

Post-Entry Selection among Newly Founded Firms in East and West Germany after Unification:

A Competing Risk Model with Forced Bankruptcy Liquidations and Voluntary Liquidations

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Comments Welcome

This paper provides an investigation of the post-entry selection among newly founded firms either via voluntary liquidation or via forced bankruptcy liquidation for the period since the unification of East and West Germany in 1990. The exit decision of newly founded firms is discussed in the context of the self-selection mechanism among entrepreneurs and the coexistent external selection mechanism implemented by the insolvency law. The estimation of semi-parametric competing risk models is based on panel data samples for the period from 1990 to 1997, which are drawn from a credit rating database. The samples cover together about 20,000 firm foundations between 1990 and 1994 in all East and West German regions and in all industries in the manufacturing, construction, trade and service sectors. The type-specific baseline hazard function estimates indicate that selection via bankruptcy liquidation starts as the first wave of voluntary liquidations already tapers off. Selection among firms founded during the period of economic transition in East Germany is delayed compared to the selection in West Germany. Further empirical results support the claimed relevance of owner-specific liquidation thresholds in addition to venture return-driven effects and the expected impacts of the German insolvency law on liquidation decisions.

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1 Introduction

Incessant endeavors of policy-makers since the end of the eighties for job creation, technological progress and deregulation of markets stimulated empirical research in the field of industrial dynamics and industrial demographics. One strand of this literature focuses on market entry and post-entry survival of newly founded firms. Dunne, Roberts and Samuelson (1988), Geroski (1991) and many related studies document the persistence of simultaneously high entry and exit rates in many industries in Western industrialized economies over time. The simultaneity of high entry and exit rates is typically linked to high turbulence in the lower half of the size distribution of firms, high failure risk and low long-term penetration of entrants into markets. This empirical evidence contradicts the neoclassical view of market entry as a simple error correction mechanism that keeps markets in equilibrium. Instead, entry happens to be a voluminous search and selection process that plays an important role in experimenting with product variants, in introducing innovations, in changing population characteristics of firms, and in restructuring markets.

This paper contributes to this strand of the literature by extending it to the case of transition economies. The post-entry selection among start-up firms that have been founded during the turbulent transition period in East Germany since 1990 is investigated. On the one hand, the German privatization agency, Treuhandanstalt (THA), restructured and privatized more than 8,000 formerly nationalized, mostly large firms with altogether more than 4 million employees during the first transition years. On the other hand, market entry of start-up firms has received a lot of public attention and considerable financial support because of its role as a seedbed for competitive small and middle-sized firms. Due to the breakdown of the planned economy and the resulting high unemployment level, such firms are urgently needed to create jobs, to build up the basis of a new industry structure and to induce the necessary revival of entrepreneurship after its strong suppression before 1990. Immediately after the political and economic breakdown of the German Democratic Republic (GDR) in November 1989, the monthly numbers of firm foundations rose sharply until July 1990, remained on a very high level until 1991 and declined steadily thereafter. Almost a decade after the entry boom, it is time to provide empirical evidence about post-entry selection among these entrants that helps to evaluate the long-term contribution of entrants to the transition of the East German economy. A direct comparison with the selection among entrants into the comparatively stable West German environment during the same period makes it possible to examine the peculiarities of the post-entry selection in a transition economy with respect to the completely different economic background provided by an established marked economy.

The most important structural difference of this paper from other studies of new firm survival and close-down exit is its focus on the consideration of several competing exit types.¹ The exit decision of newly founded firms is discussed in the context of the self-selection mechanism among entrepreneurs and the

¹Schary (1991) and Harhoff, Stahl and Woywode (1998) implement such a distinction between different exit modes while studying exit in populations with incumbent firms.

coexistent external selection mechanism implemented by the insolvency law. Valuable insights about the selection among newly founded firms can be gained by considering how observable firm heterogeneity determines whether a firm faces rather a high bankruptcy liquidation or a high voluntary liquidation risk. Newly founded firms are controlled by their owners as long as they cover all their financial obligations. Under these circumstances rational, risk-neutral owners will close down their firm via voluntary liquidation if the expected future returns from optimal continuation of the firm fall below their individual liquidation threshold. The level of this threshold depends mainly on alternative employment opportunities for owner-managers of the firm. Firms with owners who do not opt for a voluntary liquidation can continue their market activity until they reach financial distress. From that moment on, the owner-specific liquidation decision loses relevance because the German insolvency law induces a transfer of control rights to the firm's creditors. The firm's creditors get entitled to file for bankruptcy in addition to owners, managers and other stakeholders. They will trigger off a liquidation of the firm if the share they can recover from the liquidation value exceeds their share of the firm's going-concern value. The resulting coexistence of self-selection by owners of newly founded firms and of an external selection mechanism implemented by the German insolvency law implies a different selection structure among newly founded firms in East and West Germany. A different selection pattern results also for firms with and without fully liable owners because owners with limited liability have weaker incentives to liquidation their firm voluntarily than fully liable owners. The links between owner-specific human capital characteristics and the voluntary liquidation risk can be shown to differ from those between human capital characteristics and the bankruptcy liquidation risk due to the different underlying decision rules. Moreover, the ownership structure of a firm is likely to have an impact on the attractiveness of a voluntary liquidation relative to a bankruptcy liquidation. The choice to liquidate a financially distressed firm in a private out-of-court settlement should depend on firm size.

The empirical analysis is based on two random samples that cover together about 20,000 firm foundations between 1990 and 1994 in East and West Germany. The samples are drawn from two extensive panel databases that originate from the leading German credit rating agency. The data is well suited for a comparison of post-entry selection in East and West Germany because the same standardized procedure of data collection and cleaning is used in both parts of Germany. Moreover, the broad coverage of the databases allows an analysis for all East and West German regions and all industries in the manufacturing, construction, trade and service sectors. So far, existing evidence on failure of newly founded firms in Germany has covered mostly specific regions or industries and has rarely concerned East German regions (Brüderl, Preisendörfer and Ziegler (1992), Wagner (1994), Brixy and Kohaut (1999), Hinz and Wilsdorf (1999)).

Semi-parametric competing risk estimates reveal that the distinction between the two competing liquidation risks allows important insights about the selection process among newly founded firms. Indicators of high academic education have significantly negative effects on the risk of bankruptcy liquidation, but not on the risk of voluntary liquidation. This result is consistent with the notion that an increase of

individual thresholds for a voluntary liquidation caused by high general human capital countervails the impact of high general human capital on venture-related returns. Whereas a liability of smallness can be observed with respect to the risk of voluntary liquidation the size effect on the risk of bankruptcy liquidation turns out to display an inverse U-shape. The result is in line with implications of several regulations in the German insolvency law. Firms, which are partly or fully affiliated to incumbent firms are relatively more prone to exit via voluntary liquidation than via bankruptcy liquidation. This result supports the view that incumbents have incentives to avoid a bankruptcy liquidation of an affiliate. Moreover, the structure of the selection process differs strongly between firms with fully liable owners and limited liability firms. The analysis of the voluntary liquidation decision shows that entrepreneurs with limited liability have c.p. weaker incentives to liquidate their firm voluntarily. Correspondingly, it can be observed that limited liability firms are relative to their voluntary liquidation risk more likely to exit via bankruptcy liquidation than firms with fully liable owners.

Non-parametric Kaplan-Meier estimates of the type-specific baseline hazard functions indicate that selection via bankruptcy liquidation starts as the first wave of voluntary liquidations already tapers off in both parts of Germany. A liability of adolescence can be observed with respect to the risk of voluntary liquidation, but the risk of bankruptcy liquidation seems to be an initially rising and then rather constant threat during the first years of market activity for German firm foundations after the unification in 1990. East German firms, founded during the period of economic transition, have higher survival chances between 1990 and 1997 than West German firm foundations of the same period. The East German selection process is delayed compared to the selection among West German firm foundations. Moreover, the risk of bankruptcy liquidation relative to the risk of voluntary liquidation is higher for East German firms than it is for West German firms. This implies a higher portion of late occurring failures that are mostly linked with defaults on debt obligations. The empirical evidence is consistent with lower individual liquidation thresholds in East Germany than in West Germany, a slower learning process and a higher option value of waiting. Moreover, East German firms obviously received enough resources to finance their long learning period.

The remainder of this paper is organized as follows. In the next section, the exit decision of newly founded firms is analyzed and it is discussed how firm-specific and owner-specific heterogeneity determine whether a firm faces a high voluntary liquidation risk or a high bankruptcy liquidation risk. Section 3 contains a brief description of the databases, some remarks on measurement issues as well as on the sample construction and an outline of the used estimation method. The empirical results are presented in section 4. Final remarks and starting points for future research in section 5 conclude the paper.

2 Exit decision of newly founded firms: Voluntary liquidation versus forced bankruptcy liquidation

A growing body of empirical studies investigates the selection among newly founded firms or plants that differ at market entry with respect to various observable characteristics such as size, ownership structure or human capital endowment.² A common feature of these studies is that observable characteristics are treated as indicators of productivity differences between entrants and linked to the entrants' exit risk. As will be shown below interesting additional insights about the selection process can be gained by analyzing the exit decision of newly founded firms in more detail and by considering how a firm's observable characteristics determine whether it will be voluntarily liquidated or forced into a bankruptcy liquidation.

Jovanovic (1982) has developed a widely recognized model of industry evolution with noisy selection among entrants. The selection process is based on passive learning about initially unknown time-invariant characteristics like an entrant's ability to provide a good product, to manage the firm and to attract customers after market entry.³ At market entry all entrants consider their unknown productivity parameter θ to be a random draw from the same known a priori distribution given their observable characteristics at market entry. In every period they observe without cost one realization of a profit-relevant random variable η whose distribution depends on θ and update their a priori expectation of θ accordingly. The Bayesian posteriors for both θ and future values of η generated from a certain history $n^t \equiv (\eta_1, \eta_2, \dots, \eta_t)$ are assumed to statistically dominate those generated by an inferior history. Furthermore, risk-neutral and profit-maximizing decision makers are assumed to decide upon continuation at the optimal production level versus liquidation by finally terminating production and physically closing down the firm.⁴ According to Pakes (1998) many functional specifications of Jovanovic's passive learning model imply that it takes time to accumulate the information necessary to ensure that exit is optimal. During an initial period the instantaneous liquidation risk for an active firm out of a certain entry cohort increases, but later the instantaneous liquidation risk starts to decrease for firms that remain in the market and get more and more precise knowledge about their productivity parameter.

