Bankruptcy Reforms when Workers Extract Rents☆

JOB MARKET PAPER, November 11, 2015

Latest Version: here

Alessandro Peri

Department of Economics, Universidad Carlos III de Madrid

Abstract

Firms file for bankruptcy reorganization (Chapter 11) not only to restructure debt but *also* to restructure labour contracts. Starting from this observation, I present a novel channel through which pro-creditor bankruptcy reforms can backfire. When workers extract rents, restructuring labour contracts helps distressed firms to regain economic soundness. Shareholders weigh the cost of restructuring labour contracts against their claims on the value of the firm. In this environment, bankruptcy reforms face a trade-off. A more creditor-friendly law raises recovery values of successful reorganizations. Yet, it reduces shareholders' claims and discourages the restructuring of labour contracts: reorganizations are more likely to fail and firms get liquidated. As a result, pro-creditors reforms can cause expected recovery values to fall and raise the cost of debt. I characterize this trade-off in a static model and show that the optimal level of creditor rights decreases with the bargaining power of workers. To test the theory, I exploit the heterogeneity in the U.S. states unionization coverage, and a shift towards a more creditor-friendly Chapter 11 in 1998. I then develop a firm dynamic model and calibrate it to the pre-1998 period. The model can account for the larger fall in the relative use and likelihood of success of Chapter 11 in regions where workers extract more rents.

☆ I am indebted to Andrés Erosa and Timothy J. Kehoe for guidance and support. I thank Dean Corbae, Fatih Guvenen, and Kyle Herkenhoff for the valuable insights. I also thank Manuel Amador, Anmol Bhandari, Ellen McGrattan, Angel Hernando Veciana, Omar Rachedi, Victor Ríos-Rull, Felix Wellschmied, Kei-Mu Yi and all the partecipants at the University of Minnesota workshops, 3rd Workshop on Macro Banking and Finance (Pavia), Doctoral Workshop on Quantitative Dynamic Economics (Konstanz), Mannheim University for helpful suggestions. This work was partially supported by the University of Minnesota Supercomputing Institute (Principal Investigator: Timothy J. Kehoe).

Email address: `aperi@eco.uc3m.es.` (Alessandro Peri)

URL: `https://sites.google.com/site/alessandroperiphd/` (Alessandro Peri)

1. Introduction

Do workers' rents matter for corporate bankruptcy reforms? The main argument in favour of pro-creditor bankruptcy reforms is that creditors recover more, and therefore lend more. This paper presents a novel channel through which this argument might break down: when workers extract rents, an increase in creditor rights ought not to increase *expected* recovery values. Pro-creditor bankruptcy reforms can actually backfire.

I start with the *theory*. Firms file for Chapter 11 (Ch 11) not only to restructure debt but *also* to restructure labour contracts[1]. From this observation, I build a theory where shareholders weigh the cost of restructuring labour contracts against their claims on the going-concern value of the firm. In this environment bankruptcy reforms face a tradeoff. A more creditor-friendly bankruptcy law raises recovery values upon successful reorganizations, but at the expenses of the other stakeholders: workers and shareholders. Shareholders have less incentives to restructure labour contracts, making more likely that reorganizations fail and firms get liquidated[2]. *When* the drop in the likelihood of success of Ch 11 is larger than the increase in recovery values upon success, expected recovery values fall, the cost of debt rises and the bankruptcy reform backfires.

The bargaining power of workers tells *when* this happens. When workers do not extract rents, restructuring labour contracts does not affect the success of the reorganization. Conversely, when workers extract a lot of rents, failing to restructure labour contracts can prevent the firm from regaining economic soundness, and cause the reorganization to fail[3]. As a

[1] In U.S. corporations can ask for debt relief under Chapter 7 (Ch 7) - which disciplines the liquidation of the assets of the firm and ends with its dissolution - *and* Chapter 11 (Ch 11) - which disciplines the reorganization process among the stakeholders - bondholders, shareholders and *workers* - in the attempt of preserving the corporation as a going concern. Under Ch 11 a debtor is granted the possibility to reject *any* executory contract bondage that impairs the firm viability (§365 (a)). These contracts include debt obligations but, by far, do not reduce to them.

