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**Working Paper**

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# Drivers of Self-Employment – A Multivariate Decomposition Analysis for the Case of Germany[1]

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**Abstract**

We analyze the sources of the rise in the levels of self-employment in Germany since reunification by applying the non-linear Blinder-Oaxaca decomposition technique. This analysis is performed separately for East and West Germany in order to account for the East German recovery of entrepreneurship after 40 years of socialist regime. We find different results for self-employed people with employees and solo-entrepreneurs. The main factors determining changes in the level of self-employment are demographic developments, the shift toward service sector employment, and a higher share of population holding a tertiary degree. The analysis also suggests that changes in personal attitudes toward self-employment might be responsible for the particular increase of solo-entrepreneurship.

Keywords: Self-employment, non-linear Blinder-Oaxaca decomposition technique, entrepreneurship, Germany

JEL classification: L26, D22

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## 1. Introduction

Entrepreneurship is long identified as a crucial driver of growth.[5] Although we know quite a lot about factors that shape the level of entrepreneurship, not much is known about the *relative* importance of these potential determinants.[6] Moreover, the prevailing studies on the determinants of self-employment do not adequately account for the dynamic nature of entrepreneurship.[7] This calls for a dynamic analysis that relates changing levels of self-employment to changes in the socio-economic environment in order to identify the most important determinants of entrepreneurship. An advantage of such kind of analysis is that the results are independent of those unobserved factors that remain constant over time. This paper reports the results of such an analysis using the case of Germany as an empirical example.

The analytic approach used in this paper is a non-linear version of the Blinder-Oaxaca decomposition technique (Oaxaca and Ransom, 1994; Fairlie, 2005). While this type of analysis is used in a number of fields, in particular investigating differences between groups within a population (see Section 4), we are not aware of any study that uses this method to analyze changes in the level of self-employment. A special merit of the Blinder-Oaxaca decomposition technique is that it allows us to assess the extent that the changes in the level of self-employment in Germany can be attributed to different aspects of structural changes and to what extent it might be regarded as a result of changing attitudes toward entrepreneurship, a more entrepreneurial spirit, among the population. To our understanding, an entrepreneurial spirit can only be determined if there is a higher propensity of people for self-employment given their individual characteristics and given the economic framework conditions.

[5] See, for example, Acs and Szerb (2009), Carree and Thurik (2010), Fritsch (2013), OECD (2003), Commission of the European Communities (2010).

[6] See, for example, Acs and Szerb (2009); Audretsch and Thurik (2000); Audretsch (2007); Audretsch, Thurik and Stam (2011); Baumol (1990); Baumol, Litan and Schramm (2007); Bosma, Wennekers and Amorós (2012); Caliendo, Fossen and Kritikos (2011), Freytag and Thurik (2007); Naudé (2011); Thurik (2011); Wennekers, et al. (2010);

[7] See, however, Wennekers et al. (2005).

Germany is an interesting case for an analysis of self-employment for several reasons. First, although Germany is often described as of having "a rather low level of entrepreneurial activity" (Bosma, Wennekers and Amorós, 2012, 124), the country experienced a pronounced increase in self-employment since reunification. Interestingly, between 1991 and 2010, many other established, innovation-driven economies faced a stagnant or even declining level of self-employment, even though they had higher start-up rates than Germany.[8] In Germany, it was the other way around: despite relatively low start-up rates, the number of people listing "self-employed" as their main occupation rose by 40 percent, with the self-employment rate increasing from 8 to 11 percent (Fritsch, Kritikos and Rusakova, 2012).

Second, given that entrepreneurial activities in East Germany were oppressed by a socialist regime for a period of 40 years, the development of self-employment in this part of the country is particularly interesting. Therefore, in order to account for special developments in East Germany, we perform the analysis separately for eastern and the western parts of the country. While the literature suggests that the convergence of East and West Germans in terms of basic attitudes, e.g., the role of government in society and own responsibility, will take one to two generations (Alesina and Fuchs-Schündeln, 2007), we find strong indication that the alignment of the propensity for self-employment in both parts of the country occurred considerably faster.

We, thirdly, identify and examine a further pronounced development in Germany: the increasing share of solo-entrepreneurs (see also

[8] According to OECD (2010), the share of self-employed persons in the economically active population decreased between 1991 and 2009 period in countries such as the USA (from nine to seven percent), France (from 13 to 9 percent), United Kingdom (from 15 to 13 percent), Australia (from 15 to 12 percent), Norway (from 11 to 8 percent), and Japan (from 22 to 13 percent). In Canada the share of self-employed stagnated around nine percent. The self-employment rate rose to a lower degree in the Netherlands (from 11.6 to 13.2 percent) and in Sweden (from 9.2 to 10.4 percent).

Bögenhold and Fachinger, 2007).[9] Hence, we also separately investigate the reasons for the change in self-employment for business owners with dependent employees ("employers") and for those who work alone ("solo entrepreneurs").

We begin our investigation with a brief review of different explanations for the changing levels of self-employment in Germany (Section 2). We then describe the data set we use and the development of self-employment in Germany between 1991 and 2009 (Section 3). Section 4 introduces the non-linear Blinder-Oaxaca decomposition technique that we apply to analyze the contribution of the different factors that shape self-employment in Germany. In the first step of the decomposition analysis we identify the determinants of self-employment at the micro-level of individuals during both the first and last years of the period under analysis (Section 5). Based on the results regarding the determinants of self-employment at the micro-level, we apply the decomposition technique to our data (Section 6). Section 7 discusses the results and draws conclusions with regard to the information that the decomposition technique reveals.

## 2. Theoretical Background

There are three possible explanations for changing levels of self-employment. First, variations in the socio-demographic characteristics of the population, such as age, gender, and education, may influence changes in self-employment. Second, self-employment may be affected by changes in the economic environment that affect the costs and benefits of running a business. Thirdly, changing attitudes toward entrepreneurship may affect the propensity of being self-employed.

Previous research provides compelling evidence that a person's propensity to start and run an own business is strongly influenced by a

[9] It is unclear, to what extent this rise of solo self-employment is a German specificity. Stam (2012) provides evidence for rising solo self-employment in The Netherlands since the year 2000. This increase is, however, less pronounced when compared to Germany.

number of socio-economic characteristics. Hence, self-employed persons tend to be distinguished from dependently employed or unemployed persons in a number of respects (for an overview see Parker, 2009). In Germany, for example, the propensity of being self-employed is higher for middle aged individuals, for individuals with a higher level of formal education, as well as for married, male, and individuals who have a non-German nationality (Fritsch, Kritikos and Rusakova, 2012).

A main factor in the economic environment that may affect the costs and benefits of being self-employed is a reduction of the minimum efficient size of production, which has lowered entry barriers and created various new entrepreneurial opportunities. The reasons behind such a reduction of minimum efficient size are manifold and include

- a demand shift away from standardized mass production toward more individual products (Piore and Sabel, 1984) and the increasing importance of knowledge as an input factor (Audretsch, 2007);
- technological developments in fields such as information and communication that facilitate the coordination of labor division and allows for flexible small scale production units (Audretsch, Thurik and Stam, 2011); and
- ongoing globalization that creates larger markets with new opportunities for a productive division of innovative labor (Audretsch, Grilo and Thurik, 2011).

In industrialized economies these developments coincide with a growing share of service sector activities, many of which can be competitively operated at rather small scales. A number of authors regard such changes in the economic conditions as a main force behind the shift from a ‘managed’ economy to a more ‘entrepreneurial’ system (Audretsch, Thurik, and Stam, 2011) and for its success over other types of capitalism and in particular over the command economies of the former Soviet block (Audretsch, 2007; Baumol, Litan and Schramm, 2007).

Another important aspect of the economic conditions for entrepreneurship is the institutional framework. In case of Germany, this particularly pertains to the shock transformation of the eastern states, formerly comprising of East Germany, from a socialist regime to a western type market economy. Additionally, there are a couple of country-wide regulatory changes that lowered the hurdles for becoming self-employed. The precondition to be a master craftsman to found a business in a number of trades was abolished, the minimum capital requirements for setting up a limited liability company were reduced, and personal bankruptcy law was altered (see Fossen, 2011). Moreover, a number of policy programs that tried to stimulate entrepreneurship were introduced during the period under analysis. Most prominent among these programs are those supporting start-ups by unemployed persons (Caliendo and Kritikos, 2010) that induced a pronounced increase of the number of start-ups in the mid-2000 (see Section 3). A further type of a pro-entrepreneurship policy, which intensified since the late 1990s, sought to promote a culture of entrepreneurship at universities and other public research institutes, including the provision of support to start-ups by students and faculty members.[10]

Comparisons of the self-employment levels across countries find a u-shaped relationship between the share of self-employed workforce and the national wealth level, thus indicating relatively high self-employment rates for both the poorest and richest countries (Wennekers, at al., 2010).[11] Based on this result it is argued that increasing levels of self-employment in highly developed economies may come from a more entrepreneurial attitude of the population, particularly from a growing desire of people for self-realization and independence (see also Freytag and Thurik, 2007).[12] According to this argument, one may expect increasing amounts of

[10] These programs, however, have led to only a few start-ups being directly supported.

