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Veröffentlichungsversion / Published Version
Arbeitspapier / working paper

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**Working Paper**

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RatSWD Research Note, No. 13

**Provided in Cooperation with:**
German Data Forum (RatSWD)

# RatSWD

*Research Notes*

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Robert Stohmeyer

2007

# Research Notes of the Council for Social and Economic Data (RatSWD)

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The *RatSWD Research Notes* are edited by:

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Managing Director of the RatSWD (Denis Huschka)

# General Information

**Author:**

Robert Strohmeyer

Research Fellow, PhD Candidate
Institute for Small Business Research
(German: Institut für Mittelstandsforschung, ifm Mannheim)
University of Mannheim
Phone :++49-621-181-2893
Fax:++49-621-181-2892
Email: strohmey@mail.ifm.uni-mannheim.de

# INTRODUCTION

There are two phenomena in the field of female entrepreneurship that have not yet been adequately explained by previous research, namely (first) the *"gender gap"* in self-employment and (second) **gender-specific occupational** *and* **industrial segregation, also** in self-employment.

The *"gender gap" in self-employment* refers to the phenomenon that despite increasing absolute numbers of self-employed women in most of the welfare states of Western Europe and North America, the women's self-employment ratio, referring to the ratio of self-employed women among all working women, remains roughly half that of men's self-employment ratio (Arum and Müller 2004, Leicht and Strohmeyer 2005). This also holds true for Germany, where the chances to become self-employed are roughly twice as low for women than for men: after all, women comprise only 28% of all self-employed in Germany (Wagner 2005, Lauxen-Ulbrich and Leicht 2002). This arises the question why women are significantly less likely to become entrepreneurs than men.

Research speaks of *gender-based occupational segregation (or occupational sex segregation)*, when occupations exist in which the share of workers of one sex is so high that they could be called either "male" or "female" occupations (Jonung 1996, Melkas and Anker 1997). Research argues that the tendency for women in dependent employment to enroll in "sex-typical occupations" is also true for self-employment. Confirming the results obtained for United Kingdom (Hakim 1998), a German study (Lauxen-Ulbrich and Leicht 2002: 49-53) and an Israeli (Kraus 2003:6-7) study show that the most common occupations for self-employed women still refer to jobs that *are person- and service-oriented* and are performed either in female-dominated occupations (typically "female jobs" include nurses, salespersons, hairdressers, beauticians, doctor's receptionist etc.) or integrated occupations (lawyers, consultants, economists, etc.). Instead, only a very small proportion of self-employed women (e.g. in Germany every fifth self-employed female, in Israel every tenth self-employed female) perform in male-dominated occupations, which mainly refer to traditional professions, craftsmen, as well as technicians and engineers.

By the same token, striking empirical evidence exists on *gender-based industrial segregation* which, analogous to occupational sex distribution, refers to the phenomenon that industries exist where the percentage of workers of one sex is so high that they could be called either "male-dominated" or "female-dominated" industries. Research argues that there is indeed an

inter-industry variability in gender composition in self-employment: across most industrialized countries, women entrepreneurs tend to operate in relatively unrewarding female-typed sectors that revolve around highly female-typed personal and educational service industries (Kalleberg and Leicht 1991, Lohmann and Luber 2000) where goods or services are produced that are either functionally or symbolically similar to women's traditional domestic roles (e.g. personal service industries, apparel or food).

However, prior research has failed to examine the causes of occupational and industrial sex segregation in self-employment. In other words, it has not provided an answer to the question *why* there is a tendency for self-employed women and men to work in different occupations and industries. What factors or mechanisms (individual or institutional) are responsible for women ending up in occupations and industries that are strongly person- and service-oriented but rather less technology and production-oriented? On the contrary, why have certain occupations always been the domain of male entrepreneurs?

Against the above background, this project sets out to explore the determinants of *two phenomena*, namely the gender gap in self-employment and the gender-specific differences in occupations and industries, while focusing especially on the role of "human capital". The underlying assumption of this study is that the factor "human capital" has not been thoroughly investigated in previous research to explain the mechanisms that generate the gender-specific differences in self-employment rates as well as the gender-based variations in occupational and industrial segregation.

## THEORETICAL BACKGROUND AND HYPOTHESES

### Vertical and Horizontal Gender-Specific Segregation and Self-Employment

Previous research has mainly focused on only one side of "human capital", namely its ***"vertical aspect"***, i.e. the *level of education achieved* and examining its effect on women's and men's entry into self-employment as well as occupations and industries. Following human capital theories (Becker 1976, Minser and Polachek 1974), it has been acknowledged that the higher the individual's educational attainment is, the higher his or her probability of entering self-employment as well as the likelihood of working in an economically rewarding industry are. Assuming that women are significantly less likely to invest in their human capital (educa-

tion and tenure)[1] and, as a consequence, less likely to acquire the skills (e.g. management and business-related know-how, financial skills) needed for the transition into self-employment, previous research has considered this as one of the main explanations of the gender gap in self-employment as well as the gender-specific distribution of self-employed across occupations and industries (for a summary of these studies see Carter 2003 et al.).

However, the assumption that women tend to invest significantly less in their education has been proved to be palpably wrong in empirical research (for a summary of studies see e.g. Glass 1990:780). More specifically, it has been shown that across industrialized states in Western Europe and North America, women have caught up with men with regard to the level of their educational attainment. In other words, women today are no longer less well-educated than men. This also holds true for Germany, where gender differences in the level of educational attainment have recently converged: the proportion of women enrolled in higher schools has consistently increased over the last ten years: in 1995, it even exceeded the 50 percent threshold. Considering this, the level of educational attainment cannot be acknowledged as a factor that generates the gendered differences in self-employment rates (or the gender-specific variations across occupations and industries), in particular for the younger cohorts of the working force.

On the contrary, this project argues that previous research has failed to analyze "human capital" adequately in entrepreneurship research. More precisely, it has ignored consideration of gender-specific choices in the fields of study and apprenticeship training as a ***horizontal aspect*** of sex segregation.

Regarding the annual educational statistics of young female and male graduates and those starting their vocational training, it is a stylized fact that women tend to choose different subjects of study than men (see "Berufsbildungsbericht" 2002, English: Vocational Training Report Germany 2002). Accordingly, women's choice of field of study differs significantly from that of men. More specifically, the highest ratio of female students can be found among teacher-training courses (German: "Lehramt"), followed by linguistics and cultural studies. The share of women enrolled in engineering has indeed increased moderately to 21%, but it is

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[1] This assumption has been backed-up by economic theories on human capital and family (Becker 1976). More specifically, it has been suggested that women, considering the later interruptions of their work due to reconciling family responsibilities and work tasks, would *ex ante* deliberately decide not to invest as much in their education and tenure as men.

still at a very low level when compared to other fields of study (Strohmeyer 2003, 2004, see also Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung 2000).

Similarly, the market for apprenticeship training within the dual system of vocational training displays highly gender-specific segregation. Only a small percentage (12%) of the 331 jobs within the vocational training system shows an even sex distribution. The majority of women (66% in Western Germany) choose a female-dominated occupation, i.e. one with a share of women employees of more than 60%. Only 4% of women choose a male-dominated occupation (Biersack 2002). At the same time, women tend to concentrate on a few selected jobs that require on-the-job training (Steinmann 2000). Also, a slow change can be observed from 1970s up to the present, with women tending to occupy sales-related white-collar jobs (with office clerk and retail salesperson ranking at the top) (see Biersack 2002:141 and Steinmann 2000: 45).

**Studies on Horizontal Segregation**

Despite a plentitude of studies examining the influence of the level of educational attainment on different labor market outcomes such as income, health, unemployment and entry into and performance in self-employment, few studies analyze the effects of field of study and occupations trained on labor market outcomes other than income of employees. Most importantly, there are virtually no studies that explore the effect of the field of study and apprenticeship training on the entry into self-employment, occupational and industrial distribution of self-employed and performance related indicators in self-employment.

(1) Empirical studies dealing with the impact of field of study on dependent employment:

- Most common, a bunch of studies show that the gender-typical choices of fields of study cause gender pay gaps, implying that women employees earn significantly less money than their male counterparts in wage-and-salaried work (e.g. Gerhart 1990 or Grogger and Eide 1995).
- Comparing Germany and Spain, Reimer and Steinmetz (2006) analyzed how differences between male and female tertiary graduates in the chosen field of study affect the likelihood of being unemployed or obtaining a low-status job. It could be shown that fields of study explain a sizable proportion of the gender gap in unemployment and low-status jobs

in both countries (for Germany between 22.7% and 25.9% of the gender-gap in unemployment and between 23.0% and 26.4% of the gender gap in low status jobs).

- In an international comparison, Smyth (2005) also found that European countries exhibiting high levels of sex segregation in the chosen fields of study (horizontal sex segregation) also tend to have higher levels of occupational sex segregation.

(2) Empirical studies in self-employment research dealing with the impact of field of study:

- According to a students' poll conducted during the winter semester 2000/2001 at ten universities - an initiative within the framework of the "EXIST-Existenzgründung aus Hochschulen" program, the students' start-up inclination varies considerably according to their fields of study. While self-employment is perceived as a possible alternative to dependent employment by about 40% of students, one can find significant differences between specific fields of study. More specifically, a high percentage of those interested in starting an own business later on is observable among students of architecture and human medicine. In contrast, the percentage of those interested in becoming their own bosses in the future is rather low among students of the natural and educational sciences. Differentiating further between those interested in starting their own businesses and potential entrepreneurs, there is a considerable under-representation of women among potential entrepreneurs (see Bundesministerium für Bildung und Forschung 2002).

