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Self-employment – A Way to End Unemployment?
Empirical Evidence from German Pseudo-Panel Data

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Empirical Evidence from German Pseudo-Panel Data

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Abstract: This paper contributes to the policy-relevant question whether self-employment is a way out of (long-term) unemployment. We estimate the relationship between the entry rate into self-employment and previous (long-term) unemployment on the basis of pseudo-panel data for Germany in the period 1996-2002. The estimation method accounts for cohort fixed effects and measurement errors induced by the pseudo panel structure. We find that previous (long-term) unemployment significantly increases entry rates into self-employment for both men and women. These effects are quantitatively important, both in absolute terms and compared to other potential determinants of self-employment transitions, such as age, the level of vocational qualification and certain household characteristics.

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1   Introduction

There is a flourishing literature on the determinants and economic effects of self-employment in advanced market economies (for a recent summary see, e.g. Parker 2004). Theoretical and empirical literature has identified various important factors influencing the self-employment decision, among them labour and goods markets regulation, taxation, individual characteristics, such as age, education, gender, ethnicity, and previous unemployment experience. In the economic policy debate, self-employment is typically considered to contribute to labour market flexibility and higher employment, and to lead to less unemployment.

The focus of this paper is on the impact of previous (long-term) unemployment on the entry rate into self-employment. Two alternative hypotheses have been suggested to rationalize this relationship: The so-called "unemployment push" hypothesis states that high unemployment may reduce the opportunity to gain salaried employment and thus positively affect self-employment. The "unemployment pull" hypothesis states that high unemployment may negatively affect individual expectations about the success of self-employment, or reinforce credit constraints. Whereas the former hypothesis would imply a positive relationship between the entry rate into self-employment and unemployment, the latter hypotheses would imply a negative relationship.

From a policy perspective, it is of particular interest whether unemployment, in particular long-term unemployment, acts as a pull or push factor on the self-employment transition. Market imperfections and government regulations may prevent unemployed people to take this exit route from unemployment. In particular, unemployed people may face severe credit constraints which could be overcome by start-up subsidies by the government put into place in a number of OECD countries, such as the "bridging allowance" and the "start-up subsidy" in Germany (see Pfeiffer and Reize 2000, Almus 2004, Baumgartner and Caliendo 2007).

The relationship between the entry rate into self-employment ("start-up rate") and unemployment has been analysed in a number of empirical studies for various OECD countries, with ambiguous results. Whereas time-series studies have tended to find a positive relationship between measures of new firm formation, most of the studies based on cross-section or panel data have found a negative relationship. Aside from measurement issues, one possible reason for these differences is spurious correlation between business-start-ups and unemployment. This seems likely to be the more severe, the higher the level of aggregation. On the other hand, estimates of the impact of long-term unemployment on the entry rate into self-employment based on cross-section or panel data may suffer from selection bias and general sample attrition.

In this paper we use pseudo-panel data derived from the German Microcensus for the period 1996-2002 and appropriate statistical methods to analyse empirically the impact of previous (long-term) unemployment on the entry rate into self-employment. In the next section we summarise hypotheses and the existing empirical evidence related to this relationship. In section 3 we describe the construction of our pseudo panel used for analysing this relationship for Germany, provide descriptive statistics on self-employment rates, and present our estimation approach. To account for cohort fixed effects and measurement errors induced by the structure of the pseudo panel used for the estimation, we apply the fixed effects estimator initially proposed by Deaton (1985). Estimation results, summarised and discussed in section 4, show that previous unemployment has significant positive effects on entry rates into self-employment for both men and women. These effects are quantitatively important, both in absolute terms and compared to other potential determinants of self-employment transitions, such as age, the level of vocational qualification and certain household characteristics.

2   Hypotheses and Previous Literature

In economic models of entrepreneurship the decision to become an entrepreneur is simply one of occupational choice: the wage an individual expects to earn through salaried employment is compared to expected earnings from entrepreneurship, with the probability of choosing self-employment given as a function of the occupational earnings differential. Lucas (1978) assumed people to differ in terms of (continuously distributed) innate entrepreneurial ability and showed that the most able individuals choose to become self-employed, where the ability of the "marginal entrepreneur" is just sufficient to make her or him indifferent to working as an employee and the most able entrepreneurs run the largest business. As the decision to become an entrepreneur is driven by expected earnings, uncertainty about the future stream of income from both regular employment and self-employment may influence occupational choice. Kihlstrom and Laffont (1979) modelled entrepreneurial choice as trading off risk and returns. Individuals in this model differ in risk aversion, which is distributed continuously across the workforce, with the least risk-averse individuals becoming entrepreneurs and running the largest firms.