[11] Along this line is also the finding that an increase in entrepreneurial activities has a positive impact on economic development (see Koellinger and Thurik, 2012).

[12] The GEM data provide strong indication that much of the self-employment observed in poorer countries is probably motivated by necessity; see Bosma, Wennekers and Amoros (2012) for details.

opportunity entrepreneurship with rising wealth levels in countries such as Germany.[13]

Because changes in the level of self-employment may have many reasons, the mere observation of increasing self-employment as such can, of course, not be regarded as corroborating the existence of a changing attitude toward entrepreneurship. Such a test requires a multivariate analysis that accounts for all relevant determinants of self-employment. The basic idea behind our application of the Blinder-Oaxaca decomposition technique is that the part of changing self-employment that cannot be explained by changes of the economic framework conditions may be interpreted as resulting from a change of the population's attitude toward entrepreneurship.

## 3. A brief description of the evolution of self-employment in Germany 1991-2009

Our investigation is based on the German Micro-Census data, a representative survey containing information about the socio-economic situation of approximately 820,000 persons living in 380,000 households across Germany.[14] This survey is probably the most reliable data source for assessing the level of self-employment in Germany (Fritsch, Kritikos and Rusakova, 2012). The analysis draws on 19 waves of the Micro-Census, starting with 1991, when the sample was substantially enlarged, and concluding with the 2009 wave, the most recently available data at the

[13] According to GEM data, the level, as well as the share, of opportunity entrepreneurship in Germany showed, however, no clear trend in the 2001-2011 period (Brixy, Sternberg and Vorderwülbecke, 2012).

[14] The Micro-Census was started in 1957 as an annual survey of private households and persons in West Germany. In 1991 it was expanded to include the former East German states. The central aim of the survey is to collect nationally representative micro-data about the population structure, economic and social situation of individuals and households, labor activity, education, as well as living conditions and health. The Micro-Census includes the most of the attributes of the European Union Labor Force Survey (EU-LFS), thus making it possible to compare the data on employment activity across EU member states. A stable set of core questions appears every year, covering the most essential areas, such as population and demography; education, training, and qualification; labor market and occupational dynamics; earnings, income. For more information on the current Micro-Census program, see Micro-Census Law 2005 of 24 June 2004 (Federal Law Gazette I, p. 1350).

time of analysis. The classification of individuals as self-employed is based on a survey question about the occupational status of the respondents. Self-employment as an occupational status applies to those individuals who own and manage a business, including craftsmen, professionals and freelancers. We address only those individuals who are self-employed in their main occupation and do not include those who are self-employed occasionally or as secondary occupation. We calculate the self-employment rate as the share of self-employed persons in the employed population between 18 and 65 years old. Civil servants and members of the military service are excluded.[15]

Between 1991 and 2009, the number of self-employed persons in the German population, East and West, rose almost constantly from 3.037 million in 1991 to 4.215 million in 2009, an increase of 39 percent (see Figure 1).[16] This increase is particularly pronounced in East Germany where, until the breakdown of the socialist GDR regime in 1989/90, a rigorous anti-entrepreneurship policy strategy was adopted, which included socialization of private enterprises and the massive suppression of any remaining private-sector activity (for details, see Brezinski, 1987; Pickel, 1992). As a result of the attempts by the socialist regime to eradicate private enterprises, in the fall of 1989, just before the regime change, the self-employment rate in East Germany amounted to about 1.8 percent (Kawka, 2007). The few private firms in existence were primarily in the small trades that were ill-served by inflexible centrally planned state firms.

With the regime-switch, more and more East Germans perceived entrepreneurship as a means to generate income, increase self-realization and to overcome economic problems. As a consequence of the new

[15] All individuals are assigned to the place of their main residence at the time of the survey. The data for East Germany include the former West Berlin.

[16] It is quite remarkable that the Total Early-Stage Entrepreneurial Activity (TEA) Index, which constitutes the main measure for the level of entrepreneurship in the GEM study, does not show an increasing trend for Germany between 2001 and 2009 (Brixy, Sternberg, Vorderwülbecke, 2012), while the Micro-Census recorded an increase of the self-employment rate of about 11 percent (from 9.8 to 10.9) over the same period.

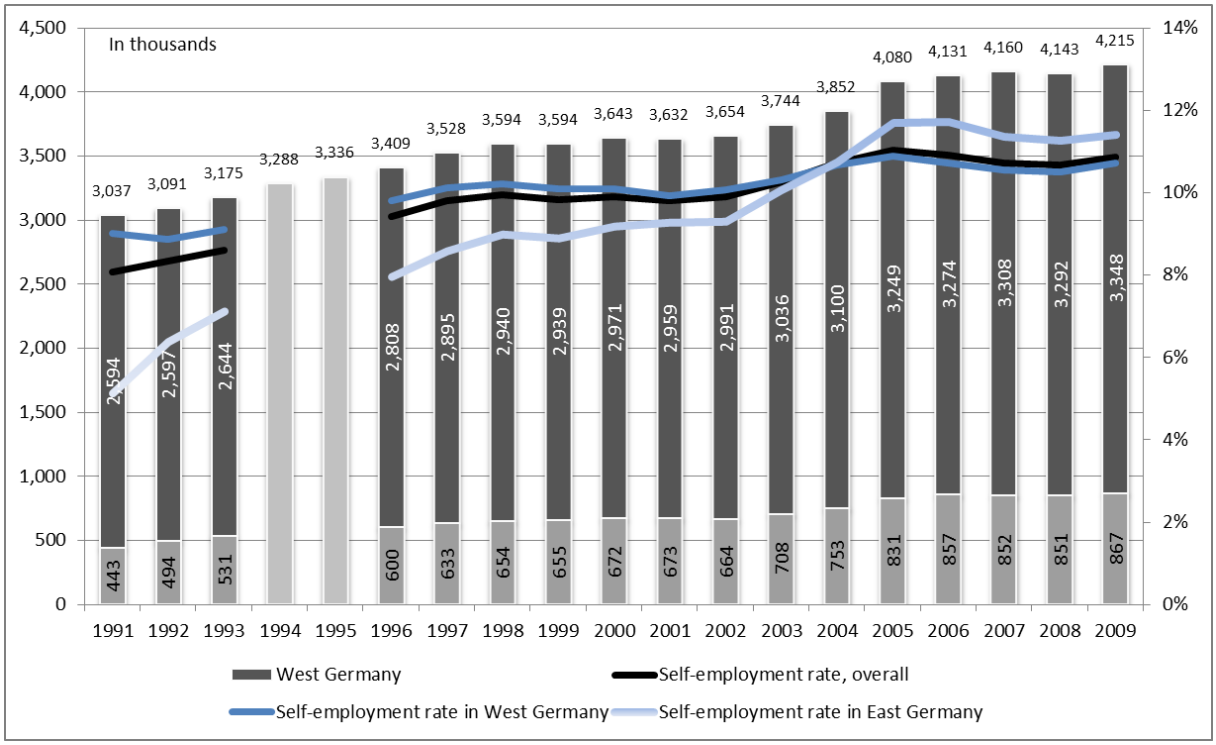


Figure 1: Self-employed individuals, absolute numbers and ratios (in %), 1991-2009

economic freedom and the new climate, the number of new businesses in East Germany boomed, particularly in the services and construction sectors. At the beginning of the observation period, in 1991, less than two years after the break down of the socialist regime, the self-employment rate in East Germany was already 5.1 percent. 15 years after the beginning of the transformation process, in 2005, self-employment in East Germany matched that of West German areas (Figure 1).

Distinguishing between self-employed persons with and without employees (Figure 2) reveals rather different developments. In West Germany the increase of self-employment is almost entirely due to solo entrepreneurs, i.e., those who do not have any employees. In East Germany the number of self-employed persons with employees peaked in 1999 and since then has declined slightly. The number and share of solo entrepreneurs have, however, continued to show pronounced growth