- Analyzing those who have successfully graduated from the dual system of vocational training, Strohmeyer and Leicht (2000) were able to show that the occupation trained for has a considerable impact on the later entry into self-employment. First, one can find an increased self-employment propensity in the service sector. Second, typical crafts occupations (such as baker, carpenter and painter) are more likely to end up in self-employment. On the contrary, most manufacturing occupations are not positively linked to the entry into self-employment. Making comparisons over time, one finds a relatively steady pattern of the entry into "self-employment" as a consequence of reproduction mechanisms caused by the specific occupation trained for.

- Furthermore, Strohmeyer (2004) found that students' field of study has important implications for the later entry into self-employment. In this context, a female academic's choice of self-employment over dependent employment hinges on her field of study to a large extent. While about 36% of students of human medicine choose self-employment, only 4.7%

of their counterparts from the educational science do so. Compared to other fields of study, the self-employment rate of those majoring in psychology, law and applied arts was also considerably higher. On the other hand, the so-called „integrated fields" of study with a women's share of 20%-50%, such as law, medical science or business studies, seem to be the most favorable for the entry into self-employment.

One of main hypotheses put forward in this context is that the segregation of women and men into different fields of study or apprenticeship training in the earlier stages of their lives will have crucial effects on their subsequent probability *of entry into self-employment*.

**Determinants of and Gender-Specific Differences in Self-Employment**

Is there a relationship between sex segregation in field of study, on the one hand, and gender-specific differences in the entry into self-employment, on the other? One also has to ask what exactly is meant by the terms „female-dominated" and „male-dominated" occupations used in segregation research and by which characteristics they are defined respectively. First of all, these terms represent *statistical constructs* that capture the ratio of men to women within certain occupations and can therefore be used as *proxies* for certain background characteristics. Therefore, it does not suffice to analyze the raw effects of the choice of fields of study and vocational training. It is even more important to investigate *characteristics* and *mechanisms* that fields of study and jobs trained for have on a potential transition into self-employment. It is thus important to study those characteristics of *current occupations or fields of activity* (German: "ausgeübte Tätigkeitsfelder") in dependent employment with regard to fields of study.

The transition from dependent employment to self-employment is increasingly related to the way labor markets of the industrialized welfare states function (Arum & Müller 2004, Aronson 1991). However, less attention has been paid to the extent to which earlier events in the individual's work career (i.e. industrial experience) encourage or, in contrast, discourage the supply of entrepreneurs. Moreover, research has also ignored the fact that vocational training and tertiary education along gender lines (the so-called "horizontal sex segregation") may set up different opportunity structures and thus impact the course of the occupational career (in this context, the transition into self-employment) of women and men employees differently.

*Entrepreneurial skills.* It is argued that women lack entrepreneurial resources which mostly acquired in the wage and salary sector (e.g. Döbler 1997, McManus 2001, Lauxen-Ulbrich & Leicht 2004). As pointed out by McManus (2002:81), "gender differences in self-employment rates can also be attributed to sex-segregation in occupations and industries. If the wage and salary sector is the nurturing ground for self-employment skills, women are less likely than men to benefit from their experience before they enter self-employment." This means that women lack entrepreneurial skills due to the character of the jobs they held, e.g. they are over-represented in clerical occupations that have low rates of self-employment. There are few chances to become self-employed for nurses, secretaries and receptionists which are typically female dominated occupations (Leicht & Lauxen-Ulbrich 2004).

Furthermore, if typical female occupations are mostly found in subordinate positions in the dependent employment, they provide only few chances for acquiring competences in the management and decision making processes, i.e. factors important for the transition into self-employment. Cross-country research on the general public shows that women (employees) are less likely to possess *positions higher-up in the job hierarchy* and thus are less able to acquire both pecuniary (financial capital) and non-pecuniary resources (specific *business and management-related know-how*) for the transition from dependent employment to self-employment. Strohmeyer & Tonoyan (2005a) have discovered that men's privileged positions within vertical occupational segregation, i.e. the fact that men (in contrast to women) are more likely to occupy positions such as managers, department heads in the occupational hierarchy, result in their more favorable perception of becoming self-employed than women's positions. The lack of proper management and business related skills may hinder women's entry into self-employment and also affect their performance in self-employment negatively. Research argues that the potential exploitation of an entrepreneurial opportunity draws disproportionately on the knowledge of management, marketing and product development than on knowledge of finance and accounting, because the former activities are undertaken in earlier phases of new ventures and are harder to outsource (Shane 2003, Roberts 1991). This idea has been corroborated empirically in studies on the entry into self-employment. For instance, Boyd (1990) finds that individuals in managerial, technical and craft functions are more likely to become self-employed than those in other functions (clerical jobs). Examining nascent entrepreneurs, Reynolds and White (1997) showed that respondents who were in the process of starting a new venture were more likely to be administrators, managers and foremen/forewomen. Therefore, it would be logical to postulate that employees with functional

experience in management and product development are more likely to exploit entrepreneurial opportunities than their counterparts lacking these skills. Assuming that women employees are less likely to be managers and supervisors than men employees, we expect them less likely to become self-employed.

### *Public Sector Employment*

*Public-sector* is viewed as a typical female employment sector not only in Germany but also in other industrialized countries of Western Europe (e.g. public sector is a clear domain of women in Scandinavian countries). It is argued that women's growing labor force participation has been marked by an increasing trend of female participation in the public sector. First, this is due to the fact that industrialized countries in Western Europe were able to support the increase in female labor force participation via direct regulations of the quantity and thus the supply of public sector jobs (e.g. child care, geriatric care, medical service, schooling etc.) which were earlier performed by women as a part of their household duties. Second, women became increasingly engaged in the public sector because they have been offered better opportunities and work arrangements to reconcile family and work responsibilities, e.g. through support services for childcare and family allowances, flexible working hours as well as part-time jobs in combination with and high job security (Korpi 2000, Gornick et al. 1997). However, prior work indicates that the expansion of the public sector in advanced welfare states has resulted in lower wages and greater occupational segregation for women at the same time (Melkas & Anker 1997, Charles 2003).

What is the relationship between the public sector and the entry into self-employment? Is the public sector a hothouse or, quite the contrary, pitfall for potential entrepreneurs? Theoretically, it can be argued that the acquisition of entrepreneurial know-how is less likely to occur in *large, bureaucratic and hierarchical organization* such as the public sector as opposed to *small firms*. This could be attributed to the fact that employees in small firms (as opposed to large organizations) take in a greater variety of activities relevant for entrepreneurship and are thus able to gather valuable information (about suppliers, vendors, human management relations) for a later entry into self-employment, because small firms are more transparent in their structure and employees thus have smaller distance to the firm owner. As a consequence, a detailed and comprehensive knowledge of the entrepreneurial behavior acquired through a direct contact with the firm owner and observations of his or her behavior fosters the employees' likelihood of becoming self-employed. At the same time, the *intimate knowledge of the*

*firm's operations* and the opportunity to *evaluate the advantages and risks of self-employment* may also be conducive to imitation. For many employees in a small firm, imitating observed role models is likely to be one of the crucial factors in support of the aspiration to attempt to manage one's own enterprise (see e.g. Strohmeyer & Leicht 2001 and Wagner 2003). On the other hand, working in large hierarchical organizations (such as public sector) characterized by a high degree of bureaucratization and formalization, where the probability of gaining knowledge and key qualifications required for self-employment is very low, may contribute less to learning and imitating of entrepreneurial behavior, decreasing one's likelihood of becoming self-employed.

Moreover, applicability of acquired skills and occupational qualifications plays a crucial role: Strohmeyer & Leicht (2001:61-62) have shown that skills gained in a small firm are much better applicable to self-employment than those acquired in large organizations. This is because firm-specific skills learned in large organizations are not universal but rather very specific and thus are not directly applicable to self-employment. This idea has been also put forward by Dareblom (1999:1), who argues that "most women working in the public sector are well educated, but their *educations are specialized in traditional, public areas*, and hence, the public sector has been their natural employer. Therefore, it can be argued that employees in the public sector will be able to find their way to self-employment only via "re-orientation" or "starting over." However, this will be associated with a loss of human capital and high occupational mobility costs and, as a consequence, high "switching costs" (see Strohmeyer & Leicht 2001).

### Gender Differences in Labor Market Outcomes and Risks

It is a stylized fact that women in comparison to men face higher labor market risks, such as lower-status positions in the occupational hierarchy, fixed-term employment contracts and higher unemployment risks.

Focusing on *highly qualified women*, i.e. those with a degree from a university or technical college, one finds that they are at a disadvantage and face discrimination in the job market. During the long-lasting period of crisis in the labor market, those with tertiary education were the winners of structural changes and formed the only labor market group gaining new jobs (Reinberg 1998). Despite these positive developments, women, however, faced substantial disadvantages since they were more frequently unemployed and had to accept jobs below their own qualifications. Although the unemployment ratio of university graduates in West

Germany was low (2.6%) compared to the total labor force (7.7%) in 2000, the percentage of unemployed women (3.7%) was much higher than that of men (2.5%) (IAB-Zahlenfibel 2003). Among younger graduates aged 20-35, Reimer and Steinmetz (2007) find a significant gender gap in unemployment, comprising 2.2% points difference (cf. unemployment share for men 2.8% with that of women 5.0%).

However, this is not a result of women choosing different fields of study than men. Statistics show that women with degrees in typically male-dominated fields, such as mechanical engineering, electro-technology, architecture and computer sciences were even more at a disadvantage. In 2000, twice as many female engineers and computer specialists were unemployed (6.6%) as their male counterparts (3.2%) (Plicht, Schreyer 2002).

