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Bankruptcy and Voluntary Liquidation: Evidence for New Firms in East and West Germany after Unification

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Non-technical Summary

Exploiting the unique economic situation after German unification, I investigate how exit decisions deviate between new firms in a transition and in a comparatively stable market environment. Two competing exit mechanisms are considered in that context: entrepreneurial self-selection via voluntary liquidation and external selection based on the German insolvency law. Semi-parametric competing risk models are estimated for a large firm data set. It comprises 14,000 firms in all East and West German regions and all industries in the manufacturing, construction and trade sectors as well as most service industries. In accordance with theoretical considerations, the empirical results suggest that distinguishing between competing exit modes is crucial for understanding entrepreneur-, firm-, ownership- and management-related effects on new firms' exit decisions. Entrepreneur-specific characteristics like education or age at market entry are related to the bankruptcy and the voluntary liquidation risk according to the distinct underlying decision rules. The effects of initial firm size, legal form or ownership affiliations to parent firms are consistent with the expected pattern of bankruptcy avoidance. Comparing East and West Germany, I find that small start-ups in East Germany after unification had no significantly higher voluntary liquidation hazard during the 1990s than larger ones - in contrast to small West German start-ups. In addition, education effects on the voluntary liquidation risk of new firms in East and West Germany differ and the share of liquidations related to bankruptcy filings turns out to be higher among start-ups in the East German transition economy than in the comparatively stable West Germany market economy. These results are argued to reflect different industry structures, capital and labor market conditions.

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Abstract

Exploiting the unique economic situation after German unification, I investigate how exit decisions deviate between new firms in a transition and a comparatively stable market environment. Two competing exit mechanisms are considered: entrepreneurial self-selection via voluntary liquidation and external selection based on insolvency regulation. Distinguishing between the competing exit modes proves to be crucial in semi-parametric proportional hazard-rate estimations. Comparing East and West Germany, I find distinct education and size effects and a higher share of bankruptcy-related liquidations in East Germany. These results are argued to reflect different industry structures, capital and labor market conditions in both parts of Germany.

Keywords: Exit, Bankruptcy, Voluntary Liquidation, Transition Economy, Duration Analysis

JEL Classification: L20, P30, P52, C41, C14

1 Introduction

The fall of the Berlin Wall in November 1989 marks the political and economic breakdown of the German Democratic Republic (GDR). Entrepreneurial activity was systematically discouraged in the GDR by expropriations of private businesses, by restrictions on input use including employment and by high profit taxation. The planned economy system of the GDR was built on centralized production in large state-owned firms. After unification of East and West Germany, more than 8,000 formerly state-owned firms with a total of more than four million employees had to be restructured and privatized or were liquidated. Production in these firms largely broke down during the transition to a market economy. Redundancies led to a high level of unemployment. At the same time the monthly start-up numbers rose exceptionally between November 1989 and July 1990, remained on a very high level until January 1991 and started only then to taper off. Since entrepreneurial activity and the emergence of new, competitive industry structures are needed for economic growth the performance and behavior of new firms in East Germany is of high interest for policy-makers and researchers.

In this study I investigate in detail the exit behavior of East German firms started during the first transition years. In addition, I show how the behavior of these firms deviates from the one of firms started during the same time period in the comparatively stable West German market economy. To that aim the unique context after unification and comprehensive data on about 14,000 firms is exploited. The sample covers all East and West German regions and all industries in the manufacturing, construction and trade sectors as well as most service industries. It is drawn from a firm data source currently providing information on more than six million firms. The presented evidence extends the existing literature on industrial dynamics and new firm exit to an interesting economy in transition. Since the end of the 1980s, many authors have investigated the exit behavior of newly founded firms in different Western industrial economies. For example, Dunne, Roberts, and Samuelson (1988, 1989), Audretsch (1991), Audretsch and Mahmood (1995), Mata and Portugal (1994), Geroski, Mata, and Portugal (2002), and Disney, Haskel, and Heden (2003) provide large sample evidence for the United States, Portugal and United Kingdom. Existing studies on new firm exit in West Germany by Brüderl, Preisendörfer, and Ziegler (1992) and Wagner (1994) are, however, based on small samples with firms in specific regions. About new firm exit in East Germany even less is

known.[1] Most importantly, so far no study has used a data set with East and West German firms to compare the exit behavior of start-ups in a transition and a comparatively stable market environment.

The empirical analysis in this paper builds upon a theoretical and institutional framework with two competing exit mechanisms: entrepreneurial self-selection via voluntary liquidation and external selection based on the German insolvency regulation. The importance of separating between different types of exit instead of treating exit as homogeneous is discussed for example by Phillips and Kirchhoff (1989) and Sutton (1997). However, only a few empirical studies address the issue. Schary (1991) investigates firm exit through bankruptcy, voluntary liquidation and merger using a very small sample of 61 firms in the declining cotton industry between 1924 and 1940 in New England. The determinants of failures and acquisitions in the U.S. banking industry are analyzed by Wheelock and Wilson (2000). They use data on about 4000 commercial banks between 1984 and 1993. Harhoff, Stahl, and Woywode (1998) examine the bankruptcy and voluntary liquidation risk for about 11,000 West German firms between 1990 and 1994. Taylor (1999) analyzes the risk of exit via bankruptcy and moves to alternative employment between 1991 and 1995 for about 1,300 British self-employed persons that started business activities after 1979. All these studies use samples with firms of very different age or self-employment spells of different length at the beginning of the respective observation period.[2] In contrast, the following study focuses on start-ups whose market activity is monitored from the moment of market entry until up to ten years later.

The main theoretical expectations derived in the first part of the paper are in line with the presented results of competing risk estimates for East and West German start-ups. Entrepreneur-specific characteristics like education or age at market entry are related to the bankruptcy and the voluntary liquidation risk according to the distinct underlying decision rules. The effects of initial firm size, legal form or ownership affiliations to parent firms are consistent with the expected pattern of bankruptcy avoidance. The comparison of competing risk estimates for East and West Germany reveals similar effects of the entrepreneur's age, the firm's legal form, its ownership and management structure, and franchise relations in both economic environments. Interestingly, non-parametric baseline hazard estimates also indicate a quite similar time-pattern of the exit process. The most striking differences between the exit process among new firms in East and West Germany after unification

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[1]Brixy and Kohaut (1999) estimate survival function estimates using data for a time period of four years. Determinants of exit decisions are, however, not investigated.

[2]For example, firms in Harhoff, Stahl, and Woywode (1998) are on average 29 years old at the beginning of the observation period.

are distinct size and education effects as well as the fact that a substantially higher share of liquidations in East Germany is related to bankruptcy filings than in West Germany. These differences are argued to reflect the different industry structures, capital and labor market conditions in the two parts of Germany during the 1990s.

The remainder of the paper is organized as follows. In the next section, I analyze the exit decision of newly founded firms and discuss how firm-specific and entrepreneur-specific characteristics are supposed to affect a firm's bankruptcy and voluntary liquidation risk. Section 3 contains a brief description of the data. In section 4, I discuss the econometric model, the estimation methods and the results. Section 5 concludes.

2 Exit decision of new firms: bankruptcy versus voluntary liquidation

2.1 Theoretical and institutional framework

Empirical studies on firm performance and exit by Dunne, Roberts, and Samuelson (1989), Baldwin and Rafiquzzaman (1995), Troske (1996), Abbring and Campbell (2003) and many others are motivated by the theoretical work of Jovanovic (1982), Ericson and Pakes (1995), and Pakes and Ericson (1998) on industry evolution with noisy selection among entrants. In Jovanovic (1982) the exit process among firms entering an industry is based on passive Bayesian learning about time-invariant firm productivity. Ericson and Pakes (1995) and Pakes and Ericson (1998) model actively learning entrants with productivity varying over time due to stochastic market changes, their own investment decisions and those of other market participants.

In the following, I use a framework with passive learning to examine the exit decision of new firms when both, self-selection by entrepreneurs and external selection according to the German insolvency regulation are at work. Consider a population of market entrants characterized by unknown, firm-specific values of a productivity parameter θ and observable firm heterogeneity. Firms believe their value of θ at the moment of entry to be a random draw from the same known a priori distribution conditional on observable firm heterogeneity. After market entry, each firm observes one realization of a profit-relevant random variable per period. This random variable is denoted by η and not observable to the econometrician. As the distribution of η depends on θ, the information history $n_t \equiv (\eta_1, \eta_2, ... \eta_t)$ in period t allows for updating the a priori expectation of θ and of future values of η. Using their posteriors, the risk-neutral and profit-maximizing entrants then

decide whether to continue the firm or to liquidate it by finally terminating all business activities.[3]

At first, I focus on the exit decision of the most frequent type of a new firm and then extend the analysis at the end of section 2.2. The "typical" new firm is started by a single entrepreneur owning and managing the firm (owner-manager). One bank creditor usually allows for overdraft and sometimes disburses loans. Unsecured trade creditors may provide additional financing.[4]

The owner-manager holds all control rights of the firm as long as all current payments on the firm's debt obligations are covered. He will opt for a *voluntary liquidation* in period t if his individual liquidation threshold in t exceeds the expected future returns from optimal continuation of the firm, that is:

$$O_t^e(x_e) + L_t^e > V_t^e(n_t, x_e, x_f). \qquad (1)$$

The individual liquidation threshold in t consists of two parts. One part is the expected present value O_t^e of the entrepreneur's (e) future returns when choosing the best alternative employment opportunity. These expected returns from wage work, an alternative firm project or retirement depend on his personal characteristics x_e. The second part is the share L_t^e of the firm's liquidation value L_t the entrepreneur receives as residual claimant when liquidating the firm's assets in t and satisfying all creditors' claims. V_t^e is his share of the maximal expected present value in t of venture-related future returns in case of optimal firm continuation. V_t^e depends on the history n_t of the profit-relevant variable η, personal characteristics x_e and firm-specific characteristics at market entry x_f.[5]

As soon as the firm runs into financial distress the German insolvency regulation transfers control rights by entitling all creditors of the firm as well as the owner-manager to file for *bankruptcy*.[6] From that moment on, a firm

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[3]In this paper, I focus on exit by liquidation. Mergers, takeovers, and other changes in ownership are not treated as exit events here because some market activities of the concerned units continue even in the case of a fundamental restructuring.