H1: The hazard function, depicting the instantaneous probability of liquidation, will initially increase and subsequently decrease in the sense of a liability of adolescence.

Before taking a closer look on a new firm's liquidation decision its ownership and capital structure has to be specified. Consider a typical German firm foundation with one owner-manager, with for example several unsecured trade creditors and a bank creditor that holds a loan with probably high collateralization

²See Caves (1998) for a recent survey about new findings on the turnover and mobility of firms.

³Frank (1988) presents a related model and Ericson and Pakes (1995) formalize active learning.

⁴The paper's focus is the analysis of such liquidation events. Mergers, takeovers and other changes in ownership that can lead to a fundamental restructuring of the concerned firm are therefore not treated as liquidation events.

and allows for overdraft.⁵

As long as a firm pays off all current payments on debt obligations the owner-manager holds all control rights. 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:

$$O_t^{om}(x_{hc}) + L_t^{om} > V_t^{om}(n_t, x_{f,me}, x_{f,t}, x_{hc}). \quad (1)$$

O_t^{om} is the expected present value of all the owner-manager's (om) future returns when choosing the best alternative employment opportunity. The expected returns from wage work or an alternative firm project depend on his personal characteristics x_{hc} . As the residual claimant he receives L_t^{om} after liquidating the firm's assets such as machines and buildings in period t and satisfying all creditors' claims. V_t^{om} is the expected present value of venture-related future returns to the residual claimant in period t when he continues the firm's activity in $t + 1$ and chooses between liquidation and continuation in subsequent periods in order to maximize the return. V_t^{om} depends on the history n_t of the profit-relevant variable η , personal characteristics x_{hc} , firm-specific characteristics at market entry $x_{f,me}$ and on firm-specific, time-dependent characteristics $x_{f,t}$.

As soon as the firm's financial situation deteriorates and defaults on debt obligations emerge the German insolvency law induces a transfer of control rights from the owner-manager to the firm's creditors. An owner-manager's decision against liquidation loses relevance when the firm enters financial distress because then all creditors get entitled to file for bankruptcy in addition to the owner-manager.⁶

Inefficient firms with low productivity, financial mismanagement or without market success are the most likely candidates for financial distress. However, efficient firms whose continuation value $V_t(n_t, x_{f,me}, x_{f,t}, x_{hc})$ exceeds their liquidation value L_t can be affected, too. These efficient firms in financial distress are unlikely to file for a court procedure because of the institutional setting provided by the German insolvency law.⁷ The German system is known for a strong orientation towards liquidation in the bankruptcy procedure and for the provision of a reorganization procedure that can only be initiated

⁵Harhoff and Körting (1998) show that German firms that are younger than 6 years have on average 1.28 bank creditors. Petersen and Rajan (1997) provide evidence about trade credits as an important source of short-term external finance.

⁶A firm is in financial distress according to the German insolvency law if either the criteria of incessant inability to pay (insolvency) or overindebtedness applies. Insolvency is fulfilled in period t , if the firm is actually and probably also in subsequent periods not able to meet its financial obligations: $C_t < TC_t + B_t$ and $C_{t+i} < TC_{t+i} + B_{t+i}, \forall i = 1, \dots, s$. $C_{t(+i)}$ denotes cash, $TC_{t(+i)}$ the payments due to trade creditors and $B_{t(+i)}$ the sum of repayment and interest payment due to the bank in period $t(+i)$. Overindebtedness applies only to corporate firms and is reached if the value of the firm's assets covers no longer the value of its liabilities LV_t . The value of the firm's assets will either be measured by the continuation value V_t of the firm or its liquidation value L_t . One of the following sets of conditions has to be fulfilled: 1) $L_t < LV_t$ and the continuation of the firm is not considered worthwhile or 2) $L_t < LV_t$ and the continuation of the firm is ex ante considered worthwhile, but a closer examination reveals $V_t < LV_t$. Overindebtedness is difficult to evaluate and therefore of much less empirical relevance than the insolvency criterion. See Häsemeyer (1998) and §102 Konkursordnung.

⁷Details about the German insolvency law given in this paper refer to the legal situation before January 1999.

by the debtor, that is rarely used and often not successfully completed (Häsemeyer (1998)). According to Hesselmann and Stefan (1990) only 4% of all filing firms become successfully restructured and these are mostly big firms with many years of market activity.

Due to the system's characteristics, a filing for bankruptcy can be expected to cause high indirect bankruptcy costs for firms that shall be continued. Suppliers, customers and employees with limited information about the firm's prospects will interpret a bankruptcy filing which obligatorily has to be published as a signal of a forthcoming liquidation. They will stop delivery transactions, seek for alternative suppliers and search for new jobs. The deterioration of business relations leaves the liquidation value of the filing firm's assets unaffected, but can reduce the going-concern value of the firm considerably (Hax (1985)). Such indirect bankruptcy costs provide a strong incentive for coalitions of owners and creditors with an interest in continuation of the firm to choose a private contractual debt restructuring and to avoid the detrimental filing. A coalition is increasingly likely to find continuation more profitable than liquidation the more efficient the firm is. Therefore, especially efficient firms in financial distress ($V_t(n_t, x_{f,me}, x_{f,t}, x_{hc}) > L_t$) are likely to become privately restructured.⁸ Inefficient firms in financial distress ($V_t(n_t, x_{f,me}, x_{f,t}, x_{hc}) < L_t$) will usually file for bankruptcy and subsequently be liquidated or they will be liquidated after an out-of-court liquidation agreement.⁹

Structure of the Selection Process and Competing Liquidation Risks

The coexistence of the self-selection mechanism among owner-managers and the external selection mechanism implemented by the insolvency law implies a different structure of selection among firms with limited liability compared to firms with fully liable owner-managers. In addition, selection in East and West Germany after unification can be expected to differ systematically.

Rational, risk-neutral owner-managers with full liability are expected to maximize the continuation value of their firm. They have no interest in continuing inefficient firms because they risk all their distrainable personal wealth and can, according to the German insolvency law that was in force until 1999, usually not even emerge from an insolvency procedure without continuing obligations. Instead, creditors are entitled to pursue their still remaining claims against any distrainable future earnings and profits of the owner-manager (Häsemeyer (1998)). Owner-managers with limited liability are liable up to the amount of their equity share. The residual value of a firm for such an owner resembles a call option and is *ceteris paribus* (c.p.) at least as high as the residual value of the firm for a fully liable owner. Additionally, moral hazard problems arise in situations with asymmetric information between creditors and an owner-

⁸A coalition with interest in continuation is not always feasible for an efficient firm due to distortions modeled for example by Bulow and Shoven (1978) and Gertner and Scharfstein (1991). See also White (1989).

⁹For 75% of all firms that file for bankruptcy the court never opens the proceedings such that a first-come-first-serve liquidation starts instead. The opening is refused, if the firm is judged unable to cover even the direct bankruptcy costs like administrative fees and the remuneration to lawyers, experts etc. by liquidating their free assets. A refusal occurs usually, because too many of the firm's assets are reserved to individual creditors by contractual liens (Hesselmann and Stefan (1990)). The remaining 25% of all filing firms enter the creditor-dominated collective legal bankruptcy procedure.

manager with limited liability where creditors cannot observe the debtors' post-contractual behavior. As his residual value resembles a call option, the debtor might be able to increase his residual firm value by choosing a riskier project with the same or even a lower expected value than the initial project and thereby to avoid a voluntary liquidation (Stiglitz and Weiss (1981)).

H2: Owner-managers with limited liability have c.p. weaker incentives to liquidate their firm voluntarily than fully liable owner-managers. Relative to the risk of voluntary liquidation the risk of bankruptcy liquidation is c.p. higher for limited liability firms than for firms with fully liable owner-managers.

Owner-managers of firms that have been newly founded in East Germany after unification face a tight local labor market with high unemployment and correspondingly low chances to find an alternative employment opportunity.¹⁰ Taking into account low regional mobility of German job seekers, the owner-managers' individual liquidation thresholds in East Germany are c.p. expected to be lower than those of owner-managers in West Germany. In addition, the learning process about the efficiency of East German firm foundations should proceed more slowly than in West Germany because market experience and managerial qualifications are missing. Moreover, firms founded in East Germany after unification are confronted with more uncertain market developments and unsettled industry structures during the turbulent transition period than firm foundations in West Germany. According to Dixit (1989) and Dixit and Pindyck (1994) a higher level of uncertainty about future profits implies greater inertia of firms, i.e. a stonger tendency to postpone a liquidation. Altogether East German firm foundations are likely to postpone liquidation decisions and are therefore expected to face a higher relative risk of bankruptcy liquidation than West German firm foundations.

H3: Relative to the risk of voluntary liquidations the risk of bankruptcy liquidations is higher for newly founded firms in East Germany than in West Germany.

Human Capital Endowment and Competing Liquidation Risks

Human capital variables x_{hc} are correlated with the bankruptcy liquidation risk according to the impact of human capital on venture-related returns and the resulting gap between the firm's continuation and liquidation values. The nexus between human capital variables and the risk of voluntary liquidation is more complex, because it depends according to equation (1) on the impact of human capital on venture-related returns and on returns of the owner-manager's best alternative employment opportunity.

