Macroeconomic Instability and Corporate Failure: The Role of the Legal System*

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We examine how macroeconomic instability affects risk of bankruptcy and liquidation. In periods of macroeconomic instability more firms become financially distressed, while the number of potential acquirers falls. Reorganization systems such as Chapter 11 *can decouple liquidation from macroeconomic conditions. We develop a model in which a firm's bankruptcy and acquisition hazards are co-determined by firm-level and sector-level factors, and by macroeconomic conditions. As a control, we also estimate the model for the UK, which is an economy without an equivalent system to Chapter* 11. *Differences in the responsiveness of bankruptcy to instability are largely attributable to reorganization under Chapter* 11.

1. INTRODUCTION

This paper examines how macroeconomic instability affects a firm's risk of bankruptcy and liquidation. Reviewing the literature, Caves (1998) concludes that US bankruptcy hazard rates are rather insensitive to variation in the macro environment. This is a puzzling result, as the number of failing firms is likely to increase when there is a macroeconomic downturn. For some of these firms, being bought is an alternative to being liquidated, but merger activity is strongly pro-cyclical, so that there are fewer acquirers around just when they are needed. As a consequence of these two effects, we might expect the economy to experience a sharp increase in liquidations in periods of macroeconomic instability. However, a missing element in this story is the role of the legal system. One effect of a reorganization system such as US Chapter 11 can be to decouple liquidation from macroeconomic conditions by providing a place where failing firms can shelter and, in some cases, wait for acquisition markets to become active again.[1]

To investigate these issues we develop and test a model in which a firm's bankruptcy and acquisition exit hazard rates are co-determined by firm-level and sector-level factors, and by macroeconomic conditions. Very few papers analyze bankruptcy and acquisition in a unified setting. A notable exception is Jovanovic and Rousseau (2002), though their focus is more to explain US merger waves. We use a similar framework as Jovanovic and Rousseau, but extend it to capture the effects of the macroeconomy. In our model, macroeconomic instability increases bankruptcy levels and reduces acquisition activity, while reduced acquisition activity in turn contributes to a higher incidence of liquidation (Shleifer and Vishny, 1992).

We estimate the model on a panel containing well over 30 years of data for US listed firms and covering several business cycles, using a competing risks hazard regression framework. To examine the effect of the legal system on liquidation, we also estimate the model for UK listed firms over a comparable period. The UK is an economy that is institutionally similar to the US, but without any equivalent system to Chapter 11. Effectively, bankruptcy leads directly to liquidation in the UK, whereas bankruptcy has a binary outcome in the US - a failing firm can be liquidated under Chapter 7 or reorganized under Chapter 11.

The estimated models show that macroeconomic conditions have a significant impact on the incidence of bankruptcy and acquisition. Macroeconomic instability increases bankruptcy, and reduces acquisition activity. However, while the impact of instability on bankruptcy is strong in the UK, it is much weaker in the US. When we partition US bankruptcies into Chapter 7 and Chapter 11, we find that the difference in responsiveness to macroeconomic instability is largely attributable to the use of reorganization under Chapter 11. The efficiency implications of deviations from absolute priority in 'debtor-friendly' bankruptcy systems have been the subject of intense debate (Bebchuk, 2002). Though we document the role of Chapter 11 in reducing the hazard of liquidation in periods of economic instability, this paper is neutral on whether this is a good or a bad thing from a welfare perspective.

Section 2 develops an economic model of the firm's exit decision and Section 3 explains the corresponding econometric model. Section 4 discusses the legal and institutional setting. Section 5 describes the data and choice of variables, while the results of the econometric analysis are presented and discussed in Section 6. We collect conclusions in Section 7.

2. AN ECONOMIC MODEL OF FIRM DYNAMICS AND EXIT[2]

The bankruptcy and merger literatures have developed along separate tracks, with very few papers analyzing bankruptcy and acquisition in a unified setting.[3] These include Peel and Wilson (1989), Schary (1991) and, notably, Jovanovic and Rousseau (2002). We use a similar framework as Jovanovic and Rousseau to develop a model in which firms take a sequence of decisions each period – the decision to exit, the decision to invest, and the decision to invest in acquired capital. In each case, these decisions depend on the characteristics of the firm and its industry, and on macroeconomic conditions.

If the firm is distressed, it exits either through bankruptcy (liquidation) or acquisition. The firm prefers to exit through acquisition because it receives a higher price for its capital, but the probability of this outcome depends on the demand for acquired capital in the economy. A firm that is not distressed can also decide to exit through acquisition if its continuation value falls below the price of acquired capital. Together, these two types of exiting firms determine the supply of acquired capital in the economy. If a firm decides to continue in business, it takes several investment decisions – no investment, investment in new capital only, or investment in new and acquired capital. We assume a deadweight cost of acquisitions, so that the type of investment is determined by the efficiency or productivity of the firm – the least productive firms do not invest while the most productive firms invest both in new and acquired capital. The total amount of acquired capital desired by each firm determines the aggregate demand for acquired capital.

In a stable and productive period, when the macroeconomic conditions are good and demand is more predictable, the incidence of financial distress will be lower. The smaller pool of distressed firms can also face a larger number of potential acquirers whose investment stances are encouraged by the macroeconomic conditions. Thus firms that are on the verge of bankruptcy will have a higher probability of being rescued and observed bankruptcy rates will be lower. Further, even though there are fewer distressed firms that are candidates for acquisition at such times, the market for acquisitions can tighten, driving up the market price of acquired assets and inducing a larger number of non-distressed firms to enter the pool of potential acquirees. These are firms who find the offers from potential acquirers to be higher than their own continuation values (Jovanovic and Rousseau, 2001). Thus

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overall, in a stable period, the propensity for bankruptcy will be lower, and the propensity for acquisitions will be higher.

3. ECONOMETRIC METHODOLOGY

We employ hazard regression models within a competing risks framework to study the impact of various explanatory factors (covariates) on firm exit. Unlike discrete outcome or scoring models, such as probit and logit, hazard models explicitly incorporate the timing of alternative outcomes, and segregate the age aspect of the propensity to survive or exit from the effect of other covariates. This is important in disentangling the influence of macroeconomic conditions on business exit from those of firm-specific and industry factors.

The risk of bankruptcy and of acquisition is modelled in a unified framework where each firm is conceived as being concurrently under risk of bankruptcy and acquisition during each year over its lifetime. Bankruptcy and acquisition can be thought of as mutually exclusive outcomes that are governed by their own underlying driving processes, and that compete to restrict the survival of a firm. In a hazard regression framework, these processes can be suitably parameterized using a competing risk model, where inference is based on the cause-specific intensity (hazard) rates $\lambda_h(t;\theta)$, defined as

$$\lambda_h(t;\theta) = \lim_{\epsilon \downarrow 0} \frac{1}{\epsilon} P[T < t + \epsilon; H = h | T \geq t; \theta] \qquad 1$$

where T is the random variable denoting the age at failure, $H = 1, \ldots k$ are the k competing causes of failure, and $\lambda_h(0;\theta) = 0; h = 1, \ldots k$.

In addition to right-censoring (by dependent competing risks), the models presented in this paper are based on duration data truncated to the left; in that they pertain only to the period since 1969 for US firms, and since 1965 for the UK firms (the competing risks model for Chapters 7 and 11 shown in Table 4, Section 6.3, uses data from 1980, the year following the introduction of Chapter 11). For the models of bankruptcies and acquisitions in the US, for example, the left-truncation duration (age) is given by $L = \max(L^{**}, 1969 - B)$, where B is the listing year of the firm, and L^{**} represents any delay in entry into the panel subsequent to listing. The Cox partial likelihood estimates based on a modified definition of risk sets (delayed entry) would be valid if truncation and exit durations are independent conditional on covariates. We evaluate the robustness of results

to dependent truncation by estimating the exit duration models conditioned on different ranges of the truncation duration and comparing estimates for similarity.

