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von Harald Habermann

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Business takeovers and firm growth: Empirical evidence from a German panel

Harald Habermann[1]

Abstract

The present article links business takeovers to the literature on serial autocorrelation of growth rates. The aim of the study is to identify the effects of successions on the performance of small German firms by analysing the growth pathways over a period of eight years after business takeover. Using panel data from 1,872 firms, the present article shows that for the first two years after a business takeover, small firms are subject to negative serial correlation of growth rates regarding employment. The analysis underlines the importance of longitudinal data to provide evidence on changes in the behaviour of a firm following a business takeover.

Keywords: Business takeovers, successions, autocorrelation, panel data, small firms

JEL classification: L25, M13, M21

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Introduction

As the population in many industrialised countries ages and many business owners approach retirement (Levesque & Minniti 2011), the relevance of business takeovers will increase in the next years. An increasing amount of business owners will search for a successor outside of the family or their business (Scholes et al. 2009; Van Teeffelen 2010). The demographic change also affects the supply of potential entrepreneurs, as studies show an inverse U-shaped relationship between age and the decision to become an entrepreneur (Bönte et al. 2009; Evans & Leighton 1989; Levesque & Minniti 2011). Estimates (Müller et al. 2011) suggest that the number of business takeovers will rise continuously until 2020, whereas the potential of future successors tends to decline at the same time. If business owners do not find successors for their firms, the economic value of these businesses may be lost, with negative implications for employment, entrepreneurial experience and economic growth (Block et al. 2013).

However, little research has been conducted on the development of a firm after such a takeover. As Block et al. (2013: p. 1116) state that "it would be intriguing to learn more about firm […] performance across […] modes of entry. […] A longitudinal design can help to answer these questions". Thus, the research question of the present article is how small firms develop after a change in ownership.

The present article divides between new venture start-ups and taking over an existing firm as ways to become an entrepreneur. For taking over an existing firm different options are available (Scholes et al. 2008; Stavrou 1999; Zellweger et al. 2011; Block et al. 2013). First, transition of ownership and management within a family; second, the firm can be sold to another firm through a trade sale; third, the firm can be floated on a stock exchange; fourth, the firm can be sold to members of the existing management team (MBO) and finally, the firm can be sold to an external management team (MBI).Whereas studies on the performace of new ventures are primarily found in the entrepreneurship literature, studies of takeovers are

mainly found in the family business literature related to firm successions (Bennedsen et al. 2007; Chua et al. 2003; Molly et al. 2010). To the best knowledge of the author there are no articles about the firm performance of small firms after MBI respectively MBO. This could be due to the fact that MBI and MBO are feasible options for larger firms but not for small ones. Therefore, the literature review focuses on family businesses bearing in mind that other forms of takeovers exist.

The present article defines business takeover as the process of transfer of ownership of an owner-managed firm to an individual including personnel change in the management (Ullrich & Werner 2013). This definition includes both within- and outside family takeovers. Due to data restrictions the different modes of takeovers cannot be distinguished in the empirical section of the present article.

Using the Start-Up Panel of the German state of North Rhine-Westphalia (NRW), the present article contributes to the literature on business takeovers, adjustment costs and serial correlation in three ways: First, the literature on business takeovers so far has mainly focused on the reasons for the mode of entrepreneurship. The present article provides first empirical evidence of the growth pathways of firms that were taken over by an individual. It is likely that adjustment costs influence this growth process.

Second, a major shortcoming of past empirical studies on business takeovers is that they tend to rely on cross-sectional data. A meta-analysis of studies of firm growth published between 1992 and 2006 shows that "rarely did a study use two or more time spans for calculating growth" (Shepherd & Wiklund 2009: p. 108). After 2006, only few longitudinal studies on the dynamics of new ventures in general (Lejárraga & Oberhofer 2015; Federico & Capelleras 2015; Triguero et al. 2014) and particular on growth trajectories (Anyadike-Danes et al. 2015) were published. This shows that the literature on growth trajectories is quite sparse (Brenner & Schimke 2014; Habermann & Schulte 2016). Cross-sectional data can only provide a static description of a succession but cannot analyse the dynamics behind such a process. A

longitudinal research design is crucial to understand the relationship between business takeovers and firm performance. Therefore, the present article follows such a longitudinal approach based on panel data.

Third, the present article adds to the literature on serial correlation of imitative, subsistence-oriented firms. Similar to the results on organic growth (Habermann & Schulte 2016), after a business takeover a negative serial correlation is observed showing a picture of erratic growth dynamics. This means that after a business takeover, small firms that grew rapidly in one year are unlikely to repeat this kind of performance the following year. Thus, growth in period t-1 can be a rather good predictor for growth in period t.

In the remainder of this paper, the theory, hypotheses, methodology and results are presented followed by a discussion of the implications and limitations of the study.

Literature review on firm performance after business takeover

The present article analyses the growth of small firms after business takeover and does not compare the development of new ventures with the development of business takeovers. Therefore, the literature review focuses entirely on firm performance after business takeover. So far, empirical studies on the growth after business takeover compared the performance of firms that were handed over to a family member to firms that were transferred to a non-family member. The empirical results for the firm performance after business takeover are mixed.