Owner-managers with high general human capital, proxied by their educational degree, can ceteris paribus be assumed to attain high venture-related returns (Cressy (1996), Bates (1990)). They will consequently face a lower bankruptcy risk than poorly educated entrepreneurs. High educational degrees promote not only high venture-related returns but also high individual exit thresholds due to well-paid job offers and

¹⁰The East German rate of registered unemployment increased from 10.7% to 17.5% between 1991 and 1997 whereas the West German rate varied between 5.5% and 9.9%. The number of registered open positions per person is also lower in East Germany than in West Germany. See Sachverständigenrat (1998/99).

good ideas for alternative firm projects. Even assuming that the best alternative employment opportunity is wage work does not clarify whether a positive or negative correlation of education with the risk of voluntary liquidation should be expected *ex ante*. 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 conflicting evidence.

H4: Owner-managers with high general human capital have c.p. a lower risk to exit via bankruptcy liquidation than less well educated entrepreneurs. The effect of high general human capital on the risk of voluntary liquidation depends on the relative strength of the venture-return-increasing versus the threshold-increasing effects.

Owner-managers who start their venture relatively late in life are likely to have acquired more business and work experience than young owner-managers could accumulate before their firm foundation. As a high level of experience usually promotes high venture-related returns a negative impact of the demographic variable ‘age of the owner-manager at market entry’ on the risk of bankruptcy liquidation follows. Cressy (1996) and Brüderl, Preisendörfer and Ziegler (1992) stress among others the relevance of age-related human capital decay. Therefore a negative, convex relation between age and the risk of bankruptcy liquidation is expected. The age of the owner-manager at market entry and the risk of voluntary liquidation should also be related negatively because the number and quality of alternative job offers is likely to decrease with age and consequently the individual threshold level for a voluntary liquidation as well (Gimeno et al. (1997), Hübler, Löwenbein and Schneider (1990)).

H5: The age of the entrepreneur is c.p. related to both liquidation risks in a negative, convex functional form.

Start-up Concept and Competing Liquidation Risks

Firm-specific, time-constant characteristics $x_{f,me}$ are correlated with both liquidation risks according to their impact on venture-related returns and therefore on the firm’s continuation value. Moreover, the attractiveness of a private liquidation arrangement versus a court procedure for financially distressed firms depends on firm-specific characteristics.

Some firms start with a diversified firm concept. According to simple portfolio theoretical rules diversification can serve as a risk-reducing investment strategy by combining projects with not completely positively correlated return distributions (Rose (1992)). New firms entering several industries at once should depend less on industry-specific risks and should have lower exit risks than non-diversified entrants.

H6: Entrants with diversified firm activities have c.p. a lower risk of bankruptcy liquidation and of voluntary liquidation than non-diversified entrants.

Firm size at market entry, measured by the number of initial employees, is usually assumed and for example by Audretsch and Mahmood (1995) and Mata and Portugal (1994) shown to be negatively correlated with an entrant’s risk of failure. Large entrants are likely to have cost advantages due to

economies of scale whereas small entrants face a high pressure to grow beyond the minimal efficient scale level (Audretsch and Mahmood (1995), Liebermann (1991)). Entering a market at large scale usually means sinking a high amount of funds. Investors involved in such a project typically call for diligently elaborated, detailed business plans that help to prevent a failure caused by insufficient pre-entry planning. Due to rationing in imperfect capital markets firm concepts can often only be realized at a reduced, smaller scale than initially planned. Such small, credit-constrained firms can easily be forced into liquidation by initial problems in the field of production, sales or management. Large firms with access to additional financial resources can cope better with start-up problems than small, credit-constrained entrants (Mata and Portugal (1994)).

Despite these arguments in favor of a liability of smallness, advantages of small-scale entry can work against it during the transition period in East Germany. Due to high concentration of the industry in the German Democratic Republic (GDR), low consumer orientation of the usually very big nationalized firms and the breakdown of the economic system in 1989 many small entrants in the subsequent years could probably occupy a local market niche with a low failure risk, for example in the craftsmen and service sector. Instead, big East German entrants had rather to take up a risky fight for a larger sales area against experienced West German or foreign competitors and according to May-Strobl and Paulini (1994) at least since 1992 also against privatized, often heavily subsidized firms that originate from the former nationalized firms. Facing a new market system, uncertain market developments and unsettled industry structures during the transition period it might pay for entrants to abstain initially from static large scale efficiency, to enter the market at a flexible small scale and to adapt subsequently by step-by-step growth (Brüderl, Preisendörfer and Ziegler (1992), Geroski (1991), Mills and Schumann (1985)).

Several institutional details of the German insolvency law imply that small insolvent or nearly insolvent, inefficient firms should prefer an out-of-court liquidation agreement instead of an exit via a formal bankruptcy procedure. With increasing employment bankruptcy procedures get more attractive. First, during a court procedure favorable legal regulations like temporary wage payments by the state and simplified worker dismissals via a collective settlement get effective.¹¹ Second, the larger the firm and therefore probably the sum of creditor claims, the less decision-relevant is the fixed amount of direct bankruptcy costs. Third, firm size is according to Harhoff and Körting (1998) correlated with the number of creditors, such that the failure of an out-of-court liquidation due to information and free-rider problems is more likely for big firms.

H7: The relation of firm size and the risk of bankruptcy liquidation has c.p. an inverse U-shape and the risk for middle-sized and large firms is higher in East Germany than in West Germany. Concerning the risk of voluntary liquidation a liability of smallness is observable in West Germany but might not hold in East Germany.

¹¹In addition, social security institutions have an increasing incentive to file for bankruptcy the more employees are concerned because not only the wages but also the social security contributions for employees of bankrupt firms will temporarily be covered by the state. The relevant regulations of the German insolvency law are discussed in Häsemeyer (1998).

Firm Evolution and Competing Liquidation Risks

Firm-specific, time-variant characteristics $x_{f,t}$ provide information about a firm's market success and the related firm behavior after market entry.

Employment growth can rather be realized by firms that already accumulated enough internal funds during the previous periods or that have easy access to additional external capital than by firms that either have still to wait for market success or suffer from credit-constraints. A period of employment growth after market entry moves a newly founded firm closer to or beyond the minimal efficient scale level. Growing firms are likely to face lower liquidation risks from the following period onwards. Firms that revise their choice of entry size by reducing employment can be expected to face subsequently higher liquidation risks because of their probably increased cost disadvantages and their vulnerability to only a few loss-bringing periods.

H8: An increase in employment during a certain period is c.p. negatively correlated with both liquidation risks in the subsequent period.

Firm foundations whose payment history shows more and more payment delays and the official registration of overdue bills can be expected to suffer from lacking market success, credit constraints, and bad financial management. After the occurrence of such events business partners are likely to offer increasingly strict payment conditions and the firm's capital constraints get stronger. As incessant inability to pay is one of the criteria that allow a filing for bankruptcy, the risk of bankruptcy liquidation is expected to be positively correlated with negative recordings in a firm's payment history. The risk of voluntary liquidation should also increase because owner-managers of inefficient firms with payment problems may liquidate before the payment problems lead to financial distress. Moreover, owners and creditors of a distressed firm might prefer an out-of-court liquidation instead of a bankruptcy liquidation.

H9: The occurrence of payment delays and defaults is positively correlated with the risk of bankruptcy liquidation. The more bankruptcy avoidance matters, the stronger the positive correlation with the risk of voluntary liquidation should be.

Ownership Structure and Competing Liquidation Risks

In contrast to the ownership structure of the firm considered so far newly founded firms can have more than one owner-manager and their owner team can include incumbent firms. These entrants face a different internal control situation than single-owner entrants which has consequences for their liquidation choice.

Compared to firms with only one owner-manager the entrants managed by an entrepreneurial team are c.p. endowed with a better human capital stock, because deficiencies of one person's education or experience can be compensated by another team member (Cressy (1996)). In addition, the existence of several owner-managers allows for specialization on the firm's management level (Eisenhardt and Schoonhoven (1990)).

However, the establishment of a viable organization with clear responsibilities and a sound internal communication system after market entry is more demanding the larger the entrepreneurial team because disagreement of the team members about central issues or incompatibility of their preferences get more likely (Eisenhardt and Schoonhoven (1990), Wagner, Pfeffer and O'Reilly (1984)). If the team fails and breaks apart, one or several of the owner-managers will leave the firm and thereby probably trigger off a voluntary liquidation of the new firm. In the case of disagreement it is unlikely that all owner-managers wait until the firm's decline forces them into bankruptcy liquidation.

H10: Firms with an entrepreneurial team are c.p. less likely to exit via bankruptcy than firms with one single entrepreneur. The existence of an entrepreneurial team has ex ante no clear impact on the risk of voluntary liquidation.

Firm foundations that are initiated entirely by an incumbent firm or whose owner team includes at least one firm as a member should face lower liquidation risks than non-affiliated foundations because of c.p. facilitated post-entry access to additional funding, network inclusion, knowledge spillovers etc. (Geroski (1991)). Especially affiliations to incumbents from West Germany or other Western countries should lower the exit risks of entrants at the beginning of the economic transition in East Germany by adding experience with a competitive market system and by offsetting their typical deficiencies of managerial skills or accounting knowledge that are discussed for example in Dyck (1997).

Apart from these resource-access arguments, the impact of an equity-holding and liable incumbent on the affiliated entrant's internal control situation should have an impact on its liquidation risks. Especially in the case of wholly owned subsidiaries declarations of patronage and explicit or implicit guarantees, often asked for by credit-providing banks, make the incumbent fully liable for the subsidiary's obligations and more prone to liquidate voluntarily. Even in the case of lacking guarantees an incumbent can be expected not to let his affiliate default on its debt obligations and not to file for bankruptcy (Li and Guisinger (1990)). The incumbent will rather voluntarily liquidate an inefficient affiliate in order to avoid a loss of reputation vis-a-vis creditors and to avoid that customers and suppliers interpret the affiliate's default as a signal for financial problems of the incumbent itself.

