

What a Difference a Y makes-Female and Male Nascent Entrepreneurs in Germany

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ABSTRACT. In western industrialized countries men are on average more than twice as active in entrepreneurship as women. Based on data from a recent representative survey of the adult population in Germany this paper uses an empirical model for the decision to become self-employed to test for differences between women and men in the *ceteris paribus* impact of several characteristics and attitudes, taking the rare events nature of becoming an entrepreneur into account. Furthermore, a non-parametric approach using Mahalanobis-distance matching of man and woman which are as similar as possible in all characteristics and attitudes but the “small difference” is used to investigate the difference in the propensity to become self-employed by sex. A core finding is that the difference between men and women in both the extent and the effect of considering fear of failure to be a reason not to start one’s own business is important for the explanation of the gap in entrepreneurship by sex.

KEY WORDS: differences in entrepreneurship by sex, Germany, Nascent entrepreneurs

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1. Motivation

It is a stylized fact that in western industrialized countries the share of men in total self-employment is much higher than the share of women (see OECD, 2000, table 5.3). Recent empirical evidence based on millions of micro data from a large number of countries is given in Blanchflower (2004), who furthermore documents that the probability of preferring to be self-employed is higher for males compared to females, too. A major pattern found in the Global Entrepreneurship Monitor (GEM) is that men are on

average more than twice as active in entrepreneurship as women (Minniti and Arenius 2003; Minniti et al., 2005; Reynolds et al., 2001, p. 15). Table I reports differences by sex in the Total Entrepreneurial Activity (TEA) rate – the number per 100 individuals 18–64 years old involved in either starting their own business or in managing their new business that is less than 42 months old – for 41 countries in 2000–2003. For most of the countries differences by sex are large. This illustrates that the question of low female entrepreneurship is important.

Germany is a case in point. According to official statistics women’s self-employment rate (percentage of all working women) is only about half of the men’s rate – the figures are 5.0 percent and 10.3 percent for 1991, and 6.3 percent and 12.9 percent for 2002 (Lauxen-Ulbrich and Leicht, 2003, p.15). According to a representative survey among the population (aged 18–64 years) in 10 German regions in 2001 the share of men who were actively involved in starting their own new business was 4.9 percent compared to 2.3 percent of all females (Bergmann et al., 2002, p.15). Similar results (4.70 percent and 2.27 percent, respectively) were obtained in the nationally representative sample for the German part of the Global Entrepreneurship Monitor 2002 (Sternberg and Bergmann, 2003, p.13); in 2004 the respective figures were 4.72 percent and 2.01 percent (Sternberg and Lueckgen, 2005, p. 18). A survey of the Rhine-Westfalia Institute for Economic Research (RWI) showed that in 1999 in Germany 15.9 percent of all men, but only 7.4 percent of all women, wish to become self-employed (Welter and Lagemann, 2003, p. 31).

In a sense this relationship between sex and self-employment is easier to understand than other relationships between entrepreneurship and individual characteristics or attitudes – sex is strictly exogeneous because it does in no way

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TABLE I
Total entrepreneurial activity (TEA) rate by sex: 41 countries, 2000–2003

Country	Male/Female ratio	Country	Male/Female ratio	Country	Male/Female ratio
Israel	3.42	United Kingdom	2.17	United States	1.72
Slovenia	2.82	Switzerland	2.14	France	1.71
Croatia	2.80	Hong Kong	2.07	Chile	1.56
Japan	2.62	Sweden	2.06	Uganda	1.55
Portugal	2.58	Spain	2.03	Chinese Taipei	1.55
Norway	2.55	India	2.02	New Zealand	1.55
Ireland	2.54	Germany	1.93	Poland	1.51
Singapore	2.49	Argentina	1.92	Brazil	1.50
Russia	2.49	Iceland	1.92	South Africa	1.50
Belgium	2.45	Hungary	1.89	Italy	1.43
Greece	2.40	The Netherlands	1.88	China	1.16
Denmark	2.38	Mexiko	1.81	Venezuela	1.13
Korea	2.34	Australia	1.80	Thailand	1.05
Finland	2.17	Canada	1.75		

Note: The TEA rate measures the number per 100 individuals 18–64 years old involved in either the start-up phase or managing a new business less than 42 months old. The male/female ratio is the male TEA rate divided by the female TEA rate. Source: Global Entrepreneurship Monitor (GEM) 2003 Executive Report; see Reynolds et al. (2004, p. 37).

depend on the choice between self-employment and paid employment, so we can exclude that causality runs from self-employment to sex. However, what about the other direction? Economists tend to be reluctant to put the blame for the choice between alternatives on a single chromosome. Individual characteristics (like age, endowment with human capital, or the profession of the father) and attitudes (like the degree of risk aversion) that are related to the (expected, discounted life-time) relative payoff of self-employment compared to paid employment are used by economists to explain the choice between these alternatives. How large is the part of the difference between men and women in the propensity to become self-employed that can be explained by differences in characteristics and attitudes – or, for short, “endowments”? And how large is the (unexplained) rest that is due to different “rates of return” to components of these endowments – differences that are due to the fact that women are women and not men?

Given the huge difference in self-employment by sex reported above, and the widespread interest in political measures aimed at fostering female entrepreneurship,¹ it comes as a surprise that the economic literature on this gap is rather small. As Simon Parker puts it in his recent

comprehensive treatise on the economics of self-employment and entrepreneurship: “Despite its intrinsic interest and importance, the subject of female entrepreneurship has arguably not commanded the degree of research effort that it deserves. Little is known about precisely why there is less female than male entrepreneurship ...” (Parker, 2004, p. 129)² Again, Germany is a case in point. According to Lauxen-Ulbrich and Leicht (2003, p. 6), there is (at least in relation to other countries) a lack of sex-related data and research on business ownership and self-employment. Lauxen-Ulbrich and Leicht (2003) present a collection of tables and figures for self-employment and start-ups by sex in Germany. Welter and Lagemann (2003, chapter 3) give a descriptive comparison of male and female nascent entrepreneurs, while Fehrenbach and Lauxen-Ulbrich (2002) report descriptive evidence on differences of self-employed and employed men and women with regard to, inter alia, age, levels of schooling, and vocational education. Sternberg et al. (2004) present descriptive evidence on differences between male and female nascent entrepreneurs and non-entrepreneurs. The *ceteris paribus* role of sex for being or starting to be self-employed is investigated with German micro data by Hübner (1991, 1992), Lechner and Pfeiffer (1993), Georgellis

and Wall (2000), Linan Alcalde et al. (2002), Lohmann (2001), Wagner (2003a, b, c, d, 2004), Wagner and Sternberg (2004, 2005), Engel and Welter (2004), and Bergmann (2004, chapter 6). The “state of the art” of research in female entrepreneurship in Germany is documented (unfortunately, in German only) in two recent collective volumes edited by Leicht and Welter (2004) and by KfW Bankengruppe (2004).