The Cox Proportional Hazards (PH) model conveniently describes the regression relationship between the cause-specific hazard rates corresponding to the competing causes of failure and various explanatory variables (covariates). These describe firm characteristics, such as firm size and profitability, and industry characteristics (jointly $\underline{f}_{i,t}$), and the macroeconomic environment ($\underline{u}_t$), given the age of the firm since listing ($a_{i,t}$). The macro environment will depend on the level of overall economic activity and primary sources of macroeconomic instability, such as volatility in price levels, interest rates, and exchange rates. The model postulates that the logarithm of the cause-specific hazard function is a linear function of the covariates,

$$\lambda_h(a_{i,t}, \underline{z}_{i,t}; \underline{\theta}_h) = \lambda_{0h}(a_{i,t}).\exp[\underline{\theta}_h{}' \underline{z}_{i,t}] \qquad 2$$

where $H = 1, ...k$ are the k competing causes of failure, $\lambda_{0h}(.)$ are the baseline hazard functions corresponding to the h-th cause of failure, $\underline{z}_{i,t}$ is the vector of covariates (comprising both $\underline{f}_{i,t}$ and $\underline{u}_t$), and $\underline{\theta}_h$ are the vectors of coefficients corresponding to the h-th cause of failure. h is binary (bankruptcy or acquisition), or constitutes alternative legal routes to bankruptcy in the US, namely Chapter 11 and Chapter 7. This is a flexible regression framework in which to study the impact of various covariates on the hazards of failure due to competing causes, as well as differences in the way different cause-specific hazards vary with changes in the explanatory variables. The cause-specific hazard rates of bankruptcy and acquisition can then be written as $\lambda_b(a_{i,t}|\underline{f}_{i,t}, \underline{u}_t)$ and $\lambda_a(a_{i,t}|\underline{f}_{i,t}, \underline{u}_t)$ respectively. λ_b will increase in $\underline{u}_t$ (adverse macroeconomic conditions, including instability), and λ_a will decrease in $\underline{u}_t$.

Estimates of the regression coefficients are obtained using STATA, by maximizing the partial log-likelihood of the coefficient vector $\underline{\theta}_h$

$$L_h(\underline{\theta}_h; a_{i,t}, \underline{z}_{i,t}) = \sum_{j=1}^{D_h}\left[\sum_{\{i,t\}\in D_{j,h}} \underline{\theta}_h' \underline{z}_{i,t} - d_{j,h} \ln\left\{ \sum_{\{i,t\}\in R_j} \exp(\underline{\theta}_h' \underline{z}_{i,t}) \right\} \right] \qquad 3$$

where j indexes the ordered ages at exit $a_{(j)}$ from the h-th competing risk ($j = 1, \ldots, D_h$), $D_{j,h}$ is the set of exits at age $a_{(j)}$, $d_{j,h}$ is the number of such exits, and R_j is the set of companies that were at risk at age $a_{(j)}$ (in other words, these companies had not exited or were otherwise censored at this

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age). Note that the risk-set of companies, R_j, at any age, is the same for both of the competing risks. The above partial likelihood treats the contributions of the baseline hazard, $\lambda_{0h}(a_{i,t})$, as nuisance parameters. The estimated baseline hazard contributions are estimated as $\widehat{\lambda}_{0h}(a_{(j)}) = 1 - \widehat{\alpha}_{j,h}$, where $\widehat{\alpha}_{j,h}$ is the solution to

$$\sum_{\{i,t\}\in D_{j,h}} \frac{\exp\left(\widehat{\underline{\theta}}_h' \underline{z}_{i,t}\right)}{1 - \widehat{\alpha}_{j,h}^{\exp\left(\widehat{\underline{\theta}}_h' \underline{z}_{i,t}\right)}} = \sum_{\{i,t\}\in R_j} \exp\left(\widehat{\underline{\theta}}_h' \underline{z}_{i,t}\right) \qquad 4$$

For a detailed development of these estimators and their properties, see Kalbfleisch and Prentice (2002). We report the maximum partial likelihood model estimates of hazard ratios, which are the exponential of the estimates of the Cox PH model regression coefficients. These estimates are interpreted as the multiplicative factor by which the hazard would be increased if there were a unit increase in the covariate under consideration, other things being equal. The reported z-scores are based on robust standard error estimates proposed by Lin and Wei (1989). These estimates are obtained using the so-called sandwich estimator, where we adjust for clustering by year by summing the score residuals within each year before applying the sandwich estimator.

The above framework allows dependence between the competing exit events. The interaction between the two hazard rates is characterized by variation in covariates included in the analysis. Note that non-identifiability of the hazard rates for the competing causes of exit necessitates partial likelihood inference on cause-specific hazard rates. In other words, our approach provides valid inference on the hazard rates for bankruptcy and acquisition only under an important assumption – that exits due to the competing risks are independent of each other after conditioning on all of the included covariates. The conditioning argument here is crucial, basically stating that the covariates which make bankruptcy and acquisition hazards dependent are all included in the covariate vector $\underline{z}_{i,t}$. Therefore, after conditioning on these covariates, the hazard rates for the two competing causes are independent of each other. Further, as shown in Spiekerman and Lin (1998), the above argument also holds in the presence of some forms of unobserved heterogeneity, specifically when there is a single scalar unobserved heterogeneity term for the two competing risks that acts multiplicatively on the two hazard rates.[4]

As emphasized by the subscript in the vector of covariates ($\underline{z}_{i,t}$), most of

the covariates, whether firm-level or macroeconomic factors, change over the lifetime of the firm – the covariates are time-varying. In addition, we explicitly allow for the possibility that the effect of some covariates may change over the lifetime of the firm; in other words, there may be age-varying covariate effects (Bhattacharjee, 2004). This constitutes a violation of the proportionality assumption underlying the Cox PH model. For each covariate included in our models, we verify the validity of the proportionality assumption using the tests proposed in Grambsch and Therneau (1994) and Bhattacharjee and Das (2002), and identify variables with age-varying effects. Several covariates are identified as having age-varying effects. With the results, we also report tests of the overall validity of the PH assumption (Grambsch and Therneau, 1994).

Several estimators have been proposed in the literature that allow for age-varying coefficients in the Cox regression model. In this paper, we use the intuitive and appealing histogram-sieve estimators of Murphy and Sen (1991). This method entails dividing the lifetime into several intervals and including the covariate interacting with indicator functions for each of the intervals as covariates in a modified Cox PH model. In the analysis that follows, the lifespans of US firms, post-listing, were divided into four intervals (0-8 years, 9-16 years, 17-25 years and > 25 years). This partitioning was chosen in order to allocate a similar number of bankruptcies to each age-interval. Based on this partition, we estimate the following non-proportional hazard regression model for the cause-specific hazard rates:

$$\lambda_h(a_{i,t}, \underline{z}_{i,t}; \underline{\theta}_h) = \lambda_{0h}(a_{i,t}).\exp[\underline{\theta}_h(a_{i,t})'.\underline{z}_{i,t}] \qquad 5$$

where the covariates can have possibly age-varying effects, $\underline{\theta}_h(a_{i,t})$. As our results will demonstrate, several of the covariates have age-varying covariate effects, and this segregation of the duration scale helps us to characterize effectively the way the impact of a covariate varies over the life of the firm.[5]

4. THE EFFECT OF THE BANKRUPTCY CODE

Chapter 11 was instituted in the US on October 1, 1979, as a consequence of the Bankruptcy Reform Act of 1978.[6] Before then, the US bankruptcy code was similar to and historically derived from the insolvency system in the UK (Skeel, 2001). A primary aim of the 1978 Act was to make it easier for businesses and individuals to file for bankruptcy in order to reorganize. To facilitate this, the existing management ('the debtor') continues to manage the firm and retain significant rights as debtor-in-possession, and the court

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mandates the management to propose a reorganization plan. The initial 120 days to do this can be extended repeatedly by the court, and for larger firms, the Chapter 11 process has frequently taken several years (LoPucki and Whitford, 1993a,b). Large listed US firms in distress almost invariably go through Chapter 11 initially. The court can then decide that the continuation value of the firm is low and convert a Chapter 11 filing to Chapter 7, which constitutes automatic liquidation. Hence, reorganization systems like Chapter 11 have the potential to offer a safe haven for distressed firms in periods of high macroeconomic instability, enabling some of these firms to recover and perhaps be acquired.