The impact of the earnings differential between self-employment and salaried employment as well as the risk differential between these two incomes sources have been analysed in a number of empirical studies.[1] Most of these studies find that, accounting for selection effects, this earnings differential is positive, on average, with a higher variance of earnings in self-employment, and that a higher earnings differential increases the entry into self-employment. In addition, the probability of becoming self-employed may also be affected by the level of a would-be entrepreneur's wealth in the presence of credit constraints. For the US, Evans and Leighton (1989) and Evans and Jovanovic (1989) find a statistically significant positive relationship

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[1]   See, e.g., Evans and Jovanovic (1989), Evans and Leighton (1989) for the US; Rees and Shah (1986) and Taylor (1996) for Britain, and Pfeiffer and Pohlmeier (1992) for Germany.

between the start-up rate and individual wealth, which they interpret as evidence supporting the credit-constraint hypothesis.[2]

Credit constraints may by reinforced in the presence of unemployment if unemployed people have already run down financial wealth and are more constrained in the credit market than employees. However, unemployment may also affect business start-ups because for reasons completely unrelated to credit constraints: On the one hand, high unemployment may reduce the opportunity to gain dependent employment and thus positively affects self-employment. On the other hand, high unemployment may negatively affect individual expectations about the success of self-employment. In terms of the basic model of occupational choice discussed above, this would affect alternative incomes in opposite ways, in addition to the effect unemployment may have on credit constraints. Theoretically, the net effect of unemployment on start-ups is therefore ambiguous.

Empirically, the relationship between self-employment and previous unemployment has been investigated in a number of empirical studies for several OECD countries both at the aggregate and the micro level. Reviewing the older literature, Storey (1991) concludes that time-series studies tend to find a positive relationship between measures of new firm formation, whereas studies based on cross-section or panel data tend to find a negative relationship. Apart from measurement issues, one possible reason for these differences is the potential endogeneity between business-start ups and unemployment, which seems likely to be the more severe, the higher the level of aggregation (see, e.g., Acs, Audretsch and Evans 1994, Audretsch et al. 2006).

Using panel data for the US, Evans and Leighton (1989) find that persons who were unemployed or in danger of becoming unemployed have a higher probability to become self-

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[2]   However, as suggested by Cressy (2000), among others, a positive relationship between the start-up rate and wealth may also derive from decreasing absolute risk aversion.

employed than other persons. For Britain, Blanchflower und Oswald (1998) find a negative relationship between die probability of becoming unemployed and the local unemployment rate. Similarly, Taylor (1996) finds similar results using British panel data. Also using British panel data, Bryson and White (1996) find that the duration of unemployment affects the entry rate into self-employment. Using more recent waves of the same panel data set and simple transition models, Martinez-Granado (2002) finds that, first, the aggregated unemployment rate has a positive effect on the probability of becoming self-employed, which he interprets as "push effect", and, second, unemployed individuals are more likely to become self-employed, but this effect is drastically reduced in case of long-term unemployment. Positive effects from individual unemployment on the entry rate into self-employment are also reported by Foti and Vivarelli (1994) for Italy, Alba-Ramirez (1994) and Carrasco (1999) for Spain, and Andersson and Wadensjö (2006) for Sweden. For Germany, Wagner and Sternberg (2002) and Constant and Zimmermann (2004) found a positive relationship between the entry rate into self-employment and previous unemployment, whereas Reize (2000) finds no significant effect of the duration of previous unemployment on the entry rate into unemployment.

In addition to the economic factors mentioned thus far, other potential determinants of self-employment transitions have been identified in the literature, among them age, education, gender, and ethnicity.[3] From an economic perspective, age is of special interest because of lifecycle effects on entry rates into self-employment. Evans and Leighton (1989) test the hypothesis that that entry-rates follow a standard Markov process and find that the effect of age (or labour market experience) on entry rates is not statistically significant. In contrast, in their comparison of entry rates into self-employment of salaried workers in Germany and the US, Holtz-Eakin and Rosen (2005) find that the entry rate first falls with age and then increases after the age of 50 in the US,

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[3] See, *inter alia*, Blanchflower and Oswald (1998), Holtz-Eakin and Rosen (2005), Constant and Zimmermann (2004), Wagner (2003).

whereas for Germany the entry rate is strictly declining in age. Similar results are also reported in other empirical studies for Germany (Caliendo, Fossen and Kritikos 2006, Fossen and Steiner 2006). However, these studies do not account for potential cohort effects which may distort the age dependency of the entry rate into self-employment.

To summarise, previous empirical research for various OECD countries has established various important factors determining the entry rate into self-employment. These include the differential between earnings from self-employment and salaried employment, the risk differential associated with these income sources, the degree of risk aversion, the presence of credit constraints, and various personal characteristics, in particular age and previous unemployment. However, most of these studies do not differentiate between short-term and long-term unemployment, which may have very different effects on the entry rate into self-employment, and do not account for its potential dependence on cohort effects.