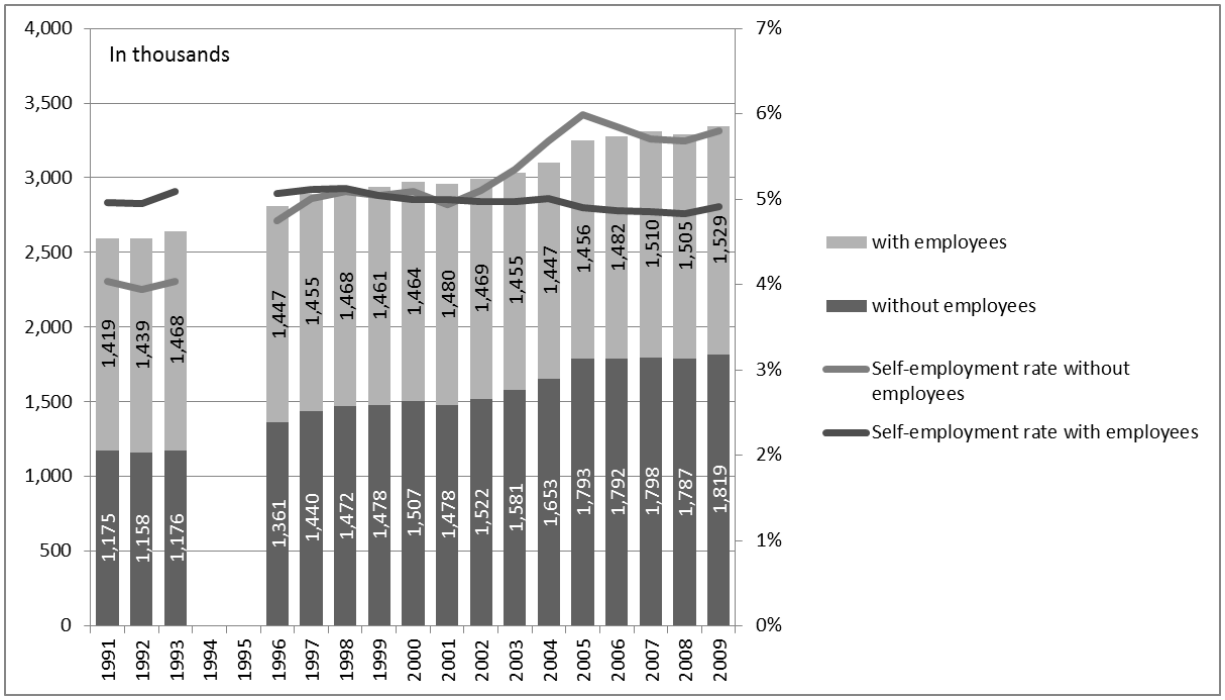


Figure 2a: Self-employed individuals with and without employees in West Germany, absolute numbers and ratios (in %), 1991-2009

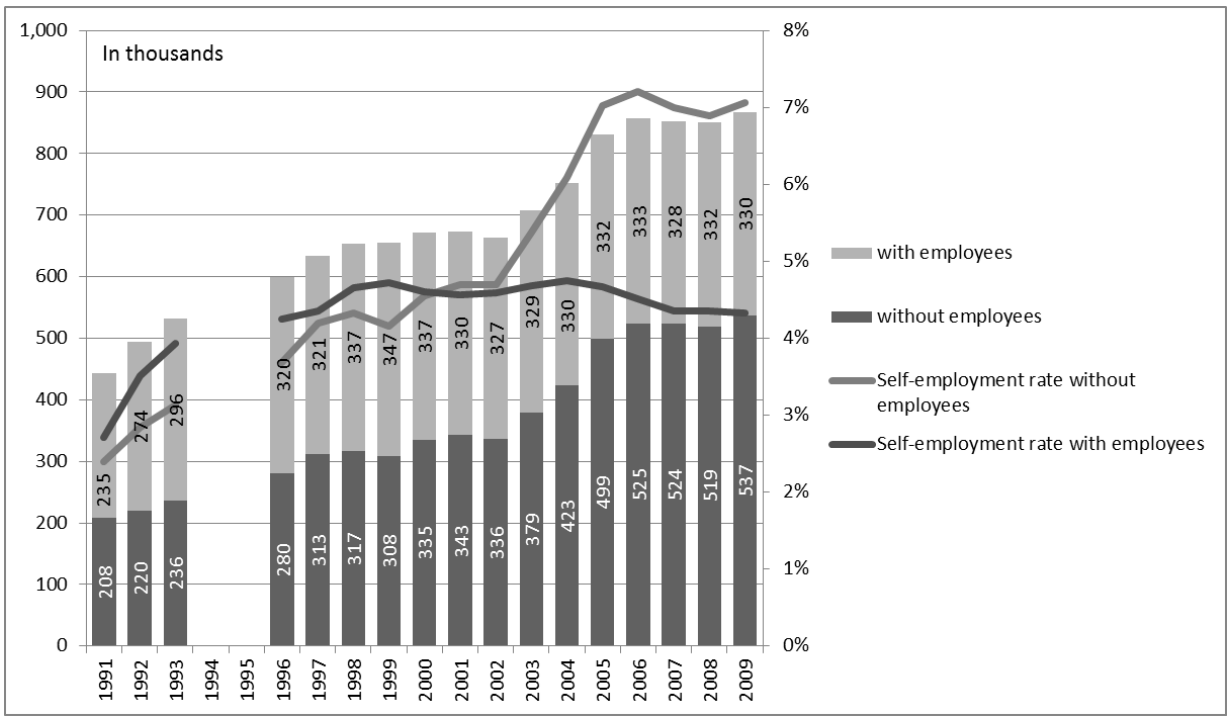


Figure 2b: Self-employed individuals with and without employees in East Germany, absolute numbers and ratios (in %), 1991-2009

through the end of the observation period, 2009. Until the late 1990s the number of self-employed persons without employees was below the number of those with employees in both parts of Germany. Shortly after 2000 the number of solo entrepreneurs began to exceed those with employees. The quantitative difference between the two groups in 2009 is particularly pronounced in East Germany where the number of entrepreneurs without employees was more than 62 percent above the number of self-employed with employees.

Looking at the overall German economy, it is clear that the industry structure of self-employment changed substantially over the observation period (Figure 3). In line with the general trend, the prevalence of self-employment in services has become more pronounced over time. The share of self-employed persons who were affiliated to this sector (including credit and insurance, transport and communication) increased from 35.8 percent in 1991 to 52.9 percent in 2009, reflecting the structural change observed in all innovation-driven economies.[17] Most other sectors faced negative trends with regard to numbers and shares of all self-employed persons. For example, in “mining, manufacturing, energy and water supply,” the number of self-employed went down by about 27 percent between 1991 and 2009, while in “agriculture and forestry” the number of self-employed was reduced by about one third. Only one other sector, “construction,” experienced an increase in the number of self-employed persons. In 2009, more than half of the solo self-employed (53.23 percent) were in the renting businesses and other public and private services, followed by trading and hospitality (16.26 percent) and construction (9.95 percent). These are also the three economic sectors that experienced the greatest increase in solo self-employment during the observation period.[18]

[17] According to the German Labor Force Statistics (*Erwerbstätigenstatistik*) the share of service employment in Germany even increased from 60.9 percent in 1991 to 73.4 percent in 2009, while the employment share of the manufacturing sector decreased from 36.1 percent to 24.9 over the same period. See Federal Statistical Office (2012).

[18] The number of solo self-employed in construction increased from about 63,000 in 1991 to 234,500 in 2009 (by 373 percent). In renting, business and other public and private

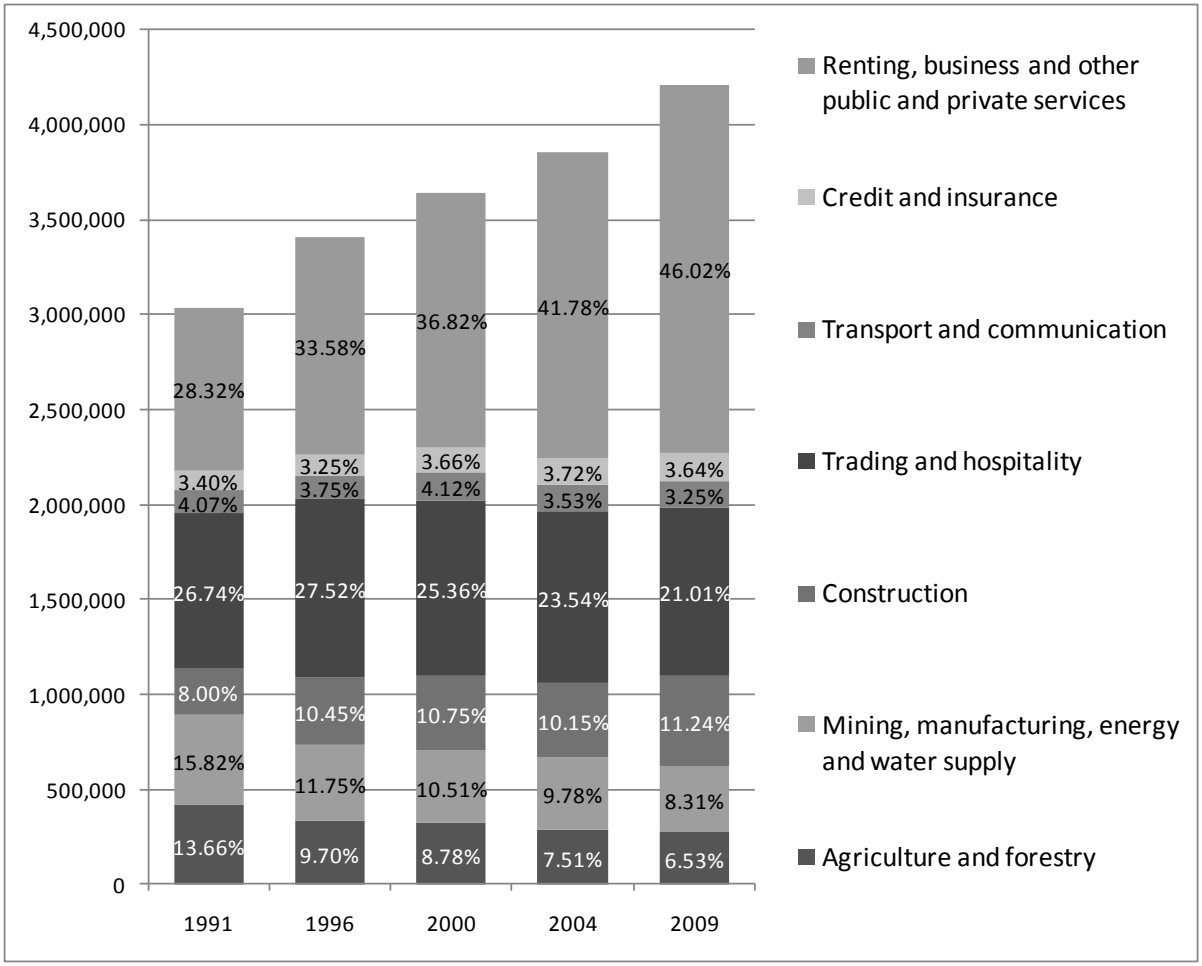


Figure 3: Self-employment by industrial sectors, absolute numbers and shares in percent, 1991-2009