In the UK, receivership has offered the principle alternative to immediate liquidation for a distressed firm, but Chapter 11 and receivership are substantially different in their effects. The receiver represents creditors and replaces management. Moreover, the receiver's scope for action is severely limited by secured creditors, who can withdraw the assets over which they have security even though those assets are vital for continuing the business. The UK 1986 Insolvency Act introduced the 'administration' process to offer some of the characteristics of Chapter 11, but secured creditors can block the appointment of an administrator by appointing a receiver and, in practice, administration has rarely been used and has not materially changed the creditor orientation of the UK system.

The efficiency implications of deviations from absolute priority in 'debtor-friendly' bankruptcy systems have been the subject of intense debate (Mooradian, 1994; Mason and Weeds, 2007; Bebchuk, 2002). However, the stark debtor-friendly/creditor-friendly dichotomy can be exaggerated, and when the legal system imposes costs, actors are likely to mitigate these costs by informal action. In both the US and the UK, informal workouts can avoid bankruptcy proceedings altogether and there is evidence that, in the 1990s, large banks became more effective in softening the impact of the UK bankruptcy code through coordination on workouts (Armour et al., 2002; Franks and Torous, 2004). In the US, Baird and Rasmussen (2002, 2003) argue that, as investors have become increasingly sophisticated in writing complex contingent contracts, few large Chapter 11 bankruptcies now fit the classic reorganization paradigm in which the court reorganizes messy and conflicting claims that threaten the survival of a firm with continuing value. They argue that, by 2002, in almost all large Chapter 11 bankruptcies, effective control was in the hands of senior creditors and that the role of Chapter 11 was to arrange an orderly sale of the firm, in whole or in part. This is consistent with the role we place on Chapter 11 in this paper.

5. DATA AND CONSTRUCTION OF VARIABLES

We construct the US sample by matching the Compustat accounting database with the CRSP database to identify all listed firms[7] and to extract listing data. This gives an unbalanced panel of about 13,700 US industrial and commercial firms over the period 1969 to 2000. There were 561 exits due to bankruptcy and 2,516 acquisitions in 132,410 firm years over the 32-year period. Table 1 reports the number of exits due to bankruptcy and acquisition for each year under study, as well as the percentage of each type of exit.

Figures 1 and 2 plot the incidence of bankruptcy and acquisition for each year, where incidence is defined as the number of companies that went bankrupt (or were acquired) during the year to the total number of listed companies. Sample statistics and unconditional correlations of the macroeconomic factors with bankruptcy and acquisition are reported in Table 2. N is the number of years. The unconditional correlations are particularly large for the long-term real interest rate and the exchange rate.

Table 1: **Incidence of Bankruptcies and Acquisitions** (**US**)

Year	Bankrupt	Acquired	No.of firms	% Bankrupt	% Acquired
1969	9	37	1607	0.56	2.30
1970	4	25	1809	0.22	1.38
1971	8	18	1892	0.42	0.95
1972	9	32	3053	0.29	1.05
1973	8	21	3235	0.25	0.65
1974	7	33	3662	0.19	0.90
1975	8	43	3670	0.22	1.17
1976	9	86	3723	0.24	2.31
1977	10	108	3718	0.27	2.90
1978	10	88	3643	0.27	2.42
1979	12	73	3584	0.33	2.04
1980	11	79	3656	0.30	2.16
1981	33	113	3879	0.85	2.91

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Table 1: **con't**.					
Year	Bankrupt	Acquired	No.of firms	% Bankrupt	% Acquired
1982	30	125	3880	0.77	3.22
1983	32	166	4221	0.76	3.93
1984	42	161	4300	0.98	3.74
1985	32	151	4285	0.75	3.52
1986	31	143	4461	0.69	3.21
1987	23	152	4576	0.50	3.32
1988	33	120	4450	0.74	2.70
1989	40	81	4331	0.92	1.87
1990	32	48	4268	0.75	1.12
1991	26	21	4361	0.60	0.48
1992	19	26	4594	0.41	0.57
1993	17	42	4999	0.34	0.84
1994	12	66	5232	0.23	1.26
1995	9	63	5434	0.17	1.16
1996	10	74	5833	0.17	1.27
1997	16	103	5912	0.27	1.74
1998	10	95	5651	0.18	1.68
1999	4	99	5540	0.07	1.79
2000	5	24	4951	0.10	0.48
Total	561	2516	132410		

Duration data, measuring the post-listing lifetime of each firm, are augmented by annual indicators of macroeconomic conditions, as well as firm and industry-specific factors. These variables constitute the time-varying covariates used to explain exit probabilities or hazard rates. The competing risks framework involves estimation of two separate Cox PH models, one for exits due to bankruptcy and one for acquisitions. In each case, we treat exits due to the other cause as censored cases, in addition to observations originally censored due to delisting and other reasons. The duration data are,

thus, left-truncated, randomly right-censored by potentially dependent competing risks, and the covariates explaining the nature of the cause-specific hazards are time-varying. We obtain efficient estimates of the model parameters making the censoring duration non-informative about the exit duration, after conditioning on an adequate selection of covariates. Further, we take into account possible violation of the proportionality assumption inherent in the Cox regression model, by allowing the covariate effects to vary over the age of the firm (Bhattacharjee et al., 2002).

For the UK, we use the Cambridge-DTI, Datastream and Exstat databases of firm accounts matched with the London Share Price Database (LSPD), and have an unbalanced panel of about 4,300 UK listed industrial and commercial firms over the period 1965 to 1998. There are 166 instances of bankruptcy and 1,859 acquisitions in around 49,000 firm years over the 34-year period. In the following, we describe construction of the macroeconomic covariates, firm-level variables and industry-dummies for the US data; the constructs for the UK data are similar.

5.1. MEASURES OF MACROECONOMIC ACTIVITY

We use the following empirical proxies for the level of macroeconomic activity:

> The business cycle or output gap (o_t), is measured by the difference between trend output and actual output, using a quarterly Hodrick-Prescott filtered series of output per capita.
>
> The indicator of business entries is the log-difference of the number of new listed firms in the accounting database for each year.
>
> Real interest rates are measured as the annual average of monthly 10-year treasury bill rates, minus the annual rate of inflation. The yields on 20-year UK sovereign bonds are used to construct the corresponding measure for the UK.
>
> The exchange rate is measured by the annual average of monthly nominal broad dollar index (based on trade composition with G-10 economies). For the UK, we use the average annual real effective exchange rate.[8]

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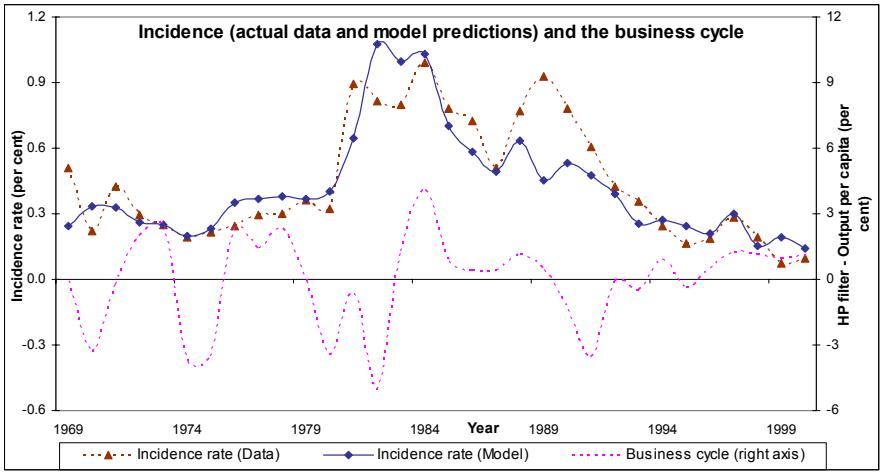