[4]Harhoff and Körting (1998a) show that German firms being younger than 6 years have on average 1.28 bank creditors. Overdraft borrowing and trade credits are important sources of short-term financing for start-ups (Cressy 1996b, Petersen and Rajan 1997).

[5]Abbring and Campbell (2003) and Geroski, Mata, and Portugal (2002) show that initial conditions at market entry have strong, long-lasting effects on firm survival chances even if current conditions are controlled for.

[6]According to German law a firm is financially distressed if either the criteria of incessant inability to pay (insolvency) or overindebtedness applies (§102 Konkursordnung, Häsemeyer 1998). Insolvency is fulfilled in period t, if the firm is actually and probably also in s subsequent periods not able to meet its financial obligations: $C_t < T_t + B_t$ and $C_{t+i} < T_{t+i} + B_{t+i} \forall i = 1, \ldots, s$. C_t denotes cash, T_t the payments owed to trade creditors and B_t the sum of repayment and interest payment owed to the bank in pe-

liquidation or restructuring can be started and realized independently of the owner-manager's decision.

The most likely candidates for financial distress are inefficient firms with low productivity and no market success. The liquidation value L_t of an inefficient firm exceeds the maximal expected present value of venture-related future returns $V_t(n_t, x_e, x_f)$:

$$L_t > V_t(n_t, x_e, x_f). \qquad (2)$$

Nevertheless, efficient firms may also enter financial distress. In Germany, such firms can, however, be assumed to choose a private contractual debt restructuring rather than a court procedure because of high indirect bankruptcy costs. German bankruptcy procedures are strongly oriented towards liquidation. Court reorganization procedures are rarely used, are usually unsuccessful and followed by a bankruptcy procedure (Hesselman and Stefan 1990, Häsemeyer 1998). Due to this situation, filing for bankruptcy would cause high indirect bankruptcy costs for firms that shall be continued. Suppliers, customers and employees with limited information about the firm's prospects usually interpret a bankruptcy filing as a signal of forthcoming liquidation. They stop delivery, seek for alternative suppliers and search for new jobs, respectively. Such a deterioration of business relations does not strongly affect the liquidation value of the filing firm's assets, but considerably reduces the firm's going-concern value (Hax 1985). Thus, coalitions of owners and creditors interested in firm continuation have strong incentives to choose private debt restructuring and to avoid the detrimental filing. In the following, I will often use the shorter term "bankruptcy risk" instead of "risk of liquidation after bankruptcy filing" since inefficiency, bankruptcy and liquidation are that closely linked in the German context.

2.2 Determinants of a new firm's exit decision

According to the theoretical and institutional framework introduced above a new firm's exit can either result from entrepreneurial self-selection (see equation (1)) or from external selection based on the insolvency regulation (see equation (2)). Referring to both coexistent mechanisms, I now derive

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riod t. Overindebtedness applies only to corporate firms. A firm is overindebted if the firm's assets are worth less in t than the face value of its debt obligations D_t. The value of the firm's assets is measured by the maximum of the firm's continuation value V_t and liquidation value L_t. Overindebtedness is difficult to evaluate and therefore of much less empirical relevance in Germany than the insolvency criterion (Häsemeyer 1998). Note that any detail on German insolvency regulation given in this paper refer to the legal situation before 1999 because the data I use covers that period.

hypotheses on the relations between entrepreneur- and firm-specific characteristics and the firm's bankruptcy and voluntary liquidation risk. The corresponding empirical results are discussed in section 4.3.

Characteristics of the entrepreneur

Characteristics of the entrepreneur, x_e, are related to the bankruptcy risk due to their impact on venture returns and thus on the firm's continuation value in equation (2). The link between characteristics of the entrepreneur and the voluntary liquidation risk is more complex. According to equation (1) it depends on both, the impact of entrepreneur-specific characteristics on venture returns and the impact on returns of the entrepreneur's best alternative employment opportunity.

Entrepreneurs with high general human capital, measured by educational degree, are usually assumed to attain high venture returns (Cressy 1996a, Brüderl, Preisendörfer and Ziegler 1992). Hence, they can be assumed to face a lower bankruptcy risk than poorly educated entrepreneurs. High educational degrees should, however, not only promote high venture returns but also high individual exit thresholds due to well-paid job offers and good ideas for alternative firm projects (Gimeno et al. 1997, Taylor 1999). Even assuming that the best alternative employment is wage work does not clarify whether a positive or a negative effect of education on the voluntary liquidation risk should be expected. Existing studies about the relative return of education in wage work versus self-employment by Evans and Leighton (1989) and Fujii and Hawley (1991) provide mixed evidence.

> H1: Well educated entrepreneurs have ceteris paribus (c.p.) a lower risk to exit via bankruptcy than poorly educated ones. The effect of education on the voluntary liquidation risk depends on the relative strength of the education effect on venture returns and on individual exit thresholds.

Bates (1990) and Cressy (1996a) use the demographic variable "age of the entrepreneur at market entry" as a proxy for specific human capital, i.e. business and work experience. Since high experience should promote high venture-related returns, I expect age and the bankruptcy risk to be negatively correlated. This expectation follows as well if not only experience but also risk-aversion and wealth increase in age (Holtz-Eakin, Joulfaian, and Rosen 1994b, Cressy 1996b).

Age is presumably not only correlated with venture-related returns but also with the entrepreneur's exit threshold. First, the number and quality of alternative job offers is likely to decrease in age and consequently the exit

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threshold should initially decrease as well. But at a certain age, retirement considerations come into play and tend to shift the exit threshold upwards. Retiring entrepreneurs often liquidate the firm's assets rather than transferring the firm as an operating unit. Harhoff, Stahl, and Woywode (1998) mention two reasons that inhibit transfers of small, young firms. First, they can often not be sold because the firm's viability and profitability depend crucially on the entrepreneur's human capital. Second, the German institutional setting can impede the transfer of ownership considerably.

> H2: The age of the entrepreneur and the bankruptcy risk are c.p. negatively correlated. The effect of age on the voluntary liquidation risk is U-shaped.

Characteristics of the firm project

Firm-specific characteristics at market entry, x_f, are correlated with both liquidation risks due to their impact on venture returns. Moreover, a financially distressed firm's interest in bankruptcy avoidance as well as the attractiveness of an out-of-court liquidation agreement versus a court procedure may depend on firm-specific characteristics.

In the empirical literature, firm size is often discussed as an important determinant of new firm exit. Mata and Portugal (1994) and Audretsch and Mahmood (1995) argue that small start-ups are more likely than large ones to operate at sub-optimal production scale and to incur cost-disadvantages. Caves (1998) interprets sub-optimal scale as a consequence of binding input constraints. Most important are probably capital constraints caused by rationing on imperfect capital markets (Evans and Jovanovic 1989, Holtz-Eakin, Joulfaian and Rosen 1994 (a,b), Blanchflower and Oswald 1998). In addition, small scale can signal low or imprecise ex ante profit expectations and avoidance of large sunk commitment. According to Frank (1988) and Caves (1998) such small firms are more prone to leave the market after only a few periods with low returns than large firms. Summing up, the understanding of small scale as disadvantage or negative signal suggests a negative correlation between initial firm size and the exit risk of start-ups.

However, certain economic environments can induce entry of small firms that are unlikely to have a higher exit risk than larger entrants. First, along the lines of Caves and Porter (1977) firms may choose to enter small in order to fit into strategic market niches. Agarwal and Audretsch (1999, 2001) provide evidence for the U. S. consistent with the hypothesis that entrants in industries at the mature stage of the product life cycle are more likely to occupy product niches than entrants in formative stages. In contrast to small

start-ups in West Germany, I do not expect small-scale entrants during the early East German transition years to face significantly higher exit risk than their large-scale counterparts that enter into a different strategic group in the same industry. Many small start-ups are likely to have filled local market niches with a low exit risk. Middle-sized and large start-ups rather had to compete with experienced West German and foreign firms. Moreover, they had to cope with privatized and often heavily subsidized firms emerging from the restructuring of formerly state-owned firms. Second, flexible small-scale entry and subsequent step-by-step growth based on updated expectations should pay off especially in uncertain and changing markets.[7] Considering that market developments were more uncertain during the transition period in East Germany, the exit risk of small and large entrants should be more similar in East than in West Germany.

In addition to the foregoing arguments, it is crucial to see how firm size can affect an exiting firm's choice between an out-of-court liquidation agreement and a bankruptcy procedure. First, bankruptcy procedures get increasingly attractive with increasing employment due to the German insolvency regulation. Most important, unpaid wages of firms in bankruptcy will temporarily be covered by the federal labor office and simplified worker dismissals via collective settlement are allowed.[8] Second, the larger the firm, the lower the share of the liquidation value which is needed to cover direct bankruptcy costs. Third, firm size is typically positively correlated with the number of creditors (Harhoff and Körting 1998a). Hence, informational asymmetries and the risk of free-riding tend to increase in firm size and the chances for a successful out-of-court agreement decrease.

> H3: The relation of firm size and the bankruptcy risk has c.p. an inverted U-shape. Firm size and the voluntary liquidation risk are negatively correlated in West Germany but probably not in East Germany.

Some start-ups opt for a diversified firm concept by entering several industries at once. According to portfolio theory, diversification can serve as a risk-reducing investment strategy by combining projects with negatively or

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[7]See Geroski (1991, 1995) for a discussion and the model of Mills and Schumann (1985). Mills and Schumann (1985) assume that small firms have higher minimum average costs than their larger competitors but a more flexible production technology due to a high share of variable costs. These flexible small firms are shown to be more successful in industries with high rather than low demand fluctuations.

[8]As the labor office covers due wage payments including social security contributions, bankruptcy filings by social security agencies become increasingly likely the more employees are concerned. Häsemeyer (1998) discusses the relevant regulation.

imperfectly positively correlated returns. Rose (1992) shows in a theoretical model for entrepreneurial firms that owner-managers choose costly diversification if it reduces the firm's liquidation risk and thus increases the expected value of their firm-specific human capital. Following Jovanovic (1993), diversified firms may also realize cost advantages by exploiting economies of scope.