According to Büchel and Weißhuhn (1998), a high influx of female academics into the labor market goes hand in hand with an increase in jobs with low qualification requirements. An analysis based on the Socio-Economic Panel (SOEP) shows that the occupational situation for female academics has become substantially worse since 1984. In 1995, around 26% of female employees in Germany with a university degree worked in positions below their level of qualification, while only 6% of male graduates did so.

***Fixed-Term Contract***. During the 1990s, temporary employment, i.e. employment based on the basis of a non-permanent (or limited) contract, has widely expanded in the welfare states of Western Europe and North America (Nannicini 2004, Goudswaard & Andries 2002, Segal & Sullivan 1997). With regard to gender differences in fixed term employment in European countries, prior work (mostly at the aggregated level) has shown that women tend to work significantly more frequently on the basis of non-permanent contracts. Using the Third European Survey on Working Conditions, Goudswaard & Andries (2002:22) find that women tend to occupy a higher percentage of non-permanent positions than men in 2000 (15% and 11% respectively). Using the OECD (2002) data, De Cuyper et al. (2002:58) confirm this finding for Belgium, Germany, Netherlands, Spain, Sweden and the UK. In contrast, Kim & Kurz (2001) find only slight gender differences in fixed-term contracts in Germany using 1996 Microcensus data.

Summing up, women face higher labor market risks such as unemployment, fixed-term employment contracts and low status jobs. On the other hand, prior work argues that unemployment and lacking labor market opportunities are crucial factors impacting one's decision to become self-employed positively, a phenomenon referred to as "necessity based entrepreneur-

ship" (see Global Entrepreneurship Monitor 2002, 2003, 2004). Drawing on prior work, it could be argued that women will be more likely to become self-employed (or necessity based entrepreneurs) than men, because they face higher labor market risks.

***Concentration within Few Occupations.*** Additionally, a high concentration of women in a few occupations such as hairdressers, nurses or beauticians in the dual system of apprenticeship may impact their possible transition into self-employment negatively due to a higher pressure of competition. In contrast, men's choices of field of study are likely to affect their later decision to enter self-employment positively because of their lower density. Subsequently, they are more able to find "niches" for a self-employed activity.

***Transmission of Segregation from Apprenticeship Training to Self-Employment.*** Besides, a strong interdependence between the applicability of the qualifications gained in the dual system of apprenticeship in Germany and the entry into female-typed versus male-typed occupations and industries may exist. The gender-specific choices of apprenticeship training may have crucial effects on a different distribution of women and men over occupations and industries in self-employment. More specifically, women's closeness to personal and service-oriented tasks in the dual system of apprenticeship training (examples are hairdressers or beauticians) may push them into typically female dominated person- and service oriented occupations and industries in self-employment.

## Summary of Research Questions and Hypotheses

In a nutshell, the primary research objective of this study is to find the extent to which *occupations trained for* and *fields of study* have a *relevant influence* on the entry into self-employment and the subsequent choice of industry and occupation. In this context, the following hypotheses are put forward with regard to the gender-specific differences in self-employment (or the so-called "gender gap").

*H1: Becoming self-employed is less likely for women and men graduated from a female dominated field of study or apprenticeship training.*

However, another important questions arises in this regard, namely what might be the causes relevant for this outcome? More importantly, what are the mechanisms underlying the relationship between one's choice of fields of study and apprenticeship training and the entry into self-employment? Put another way, why exactly may those graduated from female dominated

fields of study be less likely to become self-employed than their counterparts graduated from other fields of study?

The following hypotheses are developed to explain the mechanisms responsible for lower self-employment rates associated with female-dominated fields of study and apprenticeship training.

*H2: Female-dominated fields of study are less favorable for the entry into self-employment because they prepare for and lead to positions in the public sector (e.g. teaching etc.).*

*H3: Female-dominated fields of study are less favorable for the entry into self-employment because they don't impart women with the relevant management and business-related skills and knowledge required for starting one's own business.*

*H4: Female-dominated fields of study are less favorable for the entry into self-employment because they lead to economically less rewarding occupations and lower up positions in the occupational hierarchy.*

*H5: Women are more likely to become self-employed than men, because they face higher labor market risks which result the graduation from fields of studies associated with higher unemployment rates and higher percentage of fixed term employment contracts.*

The second objective of this project is to examine variations in performance-related indicators between female-owned and male-owned enterprises. In this context, it has to be explored whether and to what extent the fields of study and apprenticeship training may explain gender-specific differences in business performance measured as such by number of employees as well as gender specific distribution among occupations and industries. Put more simply, the association between the field of study (or apprenticeship training) and the subsequent choice of the occupation and industry in self-employment has first to be ascertained. Furthermore, the relationship between the field of study (or apprenticeship training) and the probability of working as a solo self-employed ("own-account worker") versus an "employer" has to be analyzed.

*H6: The field of study (or apprenticeship training) is a strong predictor of the occupation and industry chosen in self-employment. Occupational and industrial sex segregations in self-*

*employment can thus be attributed to gender-specific differences in the field of study and apprenticeship training.*

*H7: Gender-specific performance differences with regard to being a "solo self-employed" versus "employer" depend crucially on the occupation and industry chosen in self-employment which, in turn, can be traced back to the field of study (or apprenticeship training) chosen at the beginning of one's work career.*

*H7': Enterprises led by self-employed women and men graduated from a female-dominated field of study will have inferior performance than those led by self-employed graduates from integrated or male dominated fields of study.*

### Control Variables

**Age.** In entrepreneurship research, it is a stylized fact that age has a curvilinear relationship with the probability of becoming self-employed, a result which is remarkably true for both genders. Initially, age increases the probability that individuals are likely to exploit entrepreneurial opportunities, since they gather much of the information, resources and skills which are required for the transition into self-employment over their lives. Age also provides credibility in transmitting the information to "significant others" when people seek to obtain the required resources and design their organizations. However, when individuals become older, the effect of age on their willingness to become self-employed diminishes. As people age, their willingness to bear uncertainty and high risk declines because their time horizons shorten. Moreover, as people age, their opportunity costs rise because their income tends to increase (for a summary of empirical studies Shane 2003: 89).

**Reconciliation of Family and Work**. It has often been argued that the reconciliation of family and work (caring for small children in one's household) is a crucial determinant of women's entry into self-employment. However, there are two possible explanations concerning the causality between one's propensity to become self-employed and the reconciliation of family and work (McManus 2001).

It is argued that the impact (either negative or positive) of small children on the mother's propensity to become self-employed depends crucially on the country-specific institutional make-

up. On the one hand, several studies from the USA (Carr 1996, Boden 1999: 83-84 as well as Lombard 2001) that being a mother with young children increases one's probability of becoming self-employed. It has been acknowledged that working conditions in self-employment (as opposed to dependent employment) referring to flexible working hours (part-time work) and flexible working places (home-based work) are more accommodating to women with young children. The positive impact of young children on the mother's propensity to become self-employed holds especially for *liberal welfare states* (such as the USA), where missing public child care coverage and maternity protection enforce women employees to choose self-employment as a form of occupation which provides them with more flexibility in terms of the choice of working time and working places and thus enabling them to better reconcile family and work duties.

On the other hand, some prior work (see e.g. Welter 2004) argues that *conservative welfare states* (such as Germany, Austria, Italy & France) supporting a traditional "male breadwinner model" (Gornick et al.1998, Korpi 1998), with *social norms* ascribing earning incomes to men and raising children/being responsible for the family to women, generally discourage women from becoming self-employed. Put differently, in countries supporting *"traditional male breadwinner model",* priority is given to a *general family support* (e.g. cash child allowances, family tax benefits for minor children and young mothers staying at home). In this context, Germany is a case in point: according to the Federal Office of Statistics in 2003, working wives who have 2 children tend to invest twice as much time for their family duties as their husbands. *Public daycare services* exist predominantly for older children (more than 3 year old), but not for minor children (up to 3 year old). *Full-time childcare* is rather limited in such countries (Gornick et al.1998, Korpi 1998). As a consequence, women's (especially young mother's) participation in the labor market is rather restricted, resulting in higher rates of female part-time employment and women's lower self-employment rates (Strohmeyer et al. 2005).

## DATA, VARIABLES AND METHODS

### *The Sample*

The empirical analyses consists of two parts: Part 1encompasses graduates from universities as well as those from universities of applied sciences, i.e. academics. Part 2 deals with non-academics, i.e. respondents with either upper secondary vocational education, or post-

secondary education or non tertiary education.[2] With a few exceptions (e.g. the BIBB/IAB surveys) German survey polls normally do not contain information on the field of study and apprenticeship training (German: "erlernter Beruf"). An improvement of the statistical data in this regard was first made in the 2003 German Microcensus, which contains information on the field of study and apprenticeship training classified according to the International Standard Classification of Education (ISCED 97). The second source of data which is used for academics refers to the pooled Microcensus Scientific Use Files 2000, 2003 and 2004 which contain information on the "field of study" according to the International Standard Classification of Education (ISCED) 1997.

Our research focuses on the population that comprises gainfully employed, unemployed and non-active persons between the ages of 25 and 65 who were neither schooled, nor participating in vocational training, nor doing their military or civil service, respectively, at the time of the survey. After excluding respondents with missing values for field of study and field of training,[3] sample 1 consists of 69,744 respondents with a tertiary education (among them 886 female and 1560 male founders). Sample 2 is comprised of 124,872 non-academics, among them 700 female and 1224 male business founders.