Caves and Porter (1976) expect low liquidation costs for affiliated firms because the entrant's employees and its specific assets can be transferred to the incumbent firm. Low liquidation costs ease the voluntary liquidation of affiliated firms with low economic performance.¹²

¹²See also Baden-Fuller (1989), Liebermann (1990) and Deily (1991) who study exit behavior of firm's in declining industries. The discussion of liquidation costs can be linked to the discussion of an entrepreneur's switching costs by Cressy (1996) and Gimeno et al. (1997).

H11: Affiliated firms, especially subsidiaries, have c.p. a lower bankruptcy risk than independent entrants. The correlation of firm affiliations with the risk of voluntary liquidation depends on the relative importance of resource-access versus liability, reputation, and liquidation-cost effects. Affiliations to West German or foreign firms reduce the liquidation risks of East German firm foundations particularly strong.

3 The Database, Descriptive Statistics and the Econometric Specification

For this study, two random samples were drawn from two large firm panels. Both, the East German panel with actually 830,000 firms and the West German panel with 1,600,000 firms are built up at the Center of European Economic Research (ZEW) with data the leading German credit rating agency, Creditreform, provides approximately every six month.¹³ In contrast to most panels based on data explicitly collected for scientific purposes these panels with credit rating data are characterized by an ongoing process of information collection and a varying frequency of information updating per firm.¹⁴

Especially the East-West comparability and the data structure merit some comments. Creditreform needs correct and comprehensive up-to-date information about legally independent, actively working enterprises in order to generate profits by selling firm ratings, handling collection orders and by providing firm data for marketing purposes. The employees of Creditreform's regionally specialized suborganizations aggregate information from public registers, newspapers, company reports etc. and from interviews they have conducted with the firm, its suppliers, customers or competitors.¹⁵ Immediately after the breakdown of the German Democratic Republic (GDR) in 1989 Creditreform extended its activity to East Germany. Local suborganizations were build up that adopted the West German data collection and cleaning procedures. The standardized procedures and similar reporting frequencies guarantee the comparability of the available data about East and West German enterprises.¹⁶

A typical firm record includes information about the firm's foundation, its liquidation and bankruptcy filing dates, several indicators of economic activity like industry classification, employment, etc. and details on the ownership structure, the management and the financial situation of the firm. Especially

¹³More details about panels constructed with data provided by Creditreform can be found in Stahl (1991), Harhoff and Steil (1997) and Harhoff, Stahl and Woywode (1998).

¹⁴For example, the databases used by Phillips and Kirchhoff (1989) and Audretsch (1995) have similar characteristics.

¹⁵Due to the decentralized organization the employees can gain useful knowledge about local industry structures. Local reporting differences are not relevant in the regression equation concerning the bankruptcy liquidation risk. But the preferable specification for the equation concerning the voluntary liquidation risk includes some indicator variables for individual suborganizations as control variables.

¹⁶This is an important advantage in the context of the intended study. Cable and Schwalbach (1991) mention differing data structure as the main problem of comparative studies.

information of high relevance for credit inquiries is recorded with few missing. Therefore, the databases are well suited for analyzing firm-specific determinants of firm failures.

3.1 Identification of Foundations and Liquidations

Due to the focus on liquidations of newly founded firms it has to be investigated how accurately firm foundations are identified by Creditreform and whether the whole population of firm foundations is represented in its database. Moreover, the completeness and reliability of the available data on liquidation events has to be evaluated.

3.1.1 Firm Foundations

Creditreform discovers firm foundations not yet registered in its database via evaluation of publicly available data sources like the trade register or via client inquiries about such firms. The initial incorporation date and additional information about a newly discovered firm will be entered into a new firm record with a unique identification number. According to its registration rules, Creditreform opens no new, unlinked records when a firm relocation between the catchment areas of two different suborganizations or a secondary incorporation event like a legal form change, an ownership succession, a takeover or a merger has been identified. This basically implies that the liquidation risks can be analyzed for a clearly defined population of newly founded firms at the beginning of their learning and selection process. However, in practice Creditreform sometimes fails to identify a relocation as such or an incorporation events as secondary and then releases a new identification number by mistake.¹⁷

Compared to the West German situation, secondary incorporation events occurred rather often after the breakdown of the GDR in November 1989. The whole stock of firms that existed already before 1990 underwent a fundamental transformation which usually meant restructuring, deconcentration and privatization or liquidation.¹⁸ Therefore, four additional indicators were used to identify firms in the East German sample with links to preceding nationalized firms.¹⁹ All in all, 1,471 firms with a foundation date after 1989 in their record could be eliminated from the East German sample. This procedure guarantees

¹⁷The most important source for such mistakes are obligatory entries about a firm's secondary incorporation event into a public register that have not obligatorily to be linked to preceding register entries of the respective firm. Phillips and Kirchoff (1989), Mata and Portugal (1994) and Wagner (1994) mention similar forms of unobserved firm heterogeneity in their databases.

¹⁸For example, the Treuhandanstalt (THA) split her initial stock of 8000 nationalized firms between 1990 and September 1994 into 13781 enterprises. See Dyck (1997).

¹⁹The following indicators were used: 1) Registration of the firm's name in a list provided by the THA, 2) Identification of a shareholding by the THA, 3) Identification of one of 30 typical terms that were only used for nationalized firms in the GDR in the descriptive texts associated with each firm record. 4) 'Genossenschaften' were excluded, because typically transformed firms used this legal form. As the focus of this study is an East-West comparison all 'Genossenschaften' in the West German sample were also eliminated.

a good identification of the firms privatized or liquidated by the Treuhandanstalt (THA). But some privatizations of small shops, hotels, restaurants etc., organized by the East German government of De Mazière in 1990 or by the suborganization of the THA for privatizations in the trade sector (Gesellschaft zur Privatisierung des Handels) and ownership successions of firms already privately held before 1990, may however remain undiscovered. In contrast to the eliminated firms with links to the THA, these mistakenly included firms in the East German panel have better survival chances than newly founded firms according to Prantl (1997). According to Brüderl, Preisendörfer and Ziegler (1992), this should apply also to firms that are included in the West German panel because of an unidentified secondary incorporation event. Therefore, the discussed aspect of unobserved firm heterogeneity can be assumed to impose no limitations on East-West comparisons.

According to comparisons with several other databases, Creditreform's databases cover firms with several employees accurately.²⁰ However, the population of very small firms, that have often only one active owner-manager and no additional employees, is likely to be underrepresented. A random undercoverage of these small firms would not affect the validity of survival estimates, but the probability of a small firm to be registered in Creditreform's database could depend on its survival chances.²¹ Such a survival dependence can be excluded for firms with an entry into the trade register, because Creditreform extracts trade register information regularly and proactively.²² But for small firm foundations without a trade register entry the demand-driven way of registration gets relevant, which is a potential source of selection biases. Demand-driven inclusion into the database is most likely for firms that enter the database a long time after their foundation date. Therefore, all enterprises with a registration lag of more than one year were eliminated from the samples. Most important, neither the comparison between size effects on the bankruptcy liquidation risk and size effects on the voluntary liquidation risk nor East-West comparisons should be affected since both panels suffer from the same undercoverage of small firms.

3.1.2 Firm Liquidations

Whenever Creditreform identifies the liquidation of a firm the respective firm record will not be removed from the database, but information concerning the liquidation event will be recorded.

The identification of forced bankruptcy liquidations with the available credit rating data is highly reliable because of several reasons. The success of a credit rating agency depends strongly on the completeness

²⁰Such comparisons have been conducted by Licht and Stahl (1994) and Harhoff and Steil (1997).

²¹Potential non-random undercoverage is a common problem for comparable panels. See Mata and Portugal (1994) and Audretsch (1995).

²²The registration in the trade register is compulsory for all commercial partnerships, limited liability firms and stock companies (§106 and §162 Handelsgesetzbuch (HGB), §7 GmbH-Gesetz, §36 Aktiengesetz). Sole proprietorships have to be registered if they are engaged in certain businesses (§1 HGB) or if they are large enough (§2 HGB). Civil law associations never enter the trade register.

and quality of their information about bankruptcy filings and procedures. Besides, information about bankruptcy filings is easily accessible due to the obligatory publication in newspapers and official registers. Creditreform does not always register the exact date after a filing for bankruptcy at which the respective firm's economic activity ends. But Creditreform monitors firms with a bankruptcy filing quite closely and usually detects the candidates for a successful restructuring. Such firms are technically treated as censored cases in the regression analysis from the moment of the last information update onwards.²³ For 60.10% (42.92%) of all filing firms in the West (East) German sample the recorded date of the refusal to open a court procedure marks the start of a first-come-first-serve liquidation and can therefore be used as liquidation date. All remaining firms for which a procedure has been opened are treated as a case with bankruptcy liquidation at the latest available date entered into their bankruptcy record, mostly the date of the procedure's end, because this date comes closest to the end of the firm's economic activity.

Liquidations without links to a bankruptcy filing are less well documented in Creditreform's database. One reason is the minor relevance of voluntary liquidations for the credit rating business because they usually do not involve defaults on debt obligations. In addition, no publicly available data source reports systematically about voluntary liquidations of small firms without a trade register entry. Consequently liquidations of these small firms face the highest risk of remaining unidentified.²⁴ Concerning firms with an entry into the trade register information about liquidation events is publicly available. The descriptive texts accompanying the firm records in Creditreform's database contain a usable liquidation date for most of the voluntary liquidation cases. For the remaining cases, we so far only know the date when Creditreform recorded information about the voluntary liquidation that might have occurred much earlier.²⁵

3.2 Sample Description and Econometric Method

The two samples drawn from the East and the West German firm panel cover 12,042 (10,251) firms founded between January 1990 and June 1994 in all East and West German regions and in all industries in the manufacturing, construction, trade and service sectors. Panel data for the period from 1990 until 1997 is available. In addition to the above already mentioned exclusion restrictions, inconsistencies or typing errors in the data cause some further exclusions. Moreover, human capital information is not available for 2,576 (2,134) firms such that the samples used for the empirical analysis contain 7,817 (7,818) East (West) German firms. For these samples table 1 provides the definitions of the variables and descriptive statistics.