> H4: Diversified start-ups have c.p. a lower risk of bankruptcy and voluntary liquidation than non-diversified start-ups.

Start-ups participating as franchisee in business format franchising pay a fee and royalties to receive a detailed business plan and a trade name (Lafontaine and Shaw 1999). Applying an already tested business plan is probably less risky than developing and using a new one. Well-known trade names can help to attract customers. Moreover, Rubin (1978) and Bates (1995) discuss that franchisers may pre-select and train their franchisees as well as facilitate access to financial resources.

> H5: Franchisees have c.p. a lower risk of bankruptcy and voluntary liquidation than non-franchise entrants.

As discussed by Harhoff, Stahl, and Woywode (1998) the legal form of a start-up in Germany can be interpreted as a signal for project risk since it determines the liability status of the owners.[9] Entrepreneurs who want to start a highly risky project tend to choose a legal form with limited liability rather than full liability.[10] Fully liable owners risk all their distrainable personal wealth and usually have continuing obligations after the completion of a bankruptcy procedure due to the German insolvency law in force until 1999.[11] Thus, a rational, risk-neutral owner-manager with full liability will liquidate voluntarily rather than continue a firm he considers to be inefficient. In contrast, owners with limited liability are only liable up to the amount of their equity share. Thus, the residual firm value for such an owner resembles a call option and is c.p. at least as high to him as to a fully liable owner. Consider a situation with asymmetric information between a rational, risk-neutral owner-manager with limited liability and the firm's creditors. If then the firm turns out to be inefficient, the owner-manager may not liquidate

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[9]Moreover, legal fees, disclosure and taxation rules as well as the mode of ownership change depend on the legal form. I omit these aspects because they are of minor relevance here.

[10]Note here that German law allows for limited liability companies started by one person alone.

[11]After bankruptcy all creditors with unmet claims are entitled to pursue these claims against any distrainable future earnings and profits of the debtors (Häsemeyer 1998).

voluntarily but increase his expected residual firm value at the expense of the creditors by shifting to a riskier project with the same or a lower expected value than the initial project (Stiglitz and Weiss 1981). Such a behavior will increase the risk of financial distress and thus bankruptcy.

> H6: Firms with fully liable owners have c.p. a lower bankruptcy risk than firms with limited liability. The relation between liability status and voluntary liquidation risk is ex ante not clear.

Ownership and management of the firm

So far, I referred to the "typical" new firm started by a single owner-manager. But start-ups can have several owner-managers and the owner team can include other firms. Different internal control and management situations are presumably a crucial factor affecting the bankruptcy and voluntary liquidation decision of new firms.

Firms started by a team of owner-managers should be endowed with a higher human capital stock than start-ups with only one owner-manager because deficiencies of one team member's education or experience can be compensated by others (Cressy 1996a). Eisenhardt and Schoonhoven (1990) mention specialization of team members for different tasks as an additional advantage. Altogether, team start-ups tend to attain higher venture returns than other start-ups and will consequently face a lower bankruptcy risk.

However, team members may disagree about central issues and preferences can turn out to be incompatible (Wagner, Pfeffer and O'Reilly 1984, Eisenhardt and Schoonhoven 1990). If a team fails to build up a viable organization and breaks apart, one or several owner-managers will probably leave the firm and may trigger a voluntary liquidation. They will hardly wait until the firm's decline forces it into bankruptcy.

> H7: Team start-ups are c.p. less likely to exit via bankruptcy than firms not managed by a team. The existence of a team has ex ante no clear impact on the voluntary liquidation risk.

Some firms are partly or fully owned by parent firms when starting their business activities. Such affiliates often benefit from the parent firm's network, funding, and knowledge (Mata and Portugal 2002). Most important, I expect Western affiliations of East German start-ups to compensate for insufficient managerial skills as well as lacking marketing, accounting and institutional knowledge. Such deficiencies were substantial at the beginning of the economic transition in East Germany (Dyck 1997). All these resource-based advantages of affiliations should increase venture returns and thus lower the

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risk of liquidation.

However, affiliated firms may have higher liquidation values than non-affiliated ones. Among others, Baden-Fuller (1989), Liebermann (1990) and Deily (1991) argue that in case of liquidation an affiliate's assets and employees and along with it some of its specific capital and human capital may be successfully transferred to the parent firm.

These arguments and the two following reasons imply a low bankruptcy risk for affiliated firms but not necessarily a lower voluntary liquidation risk. Firstly, a parent firm is often fully liable for its affiliate's obligations and the affiliate can not default as long as the parent firm is not bankrupt itself. Full liability is implied by several types of firm relations, for example by agreements to transfer profits (Häsemeyer 1998). Full liability of the parent firm can also result from declarations of patronage and explicit or implicit guarantees often asked for by the affiliate's creditors. Secondly, even in cases where bankruptcy of the affiliate is independently feasible, parent firms often cover the affiliate's obligations and may liquidate it voluntarily (Li and Guisinger 1991). They do so in order to preserve their own reputation on the credit market and to prevent customers and suppliers from interpreting the affiliate's default as a signal of financial problems of the parent firm itself.

> H8: Affiliated start-ups have c.p. a lower bankruptcy risk than non-affiliated ones. The relation between affiliation and voluntary liquidation risk depends on the relative importance of the affiliation effect on venture returns, of the affiliation effect on liquidation values, and of bankruptcy avoidance. East German start-ups with an affiliation to Western parent firms have lower liquidation risks than other affiliated start-ups in East Germany.

3   Data

The empirical analysis is based on a large firm sample well suited for analyzing and comparing exit decisions of new firms in East and West Germany. To set it up a stratified random sample with 10,000 East and 12,000 West German firms was drawn from two complementary firm panels maintained at the Centre of European Economic Research (ZEW), Mannheim. Currently, the East and the West German panel cover altogether more than six million firms. The data are provided by the leading German credit rating agency, called Creditreform, approximately every six months.[12] Creditreform collects

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[12]Credit rating data is also used by Phillips and Kirchhoff (1989), Audretsch (1995), and Harhoff, Stahl, and Woywode (1998).

information on legally independent, active firms either proactively or on demand. Information collection from public registers, newspapers, company reports, and in firm interviews is an ongoing process such that the frequency of information updating varies among firms. A typical firm record in the panels provides a lot of information about firm formation, insolvency filings and liquidation. Moreover, it indicates the firm's location, industry classification, number of employees, legal status, ownership and management details.[13]

Now, I briefly comment on three issues crucial in the context of the following empirical analysis. Firstly, I want to compare firm behavior in East and West Germany during the decade right after unification. The East and West German panel at the ZEW are well suited for that purpose since Creditreform uses standardized data collection and cleaning procedures. Such comparative studies are of high interest since obtaining reliable data for transition economies and comparing it to data for Western market economies is typically very difficult (Filer and Hanousek 2002).

Secondly, data on a well-defined population of start-ups should be used to analyze exit decisions of new firms. Creditreform collects information on firms of any size or legal form in all industries and regions. Comparisons with other data bases conducted by Harhoff and Steil (1997) show that firms having several employees or being registered in the trade register are very well covered in Creditreform's data base.[14] In contrast to many other data bases, micro firms with often only one owner-manager, no additional employee and no trade register entry are also covered.[15] Such firms may, however, be underrepresented and may enter the data base only some time after market entry.[16] Since late recording is correlated with firm survival and implies missing information on start-up characteristics, all firms entering Creditreform's data base more than one year after the first recorded formation date were eliminated from the panel population before drawing the sample.

Being interested in start-ups during the first years after unification, only firm records with a primary or secondary firm formation date between 1990

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[13]Further information on ZEW firm panels can be found in Almus, Engel, and Prantl (2000) and Harhoff, Stahl, and Woywode (1998).

[14]Registration in the trade register is compulsory for all commercial partnerships, limited liability firms, stock companies and large sole proprietorships (§1, §106 and §162 Handelsgesetzbuch (HGB), §7 GmbH-Gesetz, §36 Aktiengesetz). Sole proprietorships classified as small businesses according to §2 HGB, freelances, firms in the agricultural sector and civil law associations do not appear in the trade register.

[15]In the main sample used below a large share of firms, i.e. 23.5 percent, has only one employee including owner-manager and no trade register entry.

[16]The extent of undercoverage is unknown since none of the official firm statistics covers all existing entrepreneurial activity in Germany.

and 1993 were considered.[17] After drawing the sample of 22,000 firms about 4,000 pages of Creditreform's free flow text material were analyzed in detail and encoded for the purpose of this study, because it contains important and comprehensive information on firm formation and liquidation events not provided in coded form. It turned out that 3,484 firms in the sample started their business activity before 1990. A legal form change, a relocation or an ownership change did cause the secondary formation date between 1990 and 1993. These firms were deleted in order to restrict the empirical analysis to firms starting market activity between January 1, 1990 and December 31, 1993.

Thirdly, detailed liquidation data is needed for an analysis of different exit types. Firm liquidation is defined here as the termination of all business activities and the sell-off of the firm's assets. This is usually accompanied by a deregistration of the firm from the trade or business register. When Creditreform detects the liquidation of a firm, it records information about it mainly in the free flow text already mentioned. Thus, the text information on liquidations between January 1, 1990 and December 31, 1999 was extracted for all 22,000 firms. A large telephone survey conducted in 1999/2000 provides further data about the activity status of 5,299 firms in the sample.[18] Liquidations were classified as bankruptcy-related or voluntary based on Creditreform's comprehensive data on bankruptcy filings and proceedings. This insolvency information is highly reliable for several reasons. First, a credit rating agency needs complete and accurate information about a firm's solvency. Second, information about insolvency proceedings is publicly accessible due to compulsory publication in newspapers and official registers. Facing time and money restrictions, a sample well suited for analyzing firm exit was obtained by oversampling firms approximately twofold if one of several indicator variables coded by Creditreform suggested a liquidation. The disproportionally stratified choice-based sampling feature increased the sample variation that is crucial for the empirical analysis presented below. However, the dependence of the sampling rule on the endogenous variable has to be taken into account in all estimation and test procedures.[19]

After having eliminated the 3,484 firms already in business before 1990, I applied three further exclusion restrictions. 927 records on holding companies, part-time projects, and legally dependent firm units were removed.

