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932 2017

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ISSN: 1864-6689 (online)

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The dynamics of solo self-employment: persistence and transition to employership

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Abstract

This study examines dynamics of solo self-employment. In particular, we investigate the extent of true state dependence and cross state dependence, i.e., whether experiencing solo self-employment causally affects the probability of becoming an employer in the future. We use data from the German Socio-Economic Panel to estimate dynamic multinomial logit models. Our results show that the extent of true (cross) state dependence is rather small. The observed persistence in solo self-employment as well as transitions from solo self-employment to employership can largely be explained by observed and unobserved heterogeneity.

Keywords: state dependence, dynamic multinomial logit, solo self-employment, own-account worker, stepping stone, German SOEP

JEL Classification: J23, J62

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Acknowledgements: For helpful comments and discussions, we would like to thank Alexander Mosthaf, Claus Schnabel, and two anonymous referees as well as participants at research seminars at the University of Erlangen-Nürnberg, the University of Osnabrück, the Halle Institute for Economic Research, the annual conference of the Scottish Economic Society 2016, and the 12th International German Socio-Economic Panel User Conference.

1 Introduction

In many countries, policy makers stimulate self-employment to create jobs (see, e.g., Congregado et al. 2010, European Commission 2013, Kritikos 2014). More often than not, self-employment starts with *solo* self-employment. That is, entrepreneurs usually start as own-account workers who do not employ other workers. For instance, in Germany, Europe's biggest economy, two thirds of all start-ups are launched by solo self-employed (cf. Metzger 2014). Among subsidized start-ups, this share is even higher. About 70% of founders who received a start-up subsidy still have not employed other workers 19 months after start up (cf. Caliendo et al. 2012). Not surprisingly then, solo self-employment is the dominant form of self-employment in many countries. In Germany, about 57% of all self-employed were solo self-employed in 2012 (cf. Brenke 2013), and this share is even higher in the US, the UK, and Canada, where it is between 70 and 80% (cf. Parker 2009, p. 293).

Although solo self-employment is a common form of self-employment, the literature does not yet provide a clear understanding of the dynamics of solo self-employment. In consequence, there is a gap in knowledge about what are the effects of experiencing solo self-employment in the past on future labor market outcomes. Such knowledge is important for policy makers aiming at stimulating job creation. In general, the literature distinguishes between two mechanisms that may explain individuals' transitions between labor market states, both of which have different policy implications (see, e.g., Prowse 2012). First, if the past experience of solo self-employment has a causal effect on the probability of solo self-employment in the future, then policy measures such as start-up subsidies will have lasting effects even after the subsidies ended. This mechanism is termed true (or genuine) state dependence in the literature (see, e.g., Heckman and Borjas 1980, Heckman 1981). Second, if persistence in solo self-employment can fully be explained by individual characteristics that determine both solo self-employment in the past and in the future

alike, such policies will hardly have long-term effects. The literature refers to this mechanism as spurious state dependence.

Spurious state dependence arises if there are (time-invariant) variables that simultaneously affect the choice of labor market state at different points in time, i.e., if past and present labor market states share common causes. In particular, some individuals may persistently have higher preferences for self-employment, e.g., because of having a lower degree of risk aversion or a strong desire for autonomous decision-making. Also, the relative rewards of self-employment may differ between individuals because of time-invariant factors. For instance, immigrants may permanently have higher relative earnings in self-employment, ceteris paribus, because of wage discrimination in paid employment. Likewise, individuals who grew up with self-employed parents may have acquired a certain level of entrepreneurial knowledge and thus have higher relative earnings in self-employment, ceteris paribus. These individuals will then have a higher probability to be self-employed at any point in time, which generates spurious correlation between labor market states over time.

True state dependence arises if experiencing a certain labor market state causally affects the choice of labor market state in the future, e.g., by *changing* the preferences for or the relative rewards of labor market states. Most importantly, working in self-employment may increase entrepreneurial human capital (see, e.g., Minniti and Bygrave 2001), so that the relative rewards in self-employment and thereby the probability of being self-employed in the future increase. Another reason for true state dependence may be switching costs. Switching costs imply that there are additional costs if the previous labor market state differs from the current one. As a consequence, in this case the relative rewards (earnings less costs) of a state also depend on the labor market state in the past.

Subsidizing self-employment often brings individuals in solo self-employment initially. Such policies may have further advantageous effects when the subsidized self-employed become em-

ployers and create jobs for others in the future (the so-called "double dividend", see, e.g., Caliendo and Kritikos 2010). Such a double dividend is likely to occur in the presence of true cross state dependence, i.e., if experiencing solo self-employment in the past increases the probability of becoming an employer in the future.

Previously, only few studies have empirically investigated state dependence in self-employment and we are not aware of any paper studying (cross) state dependence in *solo* self-employment. Among the few studies analyzing state dependence in self-employment, Henley (2004) and Caliendo and Uhlendorff (2008) find evidence for state dependence in the UK and Germany, respectively. Millán et al. (2014) using ECHP data from 1994 to 2001 estimate competing risks models. They distinguish between own-account workers and job creators and find persistence in entrepreneurship. Congregado et al. (2010) investigate the determinants of transitions between solo self-employment and other labor market states but do not address state dependence in solo self-employment and whether it may be a stepping-stone to employership. Buschoff and Schmidt (2005) provide descriptive evidence on transitions from solo self-employment in five European countries. There is, thus, a clear lack of evidence on whether solo self-employment exhibits true state dependence and on its role as a stepping-stone to employership.

This paper fills this research gap by making the following contributions. First, we contribute to the international literature by estimating the extent of true state dependence in solo self-employment, an issue which, to the best of our knowledge, has not yet been investigated by prior research. Second, we contribute a comprehensive picture of the dynamics of solo self-employment by modeling transitions between four different labor market states: solo self-employment, employership, paid employment, and non-employment. This four-state categorization allows us to differentiate alternative pathways into, within, and out of solo self-employment. In particular, we examine to what extent solo self-employment serves as a stepping-stone to em-

ployership by identifying cross state dependencies between these states. Finally, we provide evidence on how dynamics of solo self-employment differ between men and women.

The analysis proceeds as follows. In section 2, we introduce our estimation strategy. Section 3 provides information on the data set used and shows descriptively that there is, for both men and women, pronounced persistence in solo self-employment and that solo self-employed are much more likely to become employers than paid employees are. Section 4 presents the results of a dynamic multinomial logit models and provides evidence that the extent of true (cross) state dependency is rather small. We discuss our findings and draw some policy implications in section 5.