²³For example, Creditreform records new employment or sales figures in the second year after the bankruptcy filing for 1.5% (1.7%) of the filing firms. This low percentage of restructured young firms is consistent with the already mentioned results of Hesselmann and Stefan (1990).

²⁴This problem is closely related to the reported undercoverage of small firm foundations without a trade register entry.

²⁵The described weakness of the identification of voluntary liquidations has been one important motive for extensive data checks and additional data collection using a telephone survey, which will last until March 2000.

Table 1: Definition of Variables and Descriptive Statistics

Variable	Definition	West German Sample		East German Sample	
		Mean/ Share	Standard Deviation	Mean/ Share	Standard Deviation
Firm Variables					
LIABSTATUS	1: limited liability firm; 0: firm with at least one fully liable owner	0.5262		0.3784	
CIVILASSOC	1: civil law association; 0: else	0.0546		0.0622	
DIVERSIFICATION	1: industry classifications in at least 2 different 2-digit sectors; 0: else	0.1830		0.1742	
SIZELN	ln(initial number of employees including active owner-managers)	0.8722	0.9020	1.3083	1.1168
SIZELN2	SIZELN squared	1.5743	2.8196	2.9587	4.1618
FULLY_AFFIL	1: fully affiliated firm, i.e. completely owned by one firm; 0: else	0.0276		0.0344	
PARTLY_AFFIL	1: partly affiliated, i.e. one or more owner firms but not fully affiliated; 0: else	0.0331		0.0298	
WEST_AFFIL	1: partly of fully affiliated to a West German or foreign firm; 0: else			0.0435	
GROWTH (tv)	growth rate of employee number	0.1417	0.8095	0.1188	0.9058
PAYPROBLEM (tv)	number of registered payment problems	0.6814	1.6863	0.3681	1.1911
TEAM	number of (owner-) managers	1.2677	0.5332	1.2756	0.5654
AGELN	mean age of (owner-) managers	3.5727	0.2536	3.6156	0.2468
AGE_MIX	highest age minus lowest age in the team	1.5707	4.8895	1.6326	4.9795
MASTERCRAFT	1: master craftsmen; 0: else	0.0687		0.0857	
BUSADMIN	1: academic degrees in business administration; 0: else	0.0232		0.0185	
ENGINEERING	1: academic degrees in engineering; 0: else	0.0376		0.1081	
OTHERACAD	1: other academic degrees; 0: else	0.0258		0.0233	
EDUC_MIX	1: teams with several different educational degrees; 0: else	0.0602		0.0756	
Industry Indicators					
MANUFACTURING	1: manufacturing; 0: else	0.1268		0.1146	
CONSTRUCTION	1: construction; 0: else	0.1243		0.1994	
TRADE	1: trade; 0: else	0.3356		0.3302	
SERVICE SECTOR	1: service sector; 0: else	0.4133		0.3558	
Cohort Indicators					
COHORT 1990	1: foundation date in 1990; 0: else	0.3291		0.3613	
COHORT 1991	1: foundation date in 1991; 0: else	0.2368		0.2873	
COHORT 1992	1: foundation date in 1992; 0: else	0.1701		0.1962	
COHORT 1993/1994	1: foundation date in 1993 or 1994; 0: else	0.2640		0.1552	

The sampling strategy deviated from simple random sampling insofar as a higher sampling rate was chosen for firms with bankruptcy filings than for firms outside this stratum. This disproportional stratified choice-based sampling feature implies the dependence of the sampling rule on the endogenous variable in a liquidation risk analysis. To avoid inconsistent maximum likelihood estimates and inflated baseline hazard estimates, the contribution of each observation to the likelihood function and to the baseline hazard estimation has to be weighted with the inverse of the observation's sampling probability.²⁶ The covariance matrix is estimated with a robust variance estimator according to Lin and Wei (1989).

The empirical analysis is based on a semi-parametric, continuous-time competing risk model. The distinction between two types of liquidation, voluntary liquidation vl and forced bankruptcy liquidation bl , implies a competing risk framework according to Cox and Oates (1984) with two observable random variables T and L for each firm that are given by $T = \min(T^{vl}, T^{bl})$ and $L = l$ if $T = T^l$. T^l is the failure time for liquidation type l . The hazard function $h^l(t; x_t)$ with t denoting time and x_t denoting a vector of time-constant and time-variant covariates depicts the instantaneous probability of a liquidation of type l :

$$h^l(t; x_t) = \lim_{\Delta t \rightarrow 0^+} \frac{p(t \leq T^l < t + \Delta t \mid t \leq T^l, x_t)}{\Delta t}. \quad (2)$$

The hazard function $h^l(t; x_t)$ equals the observable function

$$h_l(t; x_t) = \lim_{\Delta t \rightarrow 0^+} \frac{p(t \leq T^l < t + \Delta t \mid t \leq T^w \text{ with } w = vl \text{ or } bl, x_t)}{\Delta t}, \quad (3)$$

for all t and l if the random variables T^{vl} and T^{bl} are mutually independent. Under the assumption of independence the likelihood function factorizes into additively separable terms for each liquidation type l . Then each type-specific hazard can be estimated separately in a single-risk model by treating duration times finishing due to another liquidation type as censored at the time of liquidation. Using an extended version of the Cox proportional hazard model that allows for stratification and time-dependent covariates, the functional form for each type-specific hazard function can be written as follows:

$$h^l(t; x_t) = h_{0,s}(t) * e^{x_t \beta}. \quad (4)$$

The coefficient vector β can be estimated without introducing a parametric specification of the stratified baseline hazard $h_{0,s}(t)$ by maximizing a partial likelihood function (Cox (1972, 1975), Kalbfleisch and Prentice (1980)). A non-parametric Kaplan-Meier estimator can be applied to compute the baseline hazard function $h_{0,s}(t)$ for each stratum s .

A firm's foundation and liquidation dates determine the duration of its economic activity. The duration measurement is based on the available daily event data in order to avoid methodical problems with

²⁶Manski and Lerman (1977) develop a consistent maximum likelihood estimator for probability choice models with choice based sampling.

strong ties (Kalbfleisch and Prentice (1980)). Surely, these exact dates do sometimes not inform about more than the time span during which the relevant economic event occurred. Voluntary liquidations or bankruptcy liquidations represent the absorbing states, but the life spans of 5,081 (5,021) East (West) German firms remain uncompleted during the observation period. Most of the firms with an uncompleted duration can be treated as right-censored cases according to a simple random censoring at the end of the observation period. Some firms get censored at an earlier moment when Creditreform stopped recording information for some reasons.

4 Empirical Results

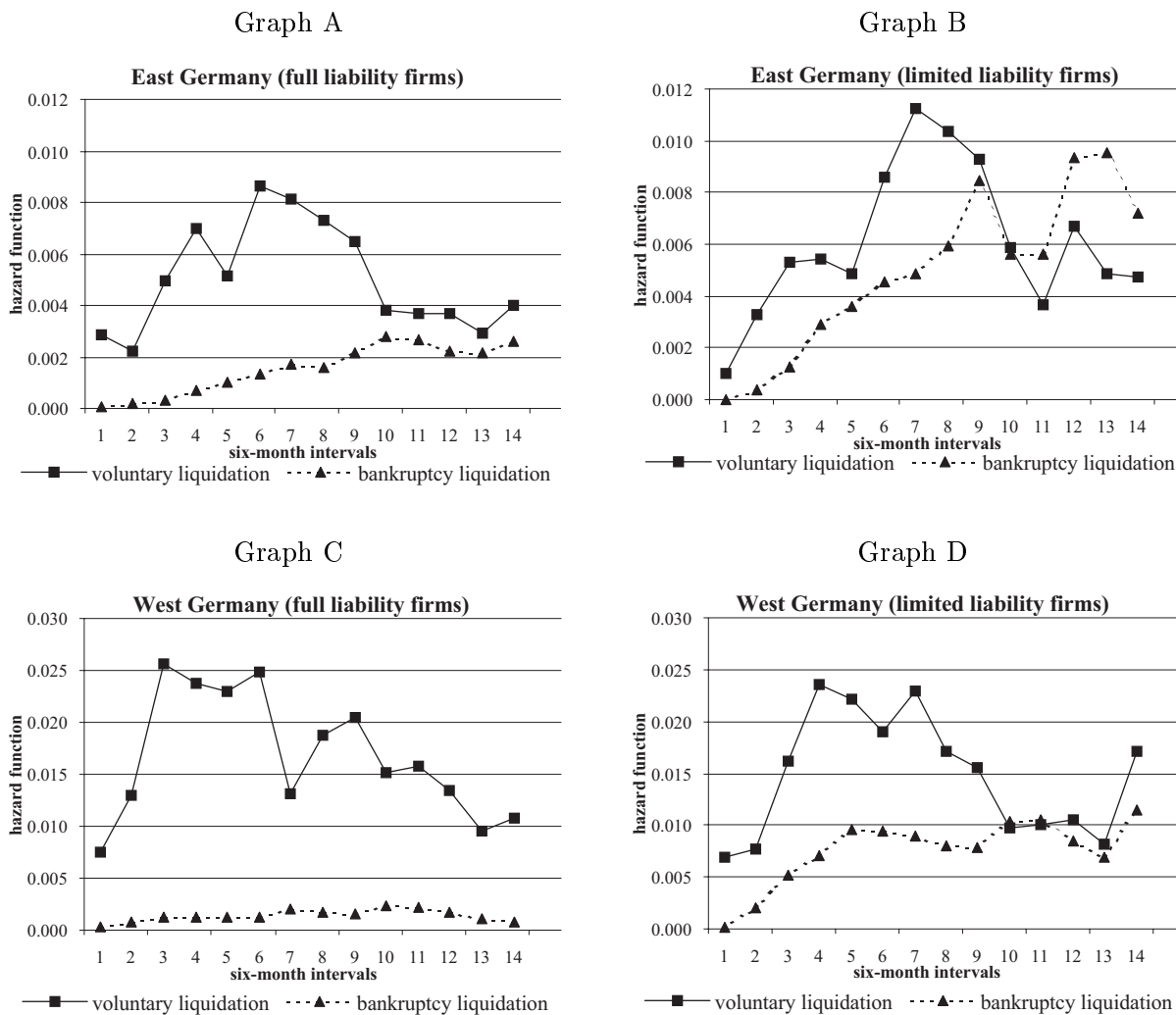
Tables 2, 3, 4 and 5 report the Cox partial likelihood estimates of two differently specified semi-parametric competing risk models for the East and West German sample. Figure 1 presents the non-parametric Kaplan-Meier estimates of the stratified baseline hazard functions corresponding to the model specification presented in tables 2 and 3.