Using data from 335 publicly traded companies, Perez-Gonzalez (2006) shows that firms, where the incoming Chief Executive Officer (CEO) is related by blood or marriage to a founder or a large shareholder, underperform relative to firms that promote unrelated CEOs. The study finds that within the first three years after business takeover returns on assets are for a firm with a related CEO 18 percent and market-to-book ratios 14 percent lower than firms with unrelated CEOs. Smith & Amoako-Adu (1999) find a similar result for 124 family controlled firms in Canada. Stock prices declined by 3.20 percent during a three-day event

window when family successors are appointed. In contrast, no significant change in stock prices was found when non-family successors were appointed. Using a dataset with 5,334 business takeovers in Denmark, Bennedsen et al. (2007) observe that family successions have a negative impact on firm performance. Operating profitability on assets fell by at least four percentage points around CEO transitions. Cucculelli & Micucci (2006) analyse small- and medium-sized private firms in Italy, which run as family businesses and show a decrease in the performance after takeover. This decrease appears to be mainly concentrated within firms that, before the succession, outperformed the sectoral average profitability. Morck et al. (2000) find that Canadian firms controlled by heirs of the founder show lower profitability than firms, which are run by individuals outside of the family. Using data on all Fortune-500 firms during 1994 and 2000, Villalonga & Amit (2006) show a negative effect of descendant-CEOs on firm value.

In contrast, Anderson & Reeb (2003) find for the Standard & Poors 500 firms as of 1992 a positive performance effect when family members serve as CEOs relative to outside CEOs. A similar result is found by McConaughy et al. (1998) who argue that descendant-controlled firms are more efficient than founder-controlled firms. The former generate significantly higher sales growth rates, sales per employee and cash flow per employee than the latter ones, indicating that successors were able to enhance firm performance. Using panel data from the US cement industry, Tushman & Rosenkopf (1996) show that CEO succession is positively associated with subsequent organisational performance if environmental turbulences are held constant. Sraer & Thesmar (2007) analyse a sample of 750 French firms that are on the French stock market and do not find a significant difference in firm performance of founder- and descendant-controlled firms. However, both types of firms are related to better performance than firms that are run by unrelated CEOs. Using panel data on 1,101 Austrian firms, Diwisch et al. (2009) find a significant and positive effect of business takeovers on employment growth, which becomes stronger over time. The effect amounts to 15 percentage

points over a six year period. Werner et al. (2010) observe for German small firms that the successors manage, with a simultaneous reduction of employment, to enter new opportunities for growth, which is reflected in higher revenue growth rates and optimistic revenue and profit expectations. Using panel data for 153 small- and medium sized Belgian firms, Molly et al. (2010) study the impact of a family business transfer on the financial structure and performance. Transfer from the first to the second generation negatively influences the debt rate of the firm, whereas in successions between later generations this effect is reversed. With respect to the growth of the firm, for first-generation firms the growth rate decreases after the business takeover, whereas in next generation firms no effect on the growth can be identified.

The present article differs from these studies in three ways. First, whereas most studies mentioned above focus mainly on large publicly traded firms, this article focuses on small- and medium sized firms because they constitute the majority of firms in Germany. It is likely that the process of transition is different for these firms. Second, the focus on small German firms also implies that stock values as performance measures cannot be used because these firms are not publicly traded firms. Instead, the present article analyses the consequences of business takeovers on the growth of employment. Third, due to lack of data the present article does not differentiate between family and non-family business takeovers.

The relationship between adjustment costs and growth of employment

There is a debate about the randomness of firm growth rates (Coad 2012; Coad et al. 2013; 2015; Derbyshire & Garnsey 2014; 2015). This debate is based on earlier discussion about Gibrat's (1931) Law of proportionate effects. However, instead of the traditional size-growth relationship, the focus is now on the degree of serial correlation of growth rates (Coad & Hölzl 2009; Coad 2007; Fotopoulos & Giotopoulos 2010; Hölzl 2014). As noted by Stam (2010), this reappraisal of Gibrat's Law has resulted in two different strands. First, an approach that suggests that growth is characterised as a close-to-random process and, thus,

one would expect a null correlation between past and current growth (Coad et al. 2013; Geroski 2005; Storey 2011). Second, the growth of firms is considered to depend on past events (Barney & Zajac 1994; Dierickx & Cool 1989), thus, serial correlation of growth rates exist. In the present article serial correlation and autocorrelation are used synonymously.

The literature on serial correlation of growth rates presents heterogeneous results. Positive autocorrelation has been shown for UK quoted firms (Chesher 1979; Geroski et al. 1997), for manufacturing firms in Germany (Wagner 1992) for Austrian farms (Weiss 1998) and for US manufacturing firms (Bottazzi & Secchi 2003). In contrast, negative serial correlation has been found in studies for German firms (Boeri & Cramer 1992), for quoted Japanese firms (Goddard et al. 2002) and for Italian and French manufacturing firms (Bottazzi et al. 2007; Bottazzi et al. 2009). There are also studies that fail to find any significant serial correlation in growth rates, for example for selected Italian manufacturing sectors (Bottazzi et al. 2002) and for the US automobile industry (Geroski & Mazzucato 2002).

In general, it seems that there is no clear pattern emerging regarding the serial correlation of the growth rates of firms (Habermann & Schulte 2016). However, this changed with the findings of Coad (2007) and Coad & Hölzl (2009), who find that serial correlation is strongly negative for small firms, whereas larger firms show positive serial correlation (Daunfeldt & Halvarsson 2015). Thus, the inconclusive results of the studies on autocorrelation of growth rates can be explained that previous studies have used datasets that include both small and large firms.

In evolutionary economics, established routines and organisational inertia are used to explain why after business takeover a positive serial correlation is expected since the change in ownership does not modify significantly the way the firm operates in the short run (Coad, 2009). In contrast, other scholars (Cooper & Haltiwanger 2006; Hamermesh & Pfann 1996) argue that at the micro level adjustment costs influence the growth pathway of firms and, therefore, are related to serial correlation. After business takeover, the successor undertakes

various changes to realign the firm. The structural changes in the business strategy are related to the firms' internal structures, which include the reorganisation of work processes, changes in business operations, in innovation efforts and in the product range. The successors often change business partners and find access to international markets (Gottschalk et al. 2010). Table 1 provides an overview about these changes in the internal and external structure.