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[17]Per firm and panel wave there exist three data fields called formation date 1 - 3. Creditreform stores primary formation dates in these fields. Moreover, secondary dates caused by legal form changes, relocations or ownership changes do also enter.

[18]A description of this telephone survey provide Almus et al. (2001).

[19]See Manski and McFadden (1981) and Angrist and Krueger (1999) for further discussion and section 4.1 for details.

1,794 firm records had to be eliminated because of missing information on firm characteristics at market entry, inconsistencies or typing errors. Moreover, I did not use 2,028 firms in the main analysis because human capital information, i.e. information on education and age, was not available for these firms.[20] Table 1 contains the definitions of all variables used and descriptive statistics for the main sample of 13,767 firms.

4 Competing risk analysis

In the following, I present the empirical analysis with voluntary liquidations and liquidations linked to bankruptcy filings in East and West Germany. In Section 4.1, I briefly describe the applied semi-parametric hazard rate model and estimation techniques. Non-parametric, stratified baseline hazard estimates are discussed in section 4.2. The baseline hazard estimates shed light on the time-pattern of the firms' learning after market entry and on the exit behavior of firms with different legal forms. In addition, the structure of the exit process in East and West Germany can be compared. Estimated covariate effects are explained in section 4.3.

4.1 Econometric model and estimation techniques

For the competing risk analysis, a semi-parametric, continuous-time proportional hazard rate model with two mutually exclusive absorbing states is used. Distinguishing between liquidation after bankruptcy filing b and voluntary liquidation v I define two latent liquidation times T^b and T^v for each firm (Kalbfleisch and Prentice 1980, Cox and Oakes 1984). The observable liquidation time T is defined as the minimum of the two latent variables: $T = \min\left(T^b, T^v\right)$. The observed type of liquidation L takes value $L = l$ if $T = T^l$ where $l \in \{b, v\}$. The following hazard function $h_l(t; X = x)$ depicts the instantaneous probability of liquidation type l:

$$h_l(t; X = x) = \lim_{\Delta t \to 0+} \frac{P\left(t \leq T^l < t + \Delta t \mid t \leq T^l, X = x\right)}{\Delta t} \qquad (3)$$

where X denotes a vector of time-constant covariates, x a realization of X and t indicates time since firm formation.

This unobservable function $h_l(t; X = x)$ equals the observable hazard function

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[20]Robustness of the empirical results for firm characteristics with respect to this last exclusion restriction is shown in table 4.

$$h^l(t; X = x) = \lim_{\Delta t \to 0+} \frac{P\left(t \leq T^l < t + \Delta t \mid t \leq T = \min\left(T^b, T^v\right), X = x\right)}{\Delta t}$$

(4)

for all t and l if the random variables T^b and T^v are mutually independent. Assuming independence, the likelihood function can be factorized into additive, separable terms for each liquidation type l. Each type-specific hazard can be estimated with a single-risk model where firms exiting by the competing type of liquidation are treated as censored at the moment of liquidation (Petersen 1995).

20.1 percent of the firms in the sample ran into liquidation after a bankruptcy filing, 19.5 percent liquidated voluntarily.[21] The remaining 60.4 percent have uncompleted duration spells and are censored in all estimations. 87.5 percent of these uncompleted spells are right-censored at the end of the observation period. 12.5 percent are censored earlier because Creditreform stopped updating the firm record after a relocation or an ownership change. Estimating a continuous-time model is considered appropriate here, since the process of interest is continuous in time. Moreover the duration of a firm's market activity can be measured in days such that tied duration spells occur only rarely.[22]

To estimate the type-specific hazard functions I used the following stratified version of the Cox proportional hazard model:

$$h^l(t; X = x) = h_{0,s}^l(t) * e^{x\beta^l} \quad \text{with} \quad l \in \{b, v\} \quad \text{and} \quad s = 1, 2. \quad (5)$$

The coefficient vector β^l can be estimated without specifying the stratified baseline hazard function $h_{0,s}^l(t)$ by maximizing a partial likelihood function (Cox 1972, 1975). Since the observations are choice-based sampled from the parent population, I used the weighted maximum likelihood estimator proposed by Manski and Lerman (1977) and the robust variance-covariance matrix estimator of Lin and Wei (1989).

One separate baseline hazard function $h_{0,s}^l(t)$ was estimated for each stratum group by applying a non-parametric Kaplan-Meier estimator. I used a legal form indicator as stratification variable since its linear modeling in the exponential factor of equation (5) would not have been appropriate. Graphical investigations and statistical tests along the line of Kalbfleisch and Prentice (1980) and Grambsch and Therneau (1994) indicated non-proportional hazard functions for different legal form groups.

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[21] All shares mentioned in this paragraph are non-weighted shares.

[22] The data base provides exact dates for all firm formation and most liquidation events. Whenever only the month and year of a liquidation is registered, I imputed the date into the 15th of the respective month.

4.2 Baseline hazard estimates

In this section, I discuss baseline hazard estimates that show the relation of new firms' exit decisions to learning, liability status and the economic environment. The baseline hazards displayed in figure 1 are calculated for the model in equation (5). The corresponding estimates of the coefficient vectors β^l with $l \in \{b, v\}$ are presented in table 3 and discussed in section 4.3. In figure 1, the graphs for East German firms refer to retail firms started in 1990 in Saxony-Anhalt. The graphs for West German firms refer to retail firms started in 1990 in North Rhine-Westphalia. In both the East and West German graphs the firms have mean employment (6 employees), mean owner-manager age (37 years), no diversified firm concept, no franchise contract, no firm affiliation, and one owner-manager who completed an apprenticeship or some other type of low education.
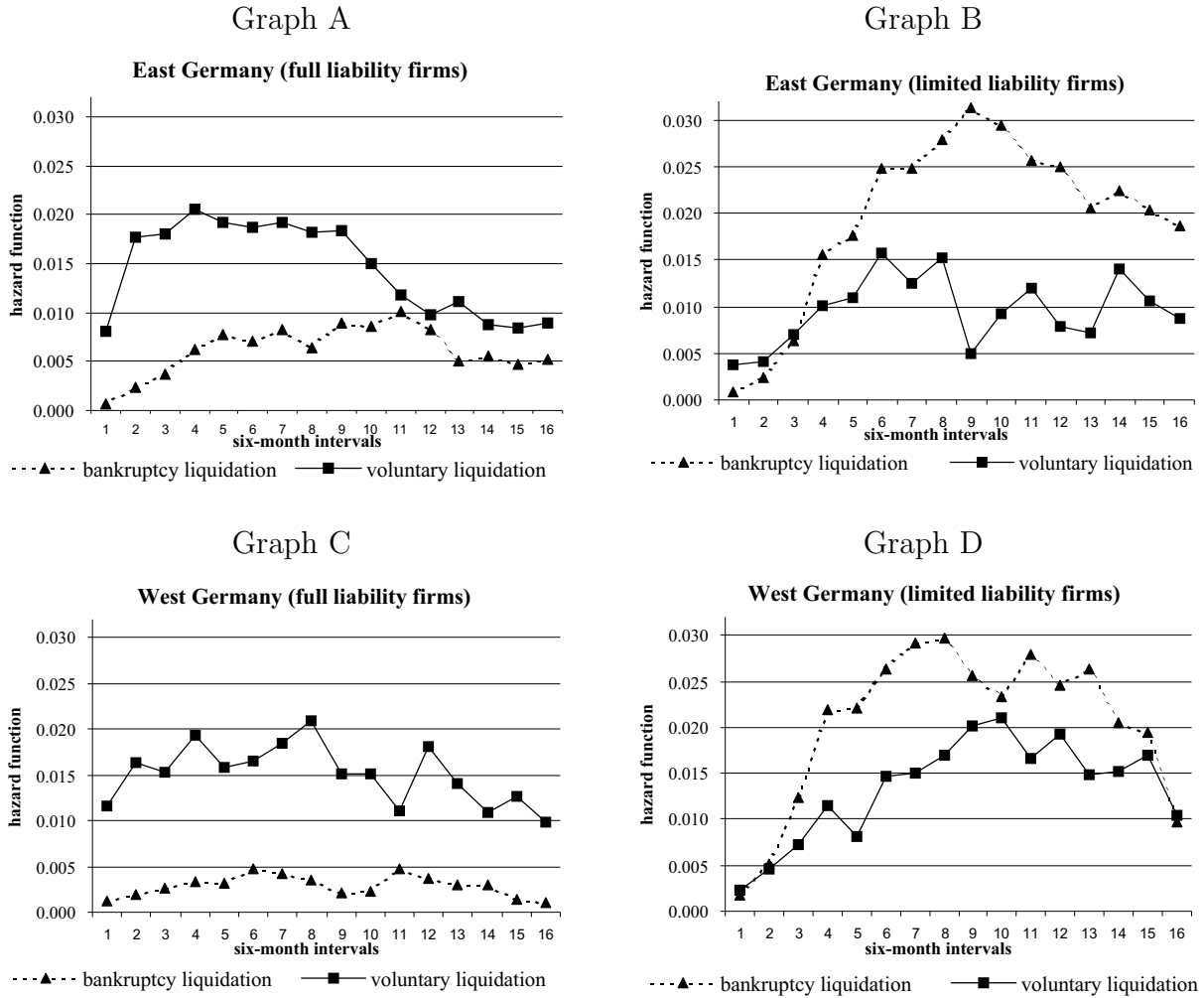
The four graphs in figure 1 reveal a non-linear pattern of the baseline hazard functions for the bankruptcy and the voluntary liquidation risk. This pattern is valid not only for firms in the reference group, but also for all other firms in the sample because other covariate values induce proportional shifts of the estimated baseline hazards due to the underlying model structure in equation (5).[23] Following Pakes and Ericson (1998), non-linear baseline hazard functions are consistent with Jovanovic's passive learning model discussed in section 2.1.[24] Many functional forms of the model imply that it takes time to accumulate a history n_t with realizations of the profit-related variable η that is sufficiently informative to ensure the optimality of a firm liquidation. Accordingly, the instantaneous liquidation risk of new firms increases in time during the initial periods after market entry. But at some point, it starts to decrease because from then on firms still active in period t are less likely to be inefficient, have more precise knowledge about their initially unknown productivity parameter θ and are less prone to liquidate than active firms in period $t-1$.