Both specifications of the competing risk model include a stratification along the indicator of the owners' liability status (LIABSTATUS). Graphical investigations along the line of Kalbfleisch and Prentice (1980) suggest that a linear modeling in the exponential factor of equation (4) is appropriate for all time-constant variables except LIABSTATUS because the two liability groups show non-proportional hazard functions. A flexible, stratified model that allows the estimation of one baseline hazard function for each liability group is chosen to take the structural differences between the groups into account. The first specification of the model includes the time-constant covariates x_{hc} , $x_{f,me}$ and variables that indicate foundations with a team of owner-managers or with affiliations to an incumbent firm. The time-variant firm-specific variables $x_{f,t}$ are added to the covariate vector x_t in the second version of the model. Both specifications contain three simple indicator variables of the entry years 1991, 1992, and 1993/1994 to control for differences across cohorts. Five (nine) crude indicators of East (West) German counties pick up regional effects in the regressions concerning the bankruptcy liquidation risk. In the regressions concerning the voluntary liquidation risk a stronger disaggregation into 18 (23) regions, coinciding with the catchment areas of individual suborganizations of Creditreform, turned out to be adequate. 17 (17) industry dummies at the two-digit level are included to control for industry-specific effects. The indicator variable CIVILASSOC pools different sorts of civil law associations (BGB-Gesellschaft, BGB-Arbeitsgemeinschaft) that are often chosen for temporary firm cooperations. Consequently these civil law associations have a significantly increased risk of voluntary liquidation in East and West Germany.

Figure 1 contains the non-parametric Kaplan-Meier estimates of the stratified baseline hazard functions. The calculations are based on the time-constant model versions and refer to firms with one employee that are founded in 1990 in the Lower Saxonian (Saxonian) electronics industry, but not as a civil law association. Moreover, the reference firm has no diversified firm-concept, no firm affiliations and one single

owner-manager at the age of 40 who completed an apprenticeship. The baseline hazard function estimates are in line with most of the implications for the time-pattern and the structure of the selection process in East and West Germany that follow from the coexistence of self-selection among owner-managers and the external selection mechanism implemented by the insolvency law.

Figure 1: Baseline Hazard Estimates



Note: Non-parametric Kaplan-Meier estimates of the baseline hazard functions that refer to firms with one employee, no diversified firm concept, no firm affiliation and one owner-manager at the age of 40 who has completed an apprenticeship. The firms are founded in 1990 in the Lower Saxonian (Saxonian) electronics industry, but not as civil law association.

All four graphs in figure 1 reveal that the type-specific hazard function for the voluntary liquidation risk increases initially and decreases subsequently. Such a liability of adolescence has been derived from Jovanovic’s passive learning model in hypothesis H1.²⁷ However, the external selection mechanism

²⁷ A liability of adolescence for the exit risk when all liquidation types are pooled has been reported for two West German

implemented by the insolvency law shows a different time-pattern than the self-selection initiated by firm owners. The type-specific hazard function estimates for the bankruptcy liquidation risk increase initially and then oscillate around a more or less constant level until the end of the observation period. The bankruptcy liquidation risk seems to be initially a rising and then a rather constant threat in the life of young East and West German firm foundations in 1990 for at least the first seven years after market entry.

Next, the differences between the selection process among firms with fully liable owners and the process among firms with limited liability of all owners are discussed. The liability status of firm owners depends on the firm's legal form. According to the German business law, owners of two types of corporate firms, joint-stock companies (AGs) and non-public limited liability firms (GmbHs), and of commercial partnerships formed with a non-public limited liability firm (GmbH & Co KGs) are only liable up to the amount of their equity share. All remaining non-corporate firms - sole proprietorships (Gewerbebetriebe and Einzelunternehmungen), civil law associations and commercial partnerships (KGs and OHGs) - and the commercial partnerships limited by shares (KGaAs) have at least one owner who is fully liable with all his distrainable personal wealth.²⁸ For the group of firms with fully liable owners, self-selection via voluntary liquidation is c.p. clearly the dominant mechanism to sort out inefficient firms. Graphs A and C in figure 1 indicate that the risk of bankruptcy liquidation plays only a minor role as long as one fully liable owner exists. In contrast, limited liability firms have a higher bankruptcy liquidation risk relative to their voluntary liquidation risk than firms with fully liable owner-managers. According to graph D, West German limited liability firms that survive five years face from this point on an equally high risk of bankruptcy and voluntary liquidation. For West German full liability firms at the age of five years, graph C shows that the voluntary liquidation risk is still about five times as high as the bankruptcy liquidation risk. Based on this evidence hypothesis H2 cannot be rejected.

Comparing the levels of the hazard functions for the East and West German samples, it is obvious that the survival chances for firms founded between 1990 and 1994 are better in East Germany than in West Germany. Brixy and Kohaut (1999) provide supporting evidence for this result in a study based on the IAB establishment database, another large German database. Looking closer at the type-specific hazard functions, a delayed self-selection via voluntary liquidation in East Germany can be identified. The type-specific hazard function for the voluntary liquidation risk reaches its peak after 3 (3.5) years for the group of East German full (limited) liability firms whereas the corresponding hazard functions for West German firms increase only during the first 1.5 (2) years. Moreover, the increasing initial parts of the type-specific hazard functions for the bankruptcy liquidation risk in East Germany are stretched

regions by Brüderl, Preisendörfer and Ziegler (1992) and Wagner (1994). The authors present results of a proportional log-logistic hazard function model without covariates respectively simple life table estimates instead of baseline hazard function estimates for a model that controls for the impact of observable firm heterogeneity.

²⁸A commercial partnership limited by shares is classified as a corporate firm because of its resemblance to a joint-stock company. See Wöhe (1986).

over a longer time period than their West German counterparts. In addition, the bankruptcy liquidation risk relative to the voluntary liquidation risk is higher for East German firms than it is for West German firms. Hypothesis H3 cannot be rejected due to the delayed selection, the higher relative bankruptcy liquidation risk observed for the East German sample and the consequently higher portion of late failures mostly linked with defaults on debt obligations. The empirical evidence is consistent with low individual liquidation thresholds caused by higher unemployment in East Germany than in West Germany. The learning process among East German firms seems to be inhibited by lacking market experience and managerial qualifications. A high option value of waiting due to the relatively more uncertain market developments and more unsettled industry structure than in West Germany can also explain postponed liquidations. Moreover, East German firms must have been equipped with enough resources to finance their long learning period.

The following comments concern the partial likelihood estimates for the samples of the East (West) German firms with human capital information displayed in tables 2 and 3. Regressions for the full samples with 12,042 (10,251) observations yield very similar estimates for the firm-specific coefficients. Regressions for the group of 5,758 (5,737) firms without firm affiliations and with only one owner-manager and for the group of 7,315 (7,343) non-affiliated firms with one or several owner-managers produce also similar firm-specific coefficients and similar human capital effects.²⁹ Therefore, only the model estimates for the sample of all 7,817 (7,818) East (West) German firms with human capital information are presented. The covariate vector x of the models includes the indicator variables of educational degrees and the average age in the team of owner-managers or of managers in fully affiliated firm foundations to measure the firm's human capital endowment.

General human capital can be operationalized with five indicators of different educational degrees: apprenticeship (APPRENTICESHIP), master craftsman (MASTERCRAFT), university degree in business administration (BUSADMIN), engineering (ENGINEERING) or any other academic field (OTHERACAD). West German firms, managed by a person or a team of persons with university degrees in business administration or engineering, face a significantly lower bankruptcy liquidation risk than firms with managers whose final educational degree is an apprenticeship. In East Germany, firms managed by engineers, but not those managed by people with a degree in business administration have a significantly lower bankruptcy liquidation risk. This result should be related to the particular situation in East Germany after unification. The majority of people with an academic degree in East German firms received this degree before the unification. In business administration, people mainly accumulated system-specific knowledge about a planned economy system that lost relevance after the unification. However, the rather system-unspecific knowledge of engineers underwent only a minor devaluation after unification. In the equation for the voluntary liquidation risk all variables that indicate an academic degree remain insignificant. According to the discussion in section 2, high returns of high education in alternative employment

²⁹The results are available from the author upon request.