2 Estimation strategy

We apply a dynamic multinomial logit model to estimate the determinants of transitions between four labor market states. The model assumes that in every time period an individual chooses the labor market state (solo self-employment, employership, paid employment, non-employment) that yields the highest utility.[1] We specify a random utility function for individual i in state j at time t as follows:

$$U_{ijt} = \boldsymbol{\beta}_j' \mathbf{x}_{it} + \boldsymbol{\gamma}_j' \mathbf{y}_{i,t-1} + \alpha_{ij} + \varepsilon_{ijt}. \tag{1}$$

The utility function includes a vector of observed individual characteristics, $\mathbf{x}_{it}$, and a set of previous state indicator variables, represented by the vector $\mathbf{y}_{i,t-1}$. The vectors $\boldsymbol{\beta}_j$ and $\boldsymbol{\gamma}_j$ represent alternative-specific coefficients. $\boldsymbol{\gamma}_j$ captures the effect of the previous state on the current state utility and measures true state dependence in labor market states. Hence, this part of the model

[1] While the model can be motivated by utility-maximizing behavior, this motivation is not at all essential for the estimates to have a meaningful interpretation. For instance, if the choice of labor market state is not entirely under the control of the individual (as would be the case if there were involuntary unemployment), the model nevertheless yields estimates of the determinants of the probability of being in a certain state at a certain time (see, e.g., Train 2009, Ch. 2.3).

represents the mechanisms through which the past labor market state changes the preferences or constraints that partly determine future labor market decisions. Identification of the coefficients on the lagged labor market states requires variation of labor market states over time.[2] The random error component α_{ij} models individual-specific unobserved heterogeneity.[3] The model assumes that the unobserved part ε_{ijt} is independently distributed with a type I extreme value distribution.

Including the lagged labor market state in the model brings the difficulty to deal with the initial conditions problem. We observe only labor market choices over the period of time covered by the data, but we generally do not observe individuals' choices in the preceding periods. In consequence, the initially observed labor market state is likely to be correlated with the random error component, leading to inconsistent estimates. To solve this endogeneity problem, we apply the conditional maximum likelihood estimator suggested by Wooldridge (2005).

Taking up the Wooldridge approach, we model the unobserved heterogeneity α_{ij} as a function of the initial state $\mathbf{y}_{i0}$, individual-specific explanatory variables $\bar{\mathbf{x}}_i$, and a new random error, a_{ij}, that is assumed to be uncorrelated with the initial state. In an alternative specification, we additionally include initial-period explanatory variables to allow for a more flexible model for the unobserved heterogeneity (Rabe-Hesketh and Skrondal 2013). Both specifications lead to identical results in our application, suggesting that the parsimonious model is not overly restrictive.[4] We assume a_{ij} to be normally distributed with zero mean and variance σ_a^2. Hence, the probability that individual i is in state j at time t conditional on observed and unobserved characteristics and the labor market state in $t-1$ can be written as (for a general derivation of choice probabilities,

[2] Note that workers who remain in the same sector in all periods do not contribute to the identification of the coefficients on the lagged labor market states that is equal to the initial condition in this case.

[3] Including α_{ij} in the utility function also relaxes the restrictive independence of irrelevant alternatives (IIA) assumption of the conventional multinomial logit model by capturing correlations in individual random effects across alternatives (for further discussion, see Skrondal and Rabe-Hesketh 2003).

[4] Wooldridge (2005) includes a vector of all explanatory variables across all periods in the model for the unobservables. This approach can, however, only be applied to a balanced panel data set. A common approach in the literature is, therefore, to use within-means of time-varying explanatory variables (for a discussion, see Rabe-Hesketh and Skrondal 2013).

see Train 2009).

$$P(Y_{it} = j|\mathbf{x}_{it}, \mathbf{y}_{i,t-1}, \mathbf{y}_{i0}, \boldsymbol{a}_i) = \frac{\exp(\boldsymbol{\beta}'_j \mathbf{x}_{it} + \boldsymbol{\gamma}'_j \mathbf{y}_{i,t-1} + \boldsymbol{\delta}'_{1j} \mathbf{y}_{i0} + \boldsymbol{\delta}'_{2j} \bar{\mathbf{x}}_i + a_{ij})}{\sum_{k=1}^{4} \exp(\boldsymbol{\beta}'_k \mathbf{x}_{it} + \boldsymbol{\gamma}'_k \mathbf{y}_{i,t-1} + \boldsymbol{\delta}'_{1k} \mathbf{y}_{i0} + \boldsymbol{\delta}'_{2k} \bar{\mathbf{x}}_i + a_{ik})}. \tag{2}$$

We estimate the coefficients in equation 2 using a dynamic multinomial logit model with random effects, which includes additional covariates for the auxiliary model for the unobserved heterogeneity. Estimation is carried out with the command -gsem- available in Stata 14.

We use average predicted probabilities to calculate state dependence in transitions, using the observed covariate values of each individual. The prediction is calculated by integrating the unobserved heterogeneity out of the likelihood. Standard errors are calculated using the delta method.

Following Immervoll et al. (2015), we define true state dependence in solo self-employment as the difference between the probability of being solo self-employed at time t conditional on being in that state in $t-1$ and the probability of being solo self-employed at time t conditional on being in an alternative state in $t-1$. In doing so, true state dependence can be interpreted as the causal effect of experiencing solo self-employment in the past on the probability of experiencing solo self-employment in the future. Formally, we calculate true state dependence (TSD) in solo self-employment as

$$\begin{aligned} \text{TSD} = & P(\text{solo self-employment}_t | \text{solo self-employment}_{t-1}) \\ & - P(\text{solo self-employment}_t | \text{alternative status}_{t-1}). \end{aligned} \tag{3}$$

Likewise, we calculate cross state dependence (CSD) between solo self-employment and employership as

$$\begin{aligned} \text{CSD} = & P(\text{employership}|\text{solo self-employment}_{t-1}) \\ & - P(\text{employership}|\text{alternative status}_{t-1}). \end{aligned} \tag{4}$$

3 Data and descriptive evidence

This study uses data from Socio-Economic Panel (SOEP 2013). The SOEP is a representative annual panel survey started in 1984 (for details, see Wagner et al. 2007, 2008). Our estimation sample covers the waves 2000 to 2012 for which information on the existence (and number) of employees for all self-employed workers (including freelancers and so-called "academic self-employed") is available. Restricting the sample to individuals aged 20 to 65 and dropping observations with missing information on key variables, our data set includes 10,371 individuals with 80,645 person-year observations.

We consider transitions between four different labor market states. Labor market states are based on the self-reported employment status of respondents. The survey is conducted annually, so we classify individuals according to the employment status they report at the time of the annual interview, regardless of when exactly between the current and the last interview the employment status may have changed. First, we distinguish between two types of self-employment (excluding farmers), namely, solo self-employment and employership. From 2000, when asked about their employment status, self-employed respondents had the option to indicate the number of employees in three categories: None, 1-9, or 10 and more. We define solo self-employment as being self-employed and having zero employees and employership as being self-employed and having 1-9 or 10 and more employees. The two alternative states are paid employment (excluding civil

service) and non-employment, i.e., unemployment or non-working (but excluding pensioners and individuals in education).[5]

Table 1 shows the distribution of labor market states in our sample. On average, 4.6% of men are solo self-employed, while about 6.2% are employers. Among women, 3% are solo self-employed and only 1.6% are employers. The share of individuals in non-employment is decreasing from about 10% to about 8% for men and from 32% to 19% for women over the observed period, mirroring among others the favorable labor market performance in Germany in recent years. As the distribution of states differs considerably between men and women, with women having lower labor market participation and self-employment rates than men, we perform separate analyses by gender.