3   Empirical Methodology

In contrast to most of the studies reviewed in the previous section, our empirical analysis of the relationship between the entry rate into self-employment and unemployment is not based on cross-section or panel data of individuals but on so-called "pseudo panel" data. In the following we describe the construction of the pseudo panel used for our empirical analysis and discuss its advantages and disadvantages compared to other data structures used in previous studies. In section 3.2 we discuss measurement issues and present some descriptive statistics on self-employment rates and start-up rates, and in section 3.3 we discuss the econometric specification of the model and estimation issues.

3.1 Construction of Pseudo Panel

Our empirical analysis is based on a pseudo panel constructed from the "Mikrozensus" (Microcensus, MZ) for the years 1996 to 2002. The MZ, which is the main general German labour force survey, is a 1 % representative sample of the German population.[4] The main advantage of the MZ is its very large sample size, which allows one to analyse small subgroups like people setting up their own business within a year. Its main disadvantage for the present purpose is that it currently does not exist as a panel but only as a number of independent cross-sections.[5] However, since 1996 the MZ does contain information on an individual's labour force status the year before the current interview, which allows us to construct a pseudo-panel for the purpose of analyzing labour force transitions as described below.

We restrict the observation period to the years 1996-2002 because in 2003 a very large start-up subsidy for unemployed people was introduced which increased transitions into self-employment (see Baumgartner, Caliendo and Steiner 2006). Given that there is no way to distinguish these self-employment transitions from non-subsidised transitions in the MZ, we cannot account for this and therefore restrict the observation period accordingly. In terms of aggregate economic developments, our observation period covers a full economic cycle for the whole of Germany with a modest upswing in the mid-nineties, a business cycle peak in 1999/2000, a recession in 2001/2002. Since the overall economic situation in East Germany is still much different from West Germany, with a much higher unemployment rate in the east, we

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[4] The scientific use file of the MZ used for the following analysis is a 70 percent subsample of this 1% sample.

[5] Another possibility would have been to use the German Socio-Economic Panel (SOEP) which is a true (yearly) panel with a much smaller data sample size. For a comparison of the MZ and the SOEP in the context of the analysis of self-employment transitions, see Fossen and Steiner (2006). In addition to its much larger sample size, one advantage of using the MZ is that, in contrast to the SOEP, there is no sample attrition.

differentiate the following analysis by region. Furthermore, to account for expected gender differences in self-employment transitions we also report results separately for men and women.

The basic assumption underlying the construction of a pseudo panel is that individuals can be unambiguously allocated to specific groups – also called cohorts – on the basis of some common invariant individual characteristic(s), which implies that all individuals within a cohort are behaving similarly over time (see, e.g., Deaton, 1985). Compared to a true panel, which is defined by the time dimension (T) and the number of individuals (N), a pseudo panel can further be differentiated along two additional dimensions, namely the number of observations within a cohort (n_c) and the number of cohorts (C). In allocating individuals to cohorts, there is a trade-off between the number of individuals within a cohort and the number of cohorts: On the one hand, in case a small number of cohorts is chosen to gain a larger number of observations per cohort, the danger arises that individuals within a cohort are rather heterogeneous, which could induce inefficiency in estimation due to aggregation. On the other hand, if individuals in the sample are allocated to a large number of cohorts there is the risk that – depending on sample size – only a small number of observations remain for any given cohort which could induce biased estimators. Thus, the challenge in construction a pseudo panel is to find the optimal choice between the numbers of cohorts on the one hand, and cohort size on the other. Ideally, the optimal choice would yield homogeneous cohorts of sufficient size.

Because of the very large sample size of the MZ, we can allocate individuals to cohorts defined by both year of birth and gender. We consider individuals between 18 and 65 years of age at the beginning of the observation period in 1996. Thus, we are analysing birth cohorts 1937-1978 by allocating each individual in the sample to a cohort defined by birth year and gender. This allocation results in an average cohort size of about 3.000 individuals, which seems a sufficiently large number to apply the asymptotic results referred to below. In the econometric analysis, we differentiate the estimation by gender, but do not differentiate between East and

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West Germany because migration between the two regions would violate our basic identifying assumption that individuals can unambiguously be allocation to a particular cohort. We will control for regional effects on start-up rates by including region of residence in addition to other control variables in the estimation.