*Variables and Measures*

The first dependent variable of this study refers to the transition into self-employment. It has been captured using two questions, namely, the respondent's self-reported status of being self-employed (first) and the duration of self-employment which refers to the time (year and month) when the respondent became self-employed (second). Respondents who reported that they had started their businesses during the last 36 months are defined as "new entrepreneurs" or business founders. The second dependent variable captures performance in self-employment, measuring whether the new entrepreneurs work on their own ("solo self-employed") or if they have one or more employees ("employers").

*Measuring Gender-specific Segregation*

There is a broad and longstanding discussion about how to measure precisely the phenomenon "segregation" exactly. While a number of index-based approaches exist that capture gender-specific variations in segregation using single measures, new approaches try to supplant

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[2] Individuals having no degree or those being in permanent training have been excluded from investigation.
[3] The category "others, miscellaneous" (98) is also excluded because of high heterogeneity within this group.

index-based measures by employing log-linear and log-multiplicative models. These new measures are especially useful to compare segregation over time and between countries.

It is important to note that there is no theoretically grounded definition of "female" and "male" occupations which could be used ubiquitously across all countries. Instead, scholars classify differently into female- and male-dominated ones. On the other hand, it is more useful to build occupational groups such as "female-dominated" and "male-dominated" occupations on the basis of available data, when the structure of segregation, itself, is a part of an investigation encompassing a more complex statistical modeling.[4]

This study uses a three-fold classification based on 79 fields of study that differentiates between male-dominated, female-dominated and integrated fields of study. Fields of study in which the percentage of women outweighs women's ratio in the total labor force by 15% points are classified as female-dominated ones. For instance, because the percentage of women among academics is about 40%, "female-dominated fields of study" are then considered as those where women comprise 55% (=40%+15%) of the labor force. Fields of study in which the percentage of women lies under the average women's ratio in the labor force by 15% points are considered as "male-dominated ones". Finally, fields of study are defined as "integrated" ones, where the percentage of women is between 25 and 55% (Hakim 1998).

*Context Level and Micro-Level Factors in Multi-Level Analysis*

The focus of this study is on the impact of field of study on entry into and performance in self-employment. It argues that different fields of study set varying opportunity structures for acquiring entrepreneurial skills in the *dependent employment*. This study thus measures the spectrum of main fields of activity in dependent employment (German: "ausgeübte Tätigkeit") by fields of study. More specifically, an indicator for every single field of study has been constructed on the aggregated level so that it contains the respective percentage of respondents from a specific field of study which is found in a specific field of activity. For example, among all female dependent employees who had studied "teaching/education", only

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[4] There are also drawbacks for such a measurement that should not be withheld: The thresholds of the occupational groups that are called "female-dominated" or "male-dominated" are quite arbitrary. While some studies use a threshold of 80% to define an occupation as "dominated" by one sex, others take 70% or 75%. Furthermore, small sample sizes of some or many of the occupations make it hard (or almost impossible) to classify these occupations, because of high standard errors. Therefore, small groups are often collapsed to bigger ones, but this could also lead to biasing of the occupational groups.

0,8% stated that they currently perform "management and supervisory work" (as a field of activity). These indicator variables are used as macro- or context variables (or "level 2 factors") in the multilevel hierarchical analysis (Raudenbush & Bryk 1992) later on (for a similar methodical approach see e.g. Liebeskind 2004 and de Ruijter and Huffman 2003).

Totally, four fields of activities, clerical work, teaching/health, management as well as research development, are isolated for academics. Moreover, four (slightly modified) fields of activities, namely clerical work, teaching/health, machine operators as well as driving/packing/loading, are defined for non-academics. Among these fields of activities, clerical work, teaching/health are typically female dominated ones, while management, machine operators as well as driving/packing/loading for non-academics describe typically male dominated ones.

A second set of variables is used to capture labor market risks, referring to "unemployment rate", "rate of employees with fixed term employment contracts" as well as the "share of employees in the public sector". All these indicators are aimed to capture the mechanisms underlying the relationship between the fields of study and entry into self-employment.

Furthermore, age and age squared, the presence of children up to 3 years old and having a spouse or partner are considered as micro-level factors.

### *Statistical Methods*

Advanced statistical methods are employed in this study. First, an advanced statistical method, namely *multilevel (or hierarchical linear) analysis* (Raudenbush & Bryk 1992), is used to examine women's and men's determinants of the entry into self-employment. Second, a new non-linear decomposition technique for binary (dependent) variables developed by Fairlie (2005; 2006) is employed to analyze the *extent* to which the gender-specific segregation in fields of study (and apprenticeship training) has important effects on women's and men's entry into and their performance in self-employment. Third and finally, *binary logit regression models* are used (see more in Long and Freese 2001) to explore gender-specific differences in performance measured by the number of employees (own account worker vs. employer).[5]

*Multilevel analysis* is employed to examine the impact of both micro-level and macro-level determinants of the entry into self-employment together, "in one bunch." *Multilevel modeling*

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[5] Because much is known about binary logit models, no detailed description of this method will be given.

is defined as a statistical method of analysis that can simultaneously handle measurements at different levels of hierarchy (Raudenbush & Bryk 2002). A hierarchy consists of lower-level observations nested within higher level(s). Examples include students nested within schools, employees nested within firms, consumers nested within a neighborhood or a region, etc. The lowest-level measurements are said to be at the *micro-level*; higher-level measurements are the so-called *macro- or context levels*. Higher levels are often referred to as groups or contexts. Why is it important to consider nested or hierarchical data structures using multilevel modeling? In the statistical sense, ignoring hierarchical data structures results in the underestimation of the standard errors of regression coefficients, suggesting inflated significance levels, thus leading to less well-fitting models (Raudenbush and Bryk 2002). Subsequently, incorrect treatment of such data violates the OLS assumptions that the errors are independent, thus causing underestimation of the standard errors (t-test statistics will be too high). This generates Type I errors, implying that independent variables will appear to be significant when, in reality, they are not.

In this context, multilevel modeling will be employed to investigate the impact of both micro-level and context-level variables (as independent variables) on "becoming self-employed" (as the dependent variable). Micro-level variables refer to the respondent's age, age squared, the presence of small children in one's household as well as the presence of a partner (or a spouse). Macro-level variables refer to the fields of study (tertiary education) or occupations trained for (vocational training). Context-level variables refer to the fields of study and occupations trained for. The assumption is made that mechanisms exist that underlie the relationship between field of study and apprenticeship training (as contextual variables) and the entry into self-employment. It is suggested that fields of study and apprenticeship training equip individuals with certain common characteristics which, in turn, will apparently differ between occupations and are thus likely to affect the probability of entering self-employment differently. For example, individuals choosing typically female-typed subjects of study (such as humanities or education) or becoming trained in typically female-typed apprenticeship fields (hairdressers, beauticians or nurses) are assumed to share common characteristics (see the description of research hypotheses) that will be different from the characteristics of their counterparts choosing either mixed-typed fields of study (medicine, law, architecture and business administration) or male-typed fields of study (e.g. natural science, engineering or informatics) and apprenticeship fields (e.g. production, technical jobs).

The micro-model expressed in equation (1) represents the simplest possible scenario with one explanatory variable (X), where the index i represents individuals (I=1…n) and j represents the occupations trained for (j=1…J); $r_{ij}$ represents the errors terms.

$$Y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + r_{ij} \qquad (1)$$

The macro-model includes one equation for each individual-level regression coefficient. Taken together, (2) and (3) comprise the level-2 model. The Gamma-coefficients are used to symbolize macro-level effects that are represented in the model by the W (group)-variables. The u-parameters in this model are disturbances.

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j} \qquad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + u_{1j} \qquad (3)$$

A single-equation expression of the model is derived by substituting (2) and (3) into (1):

$$Y_{ij} = \gamma_{00} + \gamma_{01}W_j + \gamma_{10} X_{ij} + \gamma_{11}W_j X_{ij} + [\ \underbrace{u_{0j} + u_{1j} X_{ij} + r_{ij}}_{\text{Error Term}}\ ] \qquad (4)$$

The statistical package for the implementation of multilevel analyses is GLAMM (Rabe-Hesketh et al. 2004). It can be downloaded at "www.gllamm.org" and be used within the STATA program.

*Decomposition Technique for Binary Dependent Variables*

It is useful to examine the extent to which the distribution of women and men across different fields of study explains the gender gap in entry rates as well as performance differences in self-employment. The *gap in entry rates* and *performance* between women-owned and men-owned new businesses can be decomposed into two parts. Concentrating first on women's and men's entry rates into self-employment, the gender-specific differences can be attributed to two factors, namely, (first) to differences in the determinants of self-employment (or the regression "coefficients") and (second) variations in women's and men's "endowments".

Differences in the determinants (and thus the regression coefficients) may exist in case certain factors considered in the model have a stronger influence on one group (e.g. women) than another group (men). For instance, one could assume that family responsibilities such as raising small children might have a deterrent impact only on women's transition into self-employment, but not on men's entry into self-employment, since it is former who tend to invest more time for family (cf. Federal Bureau of Statistics in Germany 2004).

One speaks of the so-called "endowments" effects when referring to the component which represents the part of the gender gap that exists due to women and men differences in the distribution of a certain independent variable Xj (for example, gender differences in management related know-how). The reason behind the gender gap in entry into self-employment might be traced back to the fact that one group (e.g. men) is much better endowed with a certain resource (here, management-related know-how) than another (women).

Statistically, one can model differences in the determinants between two groups using the interaction effects (between gender and the specific determinant) in regression models, while "endowments" effect on the transition into self-employment can be deciphered using Blinder-Oaxaca decomposition technique.