The stratification variable distinguishes between two firm groups. One group covers non-public limited liability firms and the few stock companies in

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[23]A non-linear pattern of the exit risk when all liquidation types are pooled was found by Brüderl, Preisendörfer, and Ziegler (1992) and Wagner (1994) for two specific regions in West Germany. These early results are, however, not directly comparable to mine because I control for observable firm heterogeneity. Brüderl, Preisendörfer, and Ziegler (1992) present proportional log-logistic hazard estimates without covariates and Wagner (1994) discusses life table estimates.

[24]Pakes and Ericson (1998) stress that the passive learning model is in line with different shapes of the hazard function. It does not necessarily imply a monotonously decreasing hazard function which was associated with the model of Jovanovic (1982) by Dunne, Roberts, and Samuelson (1989) and in related work.

Figure 1: Baseline Hazard Estimates

Graph A

East Germany (full liability firms)

Graph B

East Germany (limited liability firms)

Graph C

West Germany (full liability firms)

Graph D

West Germany (limited liability firms)

Note: Non-parametric Kaplan-Meier baseline hazard estimates referring to retail firms started in 1990 in Saxony-Anhalt (North Rhine-Westphalia) with mean employment, mean owner-manager age, no diversified firm concept, no franchise contract, no firm affiliation, and one owner-manager who completed an apprenticeship or some other type of low education.

the sample. According to the German business law, owners of such corporate firms are only liable up to the amount of their equity share. The other group consists of all non-corporate legal forms in the sample: sole proprietorships, civil law associations and commercial partnerships. These non-corporate firms have at least one owner who is fully liable with all his distrainable

personal wealth.

In East and West Germany, limited liability firms have a substantially higher bankruptcy hazard than firms with fully liable owner-managers. By contrast, the levels of the voluntary liquidation hazards are not that different. According to graphs A and B the bankruptcy hazard of East German limited liability firms is at least two and a half times as high as the bankruptcy hazard of East German full liability firms surviving more than two and a half years. For West German firms surviving more than one and a half years, graphs C and D exhibit a bankruptcy hazard in case of limited liability which is at least five times higher than in case of full liability. Altogether, this evidence on the relation between a firm's liability status and its liquidation hazards is in line with hypothesis H6 in section 2.2.

Comparing graphs B and D indicates a deviating structure of the exit process in the transition economy in East Germany and the stable West German market environment. The bankruptcy hazard for East German limited liability firms relative to their voluntary liquidation hazard is higher than for West German firms in the group the figures refer to. A similar pattern can be observed in graphs A and C for full liability firms. Before interpreting this result, it has to be checked whether it holds for all other firms in the sample.[25] When looking at the whole sample population, 39.17 percent of all liquidations in East Germany are related to bankruptcy filings, but only 28.78 percent of those in West Germany. To show that the observed gap is not simply a consequence of the different composition of the East and the West German firm population with respect to industry, size or legal form table 2 describes the composition of the East and West German sample population and shows the structure of the exit process in several sub-samples.

The second and third column in table 2 indicate the shares of each industrial sector, size class and legal form class in the East and West German sample population. In the fourth column the results of two-tailed tests of the null hypothesis stating equality of the means in column 2 and 3 are shown. East German start-ups belong more often to the sectors construction and retail trade and less often to wholesale or intermediate trade and services than West German ones. In contrast to West German firms, East German firms appear more often in the two upper size classes and less often in the group of firms with only 1 employee including the owner-manager. East German start-ups are more often organized as sole proprietorships or commercial partnerships and less often as limited liability firms or stock companies. The

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[25]Note that each curve in the graphs B and D or A and C results from the estimation of another model. Hence, stability of the described pattern is not guaranteed for other firm groups by proportionality of the hazards within a model.

fifth and sixth column in table 2 show for each sub-sample in East and West Germany which share of liquidations is linked to bankruptcy filings. Column 7 indicates a significantly higher bankruptcy share in East than in West Germany for all legal form classes, both the higher size classes and the manufacturing, construction, retail trade and transport and communication sectors.

This result is very interesting since it is not simply caused by different insolvency regulation in East and West Germany.[26] At first, the result can be linked to differences in capital availability and capital use in both parts of Germany. Private capital accumulation in East Germany before unification was low such that East German entrepreneurs after unification typically started their firms with a lower share of private equity and collateral than West German entrepreneurs. According to Harhoff and Körting (1998b) banks charged East German firms after unification with less than 500 employees c.p. significantly higher interest rates for lines of credits than West Germany ones. However, the government supported East German investment by substantial investment allowances, investment grants and special depreciation provisions not available to firms in West Germany (Sinn 1995). In addition, subsidized loans were more generously offered to start-ups in East than in West Germany (Prantl 2003). Despite these government interventions, Harhoff and Körting (1998b) find that East German firms are c.p. significantly less likely to take advantage of fast payment discounts on trade credits than West German firms. Thus, they pay implicit interest rates that are much higher than rates charged by banks which indirectly reveals binding financial constraints (Petersen and Rajan 1994). Stronger financial constraints imply a higher risk of financial distress and are thus consistent with a higher share of bankruptcy-related liquidations in East than in West Germany.

Different labor market situations in East and West Germany are also likely to contribute to the higher share of bankruptcy cases among all liquidations in East Germany. Labor market conditions affect the individual liquidation threshold of entrepreneurs. After unification, the restructuring of large, formerly state-owned firms triggered a huge number of dismissals in East Germany and the labor market situation remained precarious during the 1990s. The East German rate of registered unemployment varied between 10.3 and 19.5 percent during the 1990s whereas the West German rate remained at a lower level between 6.3 and 11.0 percent. Furthermore, the number of registered open positions per person was lower in East than in

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[26]The German insolvency law after unification was implemented in the same way in East and West Germany (Häsemeyer 1998).

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West Germany (Sachverständigenrat 2000/2001). Taking into account low regional mobility of German job seekers, the individual liquidation thresholds of entrepreneurs in East Germany should be lower than in West Germany. According to equation 1 this implies a lower propensity to liquidate voluntarily and can thus contribute to a higher share of bankruptcy-related liquidations. Further evidence in line with an impact of labor market conditions on the exit process among new firms is presented in the next section.

4.3 Covariate effects on the hazards

Now, I turn to empirical evidence related to those hypotheses of section 2.2 not dealt with in the foregoing section. Firstly, I concentrate on the risk-specific effects of management and ownership covariates. Especially interesting insights can be gained by distinguishing between different types of firm affiliations in East Germany. Secondly, basic human capital effects, more complex human capital effects in team start-ups as well as firm size effects are shown to be risk-specific and to depend on the economic environment in East and West Germany.

In the East German competing risk regressions in table 3 all 6,236 East German firms in the sample of 13,767 firms with human capital information are used. In the West German regressions 7,531 firms are used. The covariate vector X covers the human capital variables and firm characteristics mentioned in section 2.2. In addition, several control variables are used to capture cohort-, industry- and location-specific effects.[27] All results in table 3 I comment on are robust with respect to substantial sample variation. As can be seen in table 4, the regressions based on an extended sample including all 15,795 firms with or without human capital information confirm the discussed effects of firm characteristics. Moreover, the regressions in table 5 for the reduced sample of 9,050 firms that are owned and managed by one entrepreneur and not affiliated to other firms indicate quite similar results as in table 3 for those human capital and firm characteristics usable in both samples.

The regressions in table 3 include several indicator variables capturing different internal control and management situations. These variables are

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[27]Three indicator variables for the firm formation years 1991, 1992, and 1993 are jointly significant in both regressions for East Germany and in the voluntary liquidation regression for West Germany. In addition to 5 (10) indicators for East (West) German states I use a measure of the population density in the district of firm location to control for location-specific effects. I find significant hazard-increasing agglomeration effects in both equations for East Germany. Finally, 18 (18) industry dummies at the two-digit level are meant to account for industry-specific effects. These are always jointly significant.

used since the sample includes not only firms owned and managed by a single entrepreneur but also team start-ups and start-ups with affiliations to other firms.[28] The dummy variable TEAM is coded one if a start-up is managed by a team of persons. Table 3 displays a significant, negative coefficient of TEAM in the bankruptcy equations for East and West Germany. Thus, the bankruptcy hazards are found to be significantly lower for team start-ups in both parts of Germany than for firms started by a single owner-manager. Hence, I do not find evidence against the higher average human capital stock or better work organization in team start-ups that are in line with hypothesis H7. TEAM is significantly and positively correlated with the voluntary liquidation hazard in both parts of Germany. This result is in line with the view that team members are unlikely to wait for bankruptcy but liquidate voluntarily if the initial team of owner-managers breaks apart.

In the regressions for West Germany, the variable FULL_AFFIL indicates whether a start-up is a subsidiary, i.e. whether it is fully affiliated to a parent firm, or not. PART_AFFIL is coded one if a start-up is no subsidiary but has at least one firm among its owners. Subsidiaries and partly affiliated start-ups exit significantly less often in connection with a bankruptcy filing than non-affiliated firms. But subsidiaries and partly affiliated firms are as prone as non-affiliated firms to liquidate voluntarily. In accordance with hypothesis H8, the results suggest the empirical relevance of bankruptcy avoidance induced by declarations of patronage, guarantees or by reputation effects. The fact that the coefficient of FULL_AFFIL is lower than the coefficient of PART_AFFIL in both the bankruptcy and the voluntary liquidation equation points towards stronger resource-based advantages of fully than of partly affiliated start-ups. The null hypothesis of equal coefficients could, however, not be rejected using Wald-tests.