Figure 1 illustrates the distribution of labor market states over time for the male subsample conditional on being in a specific initial status. While persistence can be observed in all states, it is most pronounced in paid employment. About 95% of men who were in paid employment in the previous year are still paid employees in the current year (cf. Figure 1, Panel C). Even after five years, about 85% are still in paid employment while about 11% are non-employed and just about 4% have become solo self-employed (2%) or employers (2%). Transitions to self-employment are somewhat more likely from non-employment where persistence is not that distinct (cf. Figure 1, Panel D). After five years, only 25% of those initially non-employed are still non-employed, while 66% have taken up paid employment, and around 5% and 3% have become solo self-employed and employers, respectively. Interestingly, persistence in solo self-employment, similar to persistence in non-employment, is clearly less pronounced than persistence in paid employment (cf. Figure 1, Panel A). Only a third of those in solo self-employment five years ago are currently solo self-employed. About the same percentage, namely 30%, moves to employership. This share is much higher than the respective shares when initially paid employed (2%) or non-employed

[5] Note that transitions from one of the omitted categories are not used in the estimation, as they are coded as missing values of the labor market state variable.

(3%). Finally, 52% of employers are still employers after five years, and additionally 22% are still self-employed but do not have other employees anymore (cf. Figure 1, Panel B).

For women, persistence in solo self-employment is of similar magnitude (32% are still solo self-employed after five years, cf. Figure 2, Panel C). However, they are much less likely to become employers. Only 14% of solo self-employed women are employers after five years, compared to 30% of men. That said, this probability is still much higher than the corresponding probability of becoming an employer when initially in paid employment (1% after five years, cf. Figure 2, Panel A) or non-employment (1% after five years, cf. Figure 2, Panel D). Unsurprisingly, women in all four states are generally more likely to become and stay non-employed, respectively, than men.

In sum, we observe that solo self-employment exhibits substantial persistence, albeit considerably less than paid employment. Even more important, the transition probability to employership is much higher from solo self-employment than from paid employment and non-employment, respectively, which may indicate that solo self-employment is a stepping-stone to employership. However, it is unclear up to now whether it is really solo self-employment that increases the likelihood of being self-employed (solo or with other employees) in the future or just individual characteristics that influence both the decision to become solo self-employed and to stay solo self-employed or to become an employer later on. To answer this question, we need to take account of unobserved and observed individual characteristics in multivariate analyses.

Table 2 displays the variables we use in the multivariate analysis. Consistent with the previous literature (see, e.g., the survey by Parker 2009, chs. 4 and 10.1.3), the self-employed in our sample are older and better educated than paid employees and more willing to take risks.[6] Also, the share of those with a self-employed father is higher among the self-employed than among paid employees or non-employed, and this particularly applies to employers. Employers are more

[6] The risk variable is based on a question that asks about willingness to take risks on an 11-point scale. This measure has been experimentally validated by Dohmen et al. (2011).

often married and have more children on average than do solo self-employed. By controlling for (lagged) household income, we also take account of income shocks that may promote the transition from solo self-employment to employership.[7]

4 Results

Table 3 reports the estimation results of the multivariate model for males (Table 4 shows the estimation results for females). The estimates indicate positive and statistically significant state dependence for all labor market states. In particular, the parameter of state dependence in solo self-employment, estimated to be 3.312 (S.E.=0.239), shows a clear increase in the probability of solo self-employment relative to the probability of non-employment (i.e., an increase in the log odds) when the individual was solo self-employed in the previous year. Furthermore, the parameter of cross state dependence, estimated to be 2.665 (S.E.=0.278), points to a stepping stone effect, as the probability of employership increases relative to the probability of non-employment when the previous state is solo self-employment. We provide a more detailed quantitative interpretation of the results below.

The coefficients of the socioeconomic control variables show interesting patterns. The estimates of the equations for solo self-employment and employership tend to have the same sign and magnitude.[8] Therefore, solo self-employment and employership appear to be similar states with correspondingly similar determinants. That said, father's self-employment appears to play a more important role for employership than for solo self-employment.

The results for the random part of the model show that the variances of the random effects for solo self-employment and employership are larger than the variance for paid employment. This implies that unobserved factors are more important for explaining tastes for solo self-employment

[7] We do not control for industry sector because this variable is not available for non-employed.

[8] For example, the coefficient on the variable measuring risk attitude is 0.218 and 0.286 in the equations for solo self-employment and employership, respectively. Thus, we conclude that a change in risk attitude is related to equivalent changes in the log odds of solo self-employment and the log-odds of employership.

or for employership than for explaining tastes for paid employment. In addition, there is a positive correlation between the random effects for solo self-employment and employership, suggesting that those who prefer solo self-employment to non-working also tend to prefer employership to non-working.

Table 5 displays the predicted transition probabilities (along with standard errors) between the four labor market states in consecutive years, separately for men and women, based on the estimates of our multionmial logit models. Conditional on being solo self-employed in a given year, the probabilities of being solo self-employed in the next year amount to about 15.6% and 10.7% for men and women, respectively. Interestingly, these probabilities are considerably lower than the observed probability of about 77%, which does not account for individual characteristics (see Panel A in Figures 1 and 2 for men and women, respectively). Hence, about 80% of the persistence observed in the raw data can be traced back to observed and unobserved individual characteristics that are controlled for in our dynamic multinomial logit models, whereas about a fifth (i.e., $15.6/77.0$) of the observed persistence may be due to true state dependence. Likewise, the model-based predictions for transitions from solo self-employment to employership in two consecutive years amount to about 9.0% and 3.0% for males and females, respectively, as compared to about 13% and 7% when individual characteristics are not controlled for.

Next, we calculate the extent of true state dependence from these probabilities, as explained in section 2. Table 6 shows that true state dependence in solo self-employment appears to be small. For men, being solo self-employed in the last year increases the probability of being solo self-employed in this year by about 13.3 percentage points compared to being in paid employment in the last year. And when non-employment is the reference state, true state dependence amounts only to 9.6 percentage points. The effect of solo self-employment on transitioning to employership (i.e., cross state dependence) is not big either, amounting to a 5.1 and 4.9 percentage points

increase compared to paid employment and non-employment, respectively. For women, state dependence and cross state dependence appear to be even lower.

Since extant studies on state dependence in self-employment do not distinguish between solo self-employment and employership, we cannot directly contrast our estimates to previous ones. However, our estimates imply that true state dependence in self-employment as a whole amounts to about 16 percentage points (for details, see appendix). In contrast, Caliendo and Uhlendorff (2008), who also use SOEP data and a similar estimation method estimate true state dependence in self-employment for men to be somewhat higher, namely, around 22 percentage points. There are at least three possible explanations for these (slightly) different results. First, Caliendo and Uhlendorff (2008) use data from 1984 to 2005, whereas we use the waves 2000 to 2012. Second, we control for a different set of explanatory variables to model individual-specific heterogeneity. In particular, unlike Caliendo and Uhlendorff (2008), we include a measure of risk attitude, which turns out to be an important determinant of state choice (cf. Table 3). Third, Caliendo and Uhlendorff (2008) apparently do not take account of time trends (e.g. by including survey-year dummies). Because time trends affect the probability of being in certain labor market states (according to the German Microcensus, the number of self-employed workers in West Germany increased by more than 50% since its low-point in 1981), neglecting the time trend likely results in spurious correlation between consecutive labor market states and thus in higher estimates of state dependence.