3.2 Data and Descriptive Statistics

In the following, the *self-employment rate* is defined as the ratio between self-employed people at the date of interview in a particular year in the MZ relative to the labour force. The *start-up rate* is defined as the ratio between the number of people who have been self-employed for less than 12 months at the date of interview in a particular year relative to the total labour force.[6] The reference period for most questions in the MZ is a week (mostly end of April each year).[7] Given this short reference period, long-term self-employment spells are overrepresented in the MZ, and brief self-employment spells are underrepresented due to the well-known length bias inherent in stock sampling (see Lancaster 1992: 185ff.). We also calculate the share of people who have been unemployed at the date of interview in the previous years among all start-ups in a particular year. Given that the retrospective information on an individual's labour force status in the previous year refers to a reference week (the end of April), short unemployment spells will be underrepresented and long unemployment spells overrepresented in the sample as well. For our purpose, this length-bias is an advantage because we are particularly interested in the impact of *long-term* unemployment on the entry rate into self-employment.

For Germany as a whole, the average self-employment rate – defined as the number of self-employed people relative to all employed people (dependently and self-employed) – hovers

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[6]   The retrospective question on last year's labour force status was only asked to a 45% random sub-sample of the Microcensus. Since selection into this sub-sample was at random, we do not expect selection bias resulting from this sampling scheme.

around 9 percent in the observation period. Men living in West Germany have the highest self-employment rate, amounting to an average value of almost 12 percent with little change over the observation period. For women living in West Germany, the self-employment rate is only about half the level of the male rate, and has also remained fairly stable in the observation period. In East Germany, the self-employment rate of men increased from a little below 10 percent to almost 12 percent in 2000, with a slight decline since then. For women living in East Germany, the self-employment rate has slightly increased in the observation period and has reached roughly the same level as the female rate in the west.

Table 1. Self-employment and start-up rates 1996-2002, by gender and region

		1996	1997	1998	1999	2000	2001	2002
Self-employment rate (in %)								
West Germany	Men	11.2	11.6	11.7	11.6	11.7	11.6	12.0
	Women	6.1	6.2	6.4	6.3	6.2	6.0	6.2
East Germany	Men	9.9	10.5	11.2	11.1	11.6	11.6	11.4
	Women	5.2	5.6	5.9	5.7	5.9	6.1	6.4
Start-up rate (in %)								
West Germany	Men	1.3	1.3	1.4	1.2	1.2	1.2	1.3
	Women	0.8	1.0	1.0	0.9	0.8	0.8	0.8
East Germany	Men	1.1	1.3	2.6	2.1	1.8	1.6	1.2
	Women	0.7	0.8	1.2	1.3	1.1	1.0	0.9
Share of start-ups from unemployment (in %)								
West Germany	Men	6.4	7.7	8.4	7.8	6.2	3.4	7.9
	Women	2.2	6.5	7.2	3.1	6.5	6.1	6.9
East Germany	Men	13.2	20.3	12.3	12.3	13.1	10.6	17.9
	Women	25.8	18.7	9.2	4.1	16.2	20.0	15.2
Aggregate numbers (in 1,000)								
Self-employed	Total	3,178	3,280	3,329	3,277	3,341	3,373	3,381
Start-ups	Total	315	340	332	311	326	284	294

Notes: The self-employment rate is the ratio (in percent) of self-employed people to all people within the age limits of 18 and 65 years, the entry rate into self-employment (start-up rate) is the number of people who have been self-employed for less than a year at the date of interview relative to the labour force. Aggregate numbers are taken from Hansch (2006, Table 1).

Source: Microcensus 1996-2002, own calculations; Hansch (2006).

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[7] Until the year 2004; starting in 2005 the MZ is conducted continuously during the year and the respective questions thus refer to the "average" week (see Hansch 2006).

The stability of the self-employment especially in West Germany may suggest that self-employment does not respond to the business cycle. This conclusion may be wrong, however, since a constant share of self-employed people could also result from large and volatile flows into and out of self-employment. Looking at the development of start-up rates in Table 1 shows, however, that at least for West Germany this does not seem to be the case: for men living in West Germany the start-up rate has been rather stable around a yearly average of 1.3 percent in the observation period; the respective rate for women living in west Germany is 0.9 percent. For men living in East Germany, the start-up rate has been increasing until the end of the 1990's when it peaked, but has been declining since then. A similar pattern can also be observed for women living in East Germany (see Table 1). Regional differences in average start-up rates are relatively small, both for men and women.

As shown in the lower part of Table 1, the share of start-ups from unemployment relative to all start-ups varies in all groups in the observation period.[8] In East Germany this share is roughly double the west German rate in most years. In 1996, about a quarter of all women living in East Germany who became self-employed in that year were unemployed in the year before, compared to only about 2 percent of the respective group of women living in West Germany. For men regional differences are also substantial, if less extreme. These differences may be related to the much higher unemployment rate prevailing in East Germany relative to the west. However, it could also be related to other factors, such as level of education and vocational qualification, age, and household characteristics. In the empirical analysis below we will control for these factors in order to identify the effect of previous unemployment on individual self-employment transitions.