[2] By law, when a Chapter 11 reorganization fails, the case is converted to Chapter 7.

[3] The bankruptcy experiences of Delta Airlines and Hostess-Brands are illustrative in this sense. Both corporations filed for Ch 11 to reduce labour expenses, but the latter failed to find an agreement with the unions. While Delta airlines emerged on april 2007 with a 20% reduction in the employees and an healthier

result, the effect of bankruptcy reforms on credit markets depends on the bargaining power of workers.

To study the implications of bankruptcy reforms for economic activity, I propose a static model where resources are misallocated from their productive alternative because of an enforcement constraint, which I microfound using the corporate bankruptcy law. The expected recovery upon default determines the ex-ante lending, and the fraction of resources that are misallocated. I use this framework to answer analytically a normative question: what is the optimal level of creditor rights? For a given bargaining power of workers, the optimal (output maximizer) level of creditor rights weighs the benefit of higher recovery values upon successful reorganizations against a lower likelihood of success of the procedure. Since restructuring labour contracts matters more (for the success of Ch 11) as workers rents increase, the optimal level of creditor rights decreases with the bargaining power of workers.

The model illustrates how the bankruptcy law affects credit markets through the labour and debt restructuring activity, and how workers' rents alter this linkage. I call this channel the *restructuring channel*.

I turn to *facts*. In the late 90s the U.S. shifted towards a more pro-creditor bankruptcy reorganization process. I use this legal experiment to test the theory in the data. The empirical question is whether the shift in creditor rights protection affected in the same way firms facing different bargaining power of workers. To address it, I exploit two sources of variation: historical differences in the degree of unionization across states, and the change in the creditor rights protection regime. The analysis uses firm level accounting data from Compustat, bankruptcy information from UCLA LoPucki Bankruptcy Research Database, and a proxy for the bargaining power of workers from the Union Membership and Coverage database (CPS), for the period 1979-2012.

financial structure, Hostess Brand assisted at the piece-meal sale of its popular brands.

I identify the break in the creditor rights protection regime in 1998 as the structural change in the relative use of the Ch 11 procedure with respect to the liquidation alternative, Ch 7. The break is associated with a drop in the likelihood of success of Ch 11 (from 95% to 92%), driven by highly unionized firms (from 96% to 92%). In the same spirit, Ch 11 becomes less attractive than Ch 7, especially for firms in highly unionized states. At the country level, firms experienced a dramatic deleveraging (−28%), mainly concentrated among highly unionized firms (−43%). Besides, dividend yields halved, and the Tobin-Q cross-sectional volatility tripled, again with significant differences across regions. Using regression techniques, I control for many sources of bias impairing the previous descriptive statistics analysis. The results hold through.

To study the positive implications of bankruptcy reforms, I build and characterize a general equilibrium dynamic model with heterogenous firms and default in equilibrium, where the default options capture salient features of the U.S. corporate bankruptcy law. I model the reorganization problem among the firms' stakeholders - shareholders, bondholders and workers - as a two stage Nash bargaining over labour and debt contracts, and a restructuring effort decision of the shareholders. Shareholders bargain first with workers and then with creditors. The rationale behind this assumption is *legal*. The U.S. Corporate bankruptcy law recognizes higher priority to workers over creditors on the firm surplus[4]. The consequence of this assumption is *economic*. Shareholders use the threat of liquidation in the second stage to reduce the bargaining position of workers in the first stage. The success of the reorganization process is stochastic and depends on the restructuring effort that shareholders decide to exert when bargaining with workers. In case of failure, the case is converted to Ch 7.