Table 1: Changes in the internal and external structure of a firm after business takeover

Changes in the internal structure of the firm			Changes in the external business relationship	
Work organisation	Business operation	Products and processes	External business partners	Access to new markets
• Hierarchy • Work time models • Remuneration models • Hiring or dismissal of employees	• Purchasing • Production • Marketing and sales • Human resources • Finance, accounting and controlling	• New production processes • New products and services • Market innovation	• Acquisition of new customers • Acquisition of new suppliers • Cancellation of contracts with existing suppliers • Change of the regular bank • Acquisition of new investors • Hiring new consultants	• Local • National • European Union • Other countries

Source: Gottschalk et al. (2010)

These changes involve adjustment costs, which consist of the time and effort required to integrate operations when changing the activities of the firm. Especially external successors need to get to know the existing structures (Cater & Justis 2009), which takes time. The period immediately after takeover is critical for all successors because they still need to acquire firm-specific knowledge and may also need a general introduction to the management of a firm. Consequently, the successors may not be able to run the firm in the same manner as

their predecessors. Against this background, it is interesting to analyse how certain corporate performance indicators, such as the growth of employment, develop over time (Moog et al. 2012).

Neoclassic theory assumes that firms have a target size that they tend towards. A positive autocorrelation of growth rates is related to convex adjustment costs because they prevent firms from immediately attaining their chosen size and lead to a gradual adjustment over time. In contrast, non-convex adjustment costs prohibit firms from instantly attaining their ideal size and are more related to the empirical evidence that employment change is non-smooth (Hamermesh & Pfann 1996). If non-convex adjustment costs play an important role a negative autocorrelation in growth rates is expected (Coad & Hölzl, 2009). This means that after positive growth, immediate subsequent further positive growth is rather unlikely and after decrease positive growth can be expected to follow. For example, asymmetric adjustment cost models imply that the process of hiring and dismissing employees is non-linear.

Due to adjustment costs, indivisibility and uncertainty the present article hypothesises that employment growth is non-linear, where a positive growth is rather followed by negative or zero growth and a negative or zero growth is rather followed by positive growth. This means that expansion follows contraction and contraction follows expansion. Indivisibility of employment results from individual employment contracts. In Germany, these contracts need to be portioned or scaled in certain regulatory boundaries (Habermann & Schulte 2016). Furthermore, some responsibilities are subject to indivisibility. As German employees are protected by strict labour laws the simple termination of labour contracts is difficult and, therefore, small firms are carefully with the recruitment of new employees. Thus, small firms need to align additional capacity and increase demand step-by-step. Recruitment and termination of employees cause costs related to information and search, reorganisation and contract design (Hamermesh & Pfann 1996; Cooper & Haltiwanger 2003; Hall 2004).

Therefore, fluctuations in the growth of small firms can be expected. After positive growth, immediate subsequent further positive growth is rather unlikely. After decrease or stagnation positive growth can be expected to follow (Habermann & Schulte 2016).

As serial correlation of growth rates varies with firm size three hypotheses are proposed. The hypotheses take into account the arguments of adjustment costs, indivisibility and uncertainty explained above.

H1 After takeover a given firm is more likely to enter a period of negative growth in a subsequent period.

H2a After a period of negative growth a given firm that was taken over is more likely to enter a period of positive growth in a subsequent period.

H2b After a period of positive growth a firm that was taken over is more likely to enter a period of negative growth in a subsequent period.

Research Design

Data

The data used is from the Start-Up Panel of the German state of North Rhine-Westphalia (NRW), which collects primary data from a standardised questionnaire sent to business owners of small firms in the skilled crafts sector. This allows long-term monitoring of a large number of small firms, which are either newly created or taken over. The skilled crafts sector is typical of many entrepreneurial activities in Germany in terms of size, business model, or legal type (Lambertz & Schulte 2013).

Table 2: Response rates

Panel wave	Survey period	Number of questionnaires distributed	Number of responses	Response rate
5	Summer 2004	6,881	3,627	0.527
6	Summer 2005	8,153	3,978	0.488
7	Summer 2006	9,149	3,610	0.395
8	Summer 2007	9,751	4,014	0.412
9	Summer 2008	7,265	3,231	0.445
10	Summer 2009	7,322	3,316	0.453
11	Summer 2010	7,880	3,272	0.415
12	Summer 2011	8,443	3,447	0.408
13	Summer 2012	8,805	3,653	0.415

Source: Habermann (2016)

Response rates ranging from 39.5 to 52.7 percent (Table 2) allow valid and reliable results (Baruch 1999). The panel covers start-ups, successions as well as active participations. The dataset only contains full time entrepreneurs and is, therefore, not biased by part-time businesses (Lambertz & Schulte 2013). Single-person firms are only covered if they are run as a full-time business. Thus, part-time businesses, which are often created only for auxiliary income, are not included in the dataset.

This survey has no survivorship bias[2]: Hidden market exits are impossible within the first two years after business takeover because governmental authorities (Landes-Gewerbeförderungsstelle) monitor all the included small firms.[3] All exits can be verified by using a special crafts register, where all entries and exits are recorded. For a longer time period the mortality of firms in the skilled crafts sector is lower than in other sectors (Paulini 1999; Albach & Hunsdiek 1987).

The questionnaires of the annual panel wave cover recurring questions assessing corporate development (achievement of profit goals, corporate profits, expected corporate earnings,

[2] Survivorship bias refers to the problem that only the track record of those firms that have survived can be seen.