This paper contributes to the economic entrepreneurship literature by reporting results of an econometric inquiry into the extent and the causes of differences between female and male nascent entrepreneurs. The data are taken from a recent representative survey of the adult population in Germany. Based on an empirical model, derived from a theoretical framework, the difference by sex in the propensity to step out of paid employment into self-employment is documented and investigated. Note that we do not consider the choice between working (in the market) or not here. This important omission is due to the fact that important variables influencing this participation decision (like age of youngest child in the household, presence of a spouse or other persons with own income, amount of earnings by a spouse or other persons, amount of income from other sources) are not available from the survey. Note further that so-called nascent entrepreneurs are investigated – people who are just about to start as self-employed (more on this below).

By focussing on differences by sex in the factors affecting the decision to become self-employed, as opposed to remaining in paid-employment, instead of looking at differences in the probability that males or females are self-employed rather than employees, we avoid confounding entry and survival effects: The probability of being self-employed at a point in time depends on the probability of switching into self-employment in the past and then surviving as a self-employed until the time of the survey (see Parker, 2004, p. 25f.). To put it differently, while differences between males and females who were self-employed for some time are an important topic, too, it is not dealt with in this paper. On this topic, see Devine (1994) who uses data from the March 1976 and March 1991 Current Population Surveys and Income

Supplements to compare female and male self-employed and their wage-and-salary counterparts. Carr (1996) who uses data from the Census of Population and Housing to compare demographic and labor supply characteristics of male and female self-employed in the US in 1980, and she estimates two logistic regression models separately for men and women to investigate differences in the determinants of self-employment by sex; a similar approach is used by Boden (1999) using data from the Contingent Work Survey, a special supplement to the February 1995 Current Population Survey. Simpson and Sproule (1998) perform a similar analysis for Canadian male and female self-employed. Lohmann (2001) uses comparable micro data for six countries (France, Germany (East and West), Italy, Sweden, the UK, and the US) to investigate differences between part-time and full-time employees and self-employed by sex; to do so he estimates multinomial logit models separately by sex and country. Parker (2004, p. 128) reviews the empirical evidence of the under-performance of female self-employees relative to males in terms of income, output, employment, and turnover. Evidence for Germany on survival and success of newly founded firms by sex of the founder is given in Jungbauer-Gans (1993); Wießner (2001) reports differences by sex in the post-entry performance of self-employed who were subsidized by a so-called “bridging allowance” when they founded their own firm out of unemployment.

In the empirical investigation two approaches (described in detail in section 4 below) are used that, to the best of my knowledge, have not been applied in this context before:

- An empirical model for the decision to become self-employed is used to test for differences between women and men in the *ceteris paribus* impact of several characteristics and attitudes, and the rare events nature of becoming an entrepreneur is explicitly taken into account when estimating this model.
- Furthermore, a non-parametric approach is applied based on a Mahalanobis-distance matching of man and woman that are as similar as possible in all characteristics and attitudes but the “small difference”, and than

looking at the difference in the propensity to become self-employed between these groups of “twins.”

Both approaches differ from those used in the earlier literature: Carter (1997) uses data from the Wisconsin Entrepreneurial Climate Study to compare selected characteristics of 58 male and 34 female nascents; Carter and Kolvereid (1998) look at small samples of male and female nascent entrepreneurs from the United States and Norway. These comparisons, however, are only descriptive, and the decision to become a nascent entrepreneur or not is not dealt with. Alsos and Ljunggren (1998) look at data from a survey conducted in Sweden to investigate whether there are differences by sex with regard to what nascent entrepreneurs do during their start-up processes, and they examine to which extent men and women who attempt to start a business succeed in actually doing so. Again, this is a purely descriptive study, and the decision to become a nascent entrepreneur or not is not looked at. Reynolds (1997) looked at differences between female and male nascent entrepreneurs in the U.S. using stepwise logistic regressions with a dummy for sex. Boden (1996) – using US data –, Georgellis and Wall (2000) – using German data –, Moore and Mueller (2002), and Rybczynski (2004) – using data from Canada –, and Delmar and Davidsson (2000) – using data from Sweden – come closer to the first approach applied in this paper in estimating probit or logit models for the step into self-employment separately for men and women. However, these authors do not test statistically for the significance of the differences in the estimated coefficients for males and females, and they ignore the rare event nature of switching from paid-employment to self-employment in applying the standard probit or logit model (which is only appropriate in the study by Delmar and Davidsson (2000) who use a control group of non-nascents which is of similar size). Note that in the papers using German micro data by Hübner (1991, 1992), Lechner and Pfeiffer (1993), Linan Alcalde et al. (2002), Wagner (2003a, b, c, d, 2004), Wagner and Sternberg (2004, 2005), and Bergmann (2004) sex is only included as a dummy variable

in the empirical models that explain (nascent) entrepreneurship.

The rest of the paper is organized as follows: Section 2 develops a theoretical framework for our investigation; Section 3 introduces the survey data used and discusses the theoretical hypotheses and measurement issues; Section 4 gives descriptive empirical information; Section 5 introduces the empirical model and reports on the results of the econometric investigation; Section 6 concludes.

2. Theoretical framework

To discuss the role of sex in the process of becoming a nascent entrepreneur consider a utility-maximizing individual that has the choice between paid employment and self-employment.³ This person will choose the option self-employment if the discounted expected life-time utility from self-employment ($DELU_s$) is higher than that from paid employment ($DELU_p$). The difference N_i between $DELU_{si}$ and $DELU_{pi}$,

$$N_i = DELU_{si} - DELU_{pi} \quad (1)$$

therefore, is crucial for the decision of individual i , and it will choose self-employment if N_i is positive.

$DELU_{si}$ and $DELU_{pi}$ are determined by the expected monetary and non-monetary returns from self-employment and paid employment according to the utility function of the person and the individual's discount rate. Higher returns lead to higher values of $DELU$.

The expected monetary and non-monetary returns from both types of employment depend on variables that can be considered as endowments of individual i (like age, a university degree, or the degree of risk-aversion) summarized in the vector x_i . Given that N_i depends on $DELU_{si}$ and $DELU_{pi}$, and $DELU_{si}$ and $DELU_{pi}$ depend on the monetary and non-monetary returns, N_i can be written as a function of x_i :

$$N_i = N_i(x_i) \quad (2)$$

Individual endowments (elements of x_i) which have a more positive or less negative impact on $DELU_{si}$ than on $DELU_{pi}$ increase N_i (and vice versa). Given that the expected monetary and

non-monetary returns from both types of employment, the utility function, and the discount rate of an individual are unknown to an observer, we cannot observe N_i . Therefore, we cannot test directly whether an individual characteristic or attitude – say, a university degree, or a high degree of risk aversion – has a positive impact on N_i or not. If, however, N_i is greater than the critical value zero, according to our theoretical framework a person will choose to become an entrepreneur, and the decision to do so or not is observable. In our empirical model we will investigate the influence of the elements of x_i on the probability that a person becomes an entrepreneur by looking at his known decision pro or contra.

The theoretical hypotheses regarding a positive or negative influence of personal characteristics and attitudes on this decision are discussed below in Section 3 together with a description of the way the elements of x_i are measured. Given that details of the specification of the empirical model are (as usual) data driven, we will turn to a description of the data base used in our study before.