In the regressions for East Germany, I can exploit information on owner location to distinguish between full and partial affiliations to East German or Western firms (FULL_AFFIL_EAST, FULL_AFFIL_WEST, PART_AFFIL_EAST, PART_AFFIL_WEST). FULL_AFFIL_EAST has a significant positive effect on the voluntary liquidation risk and all other indicators do not affect the voluntary liquidation hazard significantly. By contrast, the bankruptcy hazard of start-ups fully or partly affiliated to Western firms is significantly lower than the one of non-affiliated start-ups. The coefficients for subsidiaries of East German firms and of other East German affiliates remain insignificant. In both the bankruptcy and voluntary liquidation equation the sign and size pattern of the four coefficients suggests

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[28]29.4 percent of all firms in the sample are team start-ups. 7.4 percent are partly affiliated to other firms and 2.3 percent are subsidiaries.

stronger hazard-reducing effects of affiliations to Western firms than to East German firms. Western parent firms seem to promote a new East German firm's prospects successfully by providing valuable management support and funding or by integration into a market-proven network. There is also statistical support for the superiority of Western affiliations since the coefficients of PART_AFFIL_EAST and PART_AFFIL_WEST in the bankruptcy equation as well as the coefficients of FULL_AFFIL_EAST and FULL_AFFIL_WEST in the voluntary liquidation regression differ significantly according to Wald-tests.

Given the sample composition, I use the following indicator variables to capture educational degrees of individual owner-managers or managers and the mixture of degrees in owner-manager or manager teams. The variable MASTER_CRAFT is coded one if a firm is either owned and managed or managed by a single person with high vocational training indicated by the master craftsman degree. It is also coded one in case of a team of owner-managers or managers who all have a master craftsmen degree. The other dummies indicate graduate degrees in business administration or economics (BUS_ADMIN), engineering (ENGINEERING), other academic fields (OTHER_GRADUATE), apprenticeships or other forms of low education (LOW_EDUC), and missing degree information (EDUC_UNKNOWN). GRAD_MIX is coded one if a team consists of members with at least two different types of graduate degrees. OTHER_MIX indicates heterogeneous teams with at least two educational degrees out of the following groups: LOW_EDUC, MASTER_CRAFT and graduate degrees. Using this set of indicator variables provides a sufficiently flexible specification of the model according to the following test results. Interaction terms between the team indicator and all education dummies referring to both, start-ups by individuals and teams, remain jointly insignificant in any of the equations in table 3. Interactions between the education dummies with an indicator coded one for fully or partly affiliated firms are jointly insignificant as well.[29] Note that the coefficient of EDUC_UNKNOWN remains insignificant in three equations and is significant only at the 10-percent significance level in the East German bankruptcy equation. This and the comparison of the results in tables 3 and 4 discussed at the beginning of this section suggest that missing human capital information raises no selectivity concern when estimating liquidation risk equations with the data at hand.

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[29]Interacting the education indicators and the indicator of subsidiaries was not feasible since many cells contained an insufficient number of observations. An interaction between an indicator of any type of high education and the indicator of subsidiaries is found to be insignificant in three of the four equations and significant at the 10-percent level in only one equation.

West German firms managed by a person or a team of persons with a graduate degree in business administration or economics, engineering or any other field, face a significantly lower bankruptcy hazard than firms managed by persons with low education. In the voluntary liquidation equation, all variables that indicate a graduate degree remain insignificant. This pattern is consistent with hypothesis H1 according to which graduation promotes high venture returns as well as high returns in alternative employment. Thus, the individual liquidation thresholds of graduates are sufficiently high to render the indicators of graduate degrees insignificant in the voluntary liquidation equation. Taylor (1999) finds no significantly lower bankruptcy hazard and a significantly higher chance of moving to alternative employment for self-employed British men with high education than for those with low education. Interestingly, his results indicate the same structural difference between the two competing exit mechanisms as my analysis. In contrast to the pattern discussed so far, the coefficient for master craftsmen is significant and negative in both, the bankruptcy as well as the voluntary liquidation equation. This result may be caused by less favorable wage offers for master craftsmen than for graduates since self-employment is traditionally high in the German crafts industries. Moreover, the master craftsman degree is an important institutional entry barrier in many areas of business activity in Germany. Thus, the master craftsman coefficient may partly reflect the survival-enhancing effect of this entry barrier not captured by the two-digit industry dummies that are included in all regressions.

In East Germany, firms managed by master craftsmen or engineers have a significantly lower bankruptcy hazard than firms managed by persons with low education. In addition, the coefficient for firms managed by persons with a graduate degree in business administration or economics is also negative and significant at the 10-percent significance level.[30] In contrast to West Germany, not only firms of master craftsmen but also firms of engineers have a significantly lower voluntary liquidation hazard than those of persons with low education. This result indicates that East German engineers who became self-employed after unification face less favorable alternative employment op-

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[30]This result was unexpected. Persons that graduated in business administration or economics in East Germany before the breakdown of the planned economy should have accumulated a lot of system-specific knowledge being useless when managing a start-up after unification. One possible explanation for the estimation result is the following. The group of persons in the East German subsample with a degree in business administration or economics may cover a high share of migrants from West Germany. Given that I can not control for the West or East German origin of persons with the data at hand, such migrants may cause the significant negative coefficient of BUS_ADMIN in the bankruptcy equation.

portunities than engineers who started a firm in West Germany.

In West Germany, firms with heterogeneous teams (GRAD_MIX, OTHER_MIX) have a significantly lower bankruptcy hazard than firms managed by homogeneous teams of persons with low education. In case of teams with more than one type of graduate degree (GRAD_MIX) the bankruptcy hazard is also significantly lower than for homogeneous teams of master craftsmen. A different pattern is found for East Germany. In contrast to homogeneous teams of master craftsmen, engineers or economists, heterogeneous teams have no significantly lower bankruptcy hazard than homogeneous teams with low education.[31] This difference between East and West German evidence can be related to the literature in organization science about the composition of teams. Following Eisenhardt, Kahwajy, and Bourgeois (1997) and Lawrence (1997) heterogeneity in teams is costly because the time needed for discussion and decision-making increases with heterogeneity. The benefit of heterogeneity is argued to be a higher propensity of innovative problem solutions, for example a new product idea or an unconventional marketing concept. Therefore, heterogeneous teams can be expected to be less successful in economic environments rewarding quick decision-making rather than unconventional ideas. As explained in the following, the evidence I find for East and West Germany is in line with this expectation. West German start-ups during the 1990s faced stable industry structures and well established, incumbent competitors such that they had to come up with new ideas to win a lasting market position. By contrast, the East German transition economy seems to have offered first-mover advantages to quickly deciding firms entering with a main-stream concept. In this environment, heterogeneous teams with a high potential for innovative ideas ran as often into bankruptcy as teams with low education, probably because of a too time-consuming decision process.

The age variable MEAN_AGE is the mean age of the start-up's owner-manager or manager team. As in the case of education indicators, including interaction terms between the age variable and the team indicator turned out to be insignificant in all four equations in table 3. Interaction terms with the indicator for subsidiaries or an indicator for full and partial affiliations were also statistically insignificant in all equations. Age is significantly negatively correlated with the bankruptcy hazards in East and West Germany. This is

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[31]Since the dummies GRAD_MIX and OTHER_GRADUATE are insignificant in the bankruptcy equation for East Germany an alternative specification with two dummies instead of GRAD_MIX was also tested. One dummy indicated the graduate teams consisting of persons with degrees in economics or engineering. The other one indicated all other mixed graduate teams. The alternative specification lead to the same conclusions as the one used in table 3.

consistent with the effects of work-experience, risk-aversion and wealth on venture-related returns as expected in hypothesis H2. The effect of age on both voluntary liquidation hazards is significant and non-monotonous. In East Germany, persons or teams with a (mean) age of about 41 years have a lower voluntary liquidation hazard than others. In West Germany, the minimum is reached at about 35 years. The age effects found here suggests that human capital decay as discussed by Bates (1990), Cressy (1996a) and Storey and Wynarczyk (1997) does probably not cause the inverse U-shaped age effects on firm survival chances they report. Human capital decay should affect not only the voluntary liquidation hazard but also the bankruptcy hazard. Hence, the business and work experience of entrepreneurs starting a firm at high age could only be judged to suffer from depreciation if I observed a U-shaped age effect on both competing hazards. By contrast, I observe an upward shifted voluntary liquidation hazard but a downward shifted bankruptcy hazard in the upper part of the age distribution. The positive age effect on the voluntary liquidation hazard in the upper part of the age distribution is thus more likely to reflect increasing individual exit thresholds and retirement decisions.

Firm size at market entry is measured by the logarithm of SIZE, i.e. the number of employees including owner-managers in full-time equivalents. In the bankruptcy equations, I use a quadratic polynomial to capture the impact of firm size. Harhoff, Stahl, and Woywode (1998) use a similar specification in a bankruptcy risk equation for a sample including mature firms. The marginal effect of firm size on the bankruptcy hazard is initially positive. For East (West) German firms with more than 25 (18) employees, it is negative. This suggests that the feasibility and attractiveness of out-of-court liquidations for financially distressed firms decreases with firm size as explained when discussing hypothesis H3 in section 2.2. Brüderl, Preisendörfer, and Ziegler (1992), Audretsch and Mahmood (1995), and Mata and Portugal (1994) among others report negative correlation of entry size and the pooled exit risk. All these studies do not distinguish between competing liquidation types and address start-up survival in Western economies. I observe a significant, negative coefficient of entry size in the voluntary liquidation equation for West Germany. In the voluntary liquidation regression for East Germany, however, the negative coefficient turns out to be insignificant. This East-West difference is in line with hypothesis H3. In contrast to small West German start-ups, small start-ups in East Germany after the breakdown of the planned economy had no higher voluntary liquidation hazard than larger start-ups. Probably, they occupied market niches with good survival chances. Another explanation can be that small-scale flexibility is more advantageous for start-ups coping with uncertain market conditions and unsettled indus-

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try structures during the transition of East Germany than for new firms in West Germany. My results for a transition and a stable market economy add to the evidence on the size-survival correlation provided by Agarwal and Audretsch (1999, 2001) for different stages of the industry life-cycle.