For a linear regression, the standard Blinder-Oaxaca decomposition of the male/female gap in the average value of the dependent variable (entry into self-employment), Y, can be expressed as follows:

$$\overline{Y}^W - \overline{Y}^B = \left[ (\overline{X}^W - \overline{X}^B) \hat{\beta}^W \right] + \left[ \overline{X}^B (\hat{\beta}^W - \hat{\beta}^B) \right] \tag{1}$$

where $X_j$ is a row vector of average values of the independent variables and $\beta_j$ is a vector of coefficient estimates for gender j.

Because our dependent variable is not a continuous but a binary variable (entry into self-employment), a new non-linear Blinder-Oaxaca decomposition technique developed by Fairlie (2005 & 2006) is employed to explain the extent to which gender specific variations in the entry into self-employment are attributable to women's and men's different "endowments" (fields of study and apprenticeship training) and different effects of the specific determinants ("coefficients") on their behaviors.

Following Fairlie (2005), the decomposition for a nonlinear equation, $Y = F(X \hat{\beta})$, can be represented as:

$$\overline{Y}^W - \overline{Y}^B = \left[ \sum_{i=1}^{N^W} \frac{F(X_i^W \hat{\beta}^W)}{N^W} - \sum_{i=1}^{N^B} \frac{F(X_i^B \hat{\beta}^W)}{N^B} \right] + \left[ \sum_{i=1}^{N^B} \frac{F(X_i^B \hat{\beta}^W)}{N^B} - \sum_{i=1}^{N^B} \frac{F(X_i^B \hat{\beta}^B)}{N^B} \right], \tag{2}$$

where $N_j$ is the sample size for gender j. This alternative expression for the decomposition is used because Y does not necessarily equal $F(X_i \beta)$. In both (1) and (2), the first term in

brackets represents the part of the gender gap that is due to group differences in distributions of X, i.e. the field of study which a female or male respondent had graduated from. The second term represents the part due to differences in the coefficients.

# EMPIRICAL FINDINGS

It is useful to give a short descriptive overview on women's most important fields of study by their entry rates into self-employment. Moreover, it is instructive to look at certain labor market characteristics of fields of study referring to the percentage of individuals working in the public sector, the percentage of unemployed as well as the proportion of fixed-term employment contracts and fields of activity.

## Descriptive Analysis

Table 1. Entry Rate and Labor Market Characteristics of Ten Most Important Fields of Study for Women With Tertiary Education

| | %-Distri-bution[1] | Sex Type* | Entry-Rate[2] | Labor market characteristics of wage-and-salary workers | | | | |
| | | | | %-Public Sector[3] | %-Manage-ment[3] | %-Educa-tion /Health[3] | %-Fixed-Term[3] | %-Unem-ploy-ment[4] |
|---|---|---|---|---|---|---|---|---|
| Teacher-Training Course | 21.7 | F | 0.81 | 87.5 | 0.8 | 89.7 | 5.9 | 2.4 |
| Educational Studies | 8.7 | F | 1.72 | 71.6 | 2.5 | 77.0 | 7.8 | 4.5 |
| Business Administration | 8.3 | I | 3.56 | 17.1 | 16.9 | 6.0 | 4.7 | 5.8 |
| Human Medicine | 7.6 | I | 6.33 | 52.2 | 1.6 | 82.5 | 24.6 | 3.9 |
| Social Work | 4.5 | F | 2.35 | 52.1 | 2.8 | 62.2 | 11.0 | 6.7 |
| Law | 4.0 | I | 5.25 | 61.4 | 7.1 | 3.3 | 12.7 | 6.2 |
| Architecture | 2.2 | I | 6.59 | 30.9 | 4.2 | 3.0 | 10.8 | 11.4 |
| German Language & Literature Studies | 2.1 | F | 4.36 | 57.3 | 4.7 | 55.3 | 8.5 | 5.4 |
| Economics | 1.9 | I | 2.07 | 31.5 | 12.8 | 5.5 | 7.1 | 11.1 |
| Psychology | 1.9 | F | 9.37 | 46.4 | 5.2 | 57.6 | 14.3 | 7.8 |
| Top Ten Females | 63.0 | | 2.81 | 62.8 | 4.5 | 61.5 | 9.1 | 4.6 |
| Other 59 Fields of Study | 37.0 | | 3.57 | 39.7 | 6.2 | 22.5 | 9.2 | 9.0 |
| *Total Women* | *100.0* | | *3.09* | *54.9* | *5.1* | *48.1* | *9.2* | *6.2* |
| (Number of observations) | (31353) | | (28744) | (21717) | (21717) | (21717) | (21717) | (23150) |
| *Total Men* | *100.0* | | *3.86* | *36.3* | *16.1* | *22.1* | *8.3* | *5.4* |
| (Number of observations) | (47301) | | (40617) | (33259) | (33259) | (33259) | (33259) | (35156) |

Source: Pooled Microcensus Scientific Use Files 2000, 2003,2004

1) refers to the whole sample population (see data and methods)
2) Entry rate is defined as the self-employed who started within the last 36 months as a percentage of the whole sample population (without self-employed working longer than 36 months)
3) Percentages based on wage-and salary workers only.
4) Unemployment rate is defined as unemployed individuals as a percentage of wage-and-salary-workers
* F = female dominated, I = integrated

Table 1 lists 10 most important women's fields of study characterized by labor market indicators relating to public sector, field of activity as well as labor market risks captured by fixed term employment contracts and unemployment rates. All in all, these fields of study cover 63% of all female academics, i.e. 63% of all women graduated from 10 fields of study. First, it could be shown that fields of study chosen to a large degree by women are not only female-dominated ones. In fact, half of fields of study are "integrated" ones, i.e. they have a relatively mixed share of both women and men. However, teaching training course and education -as integrated fields of study- are on the top of the list of women's chosen majors since about 30% of women with a university degree are found here. On the other hand, social work (4.5%), German language and literature study (2.1%) as well as psychology (1.9%) are strongly female-dominated fields of study. Law (4.0%), architecture (2.2%) and economics (1.9) are integrated fields of study, which have increased in their relative importance for women as shown by Strohmeyer (2004).

Ten most important fields of study for women show a somewhat smaller start-up rate (2.81%) than "other fields of study" (3.57%). Taking a closer look at specific fields of study, it becomes apparent that this result can be mainly traced back to "teacher training course" and "education" as relatively "crowded" majors, since the start-up rates associated with these two fields of study are considerably below the average (0.81% and 1.72%, respectively). On the other hand, start-up rates linked with the study of "medicine", "law", "architecture" and "psychology" are significantly above the average.

With regard to the ***labor market characteristics***, it becomes clear that a high percentage of female academics, strictly speaking, more than every second woman (54.9%) from all fields of study is employed in the *public sector*. Among the top ten fields of study, this share is even higher (62.8%), with "teacher-training courses" and "education" most closely associated with working in the public sector (87.5% and 71.6%, respectively).

Moreover, women graduated from "teacher training courses" and "education" have one of the lowest *unemployment rates* (2.4% and 4.5%, respectively). On the other hand, fields of study such as "architecture" or "economics" have an unemployment rate of more than 10%.

When comparing female and male academics, striking differences become apparent. While 54.5% of females in paid employment work in the public sector, only 36.3% of men does so.

Moreover, almost every second woman but only every fifth man are found in "education" and "health care" activities. A reverse picture emerges when looking at management-related activities. While 16.1% of men stated that management is their main activity, only 5.1% of women did so. Our results also confirm the stylized fact that women face higher labor market risks than men which can be seen in women's (slightly) higher unemployment rates and a percentage of women working on the basis of fixed term contracts.

**Entry into Self-employment for University Graduates**

Table 2. Entry Rates into Self-employment by Field of Study (tertiary education)

| Field of Study | Entry Rate | | Logit: Odds-Ratio (Std. Err) | | Female /Male | |
| | (1) Female | (2) Male | (3) Female | (4) Male | (5) Differences in Coefficients* | (6) Endowment Effects |
| --- | --- | --- | --- | --- | --- | --- |
| Integrated | 4,19 | 5,28 | Ref. Cat. | Ref. Cat. | Ref. Cat. | Ref. Cat. |
| Female-dominated | 2,25 | 2,58 | 0,525** (0,038) | 0,474** (0,042) | 1,106 (0,128) | 0,00430** (0,00031) |
| Male-dominated | 2,00 | 2,81 | 0,466** (0,070) | 0,516** (0,030) | 0,903 (0,145) | -0,00439** (0,00036) |
| Total / Constant | 3,09 | 3,86 | -3,134** (0,044) | -2,892** (0,034) | | -0,00009 -1,23 % |

Source: Pooled Microcensus Scientific Use Files 2000, 2003 and 2004

* Interaction effects with gender

First, the gender gap among highly qualified self-employed is explored. Table 2 shows academics' entry rates into self-employment by field of study. Without considering fields of study, only a small gender gap in the entry rate shows up. While 3.86% of male academics entered self-employment, only 3.09% of women did so. Therefore, the gender gap among academics is below one percent (0.8%). Expressed as an odds-ratio, men's chances are 1.26 times better than women's for becoming self-employed.[6]

Focusing on variations among fields of study, a more differentiated picture emerges. More specifically, both women and men graduated from "integrated fields of study" have the highest probability of becoming self-employed. For example, 4.19% of female academics and

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[6] On the other hand, if one takes a look at all self-employed - not only at start-up entrepreneurs, but also those who are already self-employed - a different picture emerges: Every fifth man (19.8%) and every seventh woman (13.9%) is self-employed. Therefore, the gender gap among all self-employed is roughly 6%. The differences to the above-mentioned entry rates might be a sign that younger women have caught up with men.

5.28% of male academics graduated from an integrated field of study entered self-employment during the last 3 years. In sharp contrast, female-dominated fields of study are rather unfavorable for the transition into self-employment. In this regard, the entry rate into self-employment of the graduates from female-dominated fields of study (this is 2.25% and 2.58% for women and men, respectively) is only half of that of graduates from integrated fields.