3. Data and theoretical hypotheses

The data used in this paper are taken from a representative survey of the population aged 18–64. This survey is part of the research project Regional Entrepreneurship Monitor (REM) Germany 2003 which focuses on the extent of the difference in entrepreneurial activities between regions in Germany, its determinants, and its consequences for regional development.⁴ It was carried out in 11 (out of 97) so-called planning regions in Germany. The regions were selected in such a way that they mirror the spatial structure with regard to old and new federal states (i.e., West and East Germany), highly industrialized versus more rural regions, and center and periphery.⁵ A comparison with results from the German part of the Global Entrepreneurship Monitor (GEM) which covers all of Germany shows that the figures for nascent entrepreneurs, and for the share of women in nascent (mentioned in the introductory section of this paper), are very similar for both surveys. The great advantage of the data used

here compared to the data from GEM Germany lies in the fact that they include information on important variables (described in detail below) that are not available from the GEM survey. The survey was conducted using computer assisted telephone interviewing by TNS EMNID, a leading opinion research institute, between June and August 2003. The data set contains information on 12,000 people.⁶ The questionnaire asked for socio-demographic characteristics (e.g., sex, age, employment status, education, fields of professional experience) and a number of items related to entrepreneurial activities (e.g., whether the interviewee is currently engaged in starting an own business).⁷

In the empirical model discussed in the next section we regress the observed decision whether to start a new business or not on a variable indicating the sex of a person, and on a set of personal characteristics and attitudes. Selection of the elements included in the empirical model are, at least in part, data driven. Although we had full control over the design of the questionnaire used in the REM survey, we were unable to collect information on all individual characteristics that are important for the decision under consideration due to budget constraints (that limited the time per interview and the number of items to be included) and the willingness of the interviewees to report information on issues like the amount of personal wealth. Effects of variables not included in the empirical model⁸ are covered by the error term. Frankly, this might lead to an omitted variables bias – a problem common to many (all?) econometric investigations.

That said, we will now turn to a discussion of the variables that are included in our empirical model.

In the survey the interviewee was asked whether she/he is (alone or with others) actively involved in starting a new business that will (as a whole or in part) belong to her/him, and whether this business did not pay full time wages or salaries for more than three months to anybody (including the interviewee). Those who answered in the affirmative are considered to be nascent entrepreneurs.⁹ Interviewees who are currently working in a private sector firm and who are not nascent entrepreneurs are considered to be

employees. The empirical model considers the decision between these two alternatives only; self-employed, public sector employees, and people out of the labor force are excluded from the sample because for these groups information regarding the size and age of the (former) employer is lacking, and both variables are part of the core of our empirical model (see below).

As regards the individual characteristics and attitudes, the empirical model includes the following variables:

- Age (measured in years). Hypothesis: On the one hand, age is a proxy variable for personal wealth – the older a person is, the longer is the potential period to accumulate wealth. Given that young firms are often constrained by lack of credit because banks usually demand collateral to finance investments, a certain amount of wealth is crucial for starting a new business (see Evans and Jovanovic, 1989).¹⁰ This leads to the expectation of a positive sign of the estimated coefficient of the age variable. On the other hand one has to acknowledge that starting a new business often leads to high sunk costs – think of all the effort to set up a business plan, doing market research, dealing with legal and administrative problems, etc. The shorter the expected life span of the new business, the shorter is the period over which these sunk costs can be earned back. To put it differently, setting up a new business with high sunk costs is more attractive at the age of 45 than at the age of 60, *ceteris paribus*. This leads to the expectation of a negative sign of the estimated coefficient of the age variable. Given these two opposite influences of age on the propensity to become an entrepreneur it is an empirical question whether one dominates the other, or whether both net out (see Evans and Leighton, 1989). To control for a non-linear influence of age on the decision to start a new firm age is included in squares, too.
- Fear of failure a reason not to start (a dummy variable taking the value one if the interviewee agreed to the following statement: “The fear to fail would prevent you from founding your own business.”). Hypothesis: If the interviewee agrees to this statement we consider this as an indicator of a high degree of risk aver-

sion, and we expect a negative impact on the probability of becoming a nascent entrepreneur (see Kihlstrom and Laffont, 1979). One might be tempted to argue that a nascent entrepreneur should never agree to this question. However, this need not be the case, and is definitely not the case in the survey used here (or in any other survey that used this item). A nascent entrepreneur who strongly believes that his own new venture will make it might as well agree that he would not have worked on a plan for starting a new business if he feared that he might fail. This item has been used in the Global Entrepreneurship Monitor (GEM) project for many years in many countries to proxy risk aversion. Evidently, a more direct measure would be better (see, for example, the approach by Cramer et al. (2002) who ask to evaluate a hypothetical lottery), but such an approach is not feasible in a telephone interview.

- Role model (a dummy variable taking the value one if the interviewee agreed to the following statement: “Someone in your family is or has been self-employed.”). We expect a positive impact of contact with such a ‘role model’. As Parker (2004, p. 85) puts it, self-employed parents might offer their offspring informal induction in business methods, transfer business experience and provide access to capital and equipment, business networks, consultancy and reputation. Furthermore, children of self-employed parents can be expected to have more pro-business attitudes on average.¹¹

While the role of age, risk aversion, and family background are widely discussed in the entrepreneurship literature and, therefore, can be dealt with in a rather cursory way here, this does not hold for the rest of the variables included in our empirical model, dealing with the jack-of-all-trades theory, and with the age and size of the firm a person is or has been working in.

In a recent paper Lazear (2002) proposed the jack-of-all-trades view of entrepreneurship. Based on a coherent model of the choice between self-employment and paid employment he shows that having a background in a large number of different roles increases the probability of becoming an entrepreneur. The intuition behind this proposi-

tion is that entrepreneurs must have sufficient knowledge in a variety of areas to put together the many ingredients needed for survival and success in a business, while for paid employees it suffices and pays to be a specialist in the field demanded by the job taken. The variety of professional experience of an interviewee that is at the heart of Lazear's theory of entrepreneurship is measured by two variables:

- The survey includes a tailor-made question asking “In how many different professional fields have you been active the past? By this we do not mean different employers, but different focuses of your professional activity until today.” The answer is included in the empirical investigation as the number of fields of experience.
- The survey collects information about professional degrees completed after school, i.e., whether or not the interviewee successfully passed apprenticeship, managed to qualify formally as a master craftsperson, or received a degree from a polytech or university. The number of professional degrees (ranging from zero to three) is included as a variable in the empirical investigation.¹²
- As regards the characteristics of the firm a person is working in we consider both firm size and firm age. Hypothesis: A stylized fact emerging from a vast number of empirical studies on the inter-regional differences in new firm formation is that the start-up rate in a region tends to be positively related to the share of employees working in small firms, or the proportion of small firms among all firms in the region (see, e.g., Armington and Acs, 2002; Audretsch and Fritsch, 1994; Gerlach and Wagner, 1994; Mason, 1991; Reynolds et al., 1994,). A similar point has been made in studies dealing with inter-industry differences in new firm formation (see, e.g., Beesley and Hamilton, 1984). A theoretical explanation for this empirical regularity argues that working in a small firm tends to provide employees with a much more relevant experience for starting a new business (e.g., contacts with customers, and with the owner of the firm who therefore provides a role model to follow) than working in a large firm (see, e.g., Johnson, 1986 and Mason 1991).