Next, we illustrate how choices of labor market states respond to temporary, exogenous shifts in employment states. For instance, a person may be selected for a program that subsidizes start-ups. We assume that the program lasts for 1 year. Since our model controls for observed and unobserved individual characteristics, the model-based predictions are indicative of the effect of being in the subsidized state for one year on the labor market choices in subsequent years.

Figures 3 and 4 show how the small degree of state dependencies reported above affects subsequent labor market choices after the program ended. The calculations show that the temporary shift has only short-run effects. For men, having been in solo self-employment instead of paid employment has practically zero effect on the probability of being an employer already three years later and the effect on solo self-employment fully disappears after four years (cf. Figure 3, Panel A). From a policy perspective, it is probably more important to look at the effect of bringing someone in solo self-employment instead of non-employment. Here, the effect approaches practically zero after two years for all four states (cf. Figure 3, Panel B). For women, the effect of solo self-employment on future solo self-employment or employership is also only discernible for one year, regardless whether paid employment or non-employment is the alternative status (cf. Figure 4, Panels A and B). There are, however, some adverse effects of solo self-employment instead of paid employment for women as their hazard of being non-employed increases for some years. Conversely, having been solo self-employed instead of non-employed seems to increase the likelihood of paid employment in the future for women.

So far, our results have shown that the substantial persistence in solo self-employment found in the descriptive statistics can largely be explained by observed and unobserved individual characteristics. As a consequence, the extent of true state dependence is estimated to be rather small for a randomly selected individual (or an average individual). However, average characteristics may not well reflect the population of individuals accepting a start-up subsidy. These individuals may, for instance, have higher-than-average permanent preferences for self-employment. In our model, permanent preferences are captured, in particular, by the initial labor market state that represents the endowment at the start of the observation period. In order to investigate how state dependence varies with permanent preferences (and other unobserved initial endowments such as heterogeneity in access to capital or in coming up with a business idea), we therefore calculate transition probabilities setting the initial labor market state to solo self-employment. In doing so,

we obtain transition probabilities for individuals with non-average characteristics that may better reflect the population of solo self-employed workers than do average characteristics. Table 7 shows that the probability of persistence in solo self-employment is considerably higher in this case. The estimated probability of staying solo self-employed amounts to 71% compared to only 16% when averaging over the initial conditions. Correspondingly, the extent of true state dependence is substantially larger for these non-average individuals compared to average individuals. In particular, for this population of workers with non-average characteristics, true state dependence in solo self-employment amounts to about 42 percentage points when paid employment is the references state, compared to only 13 percentage points for randomly selected individuals. These figures imply that start-up subsidies that target non-average individuals with specific initial endowments may have more pronounced effects on the future labor market state choices than subsidies for randomly selected individuals.

[Table 7 about here]

Next, we check whether the parsimonious dynamic model with just one lag is too restrictive to capture the role played by the past on current labor market choices. In particular, the extent of state dependence may vary with accumulated labor market experience in each state. For example, a worker who was already solo self-employed in period $t-2$ may exhibit greater state dependence than a worker who was paid employed in period $t-2$, ceteris paribus, because of the differences in accumulated experience in that state. We estimate a more flexible, dynamic model that includes second-order lags of the labor market states on the right-hand side of the estimation equation to investigate this issue. Generally, the results confirm the findings from the first-order dynamic model.[9] Panel A of Table 8 shows that the predicted transition probabilities for an average individual are quite similar to those from the model with only one lag. For instance, the probability of staying solo self-employed amounts to 18% compared to 16%, and the transition probability

[9] We present results for men only because the estimation of the second-order dynamic model did not converge for women.

to employership amounts to 8% compared to 9% in the model with one lag. We conclude that the first-order dynamic model is not overly restrictive.

[Table 8 about here]

Nevertheless, the second-order dynamic model offers additional insights into heterogeneities of state dependence in solo self-employment with respect to the labor market state in period $t-2$. In particular, we investigate how transition probabilities from solo self-employment in period $t-1$ vary with the labor market state in period $t-2$. In doing so, we are able to asses whether transition probabilities vary with experience in the respective labor market states. Panels B to D in Table 8 show the resulting transition probabilities. In general, we find substantial heterogeneity in transition probabilities with respect to the second-order lag. In particular, persistence in solo self-employment is larger for individuals who were already solo self-employed two years ago (Panel B) than for individuals who newly enter solo self-employment from paid employment (Panel C) or non-employment (Panel D). For individuals who were solo self-employed two years ago, the probability of staying solo self-employed in the current year amounts to 30%. For those newly entering solo self-employment from paid employment, the respective probability amounts to only 17.8%. New entries from non-employment stay solo self-employed with probability 25.5%. Interestingly, those who enter solo self-employment from paid employment have (slightly) higher transition probabilities to employership than those entering from non-employment, namely, 7.2% and 6.5%, respectively. Entries from paid employment may be by so-called opportunity entrepreneurs whose businesses grow faster than those of so-called necessity entrepreneurs who enter from non-employment. Overall, these figures from the second-order dynamic model once again show that the expected effect of promoting self-employment substantially depends on whether we consider a random individual or individuals with a specific labor market history.

5 Conclusions

This paper studied the dynamics of solo self-employment using data from the German SOEP 2000 to 2012. Looking at actual transitions, we found considerable persistence in solo self-employment, albeit much lower than in paid employment. After five years, about a third of those initially solo self-employed are still solo self-employed. In addition, transition rates to employership are much higher from solo self-employment than from paid employment or non-employment.

Multivariate analyses using dynamic multinomial logit models with random effects showed, however, that these dynamics are primarily due to spurious rather than true state dependence, i.e., they are mainly caused by selection into self-employment based on observed and unobserved individual characteristics. The genuine effect of experiencing solo self-employment on future solo self-employment or employership is small and generally not lasting longer than one year.

These findings are consistent with the view that individuals predominantly enter entrepreneurship on a small scale, i.e., as solo self-employed, in order to learn about their aptitude for entrepreneurship (see, e.g., Jovanovic 1982). After having discovered their entrepreneurial talent, they either expand their business, moving to employership, or switch back to paid employment accordingly. On the other hand, individuals may also increase their entrepreneurial ability by working in self-employment (cf., e.g., Minniti and Bygrave 2001) but if "learning by doing" played a major role, the extent of true (cross) state dependence should probably be higher.

The fact that we find little true state dependence in solo self-employment also implies that policy measures that bring individuals into solo self-employment, like the German *Gründungszuschuss*, a start-up subsidy for the unemployed, may have predominantly short-run effects. They might incentivize individuals to work in self-employment as long as these subsidies are paid but the incentive is expected to disappear after the program ended. As true cross state dependence from solo self-employment to employership is also low, expectations for yielding a

"double dividend" by turning unemployed into self-employed who later become employers and create jobs for others seem questionable.