Astonishingly, not only female-dominated fields of study are unfavorable for a (later) transition into self-employment, but also male-dominated ones. Compared to male dominated fields of study, the probability for the entry into self-employment is 2.14 times (=1/0.466) higher for women and 1.94 (=1/0.516) higher for men graduated from an integrated field of study. The test for differences in coefficients (this is operationalized by interaction terms between gender and female/male-dominated and integrated fields of study) shows that the gender-specific variations within the same field of study are not statistically significant. That is, it could not be supported that either women in male-dominated fields of study or men in female-dominated fields of study (as minorities) become self-employed significantly more (or less) often than women or men in their own "domains" (i.e. women in female-dominated fields of study and men in male-dominated fields of study).

The descriptive results discussed above could additionally been supported by using non-linear **decomposition technique**[7] (see Table 2, Column 6). Female-dominated fields of study explain virtually 56.8% of gender-specific differences in the entry into self-employment.[8] At the same time, the findings point to a reverse effect of male-dominated fields of study on the entry into self-employment. This means that male-dominated fields of study account positively for women by 57.9%. Finally, female- and male-dominated fields of study do *not* explain women's and men's differences in entry into self-employment.

Summing up, the choice of field of study has a considerable influence on women's and men's potential transition into self-employment. However, a small gender gap in entry into self-employment for academics cannot be fully explained by field of study. Although the hypothesis that female-dominated fields of study offer unfavorable conditions for the potential transition into self-employment could be substantiated descriptively, however, this is also the case for male-dominated fields of study. Surprisingly, this is also true for "female minorities" in

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[7] Men's sample is used as a reference category with 1000 different sub-samples.
[8] This is calculated as the explained share of 0,00430 for female dominated fields of study of the total difference of 0,008, i.e. the gender-specific gap in entry rate for academics.

male dominated fields of study and "male minorities" in female dominated fields of study, since in both these cases the likelihood of becoming self-employed is particularly low (opposed to the likelihood of the transition into self-employment from integrated fields of study).

Table 3. Results of Multilevel Analyses for Entry Into Self-Employment (tertiary education)

|  | (1) Female | (2) Male | (3) Differences in Coefficients |
|---|---|---|---|
| *Level 1: Individual variables* |  |  |  |
| age | 0,239** | 0,162** | 0,083 |
|  | (0,036) | (0,025) | (0,043) |
| age squared | -0,003** | -0,002** | -0,001* |
|  | (0,0004) | (0,0003) | (0,001) |
| children (< 3 Years) | -0,321** | 0,029 | -0,348* |
|  | (0,124) | (0,086) | (0,150) |
| Spouse | -0,272** | -0,155* | -0,140 |
|  | (0,074) | (0,062) | (0,097) |
| *Level 2: Field of study variables* |  |  |  |
| Office work | -0,011 | 0,036* | -0,027 |
|  | (0,014) | (0,018) | (0,015) |
| Teaching & health care | 0,000 | 0,002 | 0,001 |
|  | (0,005) | (0,004) | (0,003) |
| Management | -0,023 | -0,041* | 0,034 |
|  | (0,026) | (0,016) | (0,018) |
| Research & development | -0,022** | -0,019** | -0,006 |
|  | (0,008) | (0,006) | (0,005) |
| Public sector | -0,018** | -0,020** | -0,001 |
|  | (0,006) | (0,005) | (0,004) |
| Fixed-term contract | 0,028* | 0,027** | -0,010 |
|  | (0,012) | (0,008) | (0,007) |
| Unemployment rate | 0,062* | 0,125** | -0,008 |
|  | (0,024) | (0,023) | (0,019) |
| Constant | -6,944** | -5,290** | -5,508 |
|  | (0,939) | (0,768) | (0,6989 |

Source: Pooled Microcensus Scientific Use Files 2000, 2003,2004

Results thus indicate that a simple reference to pre-defined categories "female-dominated" or "male-dominated" fields of study falls too short, because these both are too heterogeneous for explaining gender-specific variations in the entry into self-employment. Therefore, multilevel analyses will next be employed to analyze the mechanisms underlying the negative association between "female-dominated" and "male-dominated" fields of study and transition into self-employment.

Table 4 lists findings from the multilevel hierarchical analysis for the sub-sample of women (see Model 1), analyzing the impact of both micro-level and context-level determinants of the entry into self-employment. On the micro-level, a curvilinear relationship between *age* and entry into self-employment has been supported: the likelihood of becoming self-employed increases up to a certain age (roughly up to 40 years) and decreases afterwards. On the one hand, the positive correlation between age and entry into self-employment can be attributed to the accumulation of resources (human capital, financial capital and social networks) crucial for establishing one's own enterprise over one's working career. On the other hand, the negative association between age and entry into self-employment can first be traced back to opportunity costs (income) which increase as individuals age. Moreover, individual's propensity of becoming self-employment decreases over the time, since elder individuals usually have lower risk-taking propensity than their younger counterparts.

Furthermore, it could be shown that the probability of becoming self-employed decreases for women with *young children* (aged up to 3 years old), thus pointing to the negative relationship between women's transition into self-employment and their reconciliation of family and work. At this stage, it should be emphasized that this result clearly contradicts prior work from the USA which has established a positive association between the presence of children in one's household and the likelihood of entering self-employment. A possible explanation for this could be that studies which have found a positive link between the presence of children in one's household and the mother's transition into self-employment have analyzed the "stock of self-employed women", but not "new businesses" established by female entrepreneurs. Subsequently, the causality of the positive association between *being self-employed* (and not becoming self-employed) and *the presence of young children* can be largely questioned, because the analysis of the stock of women's self-employed draws largely on women who have been self-employed for a long time, but not those who recently have become self-employed (cf. Taniguchi 2003). Moreover, contrasting results for Germany and the USA about negative versus positive impact of young children on the mother's transition into self-employment may be traced back to the differences in the country-specific institutional setting of these two countries. It is possible that women in the USA are enforced to become self-employed to take advantage of their flexible working hours (part-time) and working places (home-based work) for being able to reconcile family and work duties in face of lacking public policy support (e.g. maternity leave, public kindergartens etc.).

Next, opportunity structures, individual resources and labor market risks for 69 different fields of study associated with a transition into self-employment will be explored. In this context, the central assumption is that fields of study have certain characteristics which influence the probability of becoming self-employed either positively or negatively. For instance, women who graduated from certain fields of study and had ended up in working in the *public sector* later on are assumed to have lower inclination to become self-employed. On the aggregated level, this implies that the higher the percentage of individuals majored in a specific field of study and working in the public sector (as opposed to private sector), the lower their probability of the transition into self-employment. The results show that the association between fields of study leading to working in public sector and the transition into self-employment is indeed negative.

Moreover, the hypothesis about the positive relationship between fields of study with a high percentage of employees working on the basis of fixed term contracts and the entry into self-employment could be supported empirically. Put another way, it has been shown that certain fields of studies (e.g. medicine, psychology, law and social work) which lead often to fixed-term employment contracts influence the transition into self-employment positively. This suggests that apart from individual risk taking propensity which has been found to be an important determinant of self-employment on the individual level (Wagner 2005), also labor market risks on the aggregated level which result from temporary employment contracts shape the individual's preference of self-employment over dependent employment. After all, insecure future prospects in dependent employment and, more specifically, risk and uncertainty resulting from this type of temporary employment, may impact the transition into self-employment positively. Similarly, also fields of study with high unemployment rates are positively linked to self-employment.

On the other hand, fields of study (such as business administration and economics) which lead to higher up positions in the occupational hierarchy (e.g. management, supervisory work) in dependent employment do not show above average likelihood of the transition into self-employment. In the same vein, the statistical effect of female-dominated fields of activity (teaching, health/care and office work) on self-employment is not significant. In contrast, the effect of another type of male-dominated field of activity on self-employment is significant but negative.

*The Model for Men's Self-Employment*

Analyzing Model 2 for the transition into self-employment for men, one notices that the results largely correspond to those obtained in the model for women's self-employment. Age has a curvilinear effect on the decision to become self-employed for men too. The percentage of employment in the public sector is also negatively related to the transition into self-employment. The field-specific percentages of fixed-term contracts and unemployment are both positively linked to the entry rates into self-employment.

However, one observes a different (although statistically not significant) result for the importance of management and supervisory related work on the transition into self-employment. More specifically, the higher the ratio of management and supervisory work achieved by the male graduates from a certain field of study, the smaller the entry into self-employment. This result might be explained by high opportunity costs for men working in management and supervisory positions in the dependent employment, since these positions in the occupational hierarchy usually imply high incomes and thus high opportunity costs for becoming self-employed.

As expected, the test for the difference of the coefficient of the interaction term between gender and small children is significant. This implies that women having children aged less than 3 years are less likely to become self-employed than their male counterparts (having children aged less than 3 years). This can certainly be attributed to the traditional division of household work in the family.

## Entry Into Self-employment for Non-Academics

The results for non-academics reveal both similarities and differences to the findings obtained for their academic counterparts. First and foremost, it is striking that the gender-specific gap in self-employment is considerably higher for non-academics (the odds-ratio is 2.26) than for university graduates (the odds-ratio is 1.24).

Similar to the findings for academics, one finds that the integrated fields of apprenticeship training are most favorable for the entry into self-employment for both non-academic women and men. On the other hand, the inclination to become self-employed is the lowest for non-

academic women having been trained in either a female- or a male-dominated apprenticeship field.