Figure 1: US business cycle and corporate bankruptcies

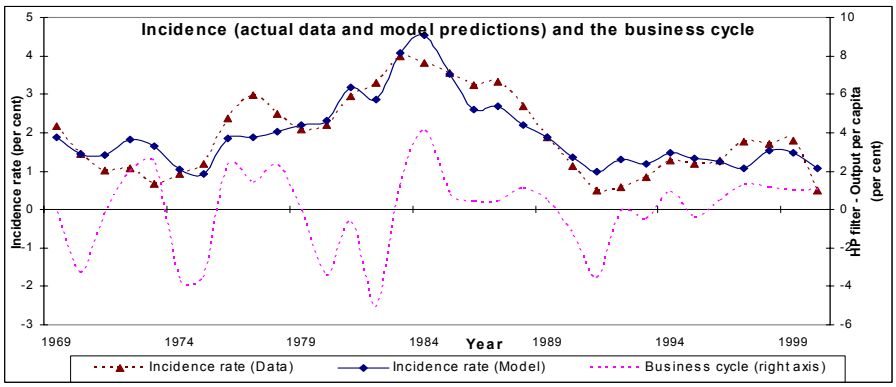

Figure 2: US business cycle and corporate acquisitions

Figures 1 and 2 for the US and Figures 3 and 4 for the UK plot the annual incidence of bankruptcies and acquisitions, respectively, against the business cycle indicator for the year. Incidence is measured as the ratio of the number of companies that went bankrupt (or were acquired) during the year to the total number of listed companies.

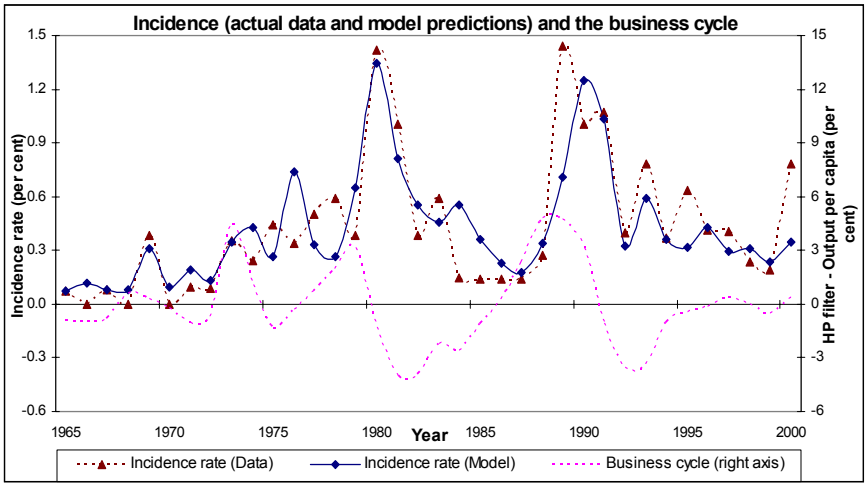

Figure 3: UK business cycle and corporate bankruptcies

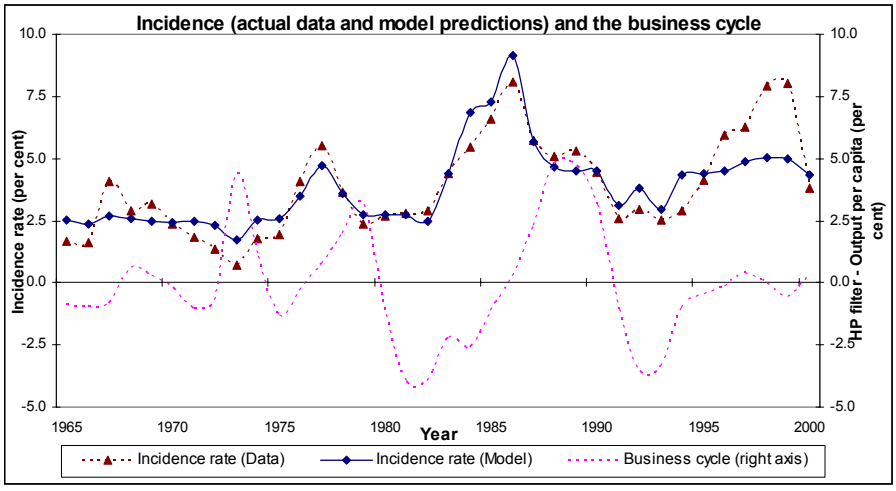

Figure 4: UK business cycle and corporate acquisitions

The incidence of bankruptcy is high during years when the economy turned down after a peak, and lower during upturns in the business cycle, while acquisitions are pro-cyclical. The growth rates in firm registration can

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provide some a priori rationalization for this; entries are pro-cyclical and it can be hypothesized that the larger number of entries during the upturn of the business cycle can force some firms out of business when the economy turns down. The responsiveness of bankruptcies to turnaround in the business cycle is lower for the US than for the UK. These plots suggest that macroeconomic conditions are important in explaining the survival of listed firms, before conditioning on firm and industry-specific characteristics.

5.2. MEASURES OF MACROECONOMIC STABILITY

Figures 1 to 4 also suggest, a priori, that even for mature (quoted) firms, the aggregate incidence of bankruptcies and acquisitions shows substantial variation over time. While a part of this aggregate movement can be explained by the business cycle, macroeconomic stability can also have a role to play. It has been argued that the impact of uncertainty on business performance is essentially asymmetric. For example, in economies with credit constraints, credit imperfections generate a transmission mechanism through which a small, temporary shock can generate large, persistent domestic balance sheet effects.[9] The amplification effect can explain why a small fundamental problem can evolve into a large-scale deterioration of economic performance. The credit constraint interacts with aggregate economic activity over the business cycle and generates asymmetric effects in response to unexpected productivity shocks. While a positive shock has only a small effect, a negative shock (even if temporary) can reduce the value of collateral to a discounted liquidation value. Since the liquidated assets cannot be restored when the shock is over, the amplification effect becomes persistent.[10]

Traditional measures of instability, for example those based on standard deviations, are not able to capture the asymmetric effects. We use signed gradients in monthly measures of macroeconomic indicators to identify sharp changes. We use the following empirical proxies for macroeconomic instability:

> The sharpness of the economic turnaround is measured by $[o_t - o_{t-1}] - [o_{t-1} - o_{t-2}]$, which is the increment of the change in output gap in the current year $(o_t - o_{t-1})$ from that in the previous year. This is a measure of the curvature or second order derivative of the Hodrick-Prescott filter of output per capita. Over a business cycle, this measure would be lowest right after the peak, when the economy turns downwards, and continue to increase gradually up to its maximum right after the trough, when

the economy picks up. Over different business cycles, this measure would be lower (or higher) for a cycle in which the economy turns down sharply after a sharp upturn (or turns up sharply after a sharp downturn).

Instability in the foreign exchange market is measured by the year-on-year change in the real exchange rate.

Price instability is measured by the largest month-to-month rate of variation of the retail price index within the calendar year.

Instability in long-term interest rates is measured by the largest month-to-month rate of variation within the calendar year, of yield rates on 20-year sovereign bonds.