The main individual characteristics that are found to distinguish between self-employed and dependently employed persons (Bates, 1995; Parker, 2009) and for which we have information available in our data are age, gender, marital status, nationality, industry affiliation, and education level. In our decomposition analysis we investigate to what extent respective developments in the population structure, such as a higher share of persons with a tertiary education, a shift of the sectoral structure and the age structure of the population (see Table A1 in the Appendix), contribute to the explanation of changes of self-employment rates in

services this number almost tripled and in credit and insurance it increased by about 50 percent.

Germany. Our data suggest that the differences between the solo self-employed and the employers with regard to these socio-demographic characteristics are modest. Compared to the employers, the solo self-employed are on average more often female, unmarried, and tend to be younger (below 40). No clear difference between the two groups can be found with regard to their education level.

Summarizing, this brief review shows three kinds of trends in the area of entrepreneurship in Germany that have significantly contributed to its unique development between 1991 and 2009. First, there is the recovery of entrepreneurship in East Germany after the end of the socialist GDR regime. A second important trend is the increase of solo entrepreneurship in both parts of the country. Third, we observe a shift of economic activity toward such parts of the service sector that are characterized by a lower minimum efficient size. The divergent developments of entrepreneurship with and without employees suggest that these two types of self-employment are driven by different factors. As a consequence, we will perform separate decomposition analyses for both entrepreneurial types.

## 4. The non-linear Blinder-Oaxaca decomposition technique

To investigate the drivers of the changes in self-employment in Germany since reunification, we apply the Blinder-Oaxaca decomposition technique adapted for non-linear models (Fairlie, 2005). This approach is widely used for the analysis of behavioral differences between groups and is common in studies of racial or gender gaps in the labor market literature. The Blinder-Oaxaca decomposition has also been applied to investigate the differences in self-employment rates of minorities and disadvantaged groups (see, e.g., Fairlie, 1999, 2006).[19] However, we are not aware of any previous study that has used this method to analyze changes in the level of self-employment.

[19] For other applications of this technique, see e.g. Fitzenberger, Kohn and Wang (2011).

For a nonlinear equation $Y = F(X\hat{\beta})$ the Blinder-Oaxaca decomposition in the average value of the dependent variable $Y$ between 1991 and 2009 can be expressed as:

$$\bar{Y}^{2009} - \bar{Y}^{1991} = \left[\sum_{i=1}^{N^{2009}} \frac{F\left(X_i^{2009}\hat{\beta}^{1991}\right)}{N^{2009}} - \sum_{i=1}^{N^{1991}} \frac{F\left(X_i^{1991}\hat{\beta}^{1991}\right)}{N^{1991}}\right] + \left[\sum_{i=1}^{N^{2009}} \frac{F\left(X_i^{2009}\hat{\beta}^{2009}\right)}{N^{2009}} - \sum_{i=1}^{N^{2009}} \frac{F\left(X_i^{2009}\hat{\beta}^{1991}\right)}{N^{2009}}\right], \quad (1)$$

with $\bar{Y}^j$ denoting the average self-employment probability of group *j*, $j \in 1991, 2009$, and $N^j$ denoting the sample size of group *j*. $X_i^j$ represents the average values of the independent variables and the $\hat{\beta}^j$ are the estimated coefficients for the respective probabilities of being self-employed. The first term in equation (1) estimates the contribution of changes of the independent variables $X_i^j$ (economic and demographic structure) to the difference of the level of self-employment between 1991 and 2009. In this specification, the coefficient estimates $\hat{\beta}$ for the year 1991 are used as the weights for individual characteristics of being self-employed. Hence, the term represents the part of the change of the level of self-employment that can be attributed to changes in the economic and demographic structure as measured by the variables that have been included in the analysis.

The second term represents the part of the difference in self-employment that cannot be explained by the variables that represent changes of the economic and demographic structure. This component may be interpreted as changes in behavior, i.e., differences in the willingness or in the ability to start an own business. It can be regarded as an indicator to what extent the German population has developed a more positive attitude toward entrepreneurship over the period under analysis.[20] These behavioral components are of particular interest for East Germany,

[20] This interpretation does, however, require that all relevant variables for structural change are included in the analysis. See Section 7 for a discussion of this issue.

where entrepreneurship in 1991 was restricted by multiple factors, including insufficient knowledge of market economies, a lack of capital, and by the cultural imprint that resulted from living under a socialist regime with strong anti-capitalistic values (cf. Fritsch, et al., 2012; Wyrwich, 2012).

An alternative and equally valid expression for the decomposition of the gap is:

$$\bar{Y}^{2009} - \bar{Y}^{1991} = \left[\sum_{i=1}^{N^{2009}} \frac{F\left(X_i^{2009}\hat{\beta}^{2009}\right)}{N^{2009}} - \sum_{i=1}^{N^{1991}} \frac{F\left(X_i^{1991}\hat{\beta}^{2009}\right)}{N^{1991}}\right] + \left[\sum_{i=1}^{N^{1991}} \frac{F\left(X_i^{1991}\hat{\beta}^{2009}\right)}{N^{1991}} - \sum_{i=1}^{N^{1991}} \frac{F\left(X_i^{1991}\hat{\beta}^{1991}\right)}{N^{1991}}\right], \quad (2)$$

In this case, the coefficient estimates for the population in 2009 ( $\hat{\beta}^{2009}$ ) are used as weights for the differences in characteristics, and the 1991 distributions of the independent variables are weights for the differences in coefficients. The use of different weights in (1) and (2) can lead to different results, particularly for East Germany, where entrepreneurship can be assumed to have been much less restricted in 2009 than it was in 1991. As a sensitivity check of the decomposition results, we also use coefficient estimates from the pooled model of all individuals in 1991 and 2009, as proposed by Oaxaca and Ransom (1994).

In addition to the decomposition of the difference in the levels of self-employment between 1991 and 2009 into characteristics and coefficients, we also provide evidence for the contribution of each independent variable to this change. These can be estimated as the change in the average predicted probability by replacing the 1991 distribution with the 2009 distribution for the variable of interest, while keeping the distributions of the other variables constant.[21]

[21] See Fairlie (2005) for a more detailed description of this procedure.

## 5. Factors related to self-employment in Germany

In the first step of our analysis, we estimate the probabilities of being self-employed in the first (1991) and last year (2009) of the observation period. In order to account for differences in behavior, and in economic and demographic structure, we perform the analysis for the whole country (Table 1), separately for East and West Germany, as well as for solo self-employed and for employers (Tables A2 to A5 in the Appendix). Table A1 in the Appendix depicts some descriptive statistics for variables used in the analysis.

The results of the logit-analyses for the determinants of self-employment are consistent with previous research (see Parker, 2009). The relationship between a person's age and the probability of being self-employed is inversely u-shaped. This means that the propensity for self-employment first increases with age and decreases again after a certain maximum level is reached. While the increasing proclivity for self-employment during early ages can be explained with growing experience and an improved access to resources, the declining part may be induced by decreasing risk tolerance and the fact that individuals who have an openness for starting an own business, mostly decide to do so before they become "too old."[22] Females have a lower propensity of self-employment than males, which may be explained by gender-specific role models and a difference in the willingness to take risks.[23] There is a positive relationship between self-employment and working in the service sector, which reflects the relatively small average size of service-sector firms and lower barriers

[22] It is remarkable that in the estimations for 1991, the coefficient for age squared is only statistically significant for East Germany (Table A2 in the Appendix); but not for the West (Table A3). This means that the decline in the propensity for self-employment after a certain age is only relevant for East Germans and not West Germans. Thus, an alternative explanation could be that older East Germans, having lived under a socialist regime for a relatively long time, maintained anti-capitalistic values and attitudes (Wyrwich, 2012). In the estimations for 2009 the coefficient for age squared is statistically significant in both parts of the country.