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[8] Note that unemployment is defined according to the concept used by the International Labour Organisation (ILO), which differs from the definition used by the Federal Labour Agency.

3.3 Econometric Specification

Assuming the availability of individual-level panel data, we could specify the following linear regression model:

(1) $y_{it} = x_{it}\beta + k_i + \varepsilon_{it}$,   with $i = 1, ..., N$ and $t = 1, ..., T$,

where y_{it} is an indicator variable with $y_{it} = 1$ if individual i made a transition into self-employment in period t, and $y_{it} = 0$ otherwise; x_{it} is a row vector of explanatory variables including a dummy variable indicating whether or not individual i was unemployed in period t-1 and a set of control variables, β is a corresponding column vector of regression coefficient; k_i is a fixed (time-invariant) individual effect, and ε_{it} is a time-varying and individual-specific error term.

Equation (1) is a fixed-effects linear probability model. Given the availability of true panel data, unbiased estimates of the parameters could be obtained from a least-squares regression, in principle.[9] If estimated on the basis of a pseudo panel, equation (1) has to be aggregated over all individuals within a specific cohort and thus refers to cohorts, indexed by c, rather than individuals:

(2) $\bar{y}_{ct} = \bar{x}_{ct}\beta + \bar{k}_{ct} + \bar{\varepsilon}_{ct}$, $c = 1, ..., C$; $t = 1, ..., T$

where $\bar{y}_{ct}$ is the observed mean of the dependent variable for cohort c at time t, and $\bar{x}_{ct}$ now is a row vector with the observed means of the explanatory variables x within cohort c at time t as its elements; as before, β is a column vector of corresponding regression coefficients, and $\bar{\varepsilon}_{ct}$ is the mean of individual-specific error terms within cohort c in period t. Note that the β

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[9]   Standard errors of estimated regression coefficients would be biased, though, due to heteroscedasticy of the error term. Furthermore, there is no guarantee that the estimated probability of a self-employment transition,

coefficients in (2) are the same as in (1) although measurement of the dependent and explanatory variables differ between the two specifications.

The crucial difference between equations (1) and (2) concerns the mean cohort effect in period t in the latter equation, $\overline{k}_{ct}$. In contrast to the individual fixed effect in equation (1), the mean of the cohort effect is no longer necessarily constant over time, since the pseudo panel is made up of individuals from independent cross sections. The cohort effect in a given period t is thus composed of the „true" unobserved cohort effect, $\overline{k}_{ct}^{*}$, and an error term, v_{it}^{*}, consisting of two components: v_t which measures the average deviation from $\overline{k}_{ct}^{*}$, and v_{ct} which measures individual deviations from cohort means (Moffitt 1993: 103). The average cohort effect in period t is therefore given by:

(3) $\overline{k}_{ct} = \overline{k}_c^{*} + v_t + v_{ct}$

Given individuals are allocated to a particular cohort according to a time-invariant rule, e.g. year of birth or gender, the error component v_{ct} can be assumed to converge to zero in large cohorts, and equation (3) approaches:

(4) $\overline{k}_{ct} = \overline{k}_c^{*} + v_t$

Inserting this equation into (2) yields:

(5) $\overline{y}_{ct} = \overline{x}_{ct}\beta + (\overline{k}_c^{*} + v_t) + \overline{\varepsilon}_{ct}$

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conditional on x, falls within the unit interval. These complications need not concern us here, however, since the linear probability model is only intended to motivate the following pseudo-panel estimator.

Since we define cohorts by year of birth (and gender), g, the cohort effect is a function of this variable which, in turn, is a function of the calendar year, t, and years of age: $k(g) = k(t-a) = k(t, a)$, with a: $g = t - a$.

Hence, if age is included in the vector of exogenous variables, $\overline{x}_{ct}$ will be correlated with $\overline{k}_c^*$, and a pooled OLS regression will yield biased coefficient estimates. Conditioning on the cohort effects and trying to eliminate them by the within-transformation of variables in equation (5) does not work here because of the time-varying error component in the cohort effect. One possibility to define away this problem is to assume that v_t will average out in case of a sufficiently large number of individuals in each cohort. However, as shown by Verbeek und Nijman (1992), the bias of the fixed-effects estimator obtained from equation (5) under this assumption could be substantial even for a large number of observations in each cohort.