However, our results also show that true state dependence is heterogeneous with respect to preferences and past labor market experience. Calculating transition probabilities for non-average individuals (e.g., workers who may have a higher-than-average taste for solo self-employment) that may better reflect the population of solo self-employed workers than randomly selected individuals, we find a substantially larger extent of true state dependence than for randomly selected individuals. Therefore, start-up subsidies that target such non-average individuals may have lasting effects after all.

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Tables and Figures

Table 1
Observed distribution of labor market states by year

	Labor market status			
Year	Solo self-employed	Employership	Paid employment	Non-employment
A. Males				
2001	4.27	5.62	79.69	10.42
2002	3.72	6.26	78.58	11.44
2003	4.21	6.20	77.36	12.24
2004	4.82	6.12	77.38	11.69
2005	4.66	6.18	77.28	11.87
2006	5.31	6.26	76.85	11.58
2007	4.68	6.65	78.87	9.80
2008	4.56	6.17	79.39	9.88
2009	4.74	6.04	79.36	9.86
2010	5.33	5.85	79.84	8.99
2011	5.14	6.32	80.24	8.30
2012	5.32	6.50	79.74	8.44
Total	4.61	6.15	78.51	10.72
B. Females				
2001	2.58	1.77	63.92	31.73
2002	2.63	1.60	64.43	31.34
2003	2.81	1.37	64.86	30.95
2004	2.70	1.66	65.54	30.11
2005	3.10	1.67	65.83	29.40
2006	3.68	1.62	66.83	27.87
2007	3.44	1.51	69.45	25.59
2008	3.08	2.03	71.33	23.56
2009	3.65	1.48	72.32	22.55
2010	3.31	1.49	73.18	22.02
2011	3.21	1.86	73.89	21.03
2012	2.88	1.85	75.83	19.45
Total	3.03	1.64	67.72	27.61

Note: Percentage of individuals.
Source: SOEP v29, 2000-2012.

Table 2
Descriptive statistics by gender and labor market state

	Solo self-employment		Employership		Paid employment		Non-employment		All states	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
A. Males										
Age	47.43	9.29	46.69	8.97	44.88	9.20	48.16	10.25	45.46	9.38
Education (years)	13.27	2.81	13.34	2.92	12.16	2.51	11.14	2.17	12.18	2.57
Risk attitude (0=low to 10=high)	5.37	1.75	5.65	1.61	4.82	1.61	4.59	1.77	4.87	1.66
Immigrant (0/1)	0.11	0.31	0.12	0.32	0.17	0.38	0.25	0.44	0.17	0.38
Father self-employed: no	0.80	0.40	0.72	0.45	0.81	0.39	0.76	0.43	0.80	0.40
Father self-employed: yes	0.10	0.31	0.17	0.38	0.05	0.23	0.04	0.19	0.06	0.24
Father self-employed: missing	0.10	0.30	0.11	0.31	0.14	0.34	0.20	0.40	0.14	0.35
Married (0/1)	0.64	0.48	0.73	0.44	0.73	0.44	0.63	0.48	0.72	0.45
No. of children	0.56	0.87	0.81	1.06	0.77	1.01	0.56	0.94	0.74	1.00
Lagged net household income (in Euro)	2929	1667	3974	2708	2848	1247	1605	868	2786	1453
Lagged household size	2.72	1.20	3.05	1.30	3.02	1.31	2.74	1.35	2.97	1.31
IC: Solo self-employment (0/1)	0.49	0.50	0.08	0.28	0.01	0.10	0.02	0.14	0.04	0.19
IC: Employership (0/1)	0.15	0.36	0.68	0.47	0.01	0.10	0.01	0.11	0.06	0.23
IC: Paid employment (0/1)	0.30	0.46	0.22	0.41	0.95	0.22	0.57	0.50	0.83	0.37
IC: Non-employment (0/1)	0.06	0.24	0.01	0.12	0.03	0.18	0.40	0.49	0.07	0.26
No. of person-year observations	1,744		2,326		29,684		4,055		37,809	
B. Females										
Age	46.06	9.12	45.88	8.75	44.63	9.09	45.85	11.2	45.03	9.73
Education (years)	13.22	2.71	14.15	2.96	11.96	2.24	11.18	2.16	11.82	2.31
Risk attitude (0 = low to 10=high)	5.00	1.56	4.80	1.78	4.06	1.58	3.73	1.68	4.01	1.63
Immigrant (0/1)	0.07	0.26	0.12	0.32	0.16	0.36	0.24	0.43	0.18	0.38
Father self-employed: no	0.81	0.39	0.66	0.47	0.81	0.39	0.76	0.43	0.79	0.41
Father self-employed: yes	0.09	0.29	0.11	0.32	0.05	0.23	0.06	0.23	0.06	0.23
Father self-employed: missing	0.10	0.30	0.23	0.42	0.14	0.34	0.19	0.39	0.15	0.36
Married (0/1)	0.67	0.47	0.72	0.45	0.70	0.46	0.82	0.39	0.73	0.44
No. of children	0.70	0.97	0.74	0.99	0.63	0.88	1.02	1.18	0.74	0.99
Lagged net household income (in Euro)	2790	1692	4088	2443	2751	1305	2311	1332	2652	1377
Lagged household size	2.77	1.24	2.89	1.21	2.85	1.16	3.27	1.37	2.96	1.24
IC: Solo self-employment (0/1)	0.45	0.50	0.18	0.39	0.01	0.09	0.01	0.11	0.03	0.16
IC: Employership (0/1)	0.08	0.27	0.57	0.49	0.00	0.06	0.01	0.07	0.02	0.13
IC: Paid employment (0/1)	0.28	0.45	0.18	0.39	0.84	0.37	0.30	0.46	0.66	0.47
IC: Non-employment (0/1)	0.19	0.39	0.06	0.23	0.15	0.36	0.68	0.47	0.3	0.46
No. of person-year observations	1,296		704		29,007		11,829		42,836	

Source: SOEP v29, 2000-2012. IC: denotes initial conditions.