[23] For further explanations of this evidence, see Caliendo, et al. (2009) and Verheul, et al. (2012).

Table 1: Determinants of self-employment – East and West Germany

| | *1991* | | *2009* | | *1991 and 2009* | |
|---|---|---|---|---|---|---|
| | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* |
| Age | 0.045*** | 0.003*** | 0.081*** | 0.006*** | 0.071*** | 0.005*** |
| | (0.004) | (0.0002) | (0.003) | (0.00026) | (0.002) | (0.0002) |
| Age, squared | -0.0001 | -0.00001*** | -0.0004*** | -0.00004*** | -0.0003*** | -0.00002*** |
| | (0.00004) | (0.000) | (0.00004) | (0.000) | (0.00003) | (0.000) |
| East | -0.607*** | -0.032*** | 0.030** | 0.002** | -0.239*** | -0.016*** |
| | (0.018) | (0.0008) | (0.015) | (0.0012) | (0.011) | (0.001) |
| Married | 0.088*** | 0.005*** | -0.024* | -0.002* | -0.032*** | -0.002*** |
| | (0.018) | (0.001) | (0.013) | (0.001) | (0.011) | (0.001) |
| Female | -0.768*** | -0.044*** | -0.873*** | -.069*** | -0.818*** | -0.056*** |
| | (0.016) | (0.0008) | (0.013) | (0.001) | (0.009) | (0.001) |
| German nationality | 0.156*** | 0.008 | -0.253*** | -.022*** | -0.136*** | -0.010*** |
| | (0.034) | (0.002) | (0.024) | (0.002) | (0.019) | (0.002) |
| Service sector affiliation | 0.465*** | 0.027*** | 0.851*** | 0.064*** | 0.678*** | 0.045*** |
| | (0.015) | (0.0008) | (0.013) | (0.001) | (0.009) | (0.001) |
| Vocational training | 0.297*** | 0.016*** | 0.319*** | 0.024*** | .293*** | 0.019*** |
| | (0.022) | (0.001) | (0.021) | (0.002) | (0.015) | (0.001) |
| Tertiary education | 0.546 | 0.039*** | 0.851*** | 0.085*** | 0.732*** | 0.064*** |
| | (0.027) | (0.002) | (0.023) | (0.003) | (0.017) | (0.002) |
| Intercept | -4.702*** | | -5.117*** | | -4.956*** | |
| | (0.079) | | (0.072) | | (0.052) | |
| Pseudo R2 | 0.0774 | | 0.0848 | | 0.0801 | |
| Log Likelihood | -79,262.01 | | -100,336.99 | | -180,584.8 | |
| Wald Chi2 | 13,592.3*** | | 17,916*** | | 31,279.8*** | |
| Number of observations | 306,204 | | 316,686 | | 622,890 | |

Notes: ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

to entry in many parts of the service sector. Having achieved higher formal qualifications, such as tertiary education or vocational training, also increases, significantly, the propensity of self-employment.

There are some changes in the directions as well as in the magnitude of the effect sizes over time. While German nationals and married persons had a significantly higher propensity of being self-employed in 1991, we find significantly negative signs for German nationality and for married persons in 2009. Such a change of signs can also be found for East German residents, who had a lower propensity of being self-employed in 1991 and a higher one in 2009. According to the marginal effects, the propensity of being self-employed has increased for employees in the service sector as well as for persons with vocational training and, particularly, for those holding a tertiary degree. Females have a lower propensity of self-employment in 2009 than 1991.

There are certain differences in the results for East and West Germany that allow us to explain changes of the direction of some variables' influence. With regard to marital status, the decreasing propensity of married persons to be self-employed is explained by a stronger effect among East Germans, for which we find a statistically negative effect in 2009 (see Table A2). Moreover, while German nationals in the East showed a lower propensity of being self-employed than non-Germans throughout the observation period, the effect of German nationality turned from significantly positive to significantly negative for persons living in the West (see Table A3). When comparing the results for the estimated determinants of self-employment for East and West Germany in 1991, it is rather remarkable that the differences are not significant and do not indicate any strong behavioral peculiarities for East Germans that may have resulted from living under the socialist regime.

Noteworthy, the determinants of solo-entrepreneurship seem to have changed considerably over the period under observation (Table A4). These changes might be responsible for the strong increase of solo self-employment. Particularly, while East Germans were significantly less likely to be solo self-employed in 1991 than West Germans, the situation is polar opposite in 2009. Moreover, while there was no significant difference in the propensity of being a solo entrepreneur between males and females in

1991, solo-entrepreneurship seems to have become male dominated. While individuals with a German nationality were significantly more likely to be solo self-employed in 1991, they showed a significantly lower propensity to make this occupational choice 18 years later.

With regard to the educational level two differences are remarkable. First, the relationship between having a vocational degree and being a solo entrepreneur has been significantly positive in 2009 while two decades earlier this relationship was significantly negative. Second, the positive role of tertiary education for the propensity of being solo self-employed increased considerably over the observation period. It is rather remarkable that the determinants of self-employment with employees did not change considerably over the period under study (Table A5). One exception in this respect is, however, that the significant difference between Germans and non-Germans concerning the likelihood of being an employer disappeared over time.

## 6. Results of the Blinder-Oaxaca decomposition

In order to assess the extent to which the different factors have contributed to the spread of self-employment in Germany, we perform the nonlinear Blinder-Oaxaca decomposition analysis using the independent variables explained in the previous section. The calculations are run in three alternative specifications: (1) using the estimated coefficients for the first year (1991) of the observation period; (2) based on the estimated coefficients for the last year (2009) of the observation period; as well as (3) for a pooled sample. Each of these models is run for the whole country, and separately for East and West Germany as well as for solo entrepreneurs and for employers.

Table 2 presents the regression-based decomposition results for the different samples with all components included. The total change in the level of self-employment is reported in the second column. The third column presents the proportion of changes that can be attributed to the differences in the structure of the population between 1991 and 2009,

Table 2: Decomposition of the change of self-employment between 1991 and 2009

| | *Total difference* | *Difference in characteristics* | *Difference in coefficients* |
|---|---|---|---|
| *Full sample* | | | |
| $\hat{\beta}^{1991}$ | 0.0291 | 0.0126 (43.29%) | 0.0165 (56.71%) |
| $\hat{\beta}^{2009}$ | 0.0291 | 0.0153 (52.65%) | 0.0138 (47.35%) |
| $\hat{\beta}^{pooled}$ | 0.0291 | 0.0153 (52.67%) | 0.0138 (47.33%) |
| *East Germany* | | | |
| $\hat{\beta}^{1991}$ | 0.0628 | 0.0077 (12.25%) | 0.0551 (87.75%) |
| $\hat{\beta}^{2009}$ | 0.0628 | 0.0197 (31.39%) | 0.0431 (68.61%) |
| $\hat{\beta}^{pooled}$ | 0.0628 | 0.0177 (28.18%) | 0.0451 (71.82%) |
| *West Germany* | | | |
| $\hat{\beta}^{1991}$ | 0.0183 | 0.0116 (63.34%) | 0.0067 (36.66%) |
| $\hat{\beta}^{2009}$ | 0.0183 | 0.0138 (75.40%) | 0.0045 (24.60%) |
| $\hat{\beta}^{pooled}$ | 0.0183 | 0.0133 (72.56%) | 0.0050 (27.44%) |
| *Solo self-employed* | | | |
| $\hat{\beta}^{1991}$ | 0.0258 | 0.0071 (27.51%) | 0.0187 (72.49%) |
| $\hat{\beta}^{2009}$ | 0.0258 | 0.0111 (42.94%) | 0.0147 (57.06%) |
| $\hat{\beta}^{pooled}$ | 0.0258 | 0.0109 (42.36%) | 0.0149 (57.64%) |
| *Employers* | | | |
| $\hat{\beta}^{1991}$ | 0.0063 | 0.0062 (99.28%) | 0.0001 (0.72%) |
| $\hat{\beta}^{2009}$ | 0.0063 | 0.0051 (81.75%) | 0.0012 (18.25%) |
| $\hat{\beta}^{pooled}$ | 0.0063 | 0.0057 (90.54%) | 0.0006 (9.46%) |

Notes: ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level. Bootstrapped standard errors with 50 replications. $\hat{\beta}^{1991}$ and $\hat{\beta}^{2009}$ correspond to equations (1) and (2), respectively. $\hat{\beta}^{pooled}$ are weights for the pooled sample of the years 1991 and 2009.

while the fourth column shows the part of changes that might be due to changes in behavior. These figures should be regarded as an upper limit for the magnitude of such behavioral changes because they might be

caused by other (unobserved) factors. Taking East and West Germany together, the decomposition procedure indicates that between 43 and 53 percent of the change in the level of self-employment can be attributed to respective structural changes while the remaining part may be regarded a result of changes in the population's behavior.

The results further suggest significant differences in the development of self-employment activities in both parts of unified Germany. In fact, the non-structural changes are considerably larger in East Germany (between 68.6 percent and 87.7 percent) than in West Germany (between 24.6 percent and 36.6 percent). If this non-structural change is interpreted as an increase of entrepreneurial spirit in East Germany, then it is partly a result of the unleashing of the formally oppressed private sector. This allows for the interpretation that, with regard to the level of self-employment, the socialist heritage may have been overcome in the first two decades after reunification, a result that was not predictable.