Hypothesis H4 about diversification as a hazard-reducing strategy has to be rejected. The variable DIVERSIFIED which indicates firms that start in more than one 5-digit industry has positive, insignificant coefficients in two of the four equations. The effect on the voluntary liquidation hazard in East Germany is positive and significant. These results can be related to negative diversification effects on firm profitability, productivity and sales reported by Berger and Ofek (1995), Schoar (2002), and Nguyen Van, Kaiser, and Laisney (2003). Along the lines of Schoar (2002) my results for the exit risks of German start-ups can be explained by distraction of the owner-managers from core competencies and overtaxing due to the number and complexity of arising management tasks.

Firms that start as a franchisee (FRANCHISEE) have significantly lower bankruptcy and voluntary liquidation risks than other start-ups in East and West Germany. Thus, I find support for hypothesis H5 in two different economic environments. By contrast, Bates (1995) reports a significantly higher exit probability for franchisees than for non-franchise firms in a sample of sole proprietorships, partnerships and S-corporations founded in the United States between 1984 and 1987. When I restrict my sample to sole proprietorships and partnerships I still find reduced hazards for franchisees in all equations. However, in two of the four equations the negative coefficients then fail to pass the 10-percent significance level.

Summing up, the presented competing risk analysis reveals that the links of many firm characteristics to the bankruptcy risk of German start-ups after unification differ systematically from those to their voluntary liquidation risk. These differences reflect the distinct underlying decision rules introduced in section 2.1. Moreover, the empirical results show how exit of new firms in the East German transition economy deviates from exit of new firms in the West German market economy.

5   Conclusions

In this paper, I analyze the exit behavior of new firms facing competing modes of exit in two different economic environments. In contrast to most existing studies of firm exit, I distinguish between entrepreneurial self-selection via voluntary liquidation and external selection via liquidation after a bankruptcy filing. Related research on competing exit risks is extended

in several respects. The patterns of basic human capital effects as well as the more complex human capital effects in team start-ups suggest that entrepreneur-specific characteristics are related to the bankruptcy hazard of start-ups according to their impact on venture returns and thus on the continuation value of the firm. By contrast, human capital effects on the voluntary liquidation hazard of start-ups reflect the human capital impact on venture returns but also on the entrepreneurs' alternative employment opportunities and thus on their liquidation thresholds. Age of the owner-managers at market entry has a non-linear, U-shaped effect on the voluntary liquidation hazard. Such non-linear age effects are often explained by human capital decay in the literature on the pooled exit risk. However, I observe a linear negative effect of age on the bankruptcy hazard not explainable by human capital decay. Hence, the U-shaped age effect on the voluntary liquidation hazard does rather reflect retirement decisions of old entrepreneurs than human capital decay. Firm size is found to have a non-linear, inverted-U effect on the bankruptcy hazard, but not on the voluntary liquidation hazard. The initial increase is in line with the view that the feasibility of out-of-court liquidation agreements decreases in firm size due to increasing information asymmetry and free-riding among creditors. Moreover, employee-related insolvency regulations in Germany render court-procedures more attractive for larger firms. Indicators of the firm's legal form, of ownership affiliations to parent firms and of team start-ups affect the bankruptcy and voluntary liquidation hazards differently as well. Summing up, distinguishing between different types of exit augments the understanding of the exit behavior of new firms.

The comparison of new firm exit during the 1990s in East and West Germany is of particular interest because of the unique economic context. East German firms in the sample started between 1990 and 1993, i.e. at the beginning of the transition from a planned to a market economy. By contrast, the West German start-ups entered a comparatively stable market economy. The comparison reveals several differences and similarities as well. In both economic environments, firm characteristics like a firm's legal form at market entry, the existence of ownership affiliations to parent firms, franchise relations and start-up teams are related to the bankruptcy and voluntary liquidation hazards in a similar way. In addition, non-parametric baseline hazard estimates exhibit a similar time-pattern. Entrepreneurs and creditors in East Germany seem to take time for collecting market experiences before realizing liquidations in a comparable way as in West Germany.

The most interesting differences between new firm exit in East and West Germany during the 1990s can be related to the different industry structures, capital and labor market conditions. In contrast to small West Ger-

man start-ups, small start-ups in East Germany after unification had no significantly higher voluntary liquidation hazard during the 1990s than larger ones. They seem to have occupied market niches with low exit risks whereas middle-sized and large start-ups competed with experienced Western firms and heavily subsidized, privatized East German firms. This result adds to the evidence on the size-survival correlation provided by Agarwal and Audretsch (1999, 2001) for different stages of the industry life-cycle. In addition, education effects on the voluntary liquidation risk of new firms in East and West Germany differ and the share of liquidations related to bankruptcy filings turns out to be higher among start-ups in the East German transition economy than in the comparatively stable West Germany market economy. The latter can be explained by stronger financial constraints in East than in West Germany. Both the deviating human capital effects and the weaker entrepreneurial self-selection in East Germany are in line with lower voluntary liquidation thresholds of East German entrepreneurs. Lower voluntary liquidation thresholds are a plausible consequence of higher local unemployment rates and correspondingly worse alternative employment opportunities in East than in West Germany.

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Tables

Table 1: Definition of Variables and Descriptive Statistics

Variable	Definition	Mean/ Share	Standard Deviation
Continuous Firm and Human Capital Variables			
survival time	duration of market activity in days until liquidation or censoring date (at latest 31/12/1999)	2188.59	992.52
SIZE	number of employees incl. working owner persons	6.309	22.146
MEAN_AGE	mean age of the (owner-) managers (see notes)	37.300	9.023
Discrete Firm and Human Capital Variables			
bankruptcy liquidation	liquidation after bankruptcy filing during observation period until 12/31/1999	0.201	
voluntary liquidation	voluntary liquidation during observation period until 12/31/1999	0.195	
DIVERSIFIED	industry classifications in more than one 5-digit sector	0.286	
FRANCHISEE	franchisee	0.028	
ltd. liability & stock corp.	limited liability firm, stock company (GmbH, AG)	0.426	
civil law association	civil law association (GBR)	0.088	
commercial partnership	commercial partnership (KG, OHG)	0.013	
sole proprietorship	sole proprietorship (Einzelunternehmung, Gewerbebetrieb)	0.473	
FULL_AFFIL	fully affiliated, i.e. completely owned by one firm	0.023	
PART_AFFIL	partly affiliated, i.e. one or more owner firms but not fully affiliated	0.074	
TEAM	more than one (owner-) manager	0.294	
EDUC_UNKNOWN	(team with) no recorded educational information	0.254	
LOW_EDUC	(team with) apprenticeships or low education	0.423	
MASTER_CRAFT	(team with) master craftsman degree(s)	0.086	

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Variable	Definition	Mean/ Share	Standard Deviation
BUS_ADMIN	(team with) graduate degree(s) in business administration	0.024	
ENGINEERING	(team with) graduate degree(s) in engineering	0.099	
OTHER_GRADUATE	(team with) other graduate degree(s)	0.023	
GRAD_MIX	team with at least 2 different graduate degrees	0.012	
OTHER_MIX	team with 2 educational levels out of LOW_EDUC, MASTER_CRAFT or graduate degrees	0.079	

Industry Indicators

manufacturing	manufacturing	0.117	
construction	construction	0.176	
wholesale & int. trade	wholesale and intermediate trade	0.126	
retail trade	retail trade	0.254	
transport & comm.	transport and communication	0.065	
services	services	0.263	

Cohort Indicators

cohort 1990	firm formation in 1990	0.274	
cohort 1991	firm formation in 1991	0.261	
cohort 1992	firm formation in 1992	0.220	
cohort 1993	firm formation in 1993	0.246	

Continuous and Discrete Regional Variables

POPUL_DENSITY	(# inhabitants/(square kilometer*1000)) in 1992 at district level	0.998	1.190
West Germany	firm location in West Germany	0.547	

Notes: The table displays non-weighted descriptive statistics for the sample of 13,767 firms. 65.7% of the firms in the sample have only one owner-manager and no firm affiliation such that the human capital variables refer to this person. Otherwise, the human capital variables refer to the team of owner-managers or managers. The population density information comes from the Bundesamt für Bauwesen und Raumordnung.

Table 2: Exit Process in East (E) and West (W) German industries, size classes and legal form classes

| Firm Group | Population Share in % | | | Bankruptcy Share in % | | |
	E	W		E	W	
Total						
	100.00	100.00		39.17	28.78	***
Industry						
manufacturing	11.58	11.97		55.97	37.46	***
construction	20.92	12.62	***	62.63	46.05	***
wholesale & intermed. trade	10.99	12.67	***	37.41	35.06	
retail trade	29.19	24.84	***	24.60	18.90	***
transport & communication	6.90	6.29		35.99	24.76	**
services	20.41	31.61	***	29.07	25.30	
Size						
1 employee	25.39	39.56	***	16.47	17.43	
2 - 10 employees	59.25	55.84	***	38.25	33.61	***
> 10 employees	15.36	4.60	***	70.34	51.29	***
Legal form						
ltd. liab. & stock corp.	35.50	38.83	***	21.21	10.49	***
civil law association	9.33	9.56		18.99	9.18	***
sole prop. & com. part.	55.17	51.61	***	65.56	49.83	***

Note: The table shows weighted shares for the sample of 6,281 East German and 7,583 West German firms. Column 2 (3) shows the shares of each industry, size and legal form class in the East (West) German sample population. Column 5 (6) indicates for each of these classes in East (West) Germany which share of liquidations is linked to bankruptcy filings. *** (**, *) indicates significance of a t-test statistic in a two-tailed test at the 1% (5%, 10%) level. The tested null hypothesis is equality of the means in the groups of East and West German firms.