Table 4. Entry Rates into Self-employment by Field of Study (vocational training and related)

| Field of Study | Entry Rate | | Logit: Odds-Ratio (Std.Err) | | Female /Male | |
| | (1) Female | (2) Male | (3) Female | (4) Male | (5) Gender: Interaction Effects | (6) Endowment Effects |
|---|---|---|---|---|---|---|
| Integrated | 1,40 | 3,36 | Ref. Cat. | Ref. Cat. | Ref. Cat. | Ref. Cat. |
| Female-dominated | 1,05 | 2,70 | 0,749** (0,082) | 0,798* (0,077) | 0,939 (0,137) | 0,0026** (0,0006) |
| Male-dominated | 1,08 | 1,70 | 0,773 (0,1249) | 0,498** (0,041) | 1,552* (0,281) | -0,0078** (0,0008) |
| Total / Constant | 1,09 | 2,01 | -3,134** (0,044) | -2,892** (0,034) | | -0,0052 -56,7% |

Source: Pooled Microcensus Scientific Use Files 2003,2004

Interestingly, the test for the difference in the coefficient effect (the interaction effect between gender and male-dominated fields of study is tested here) is significant. This implies that women trained in a male-dominated apprenticeship field tend to become self-employed more often than their male counterparts from the same apprenticeship field, a result which could be attributed to the discrimination of women in male-dominated apprenticeship fields.

The results from the Blinder-Oaxaca decomposition also indicate that the gender gap in entry into self-employment cannot be fully explained by the choice of the apprenticeship training. Only 28% of the gender-specific difference in self-employment can be attributed to the choice of a female-dominated apprenticeship training. On the other hand, male-dominated field of apprenticeship trained for are more favorable for women's entry into self-employment (to 84%), a result which even increases the gender gap in self-employment.

Even more promising is the focus on the mechanisms associated with occupations trained for which are responsible for women's and men's varying self-employment rates. In Table 5 it could be shown that roughly the same factors which are responsible for the gender gap in self-employment rates among academics explain the gender gap in self-employment among non-academics. More specifically, age has a curvilinear relationship with the entry into self-employment for non-academics as well. The presence of young children (up to 3 year old) has

a negative impact on the transition into self-employment for (female) non-academics. Analogous to the results for female academics, the apprenticeship fields specific percentage of the employees in the public sector is negatively linked to self-employment. By the same token, high labor market risks (measured by the percentage of employees with fixed term employment contracts, i.e. contracts with a limited duration) are positively associated with self-employment rates among non-academics. Nearly all these findings could be supported for the sub-population of male non-academics and male academics, except for the effect of apprenticeship field specific unemployment rates. Finally, the effect of clerical work and trade (female dominated fields of activity) on the entry into self-employment is negative. In the same vein, there are also male-dominated fields of activity such as driving, packing and loading which are also negatively associated with the transition into self-employment.

Table 5. Results of Multilevel Analyses for Entry Into Self-Employment
(non-academic education)

| | (1) Female | (2) Male | (3) Differences in Coefficients |
|---|---|---|---|
| *Level 1: Individual variables* | | | |
| age | 0,161** | 0,132** | 0,056 |
| | (0,034) | (0,025) | (0,046) |
| age squared | -0,002** | -0,002** | -0,001 |
| | (0,0004) | (0,0003) | (0,001) |
| children (< 3 Years) | -0,617** | -0,062 | -0,712** |
| | (0,174) | (0,106) | (0,221) |
| spouse | -0,248** | -0,008 | -0,211 |
| | (0,087) | (0,068) | (0,121) |
| | | | |
| *Level 2: Field of study variables* | | | |
| Office work and trade | -0,010* | -0,001 | 0,003* |
| | (0,005) | (0,005) | (0,007) |
| Education and health care | -0,004 | 0,001 | 0,007 |
| | (0,005) | (0,005) | (0,006) |
| Machine (and other) operators | -0,007 | -0,044** | 0,046 |
| | (0,025) | (0,009) | (0,022) |
| Driving, packing, loading | -0,049* | -0,025** | -0,014 |
| | (0,025) | (0,007) | (0,021) |
| Fixed-term contract | 0,054* | 0,019 | 0,006 |
| | (0,026) | (0,024) | (0,007) |
| Public sector | -0,024** | -0,027** | 0,044 |
| | (0,006) | (0,005) | (0,035) |
| Unemployment | -0,019 | 0,022 | -0,015 |
| | (0,019) | (0,013) | (0,020) |
| Constant | -5,492** | -4,340** | -3,587 |
| | (0,838) | (0,635) | (0,694) |

Source: Pooled Microcensus Scientific Use Files 2003,2004

**Working as Solo Self-Employed or Employer? Performance Differences of Female and Male business starter with Tertiary Degree**

Next, gender-specific differences in a performance related indicator capturing the extent to which female and male self-employed tend to work as solo self-employed versus employer are examined.

Table 6a. Share of Solo Self-Employment by Field of Study (tertiary education)

|  | Integrated | Female dominated | Male dominated | Total |
|---|---|---|---|---|
| Female | 69,5 | 89,3 | 66,0 | 76,0 |
| Male | 57,9 | 74,7 | 67,9 | 62,6 |
| Male / Female Odds-Ratio | 1,66 | 2,82 | 0,92 | 1,89 |

Source: Pooled Microcensus Scientific Use Files 2000, 2003, 2004

The vast majority of self-employed women and men are own-account workers (or the so-called "solo self-employed", see more on this topic by Leicht 2000), i.e. they do not have (paid) employees. More specifically, the level of female own-account workers (76.0%) is considerably higher than that of male own-account workers (62.6%). In other words, the odds-ratio is 1.89, which implies that the probability of setting up an enterprise without employees is higher for women by 89% than for men. At the same time, considerable differences are found among female self-employed according to their field of study and the probability of working without employees. The highest share of about 90% of all solo self-employed is found among women graduated from a female-dominated field of study. This outweighs the percentage of female graduates from either an integrated field of study which have become self-employed (69.5%) or graduates from a male-dominated field of study which entered self-employment (66%) by more than 20% points. Additionally, the differences in the chosen fields of study and their consequences for solo self-employment are also salient between the two genders.

Table 6b: Non-linear decomposition of the gender gap in solo-self-employment

|  | Coef. | Std. Err. | z | Endowment Effect (in%) |
|---|---|---|---|---|
| Female dominated | 0,0440 | 0,0048 | 9,08 | 32,8 |
| Male dominated | -0,0138 | 0,0039 | -3,58 | -10,3 |

Source: Pooled Microcensus Scientific Use Files 2000, 2003,2004

The Blinder-Oaxaca decomposition shows that the gender-specific segregation in the choice of field of study contributes to a certain degree to the higher solo-self-employment rates

among female entrepreneurs (compared to male entrepreneurs), thus explaining the gender differences to 32,8% points. However, one has to consider that graduates from male-dominated fields of study also become solo-self-employed significantly more often than graduates from integrated fields of study.

Table 7. Logit Estimation of Starting a New Business With or Without Employees

|  | Female | Male | Endowment Effects (in%) |
|---|---|---|---|
| Age | ,222* | ,222*** | -26,4 |
| Age squared | -0,003 | -,0028*** | 17,1 |
| Children (< 3 years) | 0,588 | 0,266 | 2,6 |
| Spouse | 0,372 | ,475** | 6,0 |
| Management | 1,007* | 1,328*** | 11,9 |
| Catering | 1,535 | 0,545 | 2,0 |
| Teaching | -2,164*** | -2,406*** | 10,9 |
| Counseling | -1,678*** | -1,133*** | 5,2 |
| Writing / Arts /Entertainment | -2,242*** | -2,599*** | 21,9 |
| Constant | -6,044** | -5,327*** | Explaind: 51,0 |

Source: Pooled Microcensus Scientific Use Files 2000, 2003,2004

Next, the results from a binary logit model on the decision to work as solo self-employed (versus employer) are discussed. It could be shown that the age of new entrepreneurs is indeed an important factor which explains the probability of working as solo self-employed (versus employer). The older the new entrepreneur (regardless of gender) is, the more likely that he or she establishes an enterprise without employees. However, this tendency holds true both for very young respondents and those of advanced age. A central explanatory factor of the probability of working as solo self-employed is the inherent characteristics of fields of activity (in this case, fields of activity are measured directly). For instance, solo self-employment is common for fields of activity such as „teaching", "counseling" as well as „arts, journalism and entertainment."

On the other hand, new entrepreneurs are more likely to have paid employees, if they deal with "management-related tasks" (as a field of activity). While the family (children and partner) is not of importance for women's solo-self-employment, it has an effect on men's solo self-employment. More specifically, men tend to establish new businesses and hire employees, if they have a partner who supports them. With regard to the "endowments" effects, 22% points of the gender-specific differences in solo self-employment can be traced back to women's higher presence in occupational fields such as „arts, journalism and entertainment". Similarly, a high percentage of women in "teaching" explains another 11% points difference of solo self-employment between women and men. Finally, a high share of men working in

management related current occupations explains another 12% points difference of women's higher propensity to work as own account workers.

## SUMMARY & CONCLUSION

This study has drawn on several stylized facts from female entrepreneurship that (first) women are significantly less likely to become entrepreneurs than men and that (second) women-owned enterprises are smaller than men-owned enterprises and that (third) women entrepreneurs (in comparison to men entrepreneurs) are likely to establish their enterprises in marginal fields.