In fact, if the attitudes and abilities of the East German population toward entrepreneurship would have remained at the level of 1991 and accounting for the structural change until the year 2009, the East German self-employment rate would have resulted only at 5.7 percent in 2009 as opposed to the actual rate of 11.2 percent (see Table A 2 in the Appendix). This figure is the sum of the East German self-employment rate in the year 1991 and the increase of self-employment in East Germany that can be attributed to changes in the economic structure between 1991 and 2009, based on the behavioral coefficients estimated for 1991. If, in 1991, the East German population had the entrepreneurial attitudes and abilities at the level they had in 2009, the East German self-employment rate in the year 1991 would have been about 7 percent. Noteworthy, our results suggest that if the entrepreneurial attitudes of the West German population would have remained at the level of 1991, the self-employment rates in West Germany in the year 2009 would have reached the level of 10.3 percent. Thus, we can conclude that over the

period under observation attitudes toward entrepreneurship among West Germans have changed to a lesser degree.

Furthermore, it is striking that the part of the development that is explained by the variables in the analysis is much higher for the employers than for the solo entrepreneurs. Taking the behavioral parameters estimated for 1991, we find that these variables may explain 99.3 percent of the changing self-employment of employers, but only 27.5 of the dynamics of solo entrepreneurship. These findings clearly indicate that the change of behavior in Germany has, in particular, led to more solo entrepreneurship but to virtually no increase of the number of entrepreneurs with dependent employees.

Table 3 shows estimates for the contribution of the individual characteristics to the explained change of self-employment in the whole of Germany as well as for East and West separately. The results of the decomposition are sensitive to the choice of coefficients that were estimated for the first (1991) and final (2009) years of the observation period. A pragmatic solution to this problem is to use the coefficients estimated on the basis of the pooled sample (Oaxaca and Ransom, 1994). In the following, we base our interpretation on these coefficients. Table 3 reveals that the structural characteristics of the economy with, by far, the strongest positive effect on the increase of self-employment in Germany are the increasing share of service sector employment (contribution of 28.5 percent)[24] and of persons with a tertiary degree (29.5 percent). Also the demographic change has a noteworthy impact: the effect of the increasing average population age is positive (17.2 percent), indicating that a large part of the population entered age categories that are characterized by a high propensity of being self-employed.

[24] For the ease of interpretation the contributions of independent variables can be expressed in percent by dividing the corresponding coefficient over the gap of the dependent variable, i.e., the change of the self-employment rate between 1991 and 2009 (see Fairlie, 2005).

Table 3: Non-linear decompositions of the change of self-employment rates

| | *East and West* | | | *East* | | | *West* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *1991* | *2009* | *1991/2009 pooled* | *1991* | *2009* | *1991/2009 pooled* | *1991* | *2009* | *1991/2009 pooled* |
| Self-employment rate in 1991 | 0.0807 | 0.0807 | 0.0807 | 0.0496 | 0.0496 | 0.0496 | 0.0909 | 0.0909 | 0.0909 |
| Self-employment rate in 2009 | 0.1098 | 0.1098 | 0.1098 | 0.1125 | 0.1125 | 0.1125 | 0.1092 | 0.1092 | 0.1092 |
| 1991/2009 change | 0.0291 | 0.0291 | 0.0291 | 0.0628 | 0.0628 | 0.0628 | 0.0183 | 0.0183 | 0.0183 |
| Age | 0.005*** | 0.004*** | 0.005*** | 0.003*** | 0.005*** | 0.005*** | 0.007*** | 0.003*** | 0.005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| East | 0.0018*** | -0.0001*** | 0.0006*** | - | - | - | - | - | - |
| | (0.000) | (0.000) | (0.000) | | | | | | |
| Married | -0.0008*** | -0.0001 | -0.0003** | -0.0006 | 0.0006 | 0.0000 | -0.0007*** | -0.0003* | -0.0005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.000) |
| Female | -0.0005*** | -0.0064*** | -0.0033*** | -0.0056*** | -0.0075*** | -0.0081*** | -0.0011*** | -0.0069*** | -0.0035*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| German nationality | 0.0000*** | 0.0003*** | 0.0001*** | 0.0004*** | 0.0011*** | 0.0011*** | 0.0001*** | 0.0002*** | 0.0000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Service sector affiliation | 0.0046*** | 0.0109*** | 0.0083*** | 0.0088*** | 0.0116*** | 0.0127*** | 0.0034*** | 0.0116*** | 0.0075*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Vocational training | -0.0024*** | -0.0049*** | -0.0035*** | -0.0058*** | -0.0048*** | -0.0067*** | -0.0022*** | -0.0047*** | -0.0034*** |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) |
| Tertiary education | 0.0051*** | 0.0117*** | 0.0086*** | 0.0076*** | 0.0136*** | 0.0133*** | 0.0055*** | 0.0110*** | 0.0085*** |
| | (0.000) | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.000) | (0.000) | (0.000) |
| Total | 0.0126 | 0.0153 | 0.0153 | 0.0077 | 0.0197 | 0.0177 | 0.0116 | 0.0138 | 0.0133 |
| Total explained | 43.29% | 52.65% | 52.67% | 12.25% | 31.39% | 28.18% | 63.34% | 75.40% | 72.56% |

Notes: Standard errors are reported in parentheses below contribution estimates. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Another interesting effect is revealed when focusing on gender issues: given the significantly lower propensity of females to be self-employed, the increased female participation in the labor market results in a negative effect on the level of self-employment (-11.3 percent). Further, the declining share of people with vocational training contributes negatively to the level of self-employment (-12.03 percent), as well. The impact of the marital status and of the nationality (thus of migrants) to the explanation of the changing level of self-employment is negligible. That only about 2.1 percent of the increasing self-employment rate in Germany as a whole can be attributed to the rather pronounced rise of entrepreneurship in East Germany is probably a result of the fact that East Germans are only about 20 percent of the overall population. Main differences between East and West Germany with regard to the contribution of the different factors are a particularly strong positive contribution of the growing service sector and of the share of people with tertiary education to the increase of the self-employment rate in West Germany.

Looking at the decomposition results for the self-employment rates of solo entrepreneurs and employers (Table 4), we find several pronounced differences. For instance, the increasing average age of the population explains about 22 percent of the increase in the employers' self-employment rate and only about 8 percent of that of solo self-employed. Moreover, the increasing share of service sector employment makes a larger contribution to the growing self-employment rate for employers (53.9 percent) than to the corresponding increase for solo self-employed (23.3 percent).

Hence, we conclude that the structural changes explain a rather large part of the increasing entrepreneurship in West Germany while they have only limited explanatory power for the development in East Germany. With regard to the role of the changes of the socio-economic environment there is a pronounced difference between solo-entrepreneurs and those self-

Table 4: Non-linear decompositions of the change of self-employment rates—Solo entrepreneurs and employers

| | *Solo self-employed* | | | *Employers* | | |
|---|---|---|---|---|---|---|
| | 1991 | *2009* | *1991/2009 pooled* | *1991* | *2009* | *1991/2009 pooled* |
| Self-employment rate in 1991 | 0.0383 | 0.0383 | 0.0383 | 0.0458 | 0.0458 | 0.0458 |
| Self-employment rate in 2009 | 0.0640 | 0.0640 | 0.0640 | 0.0521 | 0.0521 | 0.0521 |
| 1991/2009 change | 0.0258 | 0.0258 | 0.0258 | 0.0063 | 0.0063 | 0.0063 |
| Age | 0.0023*** | 0.0009*** | 0.0021*** | 0.0018*** | 0.0012*** | 0.0014*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| East | 0.0012*** | -0.0003*** | 0.0002*** | 0.0009*** | 0.0002*** | 0.0005*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Married | 0.0010*** | 0.0023*** | 0.0021*** | -0.0017*** | -0.0026*** | -0.0022*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Female | -0.0003*** | -0.0033*** | -0.0025*** | -0.0002*** | -0.0024*** | -0.0009*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| German nationality | 0.0000*** | 0.0004*** | 0.0002*** | 0.0001*** | 0.0000*** | 0.0000*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Service sector affiliation | 0.0024*** | 0.0068*** | 0.0060*** | 0.0024*** | 0.0050*** | 0.0034*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Vocational training | 0.0001** | -0.0023*** | -0.0005*** | -0.0051*** | -0.0047*** | -0.0049*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Tertiary education | 0.0003** | 0.0066*** | 0.0032*** | 0.0082*** | 0.0084*** | 0.0083*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Total | 0.0071 | 0.0111 | 0.0109 | 0.0062 | 0.0051 | 0.0057 |
| Total explained | 27.51% | 42.94% | 42.36% | 99.28% | 81.75% | 90.54% |

Notes: Standard errors are reported in parentheses below contribution estimates. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

employed that have employees. While 99 percent of the development of self-employed with employees can be traced back to such changing structures, this part is much smaller for the solo entrepreneurs. For the increase of solo-entrepreneurship and for the development in East Germany changes of structural variables mattered only little, allowing us for the interpretation that this increase might rather be explained by behavioral changes.