[3] The Landes-Gewerbeförderungsstelle (LGH) is a joint service institution set up both by the chambers and the confederations of skilled trades in NRW. The LGH advises and assists SMEs to strengthen their potential, competitiveness and success (LGH, 2016).

investment volume, number of employees, sales volume and utilization) as well as non-recurring questions (counselling, entrepreneurial marketing, motivation, etc.) (Lambertz & Schulte 2013).

The study begins with Wave 5 and is based on data that includes nine waves of the Start-Up Panel NRW. As the survey period changed from six months to one year, the first four waves are excluded. The survey is conducted once a year in summer and if the business takeover took place in spring of the same year, it still does not have one complete year in business. Thus, the time span between the time of business takeover and the first survey is defined as Year 0. This time span, therefore, is shorter than twelve months. This does not affect, however, the analysis on the growth of small firms. This study investigates up to eight years of a given firm after business takeover, it covers Year 0 and eight years, which are numbered 1 to 8 and are equal to an entire year of business activity following Year 0. It is important to mention that the present article distinguishes between periods and years. In general, absolute numbers of employment from one year are related to absolute numbers in the preceding year. The ratio between the total number of employees of Year 0 and Year 1 is defined as Period 0. Consequently, state changes can be defined, e.g. if the total number of employees decreases, does not change or increases in a given period (Habermann & Schulte, 2016). The concept of state changes will be explained in more detail below.

The focus of the present article is solely on business takeovers. The total dataset contains information on 7,082 firms, which were set-up or taken over between 2003 and 2012. Out of these 7,082 firms 1,872 (27 percent) firms were taken over by an individual. This data is in line with information from the Register of Craftsmen (Müller 2014) that states that in 2009 around 28 percent of all German firms in the skilled crafts sector were taken over. 75 percent out of the 1,872 firms are sole proprietorships, and 73 percent are owned by men. The dataset contains information about the sector for 1,725 firms. Out of these 1,725, 267 (15 percent) firms work in the building and interior finishing trades, 549 (32 percent) in the electrical and

metalworking trades, 580 (34 percent) in the health and body care trades as well as the chemical and cleaning sector, 119 (7 percent) in the woodcrafts and plastic trades, and 149 (9 percent) in the food crafts and trades. There are 61 (3 percent) firms representing other trades. On average, the firms have 6.1 employees (including the entrepreneur) at the time of business takeover.

To analyse if the data set is representative for new ventures in the German craftsman sector the data set is compared to official data from the Register of Craftsmen (Müller, 2014). This analysis shows that the numbers are comparable, for example in 2009, 72 percent of all new ventures were sole proprietorships and 79 percent were male. One limitation is that sector alignment is difficult because the sectors in the Register of Craftsmen are defined different than the sectors in the data set.

Table 3: Descriptives

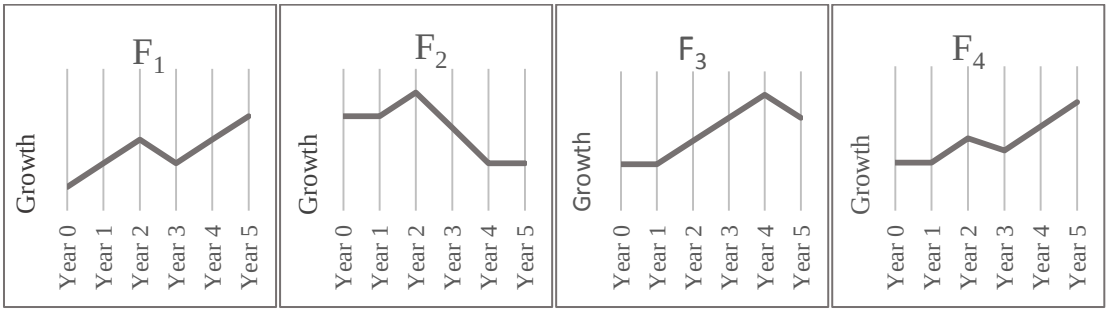
Variable	**Mean**	**Standard deviation**
Number of employees (including entrepreneur, at takeover)	6.12	6.687
Gender: male	0.73	0.444
Profit situation	2.00	0.573
Form of organisation		
Unlimited private company	0.11	0.174
Sole proprietorship	0.75	0.432
Limited liability company	0.14	0.350
Age (in years)		
Age of firm (in 2012)	5.37	2.517
Age of business owner (in 2012)	41.46	7.657
Sector		
Building and interior finishes trades	0.15	0.362
Electrical and metalworking trades	0.32	0.466
Woodcrafts and plastic trades	0.07	0.254
Clothing, textiles and leather crafts and trades	0.02	0.131
Food crafts and trades	0.09	0.281
Health & body care trades and chemical & cleaning	0.34	0.473
Others	0.01	0.133

Date-related tendencies

Employment and sales are the most commonly used indicators to measure average business growth (Delmar 2006; Gilbert et al. 2006). The present article focuses on the growth of employment because employment data offers standardised, comparable data on the rate and direction in which small firms expand (Garnsey et al. 2006). In contrast, sales are influenced by price effects, productivity effects, exchange rate effects and taxes (Brenner & Schimke 2014). Coad (2009) provides an extensive discussion about the advantages and disadvantages of each indicator.

The approach of date-related tendencies is developed by Habermann & Schulte (2016) who divide long-term developments of firms into state changes between time points. These state changes are called date-related tendencies and allow identifying the pathway of a given firm's development. In general, a state change is the analysis if the change in input or outcome from year t to the subsequent year t+1 is negative, constant or positive. This approach is exemplified for employment in Figure 1 and shows the approach of state changes by four different firms ($F_{1\ to\ 4}$). The change in the total number of employees from Year 1 to Year 2 is for all four firms non-negative. During the transition from Year 4 to Year 5, F_1 and F_4 experience an increase, whereas F_2 and F_3 show a constant respectively negative development. This approach allows to consider individual temporal interdependencies of absolute change and to distinguish different patterns of growth. Thus, the growth of a firm is defined as the comparison of date-related tendencies of employment between two consecutive periods (Habermann & Schulte 2016).