TABLE 2: Sample Characteristics of the Macro Factors[11]

Variables	N	Mean	S.D.	Correlation	Correlation
				Bank, Exit	Acq, Exit
Macro-Conditions					
Output gap	32	-3.7*e*-4	0.021	0.012	0.243
Entries	32	0.036	0.821	0.011	0.062
LT real interest rate	32	3.621	2.382	0.630	0.514
Exchange rate	32	60.40	28.97	-0.226	-0.261
Macro-Instability					
Turnaround	32	-7.8*e*-4	0.043	0.023	-0.006
Increase in exchange rate	32	0.582	2.495	0.288	-0.009
Vol. - CPI inflation	32	0.643	0.326	0.090	0.171
Vol.- LT interest rate	32	7.133	2.874	0.080	0.181
Vol.- ST interest rate	32	-1.975	12.896	-0.276	-0.186

This paper focuses on the relationship between the macroeconomic environment (including macroeconomic activity and macroeconomic stability) and exits at the firm level. In Table 2, we present sample features of

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the macroeconomic variables included in our analysis. In addition to sample means and standard deviations over the 32-year period under study, Table 2 also reports simple correlation coefficients between the macroeconomic factors and aggregate incidence rates for bankruptcies and acquisitions. In combination with Figures 1 and 2, the correlations provide a preliminary idea about the nature of the above relationships; however, they present a rather simplistic and descriptive view. Estimates of the partial effects on the hazard rate of exits requires estimation of the econometric models presented in the previous section. In addition to the special role attributed to age of the firm, these models adequately account for simultaneous changes in all the macroeconomic factors as well as firm-level and industry-level characteristics.

5.3. FIRM-LEVEL AND INDUSTRY-LEVEL CHARACTERISTICS

The existing theoretical and empirical literature has identified a number of firm and industry-specific features as important determinants of firm exits (Altman and Saunders,1997; Siegfried and Evans, 1994; Caves, 1998). The literature suggests that the age of a firm is an important determinant of survival probabilities of new entrants, though it is not clearly indicated whether the same also holds for mature (listed) firms. In the hazard model specification, age-since-listing (in years) is used as the measure of firm age to explore this issue. We include dummies to capture industry effects, and a number of variables characterizing the firm and its financial performance:

> Firm size is measured as the logarithm of fixed capital in real terms, incremented by unity.
>
> Profitability is measured by the ratio of cash flow to one-year-lagged total assets.
>
> Current ratio, which is the ratio of current assets to current liabilities, is used as a measure of liquidity.
>
> Debt sustainability is measured using interest cover (ratio of interest expenses to profits before interest and tax).
>
> The firm's financial structure is measured by its gearing ratio, which is the ratio of debt to the sum of debt and equity.

The sample characteristics display significant variability both across firms, and over the period of analysis: the 32-year period 1969 to 2000 for the US,

and the 34-year period 1965 to 1998 for the UK. Current ratio, interest cover and gearing ratio are strongly collinear with the macroeconomic variables included in the analysis, and are therefore not included in the estimated hazard regression models. These variables are, however, used in the models for US bankruptcy exit in order to correct for potential endogenous selection of the exit route: Chapter 7 or Chapter 11.

6. RESULTS

Table 3 presents parameter estimates and goodness-of-fit measures for the estimated models.

The coefficients estimates (hazard ratios) are interpreted as follows. If the hazard ratio is unity, the covariate has no effect, while if it is 2, a unit rise in the covariate will double the hazard rate of exit. To take an example, consider the estimates for the effect of changes in long-term real rates of interest on the youngest US firms (less than nine years post-listing). The estimated effect on bankruptcy hazard (Table 3) is 1.469, which is higher than unity; this means that higher real interest rates are detrimental to the survival of young firms. Further, combined with the range of values taken by the variable (-1.45 to 8.71), this implies that the hazard of bankruptcy in the period of highest real interest rates would have been higher than that at the lowest by a factor of $\exp[8.71 \times \ln(1.469)]/\exp[-1.45 \times \ln(1.469)] = [1.469]^{8.71+1.45} = 49.8$ times, other factors remaining unchanged.

6.1. IMPACT OF MACROECONOMIC CONDITIONS ON FIRM EXIT

Controlling for industry and firm-level characteristics, macroeconomic conditions have a significant impact on hazard rates of exit by bankruptcy or acquisition in both economies. But there are considerable differences in the impact of the macroeconomy on business failure in the UK and the US.

Figures 5 and 6 show hazard ratios against the quantiles of volatility in the different macroeconomic factors for the US and the UK. The severely traumatic experience that periods of adverse macroeconomic conditions generate for firms is robust, and is one of the main findings of this paper. The dramatic increase in hazard rates during periods of extreme instability is visually demonstrated in Figures 5 and 6 by the slope of the hazard ratios at the highest and lowest ends.

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TABLE 3: Model Estimates, US and UK				
	US	US	UK	UK
Variables	Bankruptcy	Acquisition	Bankruptcy	Acquisition
Industry Effects	Yes	Yes	Yes	Yes
Firm x Year Level				
Size = s			1.487 (1.6)	1.412 (5.3)**
$- s \times I_1$	0.571 (-1.4)	2.539 (5.1)**		
$- s \times I_2$	0.078 (-6.6)**	1.120 (0.8)		
$- s \times I_3$	0.067 (-5.4)**	1.149 (0.8)		
$- s \times I_4$	0.132 (-6.0)**	0.931 (-0.7)		
Size-squared = s^2			0.942 (-2.2)*	0.961 (-6.2)**
$- s^2 \times I_1$	1.058 (0.3)	0.725 (-3.5)**		
$- s^2 \times I_2$	1.549 (5.8)**	0.917 (-1.6)		
$- s^2 \times I_3$	1.463 (3.1)**	0.889 (-1.9)+		
$- s^2 \times I_4$	1.297 (3.6)**	0.950 (-2.0)*		
CashF/Cap = c	1.000 (1.6)	1.001 (2.4)*		
$- c \times I_1$			0.908 (-3.3)**	4.179 (4.4)**
$- c \times I_2$			0.682 (-4.0)**	1.302 (2.5)*
$- c \times I_3$			0.113 (-1.6)	0.351 (-2.8)**
$- c \times I_4$			0.381 (-3.3)**	0.661 (-2.0)*
Return on cap. empl.	1.000 (-4.2)**	0.999 (-2.3)*	0.997 (-2.2)*	1.001 (0.9)

TABLE 3 (**con't.**): **Model Estimates, US and UK**				
	US	US	UK	UK
Variables	Bankruptcy	Acquisition	Bankruptcy	Acquisition
Macro-Conditions				
Output gap = o				
$- o \times I_1$	0.409 (-0.2)	29.60 (1.4)	34901 (1.4)	75131 (4.2)**
$- o \times I_2$	0.001 (-2.0)*	2.231 (0.4)	0.002 (-0.7)	1734 (3.2)**
$- o \times I_3$	0.000 (-1.5)	1920 (2.5)*	2.9e-5 (-1.1)	0.043 (-1.0)
$- o \times I_4$	0.002 (-0.8)	336.9 (1.9)+	4716 (1.2)	28.53 (1.2)
Entry (gr. rt.)	0.979 (-0.3)	1.043 (1.7)+	1.014 (1.7)+	0.997 (-1.7)+
LT real interest rate = r				
$- r \times I_1$	1.469 (9.0)**	1.345 (14.1)**	1.163 (1.4)	1.121 (3.6)**
$- r \times I_2$	1.142 (4.2)**	1.246 (12.4)**	1.018 (0.4)	0.945 (-4.0)**
$- r \times I_3$	1.130 (2.4)*	1.133 (4.5)**	0.962 (-0.9)	0.994 (-0.3)
$- r \times I_4$	1.189 (2.4)*	1.167 (5.7)**	1.072 (0.9)	0.973 (-1.4)
Exchange rate = e			0.080 (-1.9)+	7.048 (5.2)**
$- e \times I_1$	0.954 (-7.1)**	0.963 (-12.6)**		
$- e \times I_2$	0.973 (-7.6)**	0.977 (-10.6)**		
$- e \times I_3$	0.985 (-3.1)**	1.001 (0.7)		
$- e \times I_4$	1.007 (1.2)	1.011 (5.7)**		