## 7. Discussion and conclusion

The rise of self-employment rates in Germany by 40 percent during the last two decades represents a unique case in innovation-driven economies. Our empirical approach employs a non-linear Blinder-Oaxaca decomposition technique in order to investigate the reasons underlying this rapid rise of self-employment activity. Three major changes of the socio-economic environment contribute to this development: the shift of the sectoral structure toward the service economy, population aging, and a higher share of people holding a tertiary degree. While these factors can explain about half of the changing self-employment overall in Germany the other half may be attributed to behavioral changes and the development of a more positive attitude toward entrepreneurial activities among the population.

We were further interested in the reasons behind the rapid convergence of East German self-employment rates to the level of West Germany which - against all expectations - occurred 15 years after the breakdown of the socialist regime. Considering that the radical shift to a market economy system in East Germany unleashed private initiative that was previously oppressed by the former socialist government for over forty years, it is comprehensible that the share of the development that can be attributed to behavioral changes is considerably larger in the East (between 71 and 88 percent) than in the West (between 22 and 38 percent). As far as the behavioral change of East Germans has resulted from this liberalization, one may not only argue for a change of *attitudes* as these attitudes may have pre-existed and might not have been completely destroyed during the communist regime where this occupational choice was not allowed to be realized. In contrast, the main drivers of increasing entrepreneurship in West Germany are the development of structural and demographic characteristics that explain up to 78 percent of the rise of self-employment, as compared to only up to 29 percent in East Germany.

The analysis further reveals that the increasing solo entrepreneurship in Germany is to a much lesser degree induced by changes of the socio-

economic structure, as these variables can explain at most 43 percent of the increase in solo self-employment. In contrast, up to 99 percent of the development of self-employment with employees could be traced back to changes of structural characteristics. This clearly indicates that these two entrepreneurial types are driven by quite different factors.

The conditions of the socio-economic environment in Germany may also have contributed considerably to the observed greater willingness to be self-employed. One of these factors could have been the high unemployment during the period under study, especially in East Germany, which may have induced unemployed persons to start a business. A number of policy programs have been introduced since 1991, which supported start-ups by unemployed persons (Caliendo and Kritikos, 2010). Hence, some parts of the behavioral change, at least in the years after 2000, might have triggered by this active labor market policy, which was accompanied by government financed nation-wide campaigns for self-employment. Other sources for the growing entrepreneurial attitude in Germany include lower barriers to entry, due to decreasing minimum efficient size in many industries, as well as increasing preferences for independence and for self-realization in a post-materialistic world (Freytag and Thurik, 2007), and may explain one part of this development. Also, a spread of entrepreneurial values that has led to an increasing acceptance of self-employment in the society may have played a role. However, still little is known about the factors that determine entrepreneurial spirit, leaving room for further investigation.

Our analysis still has a number of limitations. For instance, the data do not allow us to control for all factors that might determine self-employment, such as the presence of self-employed parents or peers, personality characteristics or previous experiences of individuals (Caliendo, Fossen and Kritikos, 2011). This incomplete coverage of the determinants of entrepreneurship may lead to an overestimation of the part of the change of self-employment that could not be explained by characteristics of the economic structure and, therefore, has been

interpreted as behavioral change. Since information about the complete set of all potential determinants of self-employment is rarely available applications of the non-linear Blinder-Oaxaca decomposition procedure to an analysis of the development of self-employment will generally suffer from a respective vagueness of interpretation. Another critical issue when interpreting the results is that the underlying causalities are not entirely clear. For instance, we are unable to reveal whether the level of self-employment is increasing due to the shift of the economy towards the service sector or if the service sector expands because it appears to be especially attractive for establishing a business in this sector.

Despite such limitations, we identify a number of factors that can have led to a rise of an entrepreneurial culture in Germany. A more positive attitude toward entrepreneurship may have played a considerable role. This does particularly pertain to solo self-employment. Interestingly, our analysis strongly indicates that employers and solo entrepreneurs tend to be rather distinct types with different factors responsible for the decision to set up an own business. As the increase of solo-entrepreneurship can hardly be explained by the variables in our analysis, this specific development needs particular attention in further research.

Our results indicate that the diverse public policy initiatives towards more self-employment and entrepreneurship in Germany during the last decades had an effect. This is particularly clear with regard to the development in West Germany, that part of the country that experienced rather stable conditions of the socio-economic framework and did not undergo any major transformation as was the case in the Eastern part of the country. We conclude that there are indicators allowing for the interpretation that Germany developed a more entrepreneurial society, but a rather significant part of this development is due to solo self-employment, i.e., micro-businesses that do not hire employees.

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## Appendix

Table A1: Sample means and standard deviations of key variables

| | All | | 1991 | | 2009 | |
|---|---|---|---|---|---|---|
| | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation |
| *East and West Germany* | | | | | | |
| Self-employment | 0.095 | 0.293 | 0.081 | 0.273 | 0.110 | 0.313 |
| Age | 40.046 | 12.509 | 38.332 | 12.352 | 41.873 | 12.416 |
| East Germany | 0.219 | 0.414 | 0.238 | 0.426 | 0.199 | 0.399 |
| Married | 0.601 | 0.490 | 0.639 | 0.480 | 0.561 | 0.496 |
| Female | 0.442 | 0.497 | 0.421 | 0.494 | 0.465 | 0.498 |
| German nationality | 0.938 | 0.241 | 0.943 | 0.233 | 0.933 | 0.249 |
| Service sector affiliation | 0.579 | 0.494 | 0.548 | 0.498 | 0.612 | 0.487 |
| Vocational training | 0.687 | 0.464 | 0.719 | 0.450 | 0.656 | 0.475 |
| Tertiary education | 0.147 | 0.354 | 0.117 | 0.321 | 0.177 | 0.381 |
| Without educational degree | 0.166 | 0.372 | 0.165 | 0.371 | 0.167 | 0.373 |
| *East Germany* | | | | | | |
| Self-employment | 0.078 | 0.268 | 0.050 | 0.219 | 0.112 | 0.316 |
| Age | 39.651 | 12.125 | 37.870 | 11.746 | 41.925 | 12.221 |
| Married | 0.612 | 0.487 | 0.681 | 0.466 | 0.523 | 0.499 |
| Female | 0.471 | 0.499 | 0.464 | 0.499 | 0.479 | 0.500 |
| German nationality | 0.978 | 0.145 | 0.982 | 0.135 | 0.974 | 0.158 |
| Service sector affiliation | 0.571 | 0.495 | 0.530 | 0.499 | 0.623 | 0.485 |
| Vocational training | 0.758 | 0.428 | 0.801 | 0.399 | 0.708 | 0.455 |
| Tertiary education | 0.148 | 0.355 | 0.119 | 0.324 | 0.182 | 0.386 |
| Without educational degree | 0.094 | 0.292 | 0.080 | 0.271 | 0.110 | 0.313 |
| *West Germany* | | | | | | |
| Self-employment | 0.100 | 0.300 | 0.091 | 0.288 | 0.109 | 0.312 |
| Age | 40.157 | 12.612 | 38.476 | 12.532 | 41.860 | 12.464 |
| Married | 0.598 | 0.490 | 0.626 | 0.484 | 0.570 | 0.495 |
| Female | 0.434 | 0.496 | 0.408 | 0.491 | 0.461 | 0.498 |
| German nationality | 0.927 | 0.260 | 0.930 | 0.254 | 0.923 | 0.266 |
| Service sector affiliation | 0.581 | 0.493 | 0.554 | 0.497 | 0.609 | 0.488 |
| Vocational training | 0.666 | 0.472 | 0.692 | 0.462 | 0.643 | 0.479 |
| Tertiary education | 0.147 | 0.354 | 0.116 | 0.320 | 0.175 | 0.380 |
| Without educational degree | 0.187 | 0.390 | 0.192 | 0.394 | 0.181 | 0.385 |