If this arguments holds one should expect that people who are working in a small firm (or did so in the past) should have a higher propensity to step into self-employment than others who work(ed) for a large enterprise. A similar argument can be made for those who work(ed) in young firms compared to those in old firms: Through a close contact to a successful entrepreneur people in a young firm have the opportunity to gather information about the transition from paid employment to self employment with all its problems, and about possible solutions (see, e.g., Sorensen and Audia, 2000). The “employer-as-a-role-model” argument put forward in the context of the small firm should be even more relevant here, because not all small firms are young (and, therefore, not all owners of small firms are role models for potential starters of new firms today), but most of the young firms are small. And we expect it to be most relevant in the case of work experience gathered in a young and small firms.

Evidence on the *ceteris paribus* role played by the size of the firm a person is or has been working in for the decision to start a new business is scarce. Blanchflower and Meyer (1994) provide an econometric study looking at the *ceteris paribus* impact of firm size on the transition into self-employment; for a sample of Australians, they find that the probability to step into self-employment decreases with firm size. Similar evidence is reported by Boden (1996) for the US; he finds a greater propensity of small business employees to switch to self-employment. Using large random samples of economically active adults from Germany Strohmeier and Leicht (2000) show that those who completed their vocational training in a small firm are more likely to become self-employed than those trained in large firms.

The role played by firm age for the individual decision to start a new business has been investigated econometrically in Wagner (2004) using the same data set as in this study. Accordingly, people from young and small firms have a higher probability to become nascent entrepreneurs, *ceteris paribus*.

Firm age is measured in years. Given that we do not expect that it matters whether a firm is, say, 25 or 145 years old, we define a young firm to be at most 10 years old. Firm size is measured by

the number of employees working in a firm. Firms with less than or equal to 20 employees are considered to be small firms. Furthermore, we will look at the group of firms that are both young and small according to the definition used here.¹³

4. Descriptive information

Descriptive statistics by sex for the variables used in this study are reported in Table II. In the sample considered here the percentage of nascent entrepreneurs is about twice as high for men (4.7 percent) than for women (2.4 percent) – this gap has exactly the same order of magnitude as the gap found for the self-employed, and for those wishing to become self-employed, cited for Germany in the first paragraph of this paper. Furthermore, the differences in mean values between men and women for all characteristics and attitudes are statistically significant at an error level of 10 percent or lower. However, these differences are negligible from an

economic point of view for age, number of fields of experience, number of professional degrees, and presence or not of a role model in the family. Statistically significant and large (in an economic sense) differences between men and women are found for risk aversion – the proportion of those who consider fear of failure to be a reason not to start an own business is 12 percentage points higher for women than for men – and for work in small, young, and small, young firms – the shares of women who are working in these “hothouses” for nascent entrepreneurs are much higher than the respective shares of men.

Next, we will compare nascent entrepreneurs and paid employees, starting with men. According to the results reported in the left half of Table III, on average nascents are younger, have more fields of experience, do less often consider fear of failure a reason not to start an own business, have more often a role model in their families, and are more often working in

TABLE II
Descriptive statistics (Part I): all males and females in the sample

	Male Mean Std. Dev.	Female Mean Std. Dev.	Test of H ₀ : Difference in means = 0 (<i>t</i> -value)
Nascent entrepreneur (Dummy; 1 = yes)	0.047 0.21	0.024 0.15	-3.78***
Age (years)	39.46 0.24	40.10 0.25	1.87*
Age (squared)	1667.94 19.31	1715.73 20.23	1.71*
Number of fields of experience	3.51 2.66	3.17 2.42	-4.05***
Number of professional degrees	1.09 0.57	0.99 0.51	-5.90***
Fear of failure a reason not to start an own business (dummy; 1 = yes)	0.44 0.50	0.56 0.50	6.81***
Role model (dummy; 1 = at least one self-employed in the family)	0.45 0.50	0.49 0.50	2.67***
Small firm (dummy; 1–20 employees)	0.24 0.43	0.42 0.49	11.71***
Young firm (dummy; up to 10 years old)	0.19 0.39	0.24 0.43	4.17***
Young firm * small firm (interaction term)	0.09 0.29	0.16 0.36	5.85***
Number of cases	1940	1708	

*, **, *** denote statistical significance at an error level of 10, 5, and 1 percent.

small, young, and small, young firms. All these differences are statistically significant at an error level of five percent or lower, are large from an economic point of view, and are in line with our priors stated above. The only exception from this rule is the number of professional degrees – on average, there is no difference between nascent entrepreneurs and paid employees here.

By and large, a similar picture can be found in the right half of Table III where female nascent entrepreneurs are compared with paid employees. Again, on average nascents have more fields of experience, do less often consider fear of failure a reason not to start an own business, have more often a role model in their families, and are more often working in small, young, and small, young firms. With the exception of the number of fields of experience, these differences are statistically significant at an error level of ten percent or lower, large from an economic point of view, and in line with the theoretical priors. As is the case for men, the number of professional degrees does not differ between female nascent entrepreneurs and paid employees. Contrary to the evidence reported for males, female nascents tend to be about 2 years older than paid employees on average; this difference, however, is not statistically significant at an error level of ten percent.

As a final step in our descriptive analysis, male and female nascent entrepreneurs are compared. According to the results reported in Table IV, on average male nascents are much younger than females (and this difference is statistically highly significant), and they have about one more field of experience. Furthermore, the share of female nascents working in small, young, and young, small firms is higher compared to males, although only the difference for “small firms” is statistically significant at a common level.

5. Results of the econometric study

5.1. *A parametric approach: rare events logit models*

The descriptive evidence given in section 4 above has documented significant differences in characteristics and attitudes between men and

women, between nascent entrepreneurs and paid employees, and between male and female nascent entrepreneurs. What is the *ceteris paribus* impact of these characteristics and attitudes on the decision to become a nascent entrepreneur? Which part of the gap in entrepreneurship by sex can be explained by these endowments? As a first step towards an answer to these questions, the *ceteris paribus* role played by sex in determining the probability of becoming a nascent entrepreneur when characteristics and attitudes of the interviewees are controlled for is investigated in an econometric model with a dummy endogenous variable taking the value one if a person is a nascent entrepreneur, zero otherwise.¹⁴

Starting a new business is a rare event; only 132 (or 3.6 percent) of all persons included in the sample are nascent entrepreneurs; 91 of them are males, 41 are females. Application of standard textbook probit or logit methods to estimate the empirical models is not appropriate here. King and Zeng (2001a, b) recently developed a version of the logit model to compute unbiased estimates in a situation like this. This method – labeled Rare Events Logistic Regression, or RELOGIT – is applied here. RELOGIT estimates the same logit model as the standard logit procedure, but uses an estimator that gives lower mean square error in the presence of rare events data for coefficients, probabilities, and other quantities of interest. Furthermore, to take the survey design into account and to allow that the observations might be dependent within a planning region, the variances of the estimated coefficients were estimated with the region as a cluster.¹⁵ Note that spatial autocorrelation is not an issue in our study because the planning regions are scattered all over Germany.