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TABLE 3 (con't.): **Model Estimates, US and UK**				
	US	US	UK	UK
Variables	Bankruptcy	Acquisition	Bankruptcy	Acquisition
TurnAround = trn	1.718 (0.4)	0.923 (-0.2)		
$- trn \times I_1$			9.3e-11 (-3.0)**	0.017 (-1.7)+
$- trn \times I_2$			0.152 (-0.3)	300.3 (2.6)**
$- trn \times I_3$			0.001 (-1.0)	19.79 (1.4)
$- trn \times I_4$			0.000 (-1.0)	1.834 (0.2)
Inc exch. rate = v	1.002 (0.1)	0.963 (-3.9)**		
$- v \times I_1$			9.6e+5 (3.5)**	0.424 (-0.7)
$- v \times I_2$			289.456 (1.4)	0.322 (-1.1)
$- v \times I_3$			17.577 (0.5)	0.072 (-1.8)+
$- v \times I_4$			1305 (1.7)+	1.037 (0.0)
Volatility of Prices	0.686 (-1.3)	1.355 (2.4)*	1.276 (5.8)**	0.904 (-5.9)**
of LT int. rate = l			0.987 (-0.2)	1.033 (1.7)+
$- l \times I_1$	1.065 (1.7)+	1.018 (1.0)		
$- l \times I_2$	0.968 (-0.9)	1.007 (0.4)		
$- l \times I_3$	0.947 (-1.4)	1.051 (2.6)**		
$- l \times I_4$	0.901 (-1.8)+	1.037 (1.8)+		
of ST interest rate	1.005 (0.9)	1.009 (3.7)**	0.949 (-1.4)	0.991 (-0.8)
Number of firms	13,655	13,655	4,320	4,320
Number of exits	561	2,516	166	1,859
Years at risk	132,410	132,410	45,527	45,527
Log-L	4210.73	-19075.2	-1090.59	-12947.1
Wald χ^2 test	528.35	916.38	201.76	455.59
Deg. frdm / p-value	39 / 0.000	39 / 0.000	38 / 0.000	38 / 0.000
χ^2 test – PH	16.52	28.19	29.99	14.36
Deg. frdm / p-value	39 / 0.999	39 / 0.900	38 / 0.820	38 / 1.000

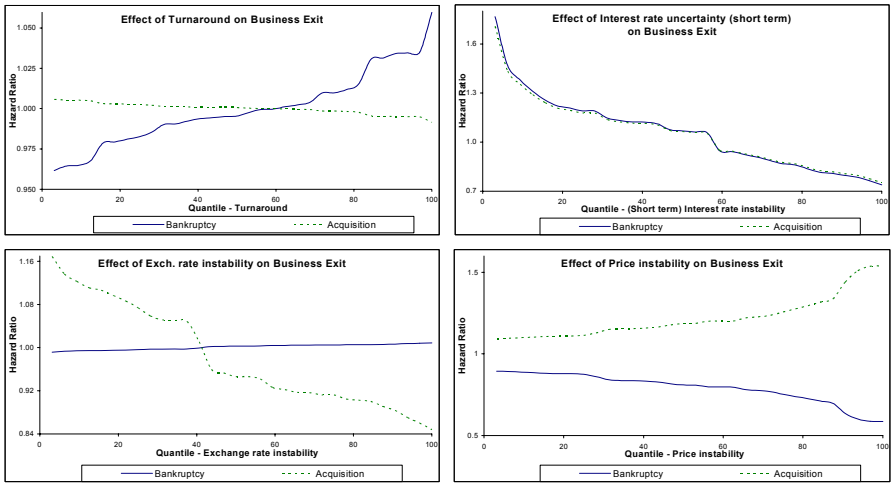

Figure 5: US – Effect of macroeconomic instability (hazard ratios)

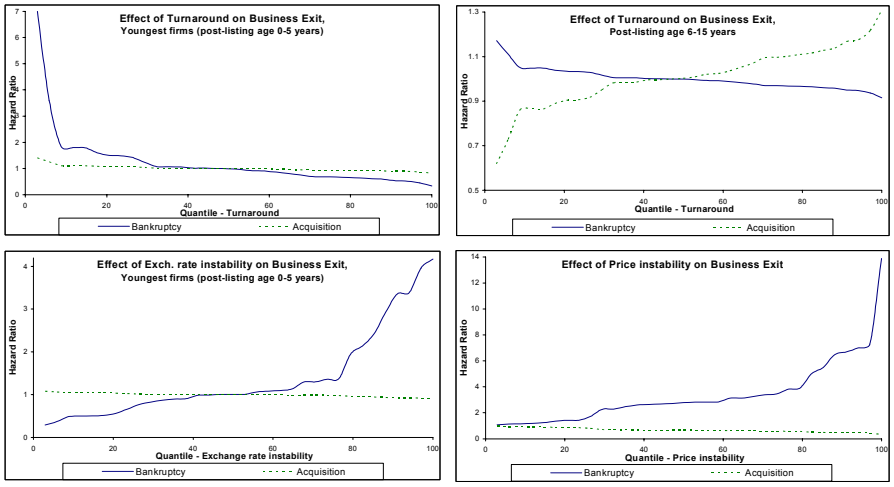

Figure 6: UK – Effect of macroeconomic instability (hazard ratios)

The effect of macroeconomic instability is non-linear and strong for UK quoted firms, but is smaller for US firms. The youngest UK firms are more likely to go bankrupt immediately after the economy passes its peak, whereas there is no significant effect of economic turnaround on US bankruptcies,

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after controlling for firm and industry-specific characteristics and other macroeconomic factors. The hazard ratio at the 3rd percentile of stability according to this measure is about 20 times higher than that at the 97th percentile in the UK, while for the US firms the hazards are about the same at both of these percentiles.

Similarly, more UK firms go bankrupt in periods when the exchange rate is stronger, while no such effect is observed for US firms. Young UK firms are likely to go bankrupt during years when the domestic currency depreciates sharply (the hazard for the 97th percentile is 14 times that for the 3rd percentile), while no such effect can be detected in the US (the hazards are about the same). Price instability increases bankruptcy in the UK, but not in the US. While interest rate instability does not have much effect on bankruptcy, bankruptcy in the US, if anything, is lower in periods of high interest rate instability.

For acquisitions, empirical observations are broadly in line with our prior expectations. Both UK and US firms are more likely to be acquired during growth phases in the economy than during downturns. Price instability has only a marginal effect on acquisitions in either economy. In both economies, firms are more likely to be acquired during periods of higher long-term real rates of interest. However, unlike the UK, acquisitions in the US are depressed in years when real rates of interest are volatile; similarly, in years when the exchange rate increases sharply.

6.2. FIRM AND INDUSTRY-LEVEL FACTORS

Firm-level covariates and industry dummies are also significant in determining exit rates. While exit rate declines in size at higher ranges in the UK, very large US firms, other than the very young, are more likely to exit. As expected, in both economies, bankruptcy is declining in profitability and cash flow. Among US firms and younger firms in the UK, those with higher cash flow are more likely to be acquired.

The age of firms, post-listing, significantly affects exit rates due to both bankruptcy and acquisitions. Plots of the baseline cumulative hazard functions of bankruptcy, for the UK and the US, against the post-listing age of the firm show a convex pattern. This indicates that exit rates due to bankruptcy decline with age (learning effect), after controlling for covariates. In the case of quoted US firms, the baseline hazard for bankruptcy seems to be lower in the first 8 years post-listing as compared to 8-25 years post-listing, before declining again after 25 years. This is consistent with what Evans (1987) and Dunne et al. (1989) report for new firms in the US. While

the baseline hazard due to acquisitions in the UK appears to be constant over the post-listing lifetime of a firm, this shows a declining trend in the US.