Figure 1: Individual growth pathways of four firms (F_1 to F_4)



Source: Habermann & Schulte (2016)

Residual analysis and mosaic plots

To test the hypotheses a residual analysis is applied, which allows identifying categories relevant for a significant Chi-square statistic. The standardised residual for each cell of the contingency table of date-related tendencies is calculated and adjusted for its variance (Haberman 1973):

$$d = \frac{\text{e}}{\sqrt{(1 - \frac{n(\text{row})}{n(total)})(1 - \frac{n(col)}{n(total)})}}$$

d represents an adjusted residual and e a standardised residual, which is corrected for the expected cell size (Tredoux & Durrheim 2002: p. 375). A two-tailed test of significance is used to analyse the probability of the adjusted residual. A significant adjusted residual indicates that the cell made a significant contribution to the Chi-square statistic (Agresti 2013).

Multivariate analysis

To allow comparability with other studies on growth of small firms (Bottazzi et al. 2009; Federico & Capelleras 2015; Habermann & Schulte 2016), the measure of growth rates is calculated by taking the differences of the logarithms of size:

$GROWTH_{it} = \log(SIZE_{i,t}) - \log(SIZE_{i,t-1})$

Where $SIZE_{it}$ is measured by employment for firm i at time t.

In line with Habermann & Schulte (2016) who analyse the autocorrelation between growths of new ventures, the following equation is estimated for pooled data:

$(\log(empl_{i,t})-\log(empl_{i,t-1})) = \alpha_0+\alpha_1 1(\log(empl_{i,t-1})-\log(empl_{i,t-2})) + \alpha_2(\log(empl_{i,t-2})-\log(empl_{i,t-3})) + \alpha_3 Legalform_{i,t} + \alpha_4 Age_{i,t} + \alpha_5 Sex_{i,t} + \alpha_6 Totalemployment_{i,t} + \alpha_7 Performance_{i,t} + \alpha_{8-9} IndustryDummy_{i,t} + \varepsilon_{i,t}$

The equation represents a growth model, where current growth of employment, which is used as dependent variable, is estimated using a set of lagged values of growth to analyse the serial correlation of these growth indicators.

As control variables firm age, the legal form of small firms, sex and industry dummies are added. This selection of control variables is in line with other studies analysing variables that influence the growth of new ventures (Gilbert et al. 2006; Gupta et al. 2013;). In addition, the total number of employees and business outlook are also used as control variables. Firm age has a negative effect on growth, which has been shown for US manufacturing (Evans 1987a; b) and service firms (Variyam & Kraybill 1992), for Taiwanese electronics plants (Liu et al. 1999), for large European firms (Geroski & Gugler 2004) and for Japanese manufacturing firms (Yasuda 2005). The present article refers to the age of the small firm at the time of the business takeover.

West German limited liability firms have significantly higher growth rates in comparison to firms with other legal forms. However, these firms also have a significantly higher risk of exit (Harhoff et al. 1998). The limited liability legal form provides incentives for managers to pursue projects, which are described by both a relatively high risk of failure and a relatively high expected return (Stiglitz & Weiss 1981).

Industry dummies are added to the equation because it is supposed that firms in mature industries are likely to have lower average growth rates than firms in new sectors. Whereas in mature industries a lower level of growth opportunities exists, firms in new sectors may have

high growth rates due to the rapid pace of technological progress and the emergence of new products (Coad 2009).

Current total number of employment and performance of a small firm are supposed to be a major influence for growth. A good performing firm is much more able to grow than an underachieving one because profit enables the firm to fund additional employees. For this reason, "profit situation" is also added as an independent variable for performance into the regression, proxied by business outlook assessed by the business owner (Habermann & Schulte 2016). The business outlook for the next six months is distinguished between i) is expected to become worse (defined as 1), ii) stays the same (defined as 2) and iii) the situation will be better than at the moment (defined as 3). Table 3 explains the descriptives of the merged data of the 1,872 firms between 2003 and 2012.

Results

Mosaic plots

Date-related tendencies regarding employment are used to explain how these firms grow within the first seven periods after business takeover. All results of the Chi-square test are significant throughout the bivariate analysis. In Period 7, more than twenty percent of the expected counts are less than five and, thus, the Chi-square test may be invalid (Wildemuth 2009). Therefore, the present article focuses on date-related tendencies for periods 0 to 6.

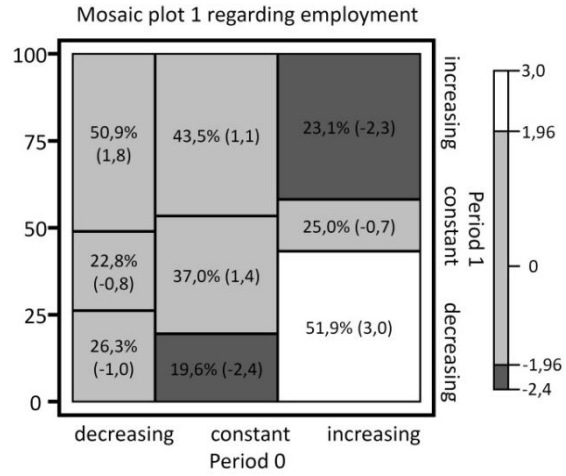
The present article uses mosaic plots to illustrate the results of the residual analysis Figure 2). Mosaic plots show percentages of cross-classified categorical variables (Friendly 2002; Hofmann 2000). On how to read mosaic plots the present article refers to Habermann & Schulte (2016). Mosaic plot 1 in Figure 2 shows the relationship between Period 0 and Period 1, mosaic plot 2 explains the relationship between Period 1 and 2 and so forth. Mosaic plot 1 supports Hypothesis 1. The number of firms that enter a period of negative growth after