Table 2: Semi-Parametric Competing Risk Model with Time-Constant Covariates: West Germany

Independent Variables	Bankruptcy Liquidation Risk		Voluntary Liquidation Risk	
	Coefficient (Standard error)			
CIVILASSOC	-0.7590**	(0.3732)	0.5008***	(0.1457)
DIVERSIFICATION	0.0418	(0.0919)	0.0160	(0.0932)
SIZELN	0.6203***	(0.1202)	-0.1932***	(0.0609)
SIZELN2	-0.1341***	(0.0356)		
PARTLY_AFFIL	0.0913	(0.1689)	0.5617***	(0.1676)
FULLY_AFFIL	-0.4124*	(0.2331)	0.3113*	(0.1886)
TEAM	-0.2822***	(0.0950)	-0.0947	(0.0941)
AGELN	-0.3947**	(0.1613)	-0.1844	(0.1372)
AGE_MIX	-0.0161*	(0.0091)	-0.0008	(0.0076)
MASTERCRAFT	-0.7959***	(0.1907)	-0.4015**	(0.1817)
BUSADMIN	-0.7397***	(0.2738)	0.2450	(0.2031)
ENGINEERING	-0.4647**	(0.1836)	-0.0634	(0.1915)
OTHERACAD	-0.3214	(0.2537)	-0.1646	(0.2221)
EDUC_MIX	-0.2026	(0.1704)	0.0835	(0.1473)
Wald-statistics (χ^2 (degrees of freedom))				
Size Variables	32.79***	(2)	10.07***	(1)
Affiliation Indicators	3.59	(2)	12.68***	(2)
Age Variables	9.72***	(2)	1.92	(2)
Education Indicators	30.40***	(5)	7.38	(5)
Cohort Indicators	43.41***	(3)	3.68	(3)
Industry Indicators	58.44***	(17)	29.62**	(17)
Location Indicators	29.13***	(9)	104.92***	(23)
Model	281.06***	(43)	255.49***	(56)
log Likelihood	-4802.16		-8778.14	
Number of Cases	7818		7818	
Weighted Number of Events	621		1109	

Notes: *** (**, *) indicates significance at the 1% (5%, 10%) level. Firms in the reference group have the following characteristics: no civil law association, no firm affiliation, no diversification, one owner-manager with apprenticeship, member of the cohort 1990 and the electronics industry, location in Lower Saxony.

opportunities seem to lead to relatively high individual liquidation thresholds of owner-managers with high general human capital that is either related to a market economy or system-unspecific.

Table 3: Semi-Parametric Competing Risk Model with Time-Constant Covariates: East Germany

Independent Variables	Bankruptcy Liquidation Risk		Voluntary Liquidation Risk	
	Coefficient (Standard error)			
CIVILASSOC	-0.4349*	(0.2484)	0.8435***	(0.1849)
DIVERSIFICATION	0.0855	(0.0867)	-0.2503**	(0.1254)
SIZELN	0.6275***	(0.1013)	-0.0852	(0.0675)
SIZELN2	-0.0646***	(0.0210)		
PARTLY_AFFIL	0.2344	(0.1884)	0.5974**	(0.2613)
FULLY_AFFIL	-0.3895**	(0.1774)	0.2782	(0.2552)
WEST_AFFIL	-0.3658**	(0.1772)	-0.3649	(0.2540)
TEAM	-0.3500***	(0.0865)	-0.1567	(0.1210)
AGELN	-0.3360*	(0.1460)	-0.1562	(0.1835)
AGE_MIX	0.0090	(0.0074)	-0.0014	(0.0096)
MASTERCRAFT	-0.2769**	(0.1392)	0.1420	(0.1736)
BUSADMIN	-0.1907	(0.2458)	-0.0438	(0.3267)
ENGINEERING	-0.3712***	(0.1112)	-0.2619	(0.1704)
OTHERACAD	-0.3573	(0.2737)	0.0726	(0.0726)
EDUC_MIX	-0.2501*	(0.1371)	0.2397	(0.1752)
Wald-statistics (χ^2 (degrees of freedom))				
Size Variables	86.37***	(2)	1.59	(1)
Affiliation Indicators	12.06***	(3)	5.81	(3)
Age Variables	6.42**	(2)	0.76	(2)
Education Indicators	15.91***	(5)	6.25	(5)
Cohort Indicators	129.61***	(3)	6.65*	(3)
Industry Indicators	83.37***	(17)	59.55***	(17)
Location Indicators	4.50	(5)	72.01***	(18)
Model	390.85***	(40)	199.42***	(52)
log Likelihood	-5469.17		-5135.98	
Number of Cases	7817		7817	
Weighted Number of Events	738		654	

Notes: *** (**, *) indicates significance at the 1% (5%, 10%) level. Firms in the reference group have the following characteristics: no civil law association, no firm affiliation, no diversification, one owner-manager with apprenticeship, member of the cohort 1990 and the electronics industry, location in Saxony.

The indicator variable of master craftsmen is significantly negatively correlated with the bankruptcy liquidation risk in West and East Germany. Moreover, master craftsmen in West Germany, but not in East Germany, have a significantly lower voluntary liquidation risk. In West-Germany, the venture-return increasing effects seem to exceed the threshold-increasing effects of high general human capital that have been discussed in hypothesis H4. This result is plausible because people in West Germany with the final vocational degree “master craftsman” are not only likely to have more general human capital than people who completed just an apprenticeship. They can also be expected to have accumulated venture-related specific human capital, to be highly interested in self-employment and therefore to have rather low individual liquidation thresholds. In contrast, a master craftsman degree based on education during GDR-times is no indicator of venture-related specific human capital or of high interest in self-employment due to the suppression of entrepreneurship in the GDR.

The age variable (AGELN), which is used to operationalize experience, measures the natural logarithm of the average age in the firm’s team. AGELN is significantly negatively correlated with the bankruptcy liquidation risk in East and West Germany. The influence of age on the voluntary liquidation risk is also negative, but remains insignificant.³⁰ In contrast to the studies of Brüderl, Preisendörfer and Ziegler (1992) and Cressy (1996) the data reject a quadratic polynomial of the age variable that would have captured a convex shape of the negative age effect. Thus, hypothesis H5 has to be rejected partly.

The variable DIVERSIVICATION indicates whether a firm has at least two industry classifications in two different industries on the two-digit level, or not. The indicator is only negatively correlated with the voluntary liquidation risk in the East German sample such that hypothesis H6 about diversification as a risk-reducing investment strategy has to be partly rejected for firm foundations. The observed pattern is similar to the results of Harhoff, Stahl and Woywode (1998). They can identify a significantly lower voluntary liquidation risk for diversified firms, but no effect of diversification on the bankruptcy liquidation risk in a population of mostly mature West German firms with a mean age of 29.17 years.

Firms size is measured by the variable SIZELN that indicates the natural logarithm of employment in full-time equivalents. A liability of smallness, which is typically documented in studies without a distinction between competing liquidation types, can be observed in the equations for the voluntary liquidation risk. In East Germany this negative correlation remains insignificant. In the equations for the bankruptcy liquidation risk, a quadratic polynomial captures the impact of firm size best. For West German firms with less than ten employees, the marginal effect of firm size on the hazard function is positive. This result suggests that the attractiveness of out-of-court liquidations for financially distressed firms decreases with firm size as discussed in connection with hypothesis H7. In East Germany the marginal effect of firm size is positive until a level of 128 employees. This higher East German turning point of the size effect in the

³⁰This result might be caused by retirement decisions of old founders. Retirement of the owner-manager leads often to a voluntary liquidation of the respective firm - especially in the case of a non-corporate firm, because the German law strongly impedes their selling.

equation for the bankruptcy liquidation risk and the insignificance of the size variable in the equation for the voluntary liquidation risk suggests that many newly founded firms in East Germany successfully occupied small market niches with good survival chances that have been available after the break-down of the East German economy. Small-scale flexibility seems to be more advantageous for firms that have to cope with uncertain market conditions and unsettled industry structures during the transition of the East German economy than for firm foundations in West Germany.

The dummy variable TEAM indicates whether a firm foundation is managed by a team. Compared to the large group of firm foundations with one single owner-manager the newly founded firms with a management team are exposed to a significantly lower bankruptcy liquidation risk in both parts of Germany. Consequently, hypothesis H10 is not rejected. TEAM is not significantly correlated with the voluntary liquidation risk in both samples. Two crude variables have been used to test for differences between teams with a homogeneous human capital endowment and teams with a heterogeneous composition. EDUC_MIX indicates teams with at least two different types of educational degrees. AGE_MIX captures the age spread between the oldest and the youngest member in the team. West German teams with high age differences between their members are significantly less likely to exit via bankruptcy liquidation. EDUC_MIX has no significant effect except in the equation for the bankruptcy liquidation risk in the East German sample in table 3. There, it has a risk-reducing effect that is less strong than the risk-reducing effect of the indicator variable for pure teams of engineers. Thus, the presented evidence concerning the impact of team heterogeneity is mixed.

The variable FULLY_AFFIL is an indicator of whether firm foundations are fully affiliated to one incumbent firm, or not. These firms exit significantly less often via bankruptcy liquidation than unaffiliated firms, which is consistent with hypothesis H11. Their voluntary liquidation risk is significantly higher in West Germany and not significantly higher in East Germany than for unaffiliated firms. East and West German firms with at least one firm in their owner team but without a full affiliation to one firm according to PART_AFFIL have a significantly higher voluntary liquidation risk than firms without affiliations. The driving force behind these results are rather the low liquidation costs for affiliated firms and the incentives to avoid a bankruptcy liquidation because of declarations of patronage, guarantees and the reputation effects discussed in section 2 than resource-access arguments. However, resource-access arguments can explain the impact of the indicator variable WEST_AFFIL for East German firm foundations with affiliations to West German or foreign firms. These firms have a significantly lower bankruptcy liquidation risk than those without such connections. An affiliation to a Western incumbent can increase a new East German firm's prospects for various reasons. Western incumbents can probably provide relatively easy access to funding capital, can give valuable management support or can include the affiliate into a market-proven network.