In the econometric investigation three different variants of the empirical model were estimated. All variants include an identical set of variables (for age, risk aversion, presence of a role model, numbers of fields of experience and professional degrees, and dummy variables indicating whether a person works or worked in a small firm, a young, and in a young, small firm), but they differ in the way sex enters the model. Model A and model B is estimated for males and females only, respectively; model C

TABLE III
Descriptive statistics (Part II): Male and female nascent entrepreneurs vs. paid employees

	Male			Female		
	Nascent Entrepreneur Mean (Std. Dev.)	Paid Employee Mean (Std. Dev.)	Test of H ₀ Difference in means = 0 (<i>t</i> -value)	Nascent Entrepreneur Mean (Std. Dev.)	Paid Employee Mean (Std. Dev.)	Test of H ₀ Difference in means = 0 (<i>t</i> -value)
Age (years)	35.26 (9.14)	39.66 (10.57)	4.45***	41.85 (8.04)	40.06 (10.42)	-1.40
Age (squared)	1326.12 (686.11)	1864.77 (854.48)	4.81***	1814.83 (675.19)	1713.29 (839.47)	-0.95
Number of fields of experience	4.40 (3.64)	3.47 (2.60)	-2.40**	3.51 (2.51)	3.17 (2.41)	-0.87
Number of professional degrees	1.12 (0.53)	1.09 (0.57)	-0.55	1.05 (0.55)	0.98 (0.51)	-0.75
Fear of failure a reason not to start an own business (dummy; 1 = yes)	0.24 (0.43)	0.45 (0.50)	4.54***	0.17 (0.38)	0.57 (0.50)	6.49***
Role model (dummy; 1 = at least one self-employed in the family)	0.59 (0.49)	0.44 (0.50)	2.91***	0.63 (0.49)	0.49 (0.50)	-1.91*
Small firm (dummy; 1 = 1 - 20 employees)	0.38 (0.49)	0.24 (0.42)	-2.84***	0.56 (0.50)	0.42 (0.49)	-1.77*
Young firm (dummy; Up to 10 years old)	0.37 (0.49)	0.18 (0.38)	-3.82***	0.49 (0.51)	0.24 (0.42)	-3.16***
Young firm * small firm (interaction term)	0.27 (0.45)	0.08 (0.27)	-4.05***	0.39 (0.49)	0.15 (0.36)	-3.10***
Number of cases	91	1940		41	1667	

*, **, *** denote statistical significance at an error level of 10, 5, and 1 percent.

TABLE IV
Descriptive statistics (Part III): Male vs. female nascent entrepreneurs

	Male nascent entrepreneur Mean Std. Dev.	Female nascent entrepreneur Mean Std. Dev.	Test of H ₀ : Difference in means = 0 (<i>t</i> -value)
Age (years)	35.26 9.14	41.85 8.04	4.17***
Age (squared)	1326.12 686.11	1814.83 675.19	3.83***
Number of fields of experience	4.40 3.64	3.51 2.51	-1.62
Number of professional degrees	1.12 0.53	1.05 0.55	-0.71
Fear of failure a reason not to start an own business (dummy; 1 = yes)	0.24 0.43	0.17 0.38	-0.95
Role model (dummy; 1 = at least one self-employed in the family)	0.59 0.49	0.63 0.49	0.44
Small firm (dummy; 1–20 employees)	0.38 0.49	0.56 0.50	1.88*
Young firm (dummy; up to 10 years old)	0.37 0.49	0.49 0.51	1.21
Young firm * small firm (interaction term)	0.27 0.45	0.39 0.49	1.28
Number of cases	91	41	

*, **, *** denote statistical significance at an error level of 10, 5, and 1 percent.

includes a dummy variables which takes the value one if the person is male, and zero otherwise, plus a full set of interaction terms of all variables and the male dummy variable. Results are reported in Table V.

To start with the determinants of becoming a male nascent entrepreneur, from the estimated coefficients of model A and their prob-values we see that the number of fields of experience, risk aversion, and working in a young and small firm matter (and in a way that is in accordance with our theoretical priors) – all other variables included in the empirical model are statistically insignificant at any conventional level. Model B paints a different picture for female nascent: Again, fear of failure matters, but other than for males neither the number of fields of experience, nor work experience in a young and small firm, has any statistically significant effect. Contrary to male nascent, age matters for females – the estimated coefficients tend to show that the propensity to step into self-employment increases up to the age of 40 years, and decreases afterwards. Like in the case of males, all the other variables included are statistically

insignificant at any conventional level. To summarize, we find that, on the one hand, results from bivariate comparisons of mean values for nascent entrepreneurs and paid employees (reported in Table III) and *ceteris paribus* results from the econometric models differ, and that, on the other hand, results from the empirical models estimated for men and women differ, too.

To shed more light on the differences between the coefficient estimates from the empirical models for male and female nascent entrepreneurs, these models were augmented with a dummy for males, and a full set of interaction terms of this dummy variable with all variables included in models A and B. The augmented model was estimated for both men and women; results for model C are reported in the last column of Table V. By construction, the coefficient estimates (and the prob-values) for the variables included both in model A and model B are identical to those from model B (i.e., the estimation results for females). The dummy variable for males is positive and statistically significant, pointing to an upward shift in the level of the probability to become a nascent entrepreneur

TABLE V
Rare events logit estimates for being a nascent entrepreneur

	Model A (Male)	Model B (Female)	Model C (Both)
Age (years)	0.070	0.242	0.242
	0.355	0.054	0.054
Age squared	-0.001	-0.003	-0.003
	0.130	0.101	0.101
Number of fields of experience	0.095	0.014	0.014
	0.002	0.845	0.845
Number of professional degrees	0.168	0.134	0.134
	0.406	0.580	0.580
Fear of failure a reason not to start an own business (dummy; 1 = yes)	-0.819	-1.709	-1.709
	0.000	0.000	0.000
Role model (dummy; 1 = at least one self-employed in the family)	0.410	0.414	0.414
	0.126	0.181	0.181
Small firm (dummy; 1–20 employees)	-0.121	-0.082	-0.082
	0.811	0.846	0.846
Young firm (dummy; 0–10 years)	0.202	0.582	0.582
	0.452	0.405	0.405
Young firm * small firm (interaction term)	1.217	0.773	0.773
	0.032	0.329	0.329
Sex (dummy; 1 = Male)			4.978
			0.018
Sex * Age (interaction term)			-0.172
			0.142
Sex * Age squared (interaction term)			0.001
			0.419
Sex * Number of fields of experience (interaction term)			0.080
			0.338
Sex * Number of professional degrees (interaction term)			0.034
			0.908
Sex * Fear of failure a reason not to start an own business (interaction term)			0.890
			0.007
Sex * Role model (interaction term)			-0.004
			0.989
Sex * Small firm (interaction term)			-0.040
			0.961
Sex * Young firm (interaction term)			-0.381
			0.666
Sex * (Young firm * small firm) (interaction term)			0.444
			0.713
Constant	-4.111	-9.088	-9.088
	0.003	0.000	0.000
Number of cases	1940	1708	3648

Note: Prob-values are reported below the estimated coefficients.

when men are compared to women, irrespective of the values of the regression coefficients for the variables included in the model. By construction, the coefficient estimates for the interaction terms are the differences between the coefficient estimates for males and females from model A and B. A joint test rejects the null hypothesis that all these coefficients of the interaction terms

are zero at any level of significance.¹⁶ A closer look reveals, however, that only the estimated coefficient for the interaction term of the dummy variable for males and the variable indicating that fear of failure is considered as a reason not to start an own business is statistically significantly different from zero at a conventional level. This coefficient estimate is positive, pointing

out that fear of failure has a smaller negative influence on the propensity to step into self-employment for men than for women. For all the other interaction terms the null hypothesis that the estimated coefficients from model A (for men) and model B (for women) do not differ can not be rejected at a conventional error level.