Table 3: Competing Risk Model with Bankruptcy (B) and Voluntary Liquidation (V)

	East Germany		West Germany	
	B	V	B	V
Independent Variable	Coefficient			
	(Robust Standard Error)			
TEAM	-0.251***	0.312***	-0.172**	0.311***
	(0.085)	(0.091)	(0.076)	(0.072)
FULL_AFFIL			-0.417*	0.127
			(0.217)	(0.236)
FULL_AFFIL_EAST	-0.279	0.667**		
	(0.288)	(0.281)		
FULL_AFFIL_WEST	-0.787***	-0.420		
	(0.240)	(0.374)		
PART_AFFIL			-0.256**	0.142
			(0.112)	(0.119)
PART_AFFIL_EAST	-0.155	0.039		
	(0.133)	(0.184)		
PART_AFFIL_WEST	-0.671***	-0.316		
	(0.168)	(0.231)		
EDUC_UNKNOWN	-0.232**	-0.000	-0.096	-0.079
	(0.105)	(0.081)	(0.093)	(0.068)
MASTER_CRAFT	-0.551***	-0.246*	-0.479***	-0.367***
	(0.129)	(0.142)	(0.140)	(0.138)
BUS_ADMIN	-0.371*	-0.064	-0.704***	-0.221
	(0.208)	(0.221)	(0.209)	(0.206)
ENGINEERING	-0.400***	-0.467***	-0.604***	-0.175
	(0.098)	(0.129)	(0.142)	(0.155)
OTHER_GRADUATE	0.017	0.254	-0.529**	0.229
	(0.211)	(0.191)	(0.211)	(0.175)
GRAD_MIX	-0.185	-0.091	-1.112***	0.137
	(0.219)	(0.291)	(0.355)	(0.283)
OTHER_MIX	-0.156	0.001	-0.380***	0.056
	(0.120)	(0.144)	(0.130)	(0.125)
MEAN_AGE	-0.009**	-0.093***	-0.011***	-0.033*
	(0.004)	(0.025)	(0.004)	(0.020)
MEAN_AGE^2		0.001***		0.000*
		(0.000)		(0.000)
ln(SIZE)	0.809***	-0.026	0.459***	-0.115***
	(0.109)	(0.042)	(0.087)	(0.042)
ln(SIZE)^2	-0.126***		-0.080***	
	(0.024)		(0.023)	

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	East Germany		West Germany	
	B	V	B	V
DIVERSIFIED	0.059	0.179***	0.054	-0.000
	(0.071)	(0.068)	(0.070)	(0.063)
FRANCHISEE	-0.937***	-0.491**	-0.453*	-0.436**
	(0.245)	(0.202)	(0.263)	(0.195)
POPUL_DENSITY	0.119***	0.087**	0.045	0.008
	(0.039)	(0.038)	(0.033)	(0.028)

Wald-statistic (χ^2 (degrees of freedom))

	East Germany		West Germany	
Size Variables	74.08 (2)***	0.36 (1)	36.46 (2)***	7.65 (1)***
Affiliation Indicators	25.53 (4)***	9.45 (4)*	8.08 (2)**	1.58 (2)
Age Variables	4.54 (1)**	13.99 (2)***	8.93 (1)***	5.03 (2)*
Education Indicators	29.40 (7)***	19.12 (7)***	48.57 (7)***	12.51 (7)*
Cohort Indicators	30.94 (3)***	8.73 (3)**	1.88 (3)	13.96 (3)***
Industry Indicators	47.65 (18)***	72.39 (18)***	62.56 (18)***	76.43 (18)***
Location Indicators	4.83 (5)	12.30 (5)**	22.72 (10)**	7.41 (10)
Model	276.62 (44)***	201.13 (44)***	231.53 (47)***	176.98 (47)***
log Likelihood	-5420.12	-8851.97	-4996.45	-12798.51
# observations	6236		7531	

Notes: The table shows the estimation results of Cox proportional hazard-rate models for East and West Germany using the main sample of 13,767 firms. Reference firms in East (West) Germany have the following characteristics: one owner-manager with apprenticeship or some other type of low education, no firm affiliations, no diversified firm concept, no franchise contract, cohort 1990, retail trade industry, Saxony-Anhalt (North Rhine-Westphalia). *** (**, *) indicates that the coefficient or the coefficients differ significantly from zero at the 1% (5%, 10%) significance level.

Table 4: Competing Risk Model with Bankruptcy (B) and Voluntary Liquidation (V), Extended Sample

| | East Germany | | West Germany | |
	B	V	B	V
Independent Variable	Coefficient			
	(Robust Standard Error)			
TEAM	-0.161**	0.284***	-0.135**	0.321***
	(0.069)	(0.079)	(0.066)	(0.062)
FULL_AFFIL			-0.641***	0.073
			(0.196)	(0.208)
FULL_AFFIL_EAST	-0.109	0.597**		
	(0.242)	(0.250)		
FULL_AFFIL_WEST	-0.814***	-0.527		
	(0.236)	(0.367)		
PART_AFFIL			-0.348***	0.182*
			(0.101)	(0.107)
PART_AFFIL_EAST	-0.107	-0.140		
	(0.121)	(0.179)		
PART_AFFIL_WEST	-0.660***	-0.029		
	(0.155)	(0.180)		
ln(SIZE)	0.766***	-0.057	0.409***	-0.093**
	(0.102)	(0.039)	(0.079)	(0.039)
ln(SIZE)^2	-0.121***		-0.083***	
	(0.022)		(0.020)	
DIVERSIFIED	0.063	0.150**	0.091	-0.028
	(0.067)	(0.064)	(0.065)	(0.059)
FRANCHISEE	-0.868***	-0.445**	-0.520**	-0.548***
	(0.229)	(0.181)	(0.254)	(0.193)
POPUL_DENSITY	0.124***	0.094***	0.033	0.037
	(0.037)	(0.035)	(0.030)	(0.027)

Wald-statistic (χ^2 (degrees of freedom))

Size Variables	75.81 (2)***	2.15 (1)	28.40 (2)***	5.71 (1)**
Affiliation Indicators	28.26 (4)***	8.86 (4)*	20.67 (2)***	2.93 (2)
Cohort Indicators	39.81 (3)***	8.14 (3)**	2.08 (3)	18.56 (3)***
Industry Indicators	59.45 (18)***	97.50 (18)***	81.83 (18)***	102.20 (18)***
Location Indicators	5.80 (5)	12.38 (5)**	17.20 (10)*	8.01 (10)
Model	262.35 (36)***	173.13 (35)***	179.85 (39)***	164.80 (38)***
log Likelihood	-6072.69	-10394.38	-5775.93	-14575.12
# observations	7119		8676	

Notes: The table shows the estimation results of Cox proportional hazard-rate models for East and West Germany using an extended sample with 15,795 firms. As the data records of 2,028 firms in this sample contain no human capital information, all human capital variables (incl. age variables) used for the regressions in table 3 are excluded here. Reference firms in East (West) Germany have the following characteristics: one owner-manager, no firm affiliations, no diversified firm concept, no franchise contract, cohort 1990, retail trade industry, Saxony-Anhalt (North Rhine-Westphalia). *** (**, *) indicates that the coefficient or the coefficients differ significantly from zero at the 1% (5%, 10%) significance level.

Table 5: Competing Risk Model with Bankruptcy (B) and Voluntary Liquidation (V), Reduced Sample

	East Germany		West Germany	
	B	V	B	V
Independent Variable	Coefficient			
	(Robust Standard Error)			
EDUC_UNKNOWN	-0.182	-0.004	-0.066	-0.072
	(0.122)	(0.092)	(0.109)	(0.077)
MASTER_CRAFT	-0.671***	-0.248	-0.415**	-0.596***
	(0.159)	(0.163)	(0.167)	(0.173)
BUS_ADMIN	-0.376	0.043	-0.562**	-0.091
	(0.279)	(0.268)	(0.269)	(0.249)
ENGINEERING	-0.516***	-0.432***	-0.521***	-0.013
	(0.134)	(0.159)	(0.187)	(0.196)
OTHER_GRADUATE	-0.339	0.183	-0.880***	0.219
	(0.287)	(0.231)	(0.286)	(0.219)
MEAN_AGE	-0.006	-0.087***	-0.011**	-0.042*
	(0.005)	(0.030)	(0.005)	(0.023)
MEAN_AGE^2		0.001***		0.001*
		(0.000)		(0.000)
ln(SIZE)	1.061***	-0.004	0.443***	-0.100**
	(0.134)	(0.051)	(0.113)	(0.056)
ln(SIZE)^2	-0.174***		-0.062*	
	(0.032)		(0.034)	
DIVERSIFIED	0.022	0.149*	0.031	0.026
	(0.100)	(0.085)	(0.091)	(0.077)
FRANCHISEE	-0.644**	-0.376*	-0.530	-0.572**
	(0.300)	(0.228)	(0.342)	(0.240)
POPUL_DENSITY	0.093*	0.047	0.046	-0.035
	(0.053)	(0.049)	(0.045)	(0.036)

Wald-statistic (χ^2 (degrees of freedom))

Size Variables	78.94 (2)***	0.01 (1)	27.72 (2)***	3.86 (1)**
Age Variables	1.31 (1)	9.78 (2)***	5.25 (1)**	3.48 (2)
Education Indicators	25.33 (5)***	10.09 (5)*	23.09 (5)***	13.65 (5)**
Cohort Indicators	8.75 (3)**	7.26 (3)*	1.41 (3)	7.96 (4)**
Industry Indicators	20.75 (18)	45.88 (18)***	55.69 (18)***	59.39 (18)***
Location Indicators	1.32 (5)	13.59 (5)**	12.48 (5)	7.86 (10)
Model	153.69 (37)***	116.06 (37)***	137.88 (42)***	135.63 (42)***
log Likelihood	-2607.61	-5755.58	-2607.56	-8042.04
# observations	4040		5010	

Notes: The table shows the estimation results of Cox proportional hazard-rate models for East and West
Germany using a reduced sample with 9,050 firms owned and managed by one entrepreneur and
not affiliated to other firms. Thus, the indicators for teams, firm affiliations or heterogeneous teams
contained in the regressions in table 3 are not used here. Reference firms in East (West) Germany
have the following characteristics: owner-manager with apprenticeship or some other type of low
education, no diversified firm concept, no franchise contract, cohort 1990, retail trade industry, Saxony-
Anhalt (North Rhine-Westphalia). *** (**, *) indicates that the coefficient or the coefficients differ
significantly from zero at the 1% (5%, 10%) significance level.