I conclude with *policy counterfactual experiments*. I calibrate the dynamic model to the U.S. economy from 1979 to 1998 to assess the macroeconomic and firm level implications of

[4] §507 (a) of the Bankruptcy Code.

changes in the bankruptcy law. Then, I run two experiments.

In the first experiment, I examine the effects of the shift in creditor rights protection regime experienced by the U.S.. I discipline the increase in creditor rights to match the likelihood of success of Ch 11 in the post-break period. The model predicts changes in firms' bankruptcy choices and financial structure which are consistent with the data. In the model economy, the shift does not produce significant changes in aggregate TFP, output, and consumption, but has seizable regional effects: output increases in lowly unionized regions by 0.60% and decreases in highly unionized region by 0.36%. Consumption displays a similar behaviour.

In a second experiment, I try to attach a value to the bankruptcy reorganization procedure. The motivation rests on historical reasons. Ch 11 was introduced in 1978, with the enactment of the Corporate Bankruptcy Code. What if it had never been introduced? The model records a sizeable deleveraging (-20%) and drop in the dividend-price ratio (80%), driven by lowly unionized firms. Despite consumption and output would have barely changed in aggregate (-0.11%), the regional dynamics would have been dramatically different: output would have been 14% lower in highly unionized states, and 24% higher in lowly unionized ones.

The rest of the paper is organized as follows. Section 2 reviews the literature. Section 3 organizes the empirical evidence. Section 4 lays out the Static Model. Section 5 builds up the Dynamic Model. Section 6 performs the Quantitative Analysis, and Section 9 concludes.

2. Related Literature

This paper seats in the nexus between the macro-finance[5] and the corporate-bankruptcy literature. It contributes to recents macroeconomic studies of the interaction between the

[5] In particular, the macroeconomic literature that studies the impact of financial frictions on firm dynamics. Among others, Cooley and Quadrini [2001], Jermann and Quadrini [2009], Jermann and Quadrini [2012].

labour and credit market in presence of limited commitment[6], by foregrounding a novel mechanism within the lines[7] of the U.S. corporate bankruptcy law: the restructuring channel. As in these papers, the mechanism works through a collateral constraint, but its legislative hallmark allows me to study the effect of changes in the law on economic activity[8]. As in Biais and Mariotti [2009][9], the final effect of bankruptcy reforms depends on the interplay between the credit and labour market. In both frameworks pro-creditor bankruptcy reforms can backfire, but for different reasons[10]: while in Biais and Mariotti [2009] an increase in creditor rights always yields higher recovery values, it ought not to be the case in my framework.

In this respect, the paper also departs from Corbae and D'Erasmo [2015][11] and Peri

[6] Michelacci and Quadrini [2009] firstly studies the interaction between financial frictions and the labour markets in order to explain a few stylized facts about wages and firm dynamics. Hence Monacelli et al. [2011] looks at the business cycle implications of the presence of search friction under limited enforcement of debt contracts for the (un)employment fluctuations. In conclusion, Quadrini and Sun [2015] studies in a firm dynamic framework the use of capital structure policy to lower the hiring cost of the workers and provide empirical evidence of a strong correlation between hiring growh and debt growth, which increases with a proxy of the bargaining power of workers.

[7] In particular, §365 of Ch 11 of the U.S. corporate Bankruptcy law. Despite the restructuring of labour contract is a well established phenomenon in the bankruptcy literature (among others, Geva [2012]), it has not received the same attention by the economic literature.

[8] Hints on this nexus between bankruptcy and economic growth can already be found in La Porta et al. [1997, 1998], where financial development is partially proxied by variables that measure the efficiency of bankruptcy laws and the extent they protect the rights of the creditors. The seminal papers La Porta et al. [1997, 1998] pioneered the burgeoning literature that investigates the implications of institutions and regulations on the development of financial and credit markets. They find that better institutions and regulations are crucial to establish well-functioning financial and credit markets. Following, King and Levine [1993] and Rajan and Zingales [1998] document that improvements in the financial and credit markets foster economic growth, an idea that traces back to Schumpeter (1911).