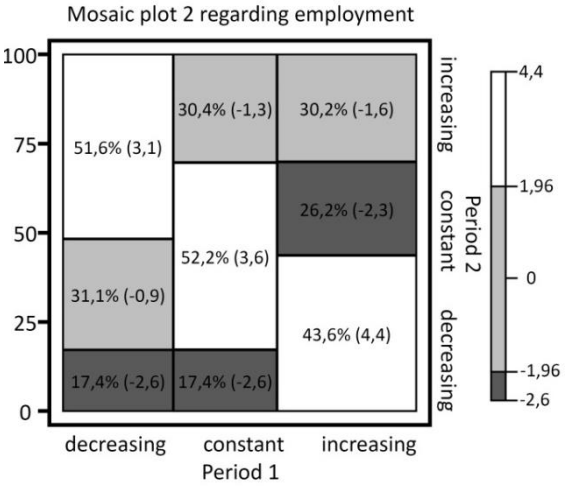
business takeover is overrepresented. In addition, the number of firms that increased their employment further after business takeover is underrepresented.

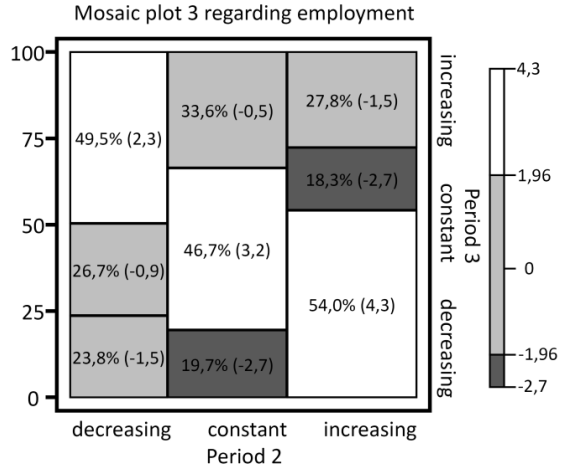
As presented in Figure 2, mosaic plots show partly evidence for Hypothesis 2a. The value of adjusted residuals shows that observations for decline of employment in period t and increase in period t+1 are, as shown in the upper left corner of the mosaic plots in Figure 2, overrepresented for mosaic plots 2, 3 and 6. For mosaic plots 1, 4 and 5 no find evidence is found that the number of cases in that cell is significantly larger than would be expected.

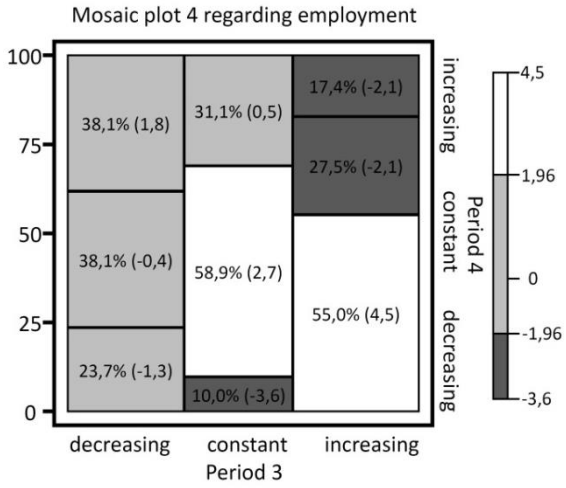
As illustrated in Figure 2, mosaic plots show evidence for Hypothesis 2b. The value of adjusted residuals shows that observations for growth of employment in period t and decline in period t+1 are, as shown in the bottom right corner of the mosaic plots in Figure 2, overrepresented within the entire period under observation. In addition, all periods, which see an increase in period t and zero growth in period t+1 are underrepresented in mosaic plots 2 to 5.

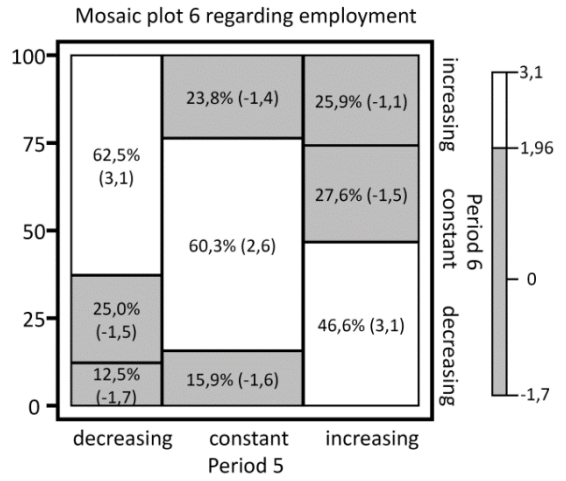
Figure 2: Mosaic plots regarding growth of employment for firms that were taken over











Multivariate analysis

As the mosaic plots show mixed result, a pooled OLS regression is run. Utilising pooled data, potential biasing effects of different economic business cycles, cohorts and outliers are reduced. Table 4 shows that the autocorrelation of the growth of small firms is low but

significant for t-1 and t-2. Adding further lags might also reduce critically the number of observations and may not imply an improvement in the explanatory power of the model. Although the approach of lagged variables is different to the analysis of the mosaic plots, the different views on the results do not affect the main objective to analyse how small firms grow after business takeover. Mosaic plots analyse future growth rates, whereas the pooled OLS regression includes past events (Habermann & Schulte 2016).

