broader to narrower: gross operating profits (GOP), gross profit before interest (GPBI), gross profit after interest (GPAI), net profit before interest (NPBI). All variables on assets.

	GOP b/p	GPBI b/p	GPAI b/p	NPBI b/p	GOP b/p
Digit ratio	0.168**	0.146***	0.159***	0.101***	0.172**
	(0.023)	(0.001)	(0.001)	(0.001)	(0.022)
Log of assets	–0.014***	–0.003*	–0.003	0.002*	–0.014***
	(0.000)	(0.090)	(0.113)	(0.065)	(0.000)
Male	0.014	0.008	0.011	0.007	0.014
	(0.183)	(0.231)	(0.135)	(0.146)	(0.211)
Age	–0.000	–0.000*	–0.000*	–0.000	–0.000
	(0.662)	(0.060)	(0.078)	(0.144)	(0.748)
Education	0.002	0.000	0.000	0.000	0.002
	(0.221)	(0.883)	(0.957)	(0.918)	(0.231)
Height	–0.001	–0.001	–0.001	–0.000	–0.000
	(0.382)	(0.163)	(0.127)	(0.175)	(0.414)
First born	–0.010	–0.000	–0.000	–0.002	–0.010
	(0.190)	(0.980)	(0.991)	(0.465)	(0.195)
Age of firm	–0.000	–0.000	0.000	–0.000	–0.000
	(0.906)	(0.438)	(0.675)	(0.606)	(0.902)
Years in control	0.000	0.000	0.000	0.000	0.000
	(0.496)	(0.180)	(0.524)	(0.312)	(0.544)
Mills ratio					–0.006
					(0.785)
r2	0.082	0.044	0.049	0.033	0.082
N	5632	5597	5600	5602	5546

Table 10: **Effect of digit ratio on firm's profitability: returns on sales**. The left hand side is a measure of return on assets computed using a measure of profits and scaling by the firm book value of sales. Profits are measured using four indicators from broader to narrower: gross operating profits (GOP), gross profit before interest (GPBI), gross profit after interest (GPAI), net profit before interest (NPBI). All variables on assets.

	GOP b/p	GPBI b/p	GPAI b/p	NPBI b/p	GOP b/p
Digit ratio	0.157**	0.138***	0.145***	0.089***	0.160**
	(0.011)	(0.003)	(0.002)	(0.003)	(0.011)
Log of sales	–0.009***	0.001	0.003*	0.005***	–0.009***
	(0.003)	(0.603)	(0.089)	(0.001)	(0.003)
Male	0.010	0.004	0.009	0.004	0.010
	(0.300)	(0.549)	(0.245)	(0.376)	(0.306)
Age	–0.000	–0.000	–0.000	–0.000	–0.000
	(0.973)	(0.299)	(0.307)	(0.254)	(0.926)
Education	0.005***	0.001	0.001	0.000	0.004***
	(0.002)	(0.168)	(0.523)	(0.798)	(0.003)
Height	–0.000	–0.000	–0.001*	–0.000	–0.000
	(0.502)	(0.307)	(0.069)	(0.210)	(0.423)
First born	–0.014*	–0.007*	–0.005	–0.006*	–0.015*
	(0.053)	(0.099)	(0.267)	(0.092)	(0.051)
Age of firm	0.000	0.000	0.000	0.000	0.000
	(0.589)	(0.919)	(0.288)	(0.984)	(0.587)
Years in control	0.000	0.000	0.000	0.000	0.000
	(0.233)	(0.123)	(0.296)	(0.288)	(0.242)
Mills ratio					0.008
					(0.709)
r2	0.062	0.040	0.043	0.038	0.062
N	5590	5554	5557	5553	5503

Table 11: **Effect of Digit ratio on firm's Gross Operating Profits**. The left hand side is the flow of total profits using gross operating profits (GOP).

	(1)	(2)	(3)	(4)
	b/p	b/p	b/p	b/p
Digit ratio	–5853.839	2940.664*	–5158.694	3204.521*
	(0.500)	(0.081)	(0.482)	(0.069)
Assets		0.113***		0.113***
		(0.000)		(0.000)
Male			–4304.466	–152.222
			(0.208)	(0.327)
Age			–19.035	–6.884
			(0.595)	(0.258)
Education			33.959	–16.647
			(0.742)	(0.617)
Height			119.379	–8.543
			(0.395)	(0.475)
First born			–671.582	–27.151
			(0.628)	(0.887)
Age of firm			–38.556	–8.856
			(0.201)	(0.316)
Years in control			36.525	16.630
			(0.270)	(0.110)
r2	0.021	0.985	0.028	0.986
N	5836	5836	5717	5717

Table 12: **Effect of digit ratio on cost of effort, ability and optimism**. The dependent variables are three measures of entrepreneur quality. In columns 1 and 2 the quality is a measure of low cost of work effort; in columns 3 and 4 the grade at secondary school diploma; in columns 5 and 6 an index of optimism. See data appendix for more detailed definition. β coefficients.