[9] To the best of my knowledge, Biais and Mariotti [2009] represents the first attempt to study the general equilibrium implications of changes in the bankruptcy law, and the first attempt to illustrate how bankruptcy laws affect economic activity by altering the general equilibrium linkage between the credit market and labour market.

[10] In Biais and Mariotti [2009] theory a more pro-creditors bankruptcy law foster investment and labour demand, driving up wages and reducing profitability. This generates a trade-off, for which soft-laws can generate more utilitarian welfare than tough laws.

[11] Corbae and D'Erasmo [2015] investigates in a fully fledged firm dynamic model the macroeconomic implication of a longly debated bankruptcy reform suggested by Aghion et al. [1994] and recently proposed by the American Bankruptcy Institute. As a result, they document - among other aspects - an increase in consumption (2.32%), output (1.99%) and measured TFP (1.03%) after the adoption, due to cheaper borrowing, and better allocation of resources in the economy.

[2015][12] - which, in the spirit of Chatterjee, Corbae, Nakajima, and Rios-Rull [2007], firstly investigate in a firm dynamic model á la Hopenhayn[13] the macroeconomic implications of changes in the U.S. corporate bankruptcy law - where an increase in the bargaining power of creditors yields higher recovery values. By breaking the identity between stakeholders[14] and stockholders[15] (enlarging the definition of stakeholders to include workers), and modelling the bargaining over labour contracts, expected recovery values can actually drop.

The focus on the misallocation of resources in the static model adds to the literature pioneered by Erosa and Cabrillana [2008]. As in Moll [2014][16], I investigate in a tractable framework the sources of misallocation in an economy where the severity of the financial frictions is pinned down by the court-supervised bankruptcy process and the bargaining power of workers.

The empirical analysis complements the findings of Klasa et al. [2009]and Matsa [2010][17] - which find that highly unionized firms tend to be more leveraged and to heard less on cash (than lowly unionized) - and the suggestive evidence of Quadrini and Sun [2015][18] - which find a positive correlation between employment growth and debt growth that is increasing in the level of unionization - by studying the effect of bankruptcy reforms on firms' bankruptcy

[12] Peri [2015] tries to identify the channels through which changes in the *actual* bankruptcy law design might affect TFP. Among others, I found that changes in the bankruptcy law that reduce the efficiency of liquidation affect TFP through the negative effect it exerts on large firms, despite large firms tend not to file for Ch 7. In doing so, I foreground a close relation between recovery value under Ch 11 and the equity issuance cost of the firm, which works through the forward looking nature of the debt restructuring process.

[13] This paper adds to the vast literature on firm dynamics pioneered by Hopenhayn [1992], in which the author extends the long run industry equilibrium theory by introducing a concept of stationary equilibrium, which allows him to investigate the phenomena of entry, exit and heterogeneity in the size and growth rates of firms.

[14] Stakeholders are formally defined as the agents that have an economic interest in the corporation.

[15] Namely, bondholders and shareholders

[16] Moll [2014] studies the effect of financial frictions on capital misallocation and aggregate productivity.

[17] Klasa et al. [2009] and Matsa [2010] study, respectively, the strategic use of corporate cash holdings and capital structure in collective bargaining with labor unions.

[18] Quadrini and Sun [2015] studies how the extent in which workers extract rents affect firms' hiring choices in a dynamic model where firms use leverage to reduce the bargaining position of the workers at the cost of a higher likelihood of distress (*the bargaining channel*).

choices and financial structure when workers extract rents.

In conclusion, I provide statistical support of the narrative approach followed by the bankruptcy literature - which has highlighted a shift in the creditor rights protection regime in the late 90s[19] - by identifying a break in the relative use of the Ch 7 and Ch 11 procedures by publicly listed firms in 1998.