Table 4: Semi-Parametric Competing Risk Model with Time-Constant & Time-Variant Covariates: West Germany

Independent Variables	Bankruptcy Liquidation Risk		Voluntary Liquidation Risk	
	Coefficient (Standard error)			
CIVILASSOC	-0.5239	(0.3795)	0.5104***	(0.1466)
DIVERSIFICATION	0.0340	(0.0942)	-0.0135	(0.0936)
SIZELN	0.4999***	(0.1214)	-0.2455***	(0.0642)
SIZELN2	-0.1051***	(0.0348)		
PARTLY_AFFIL	0.1210	(0.1696)	0.5456***	(0.1690)
FULLY_AFFIL	-0.3862*	(0.2337)	0.3032	(0.1932)
GROWTH	-0.1718***	(0.0442)	-0.2423***	(0.0335)
PAYPROBLEM	0.3673***	(0.0234)	0.1177***	(0.0269)
TEAM	-0.2157**	(0.0952)	-0.1237	(0.0947)
AGELN	-0.2395	(0.1840)	-0.1651	(0.1370)
AGE_MIX	-0.0166*	(0.0091)	-0.0016	(0.0076)
MASTERCRAFT	-0.6537***	(0.1931)	-0.3532*	(0.1815)
BUSADMIN	-0.6381**	(0.2827)	0.2864	(0.2039)
ENGINEERING	-0.4220**	(0.1870)	-0.0711	(0.1944)
OTHERACAD	-0.3124	(0.2515)	-0.1579	(0.2221)
EDUC_MIX	-0.2153	(0.1674)	0.0899	(0.1470)
Wald-statistics (χ^2 (degrees of freedom))				
Size Variables	20.62***	(2)	14.64***	(1)
Affiliation Indicators	3.44	(2)	11.71***	(2)
Age Variables	5.45*	(2)	1.63	(2)
Education Indicators	21.42***	(5)	6.87	(5)
Cohort Indicators	42.92***	(3)	3.14	(3)
Industry Indicators	37.51***	(17)	29.36**	(17)
Location Indicators	22.58***	(9)	104.89***	(23)
Model	512.43***	(45)	325.52***	(58)
log Likelihood	-4665.90		-8754.33	
Number of Cases (Episodes)	7818 (15111)		7818 (15111)	
Weighted Number of Events	621		1109	

Notes: *** (**, *) indicates significance at the 1% (5%, 10%) level. Firms in the reference group have the following characteristics: no civil law association, no firm affiliation, no diversification, one owner-manager with apprenticeship, member of the cohort 1990 and the electronics industry, location in Lower Saxony.

Table 5: Semi-Parametric Competing Risk Model with Time-Constant & Time-Variant Covariates: East Germany

Independent Variables	Bankruptcy Liquidation Risk Voluntary Liquidation Risk			
	Coefficient (Standard error)			
CIVILASSOC	-0.2898	(0.2495)	0.8399***	(0.1850)
DIVERSIFICATION	0.1158	(0.0872)	-0.2454**	(0.1253)
SIZELN	0.5504***	(0.1032)	-0.1194*	(0.0699)
SIZELN2	-0.0531**	(0.0211)		
PARTLY_AFFIL	0.2455	(0.1880)	0.5812**	(0.2620)
FULLY_AFFIL	-0.3611**	(0.1767)	0.2837	(0.2570)
WEST_AFFIL	-0.3469**	(0.1766)	-0.3489	(0.2540)
GROWTH	-0.0975***	(0.0345)	-0.1713***	(0.0351)
PAYPROBLEM	0.3746***	(0.0220)	0.0687	(0.0610)
TEAM	-0.3324***	(0.0869)	-0.1386	(0.1203)
AGELN	-0.2603*	(0.1481)	-0.1656	(0.1838)
AGE_MIX	0.0109	(0.0073)	-0.0010	(0.0095)
MASTERCRAFT	-0.2083	(0.1387)	0.1557	(0.1733)
BUSADMIN	-0.3794	(0.2979)	-0.0664	(0.3281)
ENGINEERING	-0.3287***	(0.1119)	-0.2474	(0.1705)
OTHERACAD	-0.3889	(0.2896)	0.0616	(0.2611)
EDUC_MIX	-0.2969**	(0.1397)	0.2268	(0.1756)
Wald-statistics (χ^2 (degrees of freedom))				
Size Variables	68.91***	(2)	2.92*	(1)
Affiliation Indicators	11.07**	(3)	5.50	(3)
Age Variables	5.00*	(2)	0.84	(2)
Education Indicators	13.83**	(5)	5.81	(5)
Cohort Indicators	104.46***	(3)	6.25*	(3)
Industry Indicators	76.99***	(17)	58.18***	(17)
Location Indicators	3.74	(5)	74.83***	(18)
Model	741.75***	(42)	224.95***	(54)
log Likelihood	-5371.26		-5129.39	
Number of Cases (Episodes)	7817 (16381)		7817 (16381)	
Weighted Number of Events	738		654	

Notes: *** (**, *) indicates significance at the 1% (5%, 10%) level. Firms in the reference group have the following characteristics: no civil law association, no firm affiliation, no diversification, one owner-manager with apprenticeship, member of the cohort 1990 and the electronics industry, location in Saxony.

Tables 4 and 5 display the partial likelihood estimates of the extended model with time-variant covariates for the West and the East German sample.³¹ The variable GROWTH captures employment growth the firm has realized during the preceding period. GROWTH is highly negatively correlated with both liquidation risks. This result is consistent with hypothesis H8 and it is in line with the empirical findings of Mata, Portugal and Guimarães (1995). Nevertheless, a causal interpretation of this result should be treated with caution, because employment reductions can be caused by an entrepreneurial decision to exit a market gradually. The coefficient of GROWTH in the equation for the voluntary liquidation risk is much larger than the coefficient in the equation for the bankruptcy liquidation risk in both parts of Germany. This difference suggests that entrepreneurs who chose to increase employment in the previous period move especially far away from their voluntary liquidation threshold.

As stated in hypothesis H9, the coefficient of PAYPROBLEM, which indicates the occurrence of payment problems, is strongly positively correlated with the bankruptcy liquidation risk due to the fact that inability to pay is one of the criteria that allow a filing for bankruptcy.

In West Germany, payment delays and defaults are significantly positively correlated with the voluntary liquidation risk, too. However, this is not the case in East Germany. A possible explanation for this East-West difference can be derived from the particular situation during the East German transition period. East German firms with c.p. inferior management qualification and less market experience than West German firms can not be expected to succeed as often as West German firms in avoiding a bankruptcy liquidation by choosing a voluntary liquidation before running into financial distress.

Time-variant covariates that provide information about a firm's market success and the related firm behavior have a high predictive power for the liquidation risks in subsequent periods. But their inclusion into the model has consequences for several time-constant variables measured at market entry. This is reasonable because for example high human capital and the existence of firm affiliations is according to Almus and Nerlinger (1999) and several other studies positively correlated with employment growth. The occurrence of payment problems should be negatively correlated with these variables. This explains why several estimated coefficients of time-constant variables chance and lose or gain significance after the inclusion of time-variant covariates into the model.

5 Conclusion

One aim of this paper is to provide empirical evidence about the post-entry selection among newly founded firms in East Germany after the political and economic breakdown of the German Democratic Republic with its planned economy system in 1989. A direct comparison with the selection among entrants in West Germany has been conducted in order to examine the peculiarities of post-entry selection in a transition economy with respect to the different economic background of an established market economy.

³¹Models with time-variant covariates can be estimated using a data set of durations that are splitted into several episodes.

Another aim is to show that valuable insights about the selection process among newly founded firms can be gained by taking the coexistence of self-selection among newly founded firms and external selection implemented by the insolvency law into account. The exit decision of newly founded firms is analyzed in detail in order to show how a firm's observable characteristics determine whether it will be voluntarily liquidated or forced into a bankruptcy liquidation.

Semi-parametric competing risk estimates reveal that the distinction between the two competing liquidation risks matters strongly in accordance with the structural differences between the underlying liquidation decisions. Indicators of market-oriented or system-unspecific academic education have significantly negative effects on the bankruptcy liquidation risk, but not on the voluntary liquidation risk. This result is consistent with the notion that an increase of individual liquidation thresholds caused by high general human capital countervails the impact of high general human capital on venture-related returns. The observation of a liability of smallness with respect to the voluntary liquidation risk and the inverse U-shape of the size effect on the bankruptcy liquidation risk is compatible with implications of several regulations in the German insolvency law. Firms, which are partly or fully affiliated to incumbent firms, are relatively more prone to exit via voluntary liquidation than via bankruptcy liquidation. This result supports the view that liquidation costs for affiliated firms are rather low and that incumbents have incentives to avoid a bankruptcy liquidation because of existing declarations of patronage and guarantees or reputation effects. Moreover, the structure of the selection process differs strongly between firms with fully liable owners and limited liability firms. According to the analysis of the voluntary liquidation decision entrepreneurs with limited liability have c.p. weaker incentives to liquidate their firm voluntarily than fully liable owners. Correspondingly, limited liability firms are, relative to their voluntary liquidation risk, more likely to exit via bankruptcy than firms with fully liable owners.

According to non-parametric Kaplan-Meier estimates of the type-specific baseline hazard functions the selection via bankruptcy liquidation starts as the first wave of voluntary liquidations already tapers off in both parts of Germany. A liability of adolescence can be observed with respect to the risk of voluntary liquidation, but the risk of bankruptcy liquidation seems to be an initially rising and then rather constant threat during the first years of market activity for German firm foundations after the unification in 1990. East German firms founded between 1990 and 1994 have higher survival chances between 1990 and 1997 than West German firm foundations of the same period. The selection process occurs with a delay compared to the selection among West German firm foundations. Moreover, the bankruptcy liquidation risk relative to the voluntary liquidation risk is higher for East German firms than it is for West German firms. This implies a higher portion of late occurring failures in East Germany that are mostly linked with defaults on debt obligations. The empirical evidence is consistent with low individual liquidation thresholds caused by higher unemployment in East Germany than in West Germany and with a high option value of waiting due to high uncertainty during the transition of the East German economy. Learning activities of East German firms seem to be inhibited by lacking market experience and managerial qualifications. Moreover, East German firms obviously received enough resources to finance

a long learning period.

The econometric analysis contained in this paper is restricted to a semi-parametric competing risk model based on the assumption of independence between the competing liquidation risks. Due to the links between the self-selection process and the selection process induced by the insolvency law, a model specification that permits correlation among the risks will be applied in an extended version of the paper. Moreover, the collection of additional data about liquidation events in a telephone survey, which runs until March 2000, will help to overcome the described weakness of the identification of voluntary liquidation events.

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