An estimation approach which yields consistent and asymptotically efficient parameter estimates was suggested by Deaton (1985). This approach, which we follow here, is also known as "error-in-variables" method. Assuming the unobserved average cohort means were known, unbiased parameter estimates could be obtained by fixed-effects estimation of eq. (5):

(6) $\overline{y}_{ct}^* = \overline{x}_{ct}^* \beta_D + \overline{k}_c^* + \overline{\varepsilon}_{ct}^*$

where $\overline{y}_{ct}^*$ is the true mean of the self-employment rate of cohort c in time period t, $\overline{x}_{ct}^*$ is a row vector with the true means of the explanatory variable as its components, and β_D is a column vector of corresponding regression coefficients; $\overline{k}_c^*$ is the "true" time-invariant cohort effect, and ε_{ct}^* is an error term assumed to be normally and independently distributed. Of course, the „true" variable means are unobserved, and sample means are observed with measurement errors.

Assuming these errors are identically and independently normally distributed, we have (Verbeek 1992: 306):

$$(7) \quad \begin{pmatrix} \bar{y}_{ct} - \bar{y}_{ct}^* \\ \bar{x}_{ct} - \bar{x}_{ct}^* \end{pmatrix} \overset{iid}{\sim} N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}; \begin{pmatrix} \sigma_{00} & \sigma' \\ \sigma & \Sigma \end{pmatrix} \right)$$

Variances of measurement errors can be estimated from individual-level data. Since the number of observations per cohort varies between 2,500 und 4,500 in our data set, we have adjusted estimated variances for differences in sample size, as suggested in Deaton (1985: 117).

The Fixed Effects estimator adjusted for measurement errors is given by (Deaton 1985):

$$(8) \quad \hat{\beta} = \left[X'X - \tau \cdot CT \cdot \hat{\Sigma} \right]^{-1} \left[X'y - \tau \cdot CT \cdot \hat{\sigma} \right]$$

with $\tau = $ (T-1)/T

   $X := $ (C×K) matrix with K explanatory variables

   $y := $ (C×1) vector

   $\hat{\Sigma}, \hat{\sigma} := $ (K×K) matrix and (K×1) vector of estimated error variances.

Due to the within-transformation of each variable, one degree of freedom is lost, which is taken care of by the adjustment factor τ (Verbeek 1993: 306). The elements of the matrix $X'X$ are defined as $\sum_{c=1}^{C} \sum_{t=1}^{T} \left(\bar{x}_{ct} - \bar{\bar{x}}_c \right)' \left(\bar{x}_{ct} - \bar{\bar{x}}_c \right)$, where $\bar{x}_{ct}$ is a row vector of observed means of the explanatory variables for cohort c in period t, and $\bar{\bar{x}}_c$ is a row vector of these means over time. Note that variables, which are measured as a binary variable at the individual level, are measured as averages or shares within a cohort in the pseudo panel. For example, the incidence of previous individual unemployment aggregates to the average unemployment rate in the previous period within a specific cohort. Likewise, a categorical variable like a dummy for higher education would aggregate to the share of this education category in the respective cohort. Definitions and descriptive statistics of explanatory variables included in the estimating equation are given in the appendix.

4　Estimation Results

Estimated effects of explanatory variables on transition rates into self-employment based on equation (8) are summarised for men and women in Table 2. Regression coefficients give the change of the start-up rate to a change of the explanatory variable by one percentage point if the latter is also measured as a share (in percent) within a cohort, such as the unemployment rate. In case the explanatory variable is measured as mean value within the cohort, such as age, the regression coefficient gives the change of the start-up rate to a change of the explanatory variable by one unit.

Table 2. Transition rate into self-employment based on pseudo-panel data, fixed-effects estimation accounting for measurement error

	Men		Women	
	Coefficient	t-value	Coefficient	t-value
Age	0.1660	7.56 **	0.1142	7.46 **
Age squared	-0.0020	-8.87 **	-0.0009	-5.11 **
East Germany (west Germany)	-0.0065	-4.73 **	-0.0077	-5.29 **
Unemployment rate in $t-1$	0.0964	5.67 **	0.0606	5.55 **
Other own income	0.0645	4.65 **	0.0378	3.30 **
Married (single)	-0.0034	-13.11 **	-0.0020	-11.15 **
Income of spouse	0.2217	12.96 **	0.0137	1.37
Foreign nationality (German)	0.0039	7.35 **	0.0015	2.11 *
Highest vocational degree (completed apprenticeship training, occupational degree)				
master craftsman, technician	0.0080	25.05 **	0.0061	20.74 **
polytechnic	0.0056	14.67 **	0.0045	14.02 **
university	0.0092	25.25 **	0.0097	28.98 **
missing	-0.0039	-1.98	-0.0059	-2.33 *
Number of children < 6 years	0.0436	1.42	-0.0921	-3.30 **
Size of community (< 20,000)				
middle (20,000 ≤ population < 500,000)	-0.0005	-2.24 *	-0.0006	-4.49 **
large (population ≥ 500,000)	0.0012	4.64 **	0.0002	1.52
Number of observations	294		294	
Number of time periods	7		7	
Number of cohorts	42		42	

Notes:　*　significant at the 5%,　**　at the 1 % level. A constant and cohort dummies are included in the estimations. For definition of variables, see the appendix.