Discussion of results hitherto was limited to the statistical significance of the estimated coefficients and the direction of influence conducted by the variables. Information on the extent of this influence, or on the economic importance, however, is even more important. Evidently, a variable that has no statistically significant impact can be ignored from an economic point of view, but the opposite is not true: A variable that is highly significant statistically might not matter at all economically – if the estimated probability for becoming a nascent entrepreneur diminishes by 0.00001 percent when a person considers fear of failure as a reason not to start a business, we can ignore the “fear of failure” – variable in any discussion on nascent entrepreneurs irrespective of any high level of statistical significance indicated by the prob-value.

Unfortunately, the estimated coefficients from a rare events logit model (or for any other non-linear model) can not easily be used for statements about the size of the *ceteris paribus* effect of a change of the value of an exogenous variable (e.g., to consider fear of failure as a reason not to start a business, or not to do so) on the value of the endogenous variable (e.g., the probability of becoming a nascent entrepreneur), because the size of this effects depends on both the value of the exogenous variable under consideration and on the values of all other variables in the model (see Long and Freese, 2001, 87ff.).

A way to ease interpretation of the estimation results is to compute the estimated values of the endogenous variable (here: the probability of becoming a nascent entrepreneur) for a person with certain characteristics and attitudes, and to show how a change in the value of one exogenous variable at a time changes the estimated probability.

For expository purposes, we start by looking at an “average person” with values for all the

exogenous variables exactly equal to the sample averages for males listed in Table II (ignoring the obvious fact that dummy variables can only take the value zero or one for any real person). If this person is a man, according to the results reported for model A in Table V for this hypothetical person the estimated probability to be a nascent entrepreneur is 3.5 percent.¹⁷ If this person is a women instead, the probability (computed by using model B) goes down to 1.6 percent – less than half the value computed for our average person if he is treated as a man. A similar pattern is observed for a hypothetical average person with values of the exogenous variables that are set at the sample average for woman: using model B the estimated probability is 1.5 percent, based on model A we get 3.3 percent. Sex matters.

To illustrate the importance of “fear of failure” let us now look at a person who is 39.46 years old, has 3.51 fields of experience and 1.09 professional degrees (these are the average values for males in the sample), has a role model in his family, and works in a small and young firm. If this person does not consider fear of failure a reason not to start an own business, and if it is a man, according to model A the probability that he is a nascent entrepreneur is 17.8 percent; if the same person is a women, according to model B this probability is 12.8 percent. Now let us assume that the person does consider fear of failure a reason not to start an own business. If he is a man, the probability of being a nascent entrepreneur drops from 17.8 percent to 9.0 percent, i.e., by a factor 2. If she is a women, it drops from 12.0 percent to 2.4 percent, i.e., by a factor 5. Sex matters a lot as regards the influence of fear or failure on the propensity to become a nascent entrepreneur – statistically and economically.

According to the results from the descriptive comparisons between males and females discussed in Section 4 both groups differ on average with respect to characteristics (like the share of employees from young and small firms) and attitudes (like the share of those who consider the fear of failure to be a reason not to start an own business), or for short, in their average endowments. The results from the rare events logit estimates of the empirical models reported

above indicate that all but one endowments are not related differently to the propensity to step into self-employment for men and women - the differences in the estimated coefficients between model A and model B are not statistically different from zero, the one exception being fear of failure (and the constant term). How large is the part of the gap in the propensity to become a nascent entrepreneur that can be explained by differences in endowments, and how much of it is due to differences in behavior as reflected in different coefficients (including the different constant terms)?

One approach that might be considered to investigate this topic is the application of the so-called Oaxaca-Blinder decomposition introduced into the economics literature some thirty years ago by Ronald Oaxaca and Alan Blinder. This technique splits up the wage differential by sex into a portion that arises because men and women, on average, have different skills, and a portion not explained by these skill differentials that is often labeled labor market discrimination (see Blinder, 1973; Oaxaca, 1973; Oaxaca and Ransom, 1994). It is discussed in introductory textbooks on labor economics (e.g., Borjas, 2000, p. 362ff.), and it has been used in the literature on self-employment to investigate earnings differentials between self-employed men and women (see Parker, 2004, p. 126ff.). One might be tempted to apply this type of decomposition to the problem under investigation here to split up the differential in self-employment by sex into a portion that arises because men and women, on average, have different characteristics and attitudes, or endowments, as documented in Table II, and a portion attributable to different coefficients, or rates of return with respect to the propensity to become self-employed, as reported in Table V.

This research strategy, however, is not technically feasible. Details aside, the Oaxaca-Blinder decomposition uses the well-known fact that the regression hyperplane estimated by OLS passes through the point of means of the data (this is derived from the first normal equation; see Greene, 2000, p. 230). If the empirical models for becoming a male or female nascent entrepreneur were estimated by OLS, therefore, this technique could be used. However, the

endogenous variable in these models is a binary variable, and we know from introductory textbooks that application of OLS (in the form of a linear probability model) is not appropriate (e.g., Studenmund, 2001, p. 436ff.). Extensions of the Oaxaca-Blinder decomposition technique to models for binary choice using a logit approach are available (Fairlie 1999, 2003; Nielsen 1998; Yun 2004). Here a useful property of the logit regression that includes a constant term is used - the average of the predicted probabilities must equal the proportion of ones (in our case, the proportion of nascent entrepreneurs) in the sample. However, Langche Zeng, the co-author of the King/Zeng papers on rare events logit, pointed out (in private correspondence on March 24, 2004) that this property, which is directly implied by the logit normal equation, does not need to hold in rare events logit, since the normal equation effectively changes from that of the standard logit. Therefore, the decomposition technique can not be applied.

5.2. *A non-parametric approach: Mahalanobis-distance matching*

An alternative path towards an answer to the question how much of the gap in the propensity to become a nascent entrepreneur by sex is due to differences in endowments, and how much is due to differences in behavior, starts with asking a different but closely related hypothetical question: Would a man with a given set of characteristics and attitudes be a nascent entrepreneur or not if he were a woman? Obviously, there is no direct way to find out for any single person, because we are unable to record the behavior of a man acting like a woman, and vice versa. If case number 478 in our sample is a female paid employee, we will never know whether she would be a male nascent entrepreneur or not. The counterfactual situation is unobservable, and, therefore, the individual causal effect of being a man or a woman (*ceteris paribus*, i.e., with a fixed set of endowments) on the propensity to be a nascent entrepreneur must remain unknown.