	Low Cost		HS Grade		Optimism	
	(1)	(2)	(3)	(4)	(5)	(6)
	beta/p	beta/p	beta/p	beta/p	beta/p	beta/p
Digit ratio	–0.059*	–0.062*	–0.082**	–0.079**	–0.051*	–0.046*
	(0.073)	(0.061)	(0.037)	(0.044)	(0.062)	(0.088)
Male	0.196***	0.231***	–0.228***	–0.230***	–0.037	0.011
	(0.000)	(0.000)	(0.000)	(0.000)	(0.341)	(0.804)
Age	0.054	0.033	0.009	0.009	–0.014	–0.041
	(0.152)	(0.433)	(0.824)	(0.843)	(0.694)	(0.282)
Education	–0.013	–0.018	0.168***	0.168***	0.048*	0.021
	(0.683)	(0.605)	(0.000)	(0.000)	(0.098)	(0.500)
Height	0.041	0.004	0.008	0.013	0.024	–0.029
	(0.340)	(0.942)	(0.858)	(0.783)	(0.547)	(0.499)
First born	0.047	0.037	0.028	0.029	0.004	–0.007
	(0.130)	(0.236)	(0.426)	(0.423)	(0.887)	(0.824)
Age of firm	–0.057**	–0.050*	–0.012	–0.015	0.008	0.030
	(0.048)	(0.099)	(0.721)	(0.673)	(0.808)	(0.393)
Years in control	0.044	0.054	0.023	0.020	0.053	0.070*
	(0.241)	(0.149)	(0.546)	(0.612)	(0.168)	(0.077)
Mills ratio		0.087		–0.019		0.186***
		(0.225)		(0.787)		(0.001)
r2	0.107	0.102	0.115	0.110	0.040	0.048
N	1002	983	835	822	1167	1148

Table 13: **Effect of Low effort cost, Cognitive Ability and Optimism on firm size**. Size is measured as log of the number of employees. Cognitive ability is measured by the high school grade. β coefficients.

	Interest rate	Rationing	Collateral
	(1)	(2)	(3)
	beta/p	beta/p	beta/p
Low cost of effort	0.067***		
	(0.001)		
Cognitive ability		0.048*	
		(0.082)	
Optimism			0.055**
			(0.011)
Male	0.044	0.054	0.053*
	(0.132)	(0.144)	(0.063)
Age	0.003	–0.012	–0.011
	(0.923)	(0.678)	(0.658)
Education	0.199***	0.162***	0.193***
	(0.000)	(0.000)	(0.000)
Height	0.026	0.043	0.030
	(0.370)	(0.236)	(0.303)
First born	0.024	0.037	0.024
	(0.262)	(0.162)	(0.256)
Age of firm	0.180***	0.183***	0.187***
	(0.000)	(0.000)	(0.000)
Years in control	0.014	–0.009	0.018
	(0.622)	(0.792)	(0.504)
r2	0.176	0.159	0.176
N	1837	1290	1941

Table 14: **Effect of measures of ability on profitability**. Panel A: The dependent variable is a index of return on assets measured as Gross Operating Profits scaled by the firm book value of assets. Panel B: as Panel A, but Gross Operating Profits are scaled by the firm book value of sales.

	(1) ROA Low Cost Effort	(2) ROA HSGrade	(3) ROA Optimism
Panel A: Returns on Assets			
Low cost of effort	–0.002*		
	(0.069)		
High school grade		0.000	
		(0.191)	
Optimism			0.000
			(0.937)
Log of assets	–0.002	–0.002	–0.002
	(0.225)	(0.321)	(0.235)
Male	0.015*	0.017*	0.013*
	(0.067)	(0.057)	(0.067)
Age	–0.000	–0.000	–0.000*
	(0.283)	(0.139)	(0.084)
Education	0.000	0.000	0.000
	(0.803)	(0.854)	(0.981)
Height	–0.001	–0.001	–0.001*
	(0.103)	(0.155)	(0.077)
First born	0.000	0.003	0.000
	(0.982)	(0.554)	(0.962)
Age of firm	0.000	0.000	0.000
	(0.597)	(0.851)	(0.763)
Years in control	–0.000	0.000	0.000
	(0.967)	(0.830)	(0.650)
r2	0.046	0.061	0.040
N	5143	3780	5481
Panel B: Returns on Sales			
Low cost of effort	–0.000		
	(0.593)		
High school grade		–0.000	
		(0.875)	
Optimism			0.001
			(0.344)
Log of sales	0.004**	0.005**	0.004**
	(0.034)	(0.048)	(0.043)
Male	0.012	0.011	0.012
	(0.150)	(0.195)	(0.123)
Age	–0.000	–0.000	–0.000
	(0.305)	(0.161)	(0.154)
Education	0.001	0.001	0.000
	(0.538)	(0.412)	(0.768)
Height	–0.001**	–0.001*	–0.001**
	(0.033)	(0.071)	(0.028)
First born	–0.004	0.001	–0.005
	(0.423)	(0.900)	(0.296)
Age of firm	0.000	0.000	0.000
	(0.241)	(0.800)	(0.230)
Years in control	0.000	0.000	0.000
	(0.805)	(0.549)	(0.541)
r2	0.039	0.051	0.039
N	5101	3739	5430