Table 3
Estimation results for males

Variable	Solo self-employment		Employership		Paid employment	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Fixed part						
Solo in t-1	3.312***	0.239	2.665***	0.278	-1.637***	0.221
Employer in t-1	2.755***	0.349	3.702***	0.351	-0.821*	0.326
Non-employment in t-1	0.311	0.211	-0.911*	0.365	-2.148***	0.083
Ln HH income in t-1	-0.372	0.208	-0.005	0.233	-0.556***	0.114
Ln HH size in t-1	0.656*	0.285	0.608*	0.309	0.653***	0.146
Age	0.233**	0.072	0.308***	0.088	0.232***	0.030
Age squared	-0.003***	0.001	-0.004***	0.001	-0.003***	0.000
Education (years)	0.194***	0.038	0.133**	0.046	0.033	0.020
Married (0/1)	-0.164	0.336	0.014	0.363	-0.253	0.173
Children (0/1)	-0.088	0.142	-0.024	0.154	-0.164*	0.067
Immigrant (0/1)	-0.117	0.272	-0.098	0.343	-0.309**	0.113
Father SE: YES	0.389	0.343	1.315***	0.390	-0.201	0.193
Father SE: MV	-0.200	0.280	0.194	0.355	-0.086	0.111
Avg. risk attitude	0.218***	0.055	0.286***	0.070	-0.011	0.024
Solo in t=0	5.400***	0.547	4.733***	0.610	-1.679***	0.311
Employer in t=0	4.604***	0.560	8.081***	0.708	-1.559***	0.345
Non-working in t=0	-0.449	0.347	-0.713	0.562	-2.095***	0.144
M: Ln HH inc in t-1	3.204***	0.334	4.615***	0.398	3.511***	0.171
M: Ln HH size in t-1	-2.188***	0.464	-3.839***	0.566	-2.626***	0.221
M: Married	0.366	0.440	0.702	0.516	0.839***	0.214
M: Children	0.288	0.214	0.841***	0.248	0.515***	0.098
Random part						
$Var(a_{ij})$	5.404	0.867	9.131	1.408	2.139	0.209
$Cov(a_{i,Solo}, a_{i,Empl.})$	5.249	0.938				
$Cov(a_{i,Solo}, a_{i,Paid})$	-0.052	0.322				
$Cov(a_{i,Empl.}, a_{i,Paid})$			-0.104	0.460		
log likelihood			-10369.915			
No. of person-year observations			37,809			

Note: Dynamic multinomial logit model with random effects. The reference category of the dependent variable is non-employment. Additional dummy variables for the year of the survey and for the federal state are included. Dependent variable: labor market state (solo self-employment, employership, paid employment). M: denotes individual-specific averages of a variable. Significance level: *<0.1, **<0.05, ***<0.01.
Source: SOEP v29, 2000-2012.

Table 4
Estimation results for females

Variable	Solo self-employment		Employership		Paid employment	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Fixed part						
Solo in t-1	2.906***	0.228	2.274***	0.343	-1.593***	0.194
Employer in t-1	3.038***	0.401	4.731***	0.443	-1.180**	0.376
Non-employment in t-1	-0.366	0.191	-0.748*	0.340	-2.642***	0.056
Solo in t=0	4.994***	0.507	3.238***	0.663	-1.731***	0.296
Employer in t=0	2.885***	0.591	4.459***	0.821	-2.029***	0.417
Non-working in t=0	-0.746**	0.266	-1.346***	0.399	-2.244***	0.099
Ln HH income in t-1	-0.219	0.228	-0.155	0.308	-0.776***	0.088
Ln HH size in t-1	1.317***	0.350	1.575***	0.467	1.523***	0.127
Age	0.373***	0.075	0.210*	0.094	0.425***	0.025
Age squared	-0.005***	0.001	-0.003**	0.001	-0.005***	0.000
Education (years)	0.211***	0.039	0.211***	0.045	0.001	0.016
Married (0/1)	0.127	0.289	-1.071**	0.379	-0.800***	0.110
Children (0/1)	-0.523***	0.145	-0.525**	0.201	-0.689***	0.050
Immigrant (0/1)	-0.522	0.282	-0.081	0.328	-0.103	0.089
Father SE: YES	0.761*	0.336	0.436	0.409	0.160	0.142
Father SE: MV	0.131	0.278	0.729*	0.316	-0.216*	0.094
Avg. risk attitude	0.277***	0.056	0.262***	0.068	0.035	0.020
M: Ln HH inc in t-1	0.825*	0.339	2.029***	0.418	2.011***	0.130
M: Ln HH size in t-1	-1.700**	0.535	-1.552*	0.668	-1.960***	0.193
M: Married	-0.578	0.406	0.452	0.511	0.095	0.151
M: Children	0.268	0.221	0.099	0.280	0.368***	0.076
Random part						
$Var(a_{ij})$	5.720	0.810	4.727	1.097	2.554	0.172
$Cov(a_{i,Solo}, a_{i,Empl.})$	3.787	0.769				
$Cov(a_{i,Solo}, a_{i,Paid})$	1.137	0.513				
$Cov(a_{i,Empl.}, a_{i,Paid})$			0.451	0.304		
log likelihood			-14173.247			
No. of person-year observations			42,836			

Note: Dynamic multinomial logit model with random effects. The reference category of the dependent variable is non-employment. Additional dummy variables for the year of the survey are included. Dependent variable: labor market state (solo self-employment, employership, paid employment). M: denotes individual-specific averages of a variable. Significance level: *<0.1, **<0.05, ***<0.01.
Source: SOEP v29, 2000-2012.

Table 5
Average predicted probabilities of labor market transitions

State at time $t-1$	State at time t							
	Solo self-employment		Employership		Paid employment		Non-Employment	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
A. Males								
Solo	0.156	0.016	0.090	0.008	0.610	0.024	0.144	0.016
Employer	0.079	0.009	0.124	0.010	0.693	0.023	0.104	0.018
Paid	0.023	0.003	0.038	0.003	0.858	0.004	0.081	0.003
Non-Employed	0.060	0.006	0.041	0.006	0.671	0.010	0.228	0.009
B. Females								
Solo	0.107	0.012	0.030	0.006	0.563	0.025	0.300	0.022
Employer	0.077	0.013	0.124	0.033	0.560	0.049	0.238	0.037
Paid	0.015	0.002	0.006	0.001	0.802	0.005	0.177	0.005
Non-Employed	0.028	0.003	0.009	0.002	0.487	0.008	0.475	0.008

Note: Calculations are based on the results in Tables 3 and 4. Standard errors are calculated using the Delta method.

Table 6
True state dependence and cross state dependence in solo self-employment

Alternative state	True state dependence		Cross state dependence	
A. Males				
Paid employment	0.133	(0.017)	0.051	(0.009)
Non-employment	0.096	(0.017)	0.049	(0.009)
B. Females				
Paid employment	0.092	(0.013)	0.024	(0.007)
Non-employment	0.079	(0.013)	0.021	(0.007)

Note: Calculations are based on the results in Table 5. Standard errors are calculated using the Delta method.

Table 7
Predicted probabilities of labor market transitions setting the initial condition to solo self-employment

State at time $t-1$	State at time t							
	Solo self-employment		Employership		Paid employment		Non-employment	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Panel A: Males								
Solo	0.711	0.025	0.139	0.018	0.096	0.016	0.053	0.010
Employer	0.517	0.035	0.265	0.030	0.173	0.027	0.045	0.012
Paid	0.291	0.040	0.099	0.019	0.522	0.043	0.088	0.015
Non-Employe	0.527	0.043	0.080	0.021	0.231	0.031	0.163	0.025
Panel B: Females								
Solo	0.649	0.032	0.080	0.015	0.140	0.021	0.131	0.019
Employer	0.472	0.050	0.319	0.055	0.118	0.029	0.091	0.024
Paid	0.250	0.037	0.033	0.012	0.531	0.043	0.185	0.026
Non-Employe	0.349	0.041	0.044	0.014	0.203	0.028	0.405	0.040