Figures 1 to 4 also show the year-wise predicted incidence rates of bankruptcies and acquisitions in both economies. By incidence rate, we mean the number of firms that fail as a proportion of total firms in business during that year. The close proximity of the predicted and observed incidence rates indicates the ability of the estimated models to reflect aggregate trends in the number of corporate bankruptcies and acquisitions in the US and the UK.

Further, the Chow χ^2 goodness-of-fit tests strongly reject the null hypothesis of no covariate effect (Table 3). The martingale residual test for validity of the proportional hazard assumption (Grambsch and Therneau, 1994) indicated non-proportional effects for several covariates. However, after allowing the effects of these covariates to vary with age of the firm, the test does not reject the null of proportionality. We also test for robustness of the results in several ways.[12] First, we estimate logit models for bankruptcy and acquisition exit with a flexible specification for the age effect. Second, we estimate models with different explanatory variables representing firm- and industry-specific factors, macroeconomic activity, and macroeconomic stability. This includes a very parsimonious model with only one variable for each of the three categories. Third, we check robustness of the age-varying covariate effects by changing the intervals over which the effects are assumed to be constant. Finally, we also check for the effect of dependent truncation, by restricting the data to shorter sample periods. The estimates are robust to these various specifications and the estimated models offer very similar inferences.

Jovanovic and Rousseau (2002) explain US merger waves in terms of the availability of profitable capital reallocation opportunities, although their model does not explain the 1960s merger wave well. Shleifer and Vishny (2003) stress the role of stock market misvaluations. Our model predicts all the major merger waves in the US - end of the 1960s, the 1980s and 1990s - fairly well, and provides a macroeconomic explanation.

6.3. THE IMPACT OF CHAPTER 11

Differences in bankruptcy codes in the US and the UK can be one reason for the differential impact of instability on bankruptcies. We argue in Section 2 that US Chapter 11, which has no correlate in the UK, reduces the impact of instability on bankruptcies in the US. Chapter 11 has a second order effect on acquisitions, by providing a ready supply of acquisition candidates during periods of low instability and high demand for acquired capital. To the extent

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that Chapter 11 shields businesses from bankruptcy during periods of high macroeconomic instability, the detrimental effect of instability on bankruptcies is lower on firms that follow the Chapter 11 route as compared with those that pass through Chapter 7. If this were true, Chapter 7 bankruptcies, like bankruptcies in the UK, would respond more to macroeconomic instability than Chapter 11 bankruptcies.

There is a self-selection issue here, in that only non-viable firms can be sent on the Chapter 7 route. However, if after conditioning on adequate firm and industry-level covariates, the exits through Chapter 7 and Chapter 11 are rendered independent of each other, then the usual partial likelihood inference would be valid. This is very similar to the non-informativeness argument embodied in hazard regression models with censoring due to competing risks. Thus, so far as the impact of macroeconomic conditions on exits through Chapters 7 and 11 goes, we can make adequate inference, conditional on firm and industry-level covariates, if the decision process allocating firms to these two routes depends only on these covariates.

In order to explore this issue further, we incorporate a correction for potential endogenous selection into exits through Chapter 7 or Chapter 11.[13] We first estimate a probit model for the Chapter 7 versus Chapter 11 choice, and then include the estimated inverse Mill's ratios in the hazard regression model as an approximate correction for sample selection. Exclusion restrictions are maintained by including firm-level regressors like age of the firm, cash flow, gearing, etc. in the probit model. The estimates show that sample selection is important, in that the inverse Mill's ratio is highly significant in the hazard regression models for Chapter 7 and Chapter 11. However, the sample selection corrected estimates are almost identical to uncorrected estimates, both in terms of magnitude and direction of effects.

We estimate models separately for Chapter 11 and Chapter 7 bankruptcies (Table 4). The Chapter 11 reorganization process was instituted in 1979, so all observations on Chapter 11 bankruptcy exits are post-1979. As compared with Chapter 11, Chapter 7 bankruptcies display a higher sensitivity to instability, especially to interest rate and exchange rate volatility. The plot of log-hazard ratios against quantiles of aggregate uncertainty, measured as the linear combination of interest rate and exchange rate volatility that is implied by the estimates for the US bankruptcy model (Figure 7), provides further support for this observation.

TABLE 4: Model Estimates for US Bankruptcy (post-1979)			
Variables	All Bankruptcies	Chapter 7	Chapter 11
Industry Effects	Yes	Yes	Yes
Firm x Year Level			
Size = s			
$- s \times I_1$	0.767 (-0.6)	0.610 (-1.1)	2.112 (0.8)
$- s \times I_2$	0.084 (-5.6)**	0.146 (-3.7)**	0.036 (-3.6)**
$- s \times I_3$	0.064 (-5.6)**	0.037 (-4.6)**	0.129 (-2.9)**
$- s \times I_4$	0.132 (-5.8)**	0.156 (-4.6)**	0.073 (-3.4)**
Size-squared = s^2			
$- s^2 \times I_1$	1.005 (0.0)	1.092 (0.6)	0.594 (-0.7)
$- s^2 \times I_2$	1.547 (5.3)**	1.338 (2.1)*	1.829 (4.0)**
$- s^2 \times I_3$	1.532 (4.0)**	1.642 (2.8)**	1.338 (1.7)+
$- s^2 \times I_4$	1.300 (3.5)**	1.262 (2.4)*	1.447 (2.7)**
Return on cap. empl.	1.000 (-4.0)**	1.000 (-3.7)**	1.000 (-3.5)**
Macro-Conditions			
Output gap	5.271 (0.5)	0.672 (-0.1)	504.1 (1.0)
LT real interest rate = r			
$- r \times I_1$	1.309 (3.8)**	1.307 (3.3)**	1.360 (2.2)*
$- r \times I_2$	0.916 (-1.3)	0.886 (-1.4)	0.960 (-0.4)
$- r \times I_3$	0.905 (-1.1)	0.820 (-1.6)	0.941 (-0.5)
$- r \times I_4$	0.865 (-1.1)	0.732 (-1.7)+	0.919 (-0.4)
Exchange rate = e			
$- e \times I_1$	0.942 (-5.5)**	0.939 (-4.9)**	0.952 (-2.6)**
$- e \times I_2$	0.956 (-8.7)**	0.962 (-6.6)**	0.943 (-5.6)**
$- e \times I_3$	0.976 (-3.8)**	0.980 (-2.5)*	0.965 (-3.0)**
$- e \times I_4$	0.997 (-0.6)	0.999 (-0.2)	0.976 (-1.7)+

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TABLE **4** (con't.): **Model Estimates for US Bankruptcy** (**post-1979**)			
Variables	All Bankruptcies	Chapter 7	Chapter 11
Macro-Instability			
Turnaround	0.042 (-2.2)*	0.052 (-1.7)+	0.043 (-1.3)
y-o-y incr. in exch. rate	0.998 (-0.1)	1.017 (0.6)	0.963 (-0.9)
Volatility - LT int. rate = l			
$- l \times I_1$	1.015 (0.3)	1.037 (0.6)	1.008 (0.1)
$- l \times I_2$	0.883 (-3.0)**	0.900 (-2.0)*	0.832 (-2.7)**
$- l \times I_3$	0.907 (-2.3)*	0.908 (-1.9)+	0.885 (-1.6)
$- l \times I_4$	0.866 (-2.4)*	0.930 (-1.0)	0.697 (-2.9)**
Volatility - ST interest rate	1.014 (1.8)+	1.027 (2.8)**	0.991 (-0.7)
Number of firms	12,596	12,596	12,596
Number of exits	490	321	169
Total time at risk (in yrs.)	100,487	100,487	100,487
Log-likelihood	-3498.28	-2280.62	-1192.96
Wald χ^2 test	430.94	307.20	244.07
Deg. freedom / p-value	33 / 0.000	33 / 0.000	33 / 0.000
χ^2 test – PH assumption	15.09	16.77	14.09
Deg. freedom / p-value	33 / 0.997	33 / 0.991	33 / 0.998
Chow test – parameter stability			49.40
Deg. freedom / p-value			33 / 0.033