Table 15: **Digit ratio and ability to raise cheap capital**. In column 1 the dependent variable is the interest rate firms are charged on their credit lines; in column 2 it is a dummy equal to 1 if the firm applied for a loan and was turned down over the 5 years prior the interview; in column 3 it is the value of collateral as a fraction of the value of the stock of outstanding loans. β coefficients.

	Interest rate (1) beta/p	Rationing (2) beta/p	Collateral (3) beta/p
Digit ratio, right hand	0.050	–0.000	0.008
	(0.273)	(0.999)	(0.858)
Male	0.010	0.009	0.016
	(0.862)	(0.895)	(0.770)
Age	–0.041	0.043	–0.097*
	(0.441)	(0.428)	(0.062)
Education	0.035	0.046	0.014
	(0.422)	(0.345)	(0.745)
Height	–0.152**	–0.022	–0.057
	(0.010)	(0.743)	(0.311)
First born	–0.032	0.056	–0.103**
	(0.466)	(0.284)	(0.018)
Age of firm	–0.069	–0.027	–0.023
	(0.144)	(0.610)	(0.648)
Years in control	–0.024	–0.110**	0.032
	(0.682)	(0.037)	(0.577)
r2	0.179	0.075	0.112
N	489	455	540

Table 16: **Digit ratio and Years of control.** Dependent variable is the Digit ratio, right hand. β coefficients.

	(1) beta/p
Years in control	–0.079**
	(0.048)
Age of entrepreneur	0.045
	(0.217)
Firm age	0.035
	(0.329)
male	0.091**
	(0.034)
First born entrepreneur	–0.043
	(0.176)
Height of entrepreneur	–0.090**
	(0.033)
Initial Size of Firm	–0.065*
	(0.052)
N	1029

Figure 1: **Density of digit ratio, right hand for all, male and female subjects.**

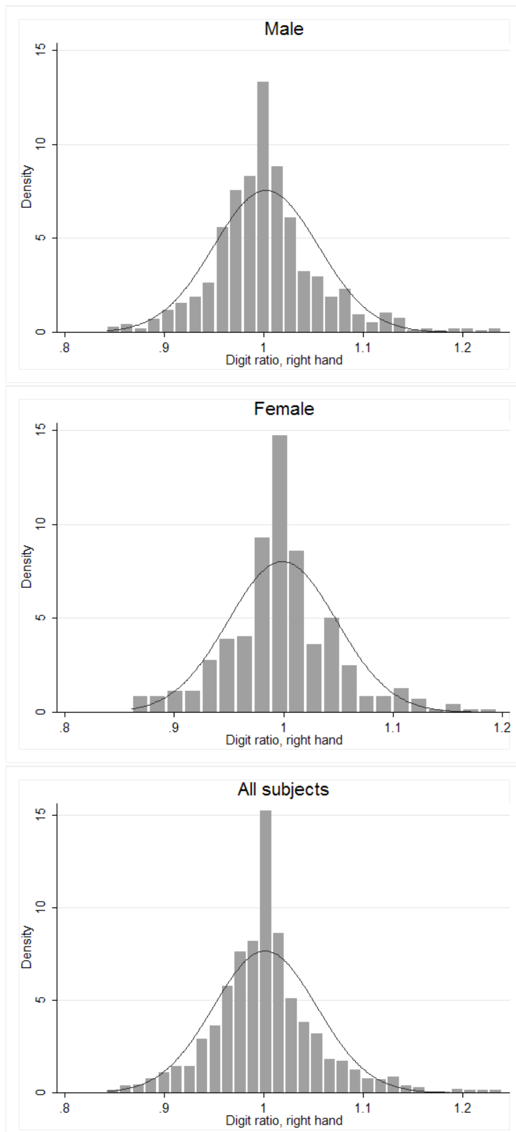

Figure 2: **Digit ratio, right hand, and Years in control.**