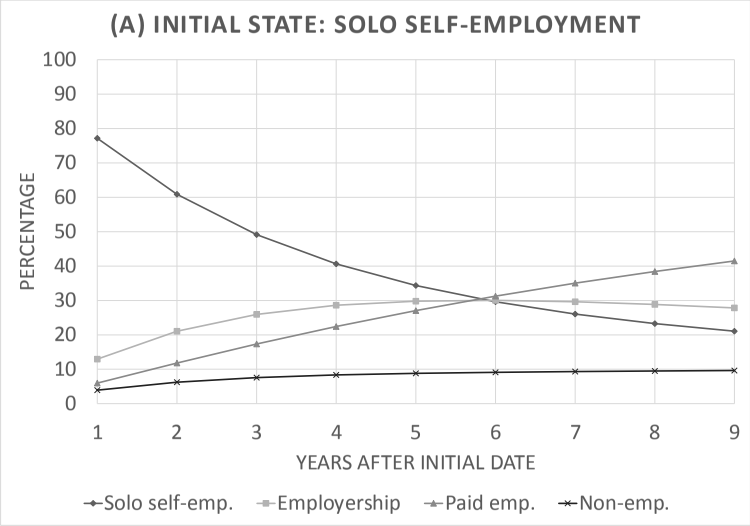
Note: Calculations are based on the results in Tables 3 and 4. Standard errors are calculated using the Delta method.

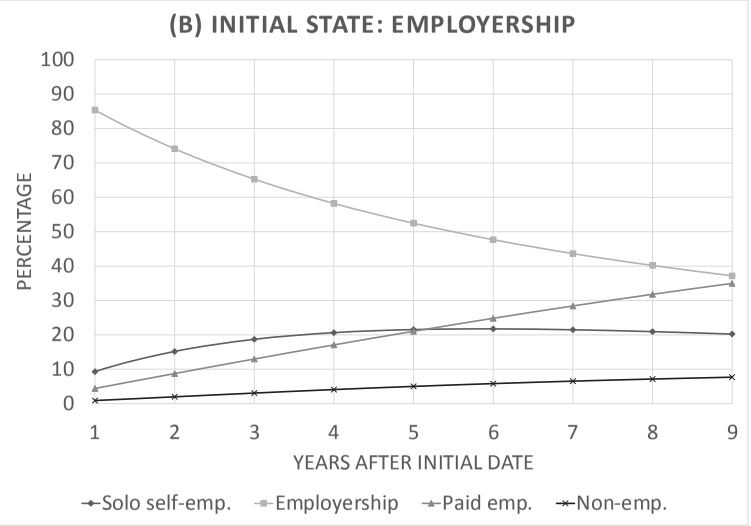
Table 8
Predicted probabilities of labor market transitions (second-order dynamic model)

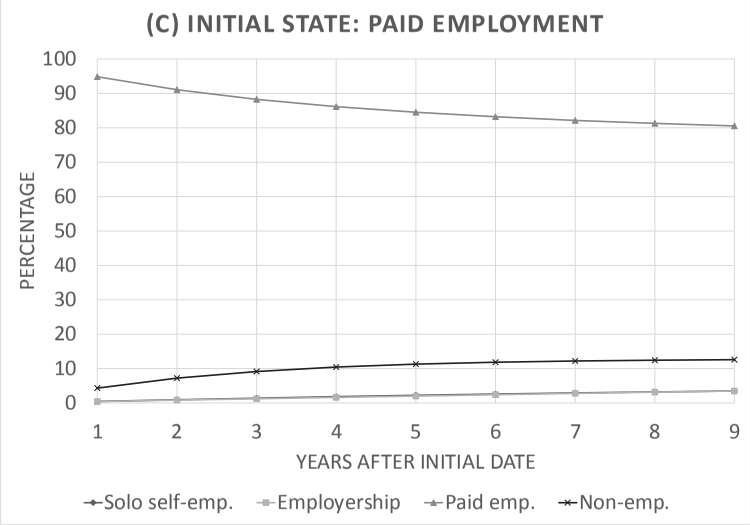
State at time $t-1$	State at time t							
	Solo self-employment		Employership		Paid employment		Non-employment	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
A. Average characteristics								
Solo	0.182	0.025	0.081	0.008	0.582	0.034	0.155	0.020
Employer	0.080	0.012	0.115	0.011	0.707	0.027	0.099	0.021
Paid	0.021	0.003	0.040	0.003	0.861	0.005	0.078	0.003
Non-Employed	0.063	0.007	0.044	0.006	0.647	0.013	0.246	0.012
B. State in $t-2$: solo self-employment								
Solo	0.300	0.052	0.098	0.016	0.440	0.054	0.161	0.025
Employer	0.141	0.026	0.158	0.022	0.593	0.046	0.108	0.026
Paid	0.035	0.005	0.046	0.005	0.825	0.017	0.094	0.014
Non-Employed	0.111	0.018	0.049	0.010	0.555	0.038	0.284	0.033
C. State in $t-2$: paid employment								
Solo	0.178	0.025	0.073	0.009	0.598	0.034	0.152	0.021
Employer	0.075	0.012	0.107	0.011	0.725	0.028	0.093	0.021
Paid	0.017	0.003	0.029	0.004	0.884	0.006	0.070	0.003
Non-Employed	0.058	0.008	0.035	0.007	0.665	0.013	0.242	0.012
D. State in $t-2$: non-employment								
Solo	0.255	0.040	0.065	0.014	0.491	0.044	0.189	0.025
Employer	0.120	0.022	0.106	0.019	0.648	0.038	0.125	0.027
Paid	0.028	0.005	0.030	0.006	0.840	0.008	0.102	0.005
Non-Employed	0.088	0.014	0.032	0.008	0.571	0.022	0.309	0.020

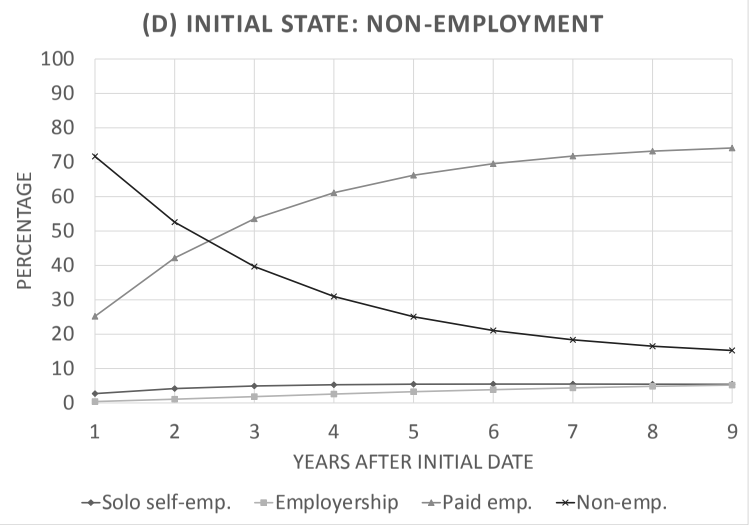
Note: Standard errors are calculated using the Delta method.