Table 4: Serial correlation between growths of employment (p-values in parentheses)[4]

	log_empl	lag_log_empl	2lag_log_empl	3lag_log_empl	4lag_log_empl	5lag_log_empl	6lag_log_empl	7lag_log_empl
log_empl	1							
	-0.3668							
lag_log_empl	(0.0000)	1						
	-0.1618	-0.3499						
2lag_log_empl	(0.0000)	(0.0000)	1					
	0.0389	-0.1587	-0.3587					
3lag_log_empl	(0.2782)	(0.000)	(0.0000)	1				
	-0.00179	0.0383	-0.1670	-0.3544				
4lag_log_empl	(0.6907)	(0.2922)	(0.000)	(0.0000)	1			
	-0.0382	-0.0224	-0.0051	-0.2013	-0.3494			
5lag_log_empl	(0.5063)	(0.6237)	(0.8953)	(0.0000)	(0.0000)	1		
	-0.0064	-0.0407	0.0457	0.0158	-0.02604	-0.3664		
6lag_log_empl	(0.9330)	(0.4914)	(0.3625)	(0.7083)	(0.0000)	(0.0000)	1	
	-0.1229	0.0129	-0.0750	0.0398	0.0180	-0.3110	-0.4139	
7lag_log_empl	(0.3109)	(0.8752)	(0.2818)	(0.4948)	(0.7194)	(0.0000)	(0.0000)	1

In Table 5, the results of three different pooled OLS regressions are summarised. Model 1 estimates the impact of the first lag of employment growth on employment growth. In model 2, the second lag is included and in model 3, the control variables are included. All three models show a significant autocorrelation for the first lag. The result is also economically significant, as one standard deviation increase in the first lag of employment growth variable yields a decrease in employment growth of 18 percent. Also for the second lag a significant

[4] log_empl refers to ($\log(empl_{i,t})$-$\log(empl_{i,t-1})$); lag_log_empl refers to ($\log(empl_{i,t-1})$-$\log(empl_{i,t-2})$) and 2lag_log_empl refers to ($\log(empl_{i,t-2})$-$\log(empl_{i,t-3})$)

negative serial correlation between growth in t in in t-2 exist, however, the coefficient is smaller. The result is also economically significant, as one standard deviation increase in the second lag of employment growth variable decreases employment growth by 11 percent.

Table 5: Pooled OLS regression results for growth of employment (standard errors in parentheses

	Model 1 log_empl	Model 2 log_empl	Model 3 log_empl
lag_log_empl	-0.3540*** (0.0200)	-0.3858*** (0.0272)	-0.3918*** (0.0279)
2_lag_log_empl		-0.244*** (0.0274)	-0.2321*** (0.0289)
legal_form			0.0325 (0.0258)
firm_age			0.0113* (0.0060)
Manufacturing			0.0191 (0.0142)
Services			-0.0071 (0.0137)
Sex			-0.0045 (0.0276)
Total employment_0			0.0093*** (0.0014)
Business outlook_0			0.0073 (0.020)
Constant	0.0171	0.0162	-22.6383
R-squared	0.13	0.17	0.20
Obs	2,004	1,175	1,055

*p ≤0.1, **p ≤0.05, ***p ≤0.01

The results of the multivariate analysis highlight two important features. First, firm growth rates are not random and non-linear, which supports the results of the mosaic plots. Second, the analysis shows that after business takeover small firms are subject to negative serial correlation of growth rates. This means that negative autocorrelation does not only exist for organic growth (Coad & Hölzl 2009; Coad 2007, Fotopoulos & Giotopoulos 2010; Hölzl 2014) but also for growth after business takeovers. For small firms showing a large increase

of employees at time t, the negative coefficient implies that in the previous period t-1 these firms probably dismissed employees. Similarly, for those slowest-growing firms at time t, the negative coefficient indicates that these firms probably performed relatively strongly in the previous period t-1. The negative autocorrelation could be explained with the fact that firms hire more than the required number of employees with the expectation of keeping only top performers. This may lead to a mechanical effect of negative autocorrelation. However, the present article focuses on small firms, which normally do not have the necessary resources to apply such a strategy (Habermann & Schulte 2016).

The significance and the positive sign of the year of business takeover mean that the younger the firm the higher the growth rate of employment. This negative dependency of the growth rate on age appears to be a robust feature of industrial dynamics in the dataset. In addition, total number of employment has a positive sign and is significant.

Further analyses to check the robusteness of the main findings are conducted and are shown in Table 6. The regression, which include the control variables are reran comparing the results of the pooled OLS regression with the results of the regression using Cluster-robust Huber/White standard errors (Rogers 1993; Williams 2000) and of a robust regression (Li 1985). A robust regression eliminates gross outliers before calculating starting values. Cluster-robust Huber/White standard errors allow controlling for intraclass correlation between the small firms in the dataset. The additional analyses allow to double-check the results from the OLS regression to make sure that the conclusions are not compromised by heteroskedasticity. Since there was no heteroskedasticity problem in the model, the findings of the OLS regression remain robust after double-checking with other estimators.