Table A2: Determinants of self-employment—East Germany

| | *1991* | | *2009* | | *1991 and 2009* | |
|---|---|---|---|---|---|---|
| | Coefficient | *Marginal effect* | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* |
| Age | 0.085*** | 0.003** | 0.099*** | 0.008*** | 0.092*** | 0.005*** |
| | (0.013) | (0.001) | (0.008) | (0.001) | (0.006) | (0.0004) |
| Age, squared | -0.001*** | -0.00003*** | -0.0008*** | -0.0001*** | -0.001*** | -0.00004*** |
| | (0.0002) | (0.0001) | (0.0001) | (0.00001) | (0.0001) | (0.000) |
| Married | -0.001 | -0.00005 | -0.065** | -0.005** | -0.216*** | -0.013*** |
| | (0.043) | (0.002) | (0.029) | (0.002) | (0.023) | (0.001) |
| Female | -1.032*** | -0.039*** | -0.868*** | -0.073*** | -0.892*** | -0.052*** |
| | (0.038) | (0.001) | (0.027) | (0.002) | (0.022) | (0.001) |
| German nationality | -0.440*** | -0.020*** | -0.673*** | -0.073*** | -0.718*** | -0.056*** |
| | (0.116) | (0.006) | (0.066) | (0.009) | (0.056) | (0.005) |
| Service sector affiliation | 0.966*** | 0.036*** | 0.845*** | 0.066*** | 0.916*** | 0.051*** |
| | (0.037) | (0.001) | (0.029) | (0.002) | (0.023) | (0.001) |
| Vocational training | 0.542*** | 0.017*** | 0.137** | 0.011** | 0.271*** | 0.015*** |
| | (0.087) | (0.002) | (0.056) | (0.005) | (0.045) | (0.002) |
| Tertiary education | 0.814*** | 0.042*** | 0.890*** | 0.095*** | 0.912*** | 0.071*** |
| | (0.095) | (0.006) | (0.058) | (0.007) | (0.048) | (0.005) |
| Intercept | -5.349*** | | -4.573*** | | -4.784*** | |
| | (0.269) | | (0.174) | | (0.138) | |
| Pseudo R2 | 0.0598 | | 0.0768 | | 0.0771 | |
| Log Likelihood | -13,998.178 | | -20,506.242 | | -35,110.314 | |
| Wald Chi2 | 1,920.46*** | | 3,453.57*** | | 6,172.98*** | |
| Number of observations | 75,407 | | 63,172 | | 138,579 | |

Notes: ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A3: Determinants of self-employment—West Germany

| | *1991* | | *2009* | | *1991 and 2009* | |
|---|---|---|---|---|---|---|
| | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* |
| Age | 0.050*** | 0.003*** | 0.083*** | .006*** | 0.072*** | 0.005*** |
| | (0.004) | (0.0003) | (0.004) | (0.0003) | (0.003) | (0.0002) |
| Age, squared | -0.00001 | -0.00001 | -0.0004*** | -0.00003*** | -0.0003*** | -0.00002*** |
| | (0.00004) | (0.000) | (0.00004) | (0.000) | (0.00003) | (0.000) |
| Married | 0.091*** | 0.006*** | -0.004 | -0.0003 | 0.014 | 0.001 |
| | (0.019) | (0.001) | (0.015) | (0.001) | (0.012) | (0.001) |
| Female | -0.721*** | -0.046*** | -0.874*** | -0.067*** | -0.799*** | -0.056*** |
| | (0.017) | (0.001) | (0.014) | (0.001) | (0.011) | (0.001) |
| German nationality | 0.204*** | 0.013*** | -0.199*** | -0.016*** | -0.070*** | -0.005*** |
| | (0.035) | (0.002) | (0.025) | (0.002) | (0.021) | (0.002) |
| Service sector affiliation | 0.375*** | 0.025*** | 0.852*** | 0.063*** | 0.626*** | 0.044*** |
| | (0.015) | (0.001) | (0.015) | (0.001) | (0.011) | (0.001) |
| Vocational training | 0.298*** | 0.019*** | 0.356*** | 0.026*** | 0.306*** | 0.022*** |
| | (0.023) | (0.001) | (0.023) | (0.002) | (0.016) | (0.001) |
| Tertiary education | 0.548*** | 0.044*** | 0.829*** | 0.081*** | 0.699*** | 0.063*** |
| | (0.029) | (0.003) | (0.025) | (0.003) | (0.018) | (0.002) |
| Intercept | -4.906*** | | -5.321*** | | -5.107*** | |
| | (0.085) | | (0.080) | | (0.056) | |
| Pseudo R2 | 0.0758 | | 0.0889 | | 0.0815 | |
| Log Likelihood | -64,977.21 | | -79,647.16 | | -145,066.39 | |
| Wald Chi2 | 11,044.06*** | | 14712.46*** | | 25,355.76*** | |
| Number of observations | 230,797 | | 253,514 | | 48,431 | |

Notes: ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A4: Determinants of self-employment—solo entrepreneurs

| | *1991* | | *2009* | | *1991 and 2009* | |
|---|---|---|---|---|---|---|
| | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* | *Coefficient* | *Marginal effect* |
| Age | 0.045*** | 0.001*** | 0.038*** | 0.002*** | 0.044*** | 0.002*** |
| | (0,001) | (0,000) | (0,001) | (0,000) | (0,001) | (0,000) |
| East | -0.549*** | -0.015*** | 0.145*** | 0.007*** | -0.117*** | -0.005*** |
| | (0,027) | (0,001) | (0,018) | (0,001) | (0,015) | (0,001) |
| Married | -0.177*** | -0.006*** | -0.253*** | -0.013*** | -0.298*** | -0.012*** |
| | (0,024) | (0,001) | (0,017) | (0,001) | (0,013) | (0,001) |
| Female | -0.555*** | -0.016 | -0.630*** | -0.031*** | -0.574*** | -0.023*** |
| | (0,022) | (0,001) | (0,016) | (0,001) | (0,013) | (0,001) |
| German nationality | 0.146*** (0,048) | 0.004*** (0,001) | -0.396*** (0,029) | -0.022*** (0,002) | -0.278*** (0,025) | -0.012*** (0,001) |
| Service sector affiliation | 0.451*** (0,021) | 0.014*** (0,001) | 0.929*** (0,018) | 0.043*** (0,001) | 0.733*** (0,013) | 0.028*** (0,000) |
| Vocational training | -0.061** (0,028) | -0.002** (0,001) | 0.250*** (0,026) | 0.012*** (0,001) | 0.097*** (0,019) | 0.004*** (0,001) |
| Tertiary education | 0.095** (0,037) | 0.003** (0,001) | 0.810*** (0,028) | 0.051*** (0,002) | 0.564*** (0,022) | 0.027*** (0,001) |
| Intercept | -4.964*** | | -4.592*** | | -4.715*** | |
| | (0,056) | | (0,042) | | (0,033) | |
| Pseudo R2 | 0.0492 | | 0.0653 | | 0.0584 | |
| Log Likelihood | -45,204.98 | | -66,977,68 | | -113,208.49 | |
| Wald Chi2 | 4,929.49*** | | 9,315.28*** | | 14,516.38*** | |
| Number of observations | 292,686 | | 301,186 | | 593,872 | |

Notes: Logit analyses, dependent variable: self-employed without employees = 1; dependently employed = 0. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.

Table A5: Determinants of self-employment—employers

| | *1991* | | *2009* | | *1991 and 2009* | |
|---|---|---|---|---|---|---|
| | Coefficient | *Marginal fixed effect* | *Coefficient* | *Marginal fixed effect* | *Coefficient* | *Marginal fixed effect* |
| Age | 0.047*** | 0.001*** | 0.042*** | 0.001*** | 0.045*** | 0.001*** |
| | (0,001) | (0,000) | (0,001) | (0,000) | (0,001) | (0,000) |
| East | -0.657*** | -0.017*** | -0.127*** | -0.004*** | -0.373*** | -0.011*** |
| | (0,025) | (0,001) | (0,022) | (0,001) | (0,017) | (0,000) |
| Married | 0.334*** | 0.010*** | 0.352*** | 0.012*** | 0.329*** | 0.010*** |
| | (0,025) | (0,001) | (0,021) | (0,001) | (0,016) | (0,000) |
| Female | -0.960*** | -0.028*** | -1.189*** | -0.041*** | -1.009*** | -0.035*** |
| | (0,022) | (0,001) | (0,020) | (0,001) | (0,015) | (0,000) |
| German nationality | 0.141*** | 0.004*** | -0.057 | -0.002 | 0.010 | 0.0003 |
| | (0,047) | (0,001) | (0,037) | (0,001) | (0,029) | (0,001) |
| Service sector affiliation | 0.460*** | 0.014*** | 0.756*** | 0.025*** | 0.617*** | 0.019*** |
| | (0,019) | (0,001) | (0,018) | (0,001) | (0,013) | (0,000) |
| Vocational training | 0.747** | 0.020*** | 0.537*** | 0.017*** | 0.617*** | 0.018*** |
| | (0,035) | (0,001) | (0,033) | (0,001) | (0,024) | (0,001) |
| Tertiary education | 1.005*** | 0.048*** | 1.034*** | 0.050*** | 1.028*** | 0.048*** |
| | (0,040) | (0,003) | (0,035) | (0,002) | (0,026) | (0,002) |
| Intercept | -5.092*** | | -5.061*** | | -5.708*** | |
| | (0,062) | | (0,053) | | (0,040) | |
| Pseudo R2 | 0.0940 | | 0.0991 | | 0.0950 | |
| Log Likelihood | -49,718.85 | | -54,848.17 | | -104,814.46 | |
| Wald Chi2 | 9,490.80*** | | 11,497.96*** | | 20,695.17*** | |
| Number of observations | 295,000 | | 297,400 | | 592,400 | |

Notes: Logit analyses, dependent variable: self-employed with employees = 1; dependently employed = 0. ***: statistically significant at the 1 percent level; **: statistically significant at the 5 percent level; *: statistically significant at the 10 percent level.