Figure 1
Observed probabilities of labor market state conditional on labor market state t years ago for males



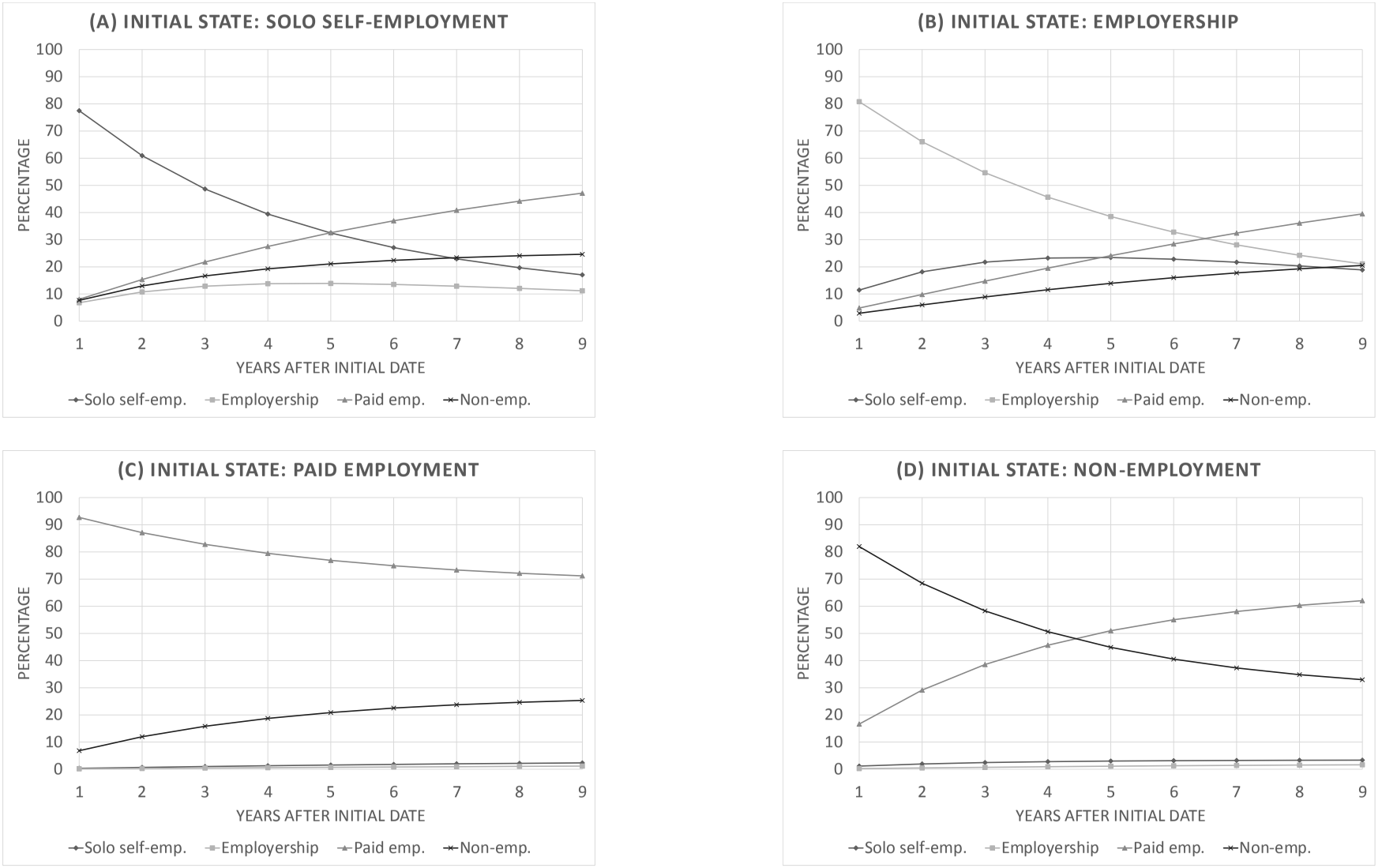






Source: SOEP v29, 2000-2012.

Figure 2
Observed probabilities of labor market state conditional on labor market state t years ago for females



Source: SOEP v29, 2000-2012.

Figure 3
Impulse response functions: Effect of a temporary shock moving individuals into solo self-employment on subsequent labor market state for males

Source: SOEP v29, 2000-2012.

Figure 4
Impulse response functions: Effect of a temporary shock moving individuals into solo self-employment on subsequent labor market state for females

Source: SOEP v29, 2000-2012.

A Appendix

This appendix shows how our estimates can be used to calculate true state dependence in self-employment as a whole, which merges solo self-employment *and* employership. True state dependence in self-employment, SE, is

$$TSD_{SE.PE} = P(SE_t|SE_{t-1}) - P(SE_t|PE_{t-1}) \tag{5}$$

where paid employment, PE, is the reference state. The second term on the right-hand side of equation 5 is

$$\begin{aligned} P(SE_t|PE_{t-1}) &= P(solo_t \cup employer_t|PE_{t-1}) \\ &= P(solo_t|PE_{t-1}) + P(employer_t|PE_{t-1}), \end{aligned} \tag{6}$$

because labor market states are mutually exclusive so that $P(solo_t \cap employer_t|PE_{t-1}) = 0$. Our model provides estimates of $P(solo_t|PE_{t-1})$ and $P(employer_t|PE_{t-1})$. Similarly, the first term on the right hand side of equation 5 can be written as

$$P(SE_t|SE_{t-1}) = P(solo_t|SE_{t-1}) + P(employer_t|SE_{t-1}), \tag{7}$$

where we have, however, no estimates for the transition probabilities $P(solo_t|SE_{t-1})$ and $P(employer_t|SE_{t-1})$. Using the definition of the conditional probability,

$$P(solo_t|SE_{t-1}) = \frac{P(solo_t \cap SE_{t-1})}{P(SE_{t-1})}. \tag{8}$$

Using the law of total probability and the fact that $solo_{t-1}$ and $employer_{t-1}$ imply SE_{t-1}, we have

$$P(solo_t \cap SE_{t-1}) = P(solo_t \cap SE_{t-1}|solo_{t-1}) \cdot P(solo_{t-1}) + P(solo_t \cap SE_{t-1}|employer_{t-1}) \cdot P(employer_{t-1})$$

$$= P(solo_t|solo_{t-1}) \cdot P(solo_{t-1}) + P(solo_t|employer_{t-1}) \cdot P(employer_{t-1}).$$

We use the steady state values for being in a certain labor market state as estimates of the marginal probabilities $P(solo_{t-1})$ and $P(employer_{t-1})$. Furthermore,

$$P(SE_{t-1}) = P(solo_{t-1} \cup employer_{t-1})$$

$$= P(solo_{t-1}) + P(employer_{t-1}),$$

because labor market states are mutually exclusive. Therefore,

$$P(solo_t|SE_{t-1}) = \frac{0.156 \cdot 0.034 + 0.079 \cdot 0.044}{0.034 + 0.044} = 0.112. \tag{9}$$

Analogous considerations apply to $P(employer_t|SE_{t-1})$. Finally, true state dependence in self-employment is

$$TSD_{SE.PE} = P(solo_t|SE_{t-1}) - P(solo_t|PE_{t-1}) + P(employer_t|SE_{t-1}) - P(employer_t|PE_{t-1})$$

$$= 0.112 - 0.023 + 0.109 - 0.038 = 0.160.$$