Although gender-specific analyses are rather scant in Germany, the bulk of international studies on women's entrepreneurship has been significantly growing for recent years. With regard to the latter, prior work has often used *gender-specific occupational and industrial segregations* as underlying factors of the gender-specific differences in (both entry into and performance in) self-employment. In this context, it has been found that women are more likely to enter highly segregated occupations and industries in self-employment than men. Moreover, it has been established that *women employees* are likely to be found in *highly segregated occupations and industries*, a fact which explains their lower inclination of entering self-employment. Besides, it has often been assumed that the *gender-specific segregation in the fields of study and apprenticeship training* is a factor which pre-determines gender specific segregation in self-employment. Summing up, prior work has argued that female-dominated occupations and industries are less favorable for both women's entry into self-employment and their performance related indicators (e.g. survival ability, employment growth) in entrepreneurship.

To our knowledge, however, no studies exist which have explored the association between gender-specific segregation in fields of study and gender segregation in the dependent employment (on the one hand), and women's and men's entry into self-employment as well as gender-specific segregation in self-employment (on the other). Moreover, prior work has failed to examine *why exactly* are the so-called female-dominated occupations and industries less favorable for (the entry into and performance in) self-employment. Put differently, no solid explanations are given for the understanding of the *mechanisms* underlying the unfavor-

able impact of female-dominated occupations, industries as well as fields of study on women's subsequent entry into and performance related indicators in self-employment.

Against this background, this study has set out the objective to fill in gap and provide explanations for understanding the consequences of the gender-specific segregation in the labor market on both the entry into and performance in self-employment.

This study draws on several Microcensus Scientific Use Files from 2000, 2003 and 2004. To isolate the effects of the fields of study and apprenticeship training on self-employment, separate analyses are conducted for the respondents graduated from a high school and their counterparts having finished apprenticeship training (which is below the tertiary level).

A surprisingly low gender gap in self-employment could be found for academics. More specifically, the probability of establishing an own enterprise is only 25% points higher for male academics than for their female counterparts. Applying the construct of "female-dominated occupations" from the research on segregation, the hypothesis could be supported that women (and men) graduated from a female-dominated field of study have worse chances for becoming self-employed than their counterparts graduated from integrated fields of study, a finding which is remarkably true also for non-academics. However, the answer to the question whether the gender-specific differences in self-employment rates, i.e. the so-called "gender gap", can solely be attributed to women's and men's different choices of fields of study, is a definite "no". It is not only female dominated fields of study which are found to be unfavorable for the transition into self-employment, but also male dominated ones.

Using a hierarchical linear model (multi-level analysis) (Raudenbush & Bryk 1992), this study has further explored the characteristics of those fields of study which are positively or, in contrast, negatively associated with women's entry into self-employment. The results have shown that gender-specific differences in self-employment could be traced back to two factors. First, women's under-representation in self-employment is associated with the fact that a high percentage of women graduated from a female dominated field of study end up in the public sector which has been shown to be a pitfall for entrepreneurship. Second, also family relevant factors play a role. In this context, the existence of young children in one's family has an adverse impact on the mother's inclination to become self-employed, while it has no impact on the father's decision to become self-employed.

Moreover, the hypothesis that women tend to occupy service sector jobs, such as social, educational and medical services, could not be substantiated (at least) for female academics. Finally, another factor has been proven to be highly relevant for self-employment. More exactly, labor markets risks, e.g. the risk of becoming unemployed or receiving a fixed term contract in the dependent employment, which are associated with the choice of a specific field of study have a significant impact on the probability of becoming self-employed. The higher the unemployment rate associated with having graduated from a specific field of study, the higher one's inclination to become self-employed. By the same token, the higher the share of respondents graduated from a specific field of study and working on a fixed contract basis in the dependent employment, the higher the self-employment rate in this specific field of study. Summing briefly up, these results make thus clear that a high percentage of female and male self-employed are the so-called "necessity-based entrepreneurs" (Global Entrepreneurship Monitor 2004), who are actually pushed into self-employment in face of high labor market risks in the dependent employment.

To a large extent, the results are identical for *non-academics*, although the gender gap is significantly higher among the latter. More specifically, public sector and the reconciliation of family and work are shown to be factors which explain the gender-specific deviations in self-employment both for academics and non-academics. Similarly, apprenticeship field specific labor markets risks which are associated with working on a fixed term employment basis also explain women's choice to become self-employed.

However, also differences in the determinants of self-employment could be found for non-academics and academics. The hypothesis that female dominated occupations do not provide resources (e.g. entrepreneurial skills) which are crucial for the transition into self-employment could be supported for clerical work and trade (as fields of activity). On the other hand, no effect could be isolated for "nursing and health services". Moreover, another interesting result is that also male-dominated fields of activity such as "operating and monitoring machines" are identified which are negatively associated with the entry into self-employment.

Apart from investigating women's and men's entry into self-employment quantitatively ( and thus employing „the more, the better„ approach of promoting entrepreneurship), it is striking to gain knowledge on qualitative aspects of entrepreneurship. Against this background, this study has set out to examine a qualitative (performance-oriented) dimension of women's and

men's entrepreneurship, examining the extent to which women and men entrepreneurs tend to work as own-account workers ("solo self-employed") versus employers. In this context, the aim of this study was to investigate whether women's choice of field of study has a significant effect on the type of enterprises (own-account worker versus "employer") they establish. Results show that the majority of women entrepreneurs (76%) and men entrepreneurs (63%) are the so-called solo self-employed. At the same time, significant differences among new businesses by fields of study are found. For instance, the proportion of female solo self-employed among those graduated from a female-dominated field of study is with 89,3% disproportionately higher than the average of all female self-employed. The Blinder-Oaxaca decomposition makes clear that the gender-specific differences in fields of study explain to 33% women' higher propensity to work as own-account workers. Using a binary logit model, other factors which underlie women's and men's choice of solo self-employment over the decision to work as employers have been examined. It could be established that the choice of solo self-employment goes along with fields of activity which are either functionally or symbolically attributed to women and are either person- or service-oriented. More specifically, fields of activity which refer to "teaching" and "counseling" as well as "arts, journalism and other entertaining tasks" are most likely to be performed by solo self-employed. All in all, more than 50% of female and male differences in the probability of being a solo self-employed (versus an employer) can be explained by women's and men's different choices of fields of activity.

Concluding, this study has shed some light on the relationship between fields of study and occupations trained for, on the one hand, and the entry into self-employment, on the other. One of the most important contributions of this study is that is has tried to explain the mechanisms which underlie the association between fields of study (and apprenticeship fields) and the transition into self-employment for women and men employees. A further advantage of this study is that it has employed advanced statistical methods of analysis such as multi-level hierarchical linear models and the Blinder-Oaxaca decomposition. It could be shown that neither female- nor male-dominated fields of study and apprenticeship fields are favorable for starting one's own business. Instead, it has been found that it is integrated fields of study and apprenticeship fields which are hothouses for self-employment. Also, the positive association between fields of study (and apprenticeship fields) and performance in self-employment (measured by the number of employees) has been substantiated empirically. One of the implications for future research is therefore to explore the characteristics of integrated fields of study (such as human medicine, business administration and law) and the reasons why they exactly provide favorable environments for both entry and performance in entrepreneurship.

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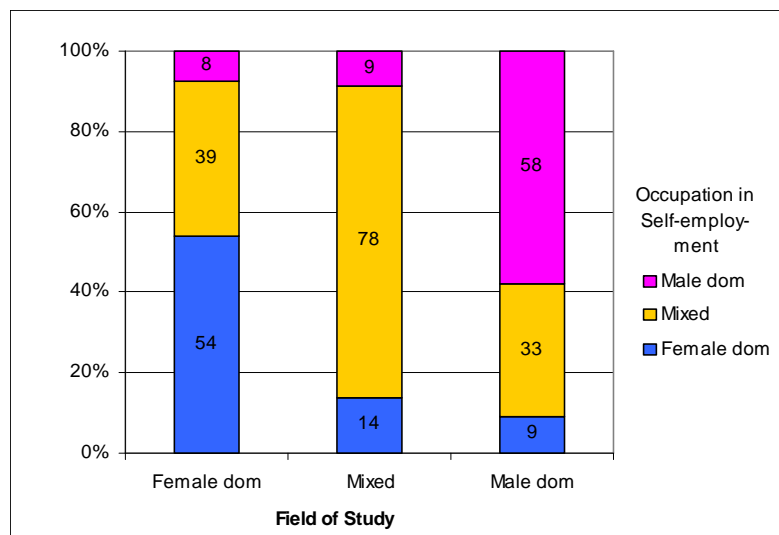
## APPENDIX

Figure1: Female Employees with Tertiary Degree by Field of Study and Sector of Employment
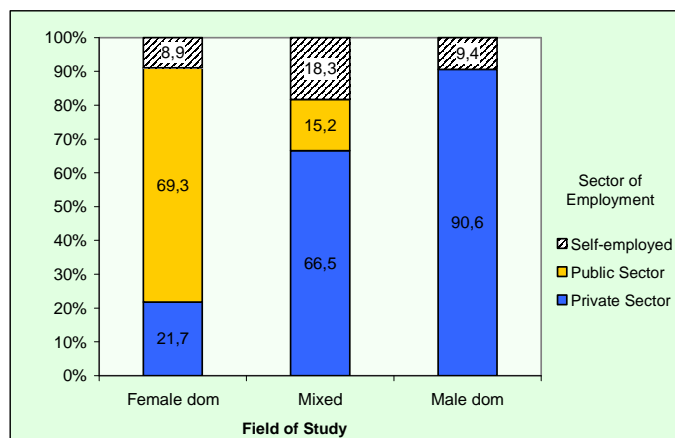


Source: Pooled Microcensus Scientific Use Files 2003,2004

Figure 2: Female Founder by Field of Study and Current Occupation in Self-Employment

Source: Pooled Microcensus Scientific Use Files 2003,2004