Table 6: Robust Pooled OLS regression results for growth of employment, taking 2 lags (standard errors in parentheses)

	Model 1 log_empl	Model 2 log_empl	Model 3 log_empl
lag_log_empl	-0.3918*** (0.0279)	-0.3918*** (0.0453)	-0.2225*** (0.0191)
2_lag_log_empl	-0.2321*** (0.0289)	-0.2321*** (0.0453)	-0.069*** (0.0197)
legal_form	0.0325* (0.0258)	0.0325 (0.031)	0.0159 (0.0176)
firm_age	0.0113* (0.0060)	0.0113** (0.0055)	0.0041 (0.0041)
Manufacturing	0.0191 (0.0142)	0.0191 (0.0123)	0.086 (0.0097)
Services	-0.0071 (0.0137)	-0.0071 (0.0120)	-0.019 (0.0094)
Sex	-0.0045 (0.0276)	-0.0045 (0.0246)	0.0005 (0.0190)
Total employment_0	0.0093*** (0.0014)	0.0093*** (0.0046)	0.0041*** (0.0010)
Business outlook_0	0.0073 (0.020)	0.0073 (0.0224)	0.0090 (0.0137)
Constant	-22.6383	-22.6383	-8.3617
R-squared	0.20	0.20	0.13
Obs	1,055	1,055	1,055

*p ≤0.1, **p ≤0.05, ***p ≤0.01

Discussion and conclusion

Although scholars have already analysed the impact of business takeovers on firm performance, these studies usually are mainly restricted to the analysis of large public firms or based on cross-sectional analysis. The present article seeks to overcome these limitations by analysing business takeovers in small German firms using a longitudinal research design. The results show that recent positive growth is more likely to lead to negative growth, and conversely, that recent negative growth increases the probability of subsequent positive growth.

The present article makes five contributions to the literature: First, it complements the literature on the autocorrelation of growth rates by focusing on the dynamics of small firms after business takeover. So far, the focus of autocorrelation has been on organic growth. The present article shows that autocorrelation and the related adjustment costs play an important role when it comes to growth after business takeover. It is likely that adjustment costs and indivisibility prevent firms from growth at certain stages of development (Habermann & Schulte 2016). Consecutive periods of constant or negative growth can be explained by the need of firms for consolidation. Growth in period t can be a good predictor for growth in period t+1. This result also suggests that variables for growth need to be included as lagged variables in models analysing growth. Second, the present article contributes to the literature on the non-linearity of growth and shows that growth is non-linear, prone to interruptions, amplifying forces and setbacks (Garnsey et al. 2006). Third, average growth rates fail to describe important dimensions of the course of growth of firms (Habermann & Schulte 2016) because different growth pathways can lead to the same average pathway (Wright & Stigliani 2013). Therefore, date-related tendencies of growth are introduced to describe the growth after business takeover in a more nuanced manner. Fourth, as growth after business takeover cannot be guaranteed and as resources of the successor are used to certain internal and external changes, small firms need to calculate the risks and opportunities of the takeover. Consultants and chambers of commerce and crafts can offer guidance on the smooth transition of the firm. Fifth, the present article shows that adjustment costs may influence the growth pathway of the firm that was taken over. This means that in addition to the cost of purchasing the firm, adjustment costs need to be calculated and considered by business owners. If the latter costs are not included, the process of integration could be hampered because unpredictable costs could mean that not enough resources are available to finance this process.

Due to the aging of the population the importance of business takeovers will increase in the future (Block et al. 2013). Takeovers are means to secure employment and prevent the loss of firm-related know-how. Policy documents have already stressed the importance of business takeovers as a form of entrepreneurship. Although the European Commission requests its member countries to afford successions the same importance as new ventures and raise awareness for takeover opportunities, many politicians focus on policies related to start-ups. The reduction of taxes or the development of measures to encourage timely preparation of those who want to sell their firms (European Commission 2003; 2006) could support the improvement of the environment of business takeovers. It would be also important to improve the match between potential buyers and sellers in marketplaces for business takeovers (European Commission, 2012).

Because it uses the same dataset as the study by Habermann & Schulte (2016), the present article is also characterised by the same limitations. The dataset consists mainly of firms from the skilled crafts sector. Although these firms represent different occupations and belong to different sectors, a precise classification into certain sectors (for example as defined by NACE code) is not possible. A more panel-specific limitation results from decreasing case numbers with longer periods. As the number of firms participating in the survey decreases with the age of the firm, the period of observation is limited to the first six periods after business takeover. Due to this panel mortality more successful firms are more likely to report their development than less successful ones. This implies that later period estimations might be overestimated because underperforming firms tend not respond to the questionnaire anymore. However, this successor bias seems to be negligible, as respondents do not report growth but current size. As only firms still in business can be surveyed, survivorship bias could be another problem. However, the dataset allows controlling for exits for the first two years after business takeover because all exits can be verified using a special crafts register, in which all entries and exits are recorded. For a longer time period, the literature shows that exit rate of full-time

businesses is much lower in the skilled crafts sector than in other sectors (Paulini 1999; Albach & Hunsdiek 1987). The present articles has a broad understanding of successions and a differentiation between different modes of succession is not possible. In particular, it would be interesting to analyse the consequences of successions on firm growth separately for family and non-family successions.

More research on adjustment costs related to the growth of small firms in general and to business takeovers in particular is required to understand the growth process of these types of firms because due to the ageing population and the increasing numbers of retirement of business owners more and more successors will be needed. The present article shows that it is likely that adjustment costs have an impact on the growth after business takeover. However, no information about the size of the adjustment costs is available, and, therefore, empirical evidence cannot be provided to analyse when and if convex or non-convex adjustment costs play an important role. Nevertheless, the results show that it is likely that after period of growth successors enter a phase of consolidation because they may not want to grow further or even decide to reverse their decisions. This could indicate that non-convex adjustment costs are predominant. It is not clear how these costs can be calculated and the differences between sectors in terms of adjustment costs are unknown. The development of a tool that would allow business owners to calculate these costs would be desirable because it could support them when they have to make a decision concerning a business takeover. Scholars could support this development by collecting and analysing available data on business takeovers and by identifying and evaluating factors that affect adjustment costs.

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