In addition to age, we also include a set of cohort dummies in the estimation. Age, cohort and calendar time effects are not separately identifiable due to the linear relationship between them as described above. There are various possibilities to break up this linear dependence between these effects. Following Boockmann and Steiner (2006), here we assume that year effects affect all cohorts in the same way. Thus, we attribute all of the difference in self-employment rates between two cohorts to the true cohort effect, although they could also result from time effects, since at given ages the two cohorts are observed at different calendar years.

Figure 1 illustrates cohort and age effects on male and female transition rates into self-employment, where start-up rates are evaluated at mean values of the other explanatory variables. Given that cohort differences are relatively small, only each third cohort is plotted to avoiding cluttering the picture.[10] Cohort effects are given by the difference in start-up rates between cohorts at a given age. To avoid cluttering the picture, only every third cohort is plotted in the figure. For example, for men aged about 40 years the difference in start-up rates between cohorts is almost 1 percentage point.

Overall, men aged between 35 and 40 years are the most likely to become self-employed, with an average transition rate of about 1.6 percent. This result corresponds with intuition since at this stage of their lifecycle they should have, on the one hand, acquired sufficient work experience and sufficient financial means to start an own business. On the other hand, they are still young enough to reap the gains from a successful start-up or, in case of an unsuccessful undertaking, to try an alternative occupation. The relatively strong decline of the male start-up rate after the age of 40 is also consistent with the lifecycle view of occupational choice. For women, the relationship between start-up rates and age is similar to that of men, although female
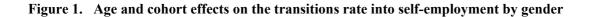
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[10] Although start-up rates in east Germany are, conditional on the other variables included in the model, somewhat
      lower than in west Germany, we do not allow for regional differences of age and cohort effects on transition rates
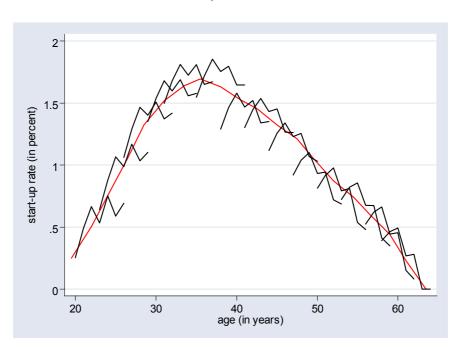
start-up rates are only half the male rates; the highest rate of a bit less than 1 percent is obtained by the age group between 30 and 40 years. For women, cohort effects are less pronounced than those for men.

Turning to the relationship between previous unemployment and the transition rate into self-employment, we find both for men and women that the higher a cohort's unemployment rate in the previous year, the higher the transition rate into self-employment, and that these effects are highly significant. For men, the self-employment transition rate is estimated to increase by roughly 0.1 percentage points if the unemployment rate within a cohort rises by 1 percentage point. For women, the effect of previous unemployment on self-employment transitions is only about half the size estimated for men, but still substantial given the relatively small levels of female self-employment rates (see Table 1).

The effect of previous unemployment on self-employment transitions is also substantial relative to the effects estimated for some of the other explanatory variables included in the model. For example, an increase in the share of male and female university graduates within a cohort by ten percentage point would raise the transition rate into self-employment by a mere tenth of a percentage points. A specialized vocational qualification obtained as a master craftsmen and technician also has a relatively strong positive effect on the estimated transition rate into self-employment, especially for men. These effects may be related to the fact that in Germany not only do the professions, such as physicians, lawyers, and architects, require a university education, but until recently (2005) a large number of crafts were restricted to self-employed with a specialized vocational qualification as a master craftsman.
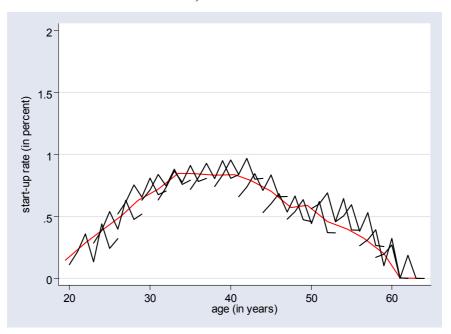
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into self-employment in the estimation, and do therefore not report separate estimates for the two regions in the figure.

Figure 1. Age and cohort effects on the transitions rate into self-employment by gender

a) Men

b) Women

Note: For a given age and cohort, start-up rates are calculated for average values of the explanatory variables.

Source: Estimation results in Table 2.