A way out is to take the women in the sample and to construct a control group of men in such a way that every woman is matched to a man

that is as similar as possible (ideally, identical) with regard to all the relevant characteristics and attitudes (besides sex). By construction, the mean values for the characteristics and attitudes between the women and the men from this control group do not differ significantly if this matching has been successful. From the survey we know for each woman and each man whether (s)he is a nascent entrepreneur or not. The difference in the percentage of nascent entrepreneurs between the group of females in the sample and the matched control group of men, therefore, can be seen as an estimate of the causal effect of sex on the propensity to become a nascent entrepreneur.

In a sense this resembles a situation familiar from the evaluation of active labor market programs (or any other form of treatment of units): If participants, or treated units, are not selected randomly from a population but are selected or self-select according to certain criteria, the effect of a treatment cannot be evaluated by comparing the average performance of the treated and the non-treated. However, given that each unit (plant, or person, etc.) either participated or not, we have no information about its performance in the counterfactual situation. A way out here is to construct a control group in such a way that every treated unit is matched to an untreated unit that has been as similar as possible (ideally, identical) at the time before the treatment. Differences between the two groups (the treated, and the matched non-treated) after the treatment can then be attributed to the treatment (for a comprehensive discussion, see Heckman et al., 1999). Obviously, sex can not literally be seen as a treatment because not all people have been men sometimes in the past, and then half of them were treated to become women. However, the idea behind the procedure can be used to net out the effects of differences in endowments. The approach to consider the sex variable as a treatment and use matching to select sub-samples of males and females such that there are no differences in observable characteristics between the matched groups has been used before by Nopo (2004) to decompose the wage gap by sex; to the best of my knowledge, it has not been applied to look at differences by sex in the propensity to become a

nascent entrepreneur before. If, for example, in the complete sample we have 6 percent of nascents among all males, and 3 percent among all females, the raw differential is 3 percentage points (or 100 percent). If the portion of nascents among the group of matched males is 5 percent, the difference due to sex (holding endowments constant) is 2 percentage points (or 66.6 percent of the raw differential), and the rest of 1 percentage point (or 33.3 percent of the raw differential) is due to differences in endowments.

To implement this approach, each woman in the sample is matched to a man whose vector of characteristics and attitudes has the minimum Mahalanobis distance from the vector of the woman.¹⁸ Matching was successful; a comparison of mean values for women and matched man reported in Table VI shows no statistically significant differences at an error level of 5 percent.¹⁹

The use of Mahalanobis-distance matching of man and woman that are as similar as possible in all characteristics and attitudes but the “small difference,” and looking at the difference in the propensity to become self-employed between these groups of “twins,” is a non-parametric approach to compute the average effect of being female on the propensity to become a nascent entrepreneur (or, in the language of the program evaluation literature, to compute the average effect of the treatment on the treated). An advantage of this non-parametric approach is that, contrary to the estimation of the logit models, we do not have to assume a functional form for the self-employment equation.

In the matched sample, the proportion of females which are nascent entrepreneurs is by construction unchanged, i.e., 2.40 percent, while the proportion of male nascents is 4.80 percent – and that is 0.11 percentage points higher than the respective proportion in the unmatched sample (which is 4.69 percent). Taken at face value, from this it follows that if women had the same characteristics as men on average the gap in nascent entrepreneurship by sex would even be higher than it is now when these endowments differ. To put it differently, it is only sex specific behavior that matters, not endowment differences by sex.

When interpreting the computed value for the effect of the treatment on the treated one must,

TABLE VI
Comparison of females and matched males

	Female Mean	Male Mean	Test of H_0 : Difference in means = 0 (<i>t</i> -value)
Age (years)	40.10	39.93	0.50
Age (squared)	1715.73	1696.44	0.69
Number of fields of experience	3.17	3.15	0.28
Number of professional degrees	0.99	0.98	0.07
Fear of failure a reason not to start an own business (dummy; 1 = yes)	0.56	0.55	0.17
Role model (dummy; 1 = at least one self-employed in the family)	0.49	0.49	-0.07
Small firm (dummy; 1–20 employees)	0.42	0.42	0.00
Young firm (dummy; up to 10 years old)	0.24	0.24	0.00
Young firm * small firm (interaction term)	0.16	0.16	0.00
Number of cases	1708	873	

however, keep in mind that this value is based on a sample of all men and women only – it is, therefore, an estimate of the treatment effect with a sampling distribution. While we have no formula for the sampling distribution of the effect we can estimate the standard errors for the computed effect by bootstrapping, and construct a confidence interval for it.²⁰ Using 1,000 replications the bias corrected 95 percent confidence interval for the computed treatment effect of –0.0234 (or –2.34 percent) is [–0.0428, –0.0034], or between –4.28 percent and –0.034 percent. Based on this result we can reject the null hypothesis that being female has no negative effect on the propensity of becoming a nascent entrepreneur at an error level of 5 percent. The effect itself, however, is rather imprecisely estimated. It seems that the non-parametric matching approach asks too much from the sample at hand which includes only 41 female nascent entrepreneurs, and the 37 matched male nascents.

6. Conclusions

This paper starts from the stylized fact that in western industrialized countries men are on average more than twice as active in entrepreneurship as women, and from the statement that little is known about precisely why this is the case, with Germany being a case point. Using data from a recent representative survey of the adult German population an empirical model for the decision to become self-employed is

estimated to test for differences between women and men in the *ceteris paribus* impact of several characteristics and attitudes, taking the rare events nature of becoming an entrepreneur into account. Furthermore, a non-parametric approach using Mahalanobis-distance matching of man and woman who are as similar as possible is used to investigate the difference in the propensity to become self-employed by sex.

The bottom line of this empirical exercise in looking at the differences between female and male nascent entrepreneurs is that considering fear of failure to be a reason not to start an own business matters a lot. The estimated coefficient for the interaction term of the dummy variable for males and the variable indicating that fear of failure is considered as a reason not to start an own business is statistically significantly different from zero at a conventional level and positive, pointing out that fear of failure has a smaller negative influence on the propensity to step into self-employment for men than for women. Given that only 44 percent of all men, but 56 percent of all women, in the sample consider fear of failure a reason not to become self-employed, this sex specific difference in risk aversion is important. This finding fits well with results on sex specific differences in risk aversion from other areas. Summarizing a large literature, Eckel and Grossman (2003) argue that “(d)ifferences between women and man in attitudes toward risk are well documented across a variety of situations and environments. Studies

have found women more likely to perceive a situation as risky. Women also exhibit greater risk aversion in their choice behavior and lower valuations of risky prospects. They are found to have less risky asset portfolios than men, and report a lower propensity to assume financial risk than men.” In the context of entrepreneurship Carter (2002) states that female founders are more risk averse and less likely to expect debt financing to capitalize their businesses. It is an open question, however, whether these differences by sex in behavior towards risk is deeply routed in the past of the human species, or whether it is due to different socialization men and women are subjected to due to their observed sex, as is argued by social feminist theories (see Fischer et al., 1993). Maybe, economists should leave the search for an answer to this question to colleagues from other sciences, including sociology and biology, noting that our comparative advantage lies in dealing with different aspects of differences in entrepreneurship by sex.