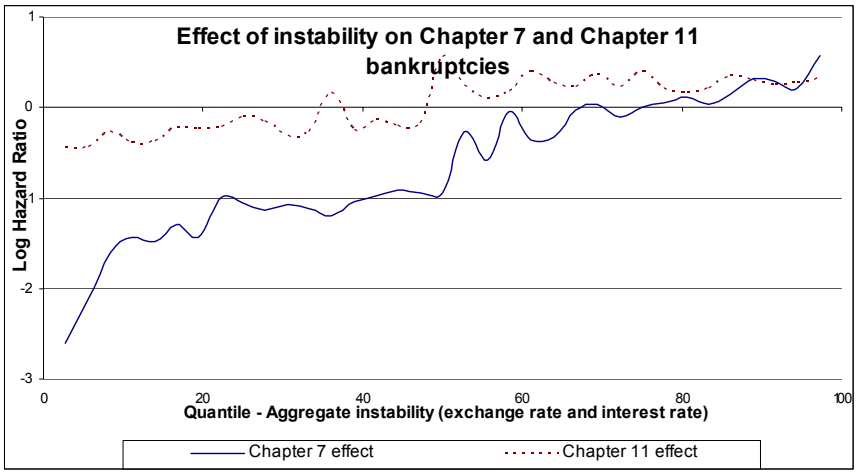

Figure 7: Effect of instability on bankruptcies – Chapter 7 and Chapter 11

While the hazard of bankruptcy through the Chapter 11 route at the 97th percentile of aggregate uncertainty is only about twice as high as that at the 3rd percentile, the hazard for Chapter 7 bankruptcies at the 97th percentile is 24 times as high as that at the 3rd percentile. For each year, we use these estimated models to predict the proportion of firms that would have failed through the Chapter 11 route as against those failing through Chapter 7. Figure 8 shows that the expected number of bankruptcies from Chapter 11 is rather less than those from Chapter 7. A similar test for the effect of Chapter 11 on the number of acquisitions was carried out by estimating models for acquisitions separately for the periods 1969 to 1979, and 1980 to 2000. The estimates for the 1980-2000 period show higher responsiveness to macroeconomic instability, but this difference is not as striking as the difference between Chapter 7 and Chapter 11 bankruptcies.

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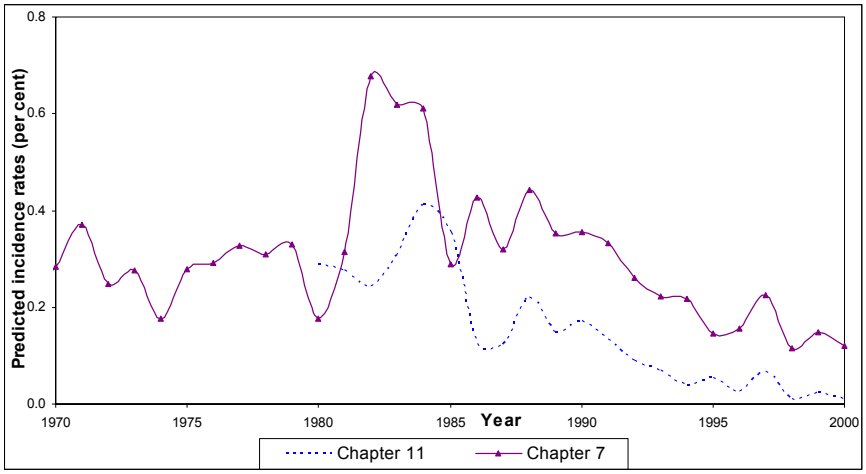

Figure 8: Predicted Incidence Rates – Chapter 7 and Chapter 11 Bankruptcies

Table 4 also includes a Chow-like test of parameter stability, testing that the covariate effects are the same for Chapter 7 and Chapter 11 bankruptcies, for the post-1980 period. This test is based on the maximized partial log-likelihoods for the three models reported in the Table. The results show that the null hypothesis of parameter stability is rejected at the 5 percent level of significance, indicating that the various explanatory factors (other than age post-listing) have different effects on the hazard of exit through the Chapter 7 and Chapter 11 routes. Of particular relevance are the effects of the macroeconomic factors, encompassing measures of both the level and instability in the macroeconomic environment. The estimates reinforce the hypothesis that Chapter 11 exits have a lower response to the macroeconomic environment than Chapter 7 bankruptcies. This is particularly evident from the effect of interest rates and their volatility.

In summary, we find evidence that the differences in the impact of macroeconomic instability on bankruptcy hazard can be attributed, in significant measure, to the difference between the Chapter 7 and Chapter 11 routes. In other words, the legal protection afforded under Chapter 11 in the US appears to reduce the adverse effect of macroeconomic instability on bankruptcies.

7. CONCLUSIONS

This paper has examined how macroeconomic instability affects a firm's risk of bankruptcy and liquidation. We developed and tested a model in which a firm's bankruptcy and acquisition hazards are co-determined by firm-level and sector-level factors, and by macroeconomic conditions. We estimate the model on a panel containing well over 30 years of data for US listed firms and covering several business cycles, using a competing risks hazard regression framework. To examine the effect of the legal system on liquidation, we also estimate the model for UK listed firms over the same period. The UK is an economy that is institutionally similar to the US, but without any equivalent system to Chapter 11. Effectively, bankruptcy leads directly to liquidation in the UK, whereas bankruptcy has a binary outcome in the US - a failing firm can be liquidated under Chapter 7 or reorganized under Chapter 11. We find that macroeconomic conditions have a significant impact on bankruptcy and acquisition hazard. However, while the impact of instability on bankruptcy is strong in the UK, it is much weaker in the US. When we partition US bankruptcies into Chapter 7 and Chapter 11, we find that the difference in responsiveness to macroeconomic instability is largely attributable to the use of reorganization under Chapter 11.

Endnotes

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1. For a recent analysis of the effects of bankruptcy codes on the capital structures of firms, see Acharya et al. (2006).
2. See Bhattacharjee et al. (2003) for a detailed derivation and discussion of the model.
3. Shleifer and Vishny (2003) provide a recent review of the acquisitions literature; Siegfried and Evans (1994) and Caves (1998) of the literature on determinants of firm failures; and Altman and Saunders (1997) of the literature on credit-scoring models.
4. Similarly, partial likelihood inference for Chapter 7 and Chapter 11 bankruptcies is valid conditional on a suitable selection of covariates.
5. For a more detailed discussion of this and other econometric issues, please refer to Bhattacharjee et al. (2002).

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6. For a more detailed discussion of the US and UK bankruptcy codes, see Higson (2003).
7. Listed on the NYSE/AMEX, NASDAQ, Over-the-Counter or any of the regional exchanges (Boston, Midwest, Montreal, Pacific or Philadelphia).
8. We regard fluctuations in the level of the exchange rate as part of the macroeconomic environment firms face, even though there is a difficulty linking many exchange rate movements to other fundamental macrofactors.
9. This feature has motivated financial accelerator-type models (Bernanke et al., 1996), including the borrowing constraint in Kiyotaki and Moore (1997), costly state verification in Bernanke and Gertler (1989), and sudden stops in Calvo (2000).
10. There is related empirical work on mechanisms which create asymmetric volatility responses (Engle and Ng, 1993).
11. Correlation with bankruptcy and acquisition exits refers to the correlation coefficients with the annual incidence rates for exits by either route.
12. The goodness-of-fit tests and robustness checks are largely motivated by the referees' comments.
13. We thank the referees for encouraging us to address this issue.

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