While higher unemployment rates prevailing in east Germany increase transition rates into self-employment, the negative effect of the share of a cohort living in the east on transition rates reflects the fact that, on average, self-employment rates are lower in east Germany than in the west both for men and women. We also find that the average size of the community of residence affects transition rates into self-employment, although in a non-linear fashion: transitions rates tend to be higher in small and large communities relative to medium-sized ones.

Regarding personal and family characteristics we find that the larger the share of foreigners in a cohort, the higher the self-employment transition rate, a result that has also been reported in previous literature for Germany (see, e.g., Constant and Zimmermann, 2004). Married women have a significantly lower self-employment transition rate than single women, and there is also a significant negative effect of the number of children on female transition rates, other things equal. Transition rates are also increasing in other household income and also in the spouse's income. Note, however, that these effects are difficult to interpret given the aggregation of individual information within cohorts and also the fact that characteristics like vocational education may proxy for differential earnings effects.

5   Conclusion

An important question in labour market policy evaluation concerns the empirical relationship between previous unemployment and the transition rate into self-employment. Theoretical literature has identified various channels through which unemployment may affect self-employment transitions. On the one hand, high unemployment may reduce the opportunity to gain dependent employment and thus positively affect self-employment, as suggested by the "unemployment push" hypothesis. On the other hand, according to the "unemployment pull" hypothesis, high unemployment may negatively affect individual expectations about the success of self-employment and thereby the start-up rate, or reinforce credit constraints which may hinder

unemployed people to become self-employed. Previous empirical literature has yielded ambiguous results concerning the relative importance of these two hypotheses. Given that long-term unemployment tends to be heavily concentrated among older workers, the relationship between the entry rate into self-employment and age is also of great policy relevance. Although this relationship has been investigated in the empirical literature, cohort effects have been neglected in most of these studies.

In this paper, we have analysed the relationship between previous unemployment and the transition rate into self-employment for Germany using pseudo-panel data and a fixed-effects estimator which accounts for cohort effects and measurement error. Estimation results show that previous (long-term) unemployment has significant positive effects on entry rates into self-employment for both men and women. These effects are quantitatively important, both in absolute terms and compared to other potential determinants of self-employment transitions, such as age, the level of vocational qualification and certain household characteristics. We have also established that entry rates into self-employment are much higher for men than for women at each age, and that accounting for cohort effects does not change the life-cycle pattern of entry rates into self-employment for both groups, with relatively low entry rates of older people. From a policy perspective, we may conclude that although long-term unemployment tends to push people into self-employment, this effect is not particularly large for older people who make up a disproportionate share of the long-term unemployed.

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Appendix

Table A1. Definition of variables and descriptive statistics for pseudo-panel data set

		Men		Women	
Variable name	**Definition**	**Mean**	**S.d.**	**Mean**	**S.d.**
Self-employment rate	Share of self-employed people in the reference week to all people in the labour force	9.08	3.62	3.81	1.67
Entry rate into self-employment	Number of transitions in self-employment between t and $t - 1$ relative to all people not self-employed in t-1 within cohort	1.06	0.52	0.55	0.29
Unemployment rate in $t – 1$	Share of unemployed people within a cohort in end of April of previous year relative to all people in this cohort	9.44	0.84	10.36	0.92
Individual income	Average other income, in 1000 Euro	1.56	0.41	0.76	0.12
Other income	Average income of spouse, in 1000 Euro	0.90	0.32	1.57	0.25
Married	Share of married persons	61.06	25.51	65.23	19.64
Foreign nationality	Share of persons with other than German nationality	7.81	2.33	7.33	2.88
Children < 6 years	Average number of children	0.16	0.15	0.18	0.20
Education					
master technician	Share of persons with master craftsmen or technician as the highest vocational qualifications	10.31	3.36	4.84	1.31
polytechnic	… with polytechnical degree	6.77	2.30	3.78	1.37
university	… with a university degree	9.95	3.78	7.75	3.08
missing	… with missing values of education	9.47	10.71	12.66	14.22
East German	Share of individuals living in east Germany	21.45	1.77	21.27	1.98
Community size					
Middle	Share of people in community with $20,000 \leq$ Population $< 500,000$	39.07	1.53	39.59	1.61
Large	Share of people in community with more than 500.000 people	18.70	1.26	19.07	1.31
Cohort size		3,296.2	370.9	3,296.4	360.5
Number of persons / year		146,471.7	1,738.5	146,482.1	638.7

Notes: Averages and shares are calculated as means of the respective variable within and between cohorts in the observation period 1996-2002; except for the income variables and the number of children, means are given in percent. Number of cohorts = 42, number of time periods = 7.

Source: Microcensus. 1996- 2002; own calculations.