It is an open question not answered in this study what part of the differential in nascent entrepreneurship by sex can be explained by different behavior towards risk, and what are the reason(s) for the remaining part. And it would be important to test whether the results from this study hold when a more direct measure of risk aversion that goes well beyond the dummy variable used here is applied. Furthermore, from the cross section data on nascent entrepreneurs investigated we have no information about differences by sex in the shares of nascent who eventually set up a new business, or give up, and about differences in the long run success of new businesses founded by women and men. Finally, it is important to replicate this study with other data sets for Germany,²¹ and with data for other countries to test whether the findings can be considered as a stylized fact or not. These are important topics for future research that have to be resolved before sound policy measures aimed at fostering entrepreneurial activities by women can be framed.

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Notes

¹ See OECD (2000, p. 183ff.) for a survey of self-employment policies for women. A case in point for Germany is the recently started initiative of the Federal Government to support women who are in the process of starting their own business. Three federal ministries finance a service agency (with 3.146 million Euro in 2004–2007) with the dedicated aim to increase the share of start-ups by women. See the press release 2004–2003–2005 by the Federal Ministry for Education and Research for details.

² For surveys of this literature, see Carter (2001), McManus (2001), and Parker (2004, pp. 124–129).

³ Remember that the decision to participate in the market is taken as given.

⁴ For further information about the REM project see Bergmann et al. (2002), and Lückgen and Oberschachtsiek (2004). REM is closely related to GEM, the Global Entrepreneurship Monitor, a multi-country study that investigates the same topics at a national level (see Reynolds et al., 2004, and Acs et al., 2005, for recent international reports, and Sternberg and Lückgen (2005) for the most recent country report for Germany).

⁵ The regions are described in detail in Lückgen and Oberschachtsiek (2004). Note that in this part of the REM project the region Hannover was added to the ten regions covered in the first part of REM (see Bergmann et al. 2002).

⁶ The data will be made available for public scientific use after the completion of the REM project.

⁷ An English version of the questionnaire is not yet available; a German version is available from the author on request.

⁸ Important variables that could not be considered here due to lack of information are: Having a young child (see Boden, 1999); self-employment experience of a spouse (see Bruce); information on labor market experience, health status, self-employment in the past, assets, income, inheritance, and scores from psychological tests (see Le, 1999; Parker 2004).

⁹ This definition of a nascent entrepreneur is identical to the definition used in the multi-country GEM project mentioned in footnote 1; see Reynolds et al. (2000), p. 9.

¹⁰ Remember that we were unable to collect more direct information on wealth in the survey.

¹¹ Using data from the 1970 through 1991 waves of the Panel Study of Income Dynamics Bruce (1999) finds that having a husband with some exposure to self-employment nearly doubles the probability that a woman will become self-employed, all else equal. Unfortunately, the survey used in this paper has no information about the employment status of the spouse of an interviewee.

¹² First evidence for the empirical validity of Lazear's theory using data for German female and male nascent entrepreneurs together is given in Wagner (2003a, b).

¹³ A more detailed discussion of how to measure firm age and firm size with the REM data, and comparable results for empirical models using continuous and categorical measures, can be found in Wagner (2004). In the survey some interviewees reported an incredibly high number of employees in their firm (up to 700,000). From the raw data we get an average firm size of 6,774 employees. These figures are nonsense. According to the Federal Statistical Office in 1999 there were only 749 firms in the industrial sector that had 1,000 or more employees. These very large firms employed 2.6 million persons – or 3,471 on average. In 2000, the average number of employees in all industrial establishments was about 130. Firms from private services and from building and construction tend to be much smaller on average (see Statistisches Bundesamt 2002, p. 289ff.). I decided to drop all (195) cases with a firm size that exceeds 17,000 employees – about five times the average number of employees among the group of the largest firms in the manufacturing sector. A comparison of the descriptive statistics from the whole sample and the reduced sample reveals no differences apart from the average firm size; the table is available on request.

¹⁴ This type of empirical model has been labeled the “reduced-form self-employment equation” by Le (1999). Note that in his survey Le mentions that studies using this approach primarily focus on males aged 16–64 years; in his Table IV he lists only three papers that report results for specifications with a dummy variable for sex, and no study that looks at differences by sex in depth. Parker (2004) does not include sex as one of the determinants in entrepreneurship in his summary table 3.3 which gives a synopsis of the findings of dozens of empirical investigations.D

¹⁵ All computations were done with Stata 8.2 (see GataCorp, 2003) using the RELOGIT ado-file available from Gary King's homepage at Harvard <<http://gking.harvard.edu>>.

¹⁶ The empirical $\chi^2(9)$ – value is 169.90 with a prob-value of 0.0000. If the sex dummy is included in the set of coefficients looked at in the joint test, the respective $\chi^2(10)$ – value is 6756.33 with a prob-value of 0.0000. These results indicate that it is not appropriate to pool data for male and female nascent and add a dummy for sex to an empirical model without checking carefully whether single variables have different effects for men and women. This point has not been taken care of in numerous empirical studies on the determinants of entrepreneurship, including earlier studies by the author and others with German data mentioned in the introductory section above.

¹⁷ All simulations were done in Stata 8.2 using the SETX and RELOGITQ programs that come with RELOGIT; see footnote 16.

¹⁸ The Mahalanobis distance (MD) is defined as follows: Let XM (XF) be a column vector of variables for males and females, respectively, and G the inverse of the covariance matrix; then $MD = (XM-XS)'G(XM-XS)$. Matching was performed in Stata 8.2 using the PSMATCH2 command (Leuven and Sianesi, 2003).

¹⁹ Testing for differences after matching was done with the Stata ado-file PSTEST1 provided by Edwin Leuven on March 11, 2004. Note that some men were matched with more than one woman due to matching with replacement; a total of 873 men was used to match 1,708 women: 434 men were used once, 236 were used twice, and 101, 60, 24, 8, 4 and 3 were used 3, 4, 5, 6, 7 and 8 times; in three cases, one man has been used 9, 12 and 18 times, respectively.

²⁰ In a nutshell, bootstrapping consists of drawing, with replacement, N observations from our N observations data set. In this new sample, some of the original observations appear once, some more than once, and some are not in it. The average effect of the treatment on the treated is computed using this new sample. This procedure is repeated for a number of times (e.g., 1,000 times), leading to a new random sample, and a new estimate of the effect, in each replication. From the estimates for the effect (in our example, 1,000) one calculates the standard deviation using the standard formula. Bootstrapping was performed with Stata 8.2, see StataCorp (2003) for details and references to the statistical literature.

²¹ Unfortunately, the German Socio-Economic Panel (www.diw.de/soep) has no information about nascent entrepreneurship (according to the international standard definition), and no information about other core variables used in this study (fear of failure, number of fields of experience, work experience in a small and young firm), and the same is true for other German micro data sets I am aware of.

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