3. Empirical Analysis

In the late 90s the U.S. shifted towards a more pro-creditor bankruptcy reorganization process. When did the shift in creditor rights protection regime happen? Did it affect the same way corporations where workers extract different amount of rents? How did it affect the bankruptcy phenomenon, and the firms' distribution?

I answer these questions by collecting firm level accounting data from Compustat North-America Fundamentals Annual , bankruptcy information from the UCLA LoPucki Bankruptcy Research Database and a proxy for the bargaining power of workers from the Union Membership and Coverage database (CPS)[20], for the period 1979-2012.

3.1. The Shift in the Creditor Rights Protection Regime

The bankruptcy literature agrees that Ch 11 looks nowadays more creditor-friendly than it did 30 years ago[21]. But when did the shift in creditor rights protection regime happen? Using Compustat data, I identify the shift as the structural break in the relative use of the bankruptcy procedures. Since an increase in creditor rights makes the reorganization process less attractive than its liquidation alternative, this statistics is highly informative about significant changes in the creditor rights protection regime.

[19] Among others, Warren [1999] and Miller [2007].

[20] The interested reader can refer to Appendix A for a detailed description of the data.

[21] Baird and Rasmussen [2003], Ayotte and Morrison [2009] sustain that the reorganization process is now in the hands of the creditors. Warren and Westbrook [2003] pushes this argument further, by claiming that the debt-in-possession era has meet his end at the hands of the secured-party-in-possession era.

Fig. 3.1 plots the annual filings for Ch 7 liquidation and Ch 11 reorganization by publicly traded firms from 1979 to 2012 (Compustat). Two bankruptcy filings regimes emerge. While Ch 11 filings dominates Ch 7 filings in the pre-1998 period[22], the liquidation alternative is steadily more attractive in the ever after. The Quandt-likelihood-ratio test - for the presence of a structural break at an unknown date in the number of annual Ch 11 filings - corroborates the eye-ball inspection of a break in 1998 (Fig. B.6).

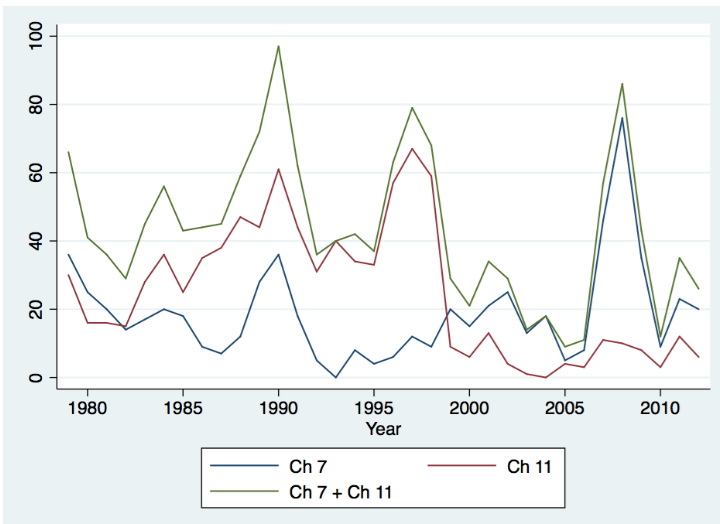

Figure 1: **Annual Ch 7 and Ch 11 filings.** *Source:* Compustat North-America Fundamentals Annual, 1950-2012. The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR).

The legal literature substantiates this finding (*narrative approach*). Warren [1999] and Miller [2007] explanations point at financial institutions lobbying for their bankruptcy agenda in 1997-1998[23].

[22] With the exception of 1979-1980, Ch 11 filings always exceeds Ch 7 filings.

[23] In Warren [1999], professor at Harvard Law School Elizabeth Warren says and I quote '*According to the New York Times [K.Q. Seelye, "House to Vote Today on Legislation for Bankruptcy Overhaul" New York Times (9 June 1998) A18. 6.], financial institutions spent, in 1997 alone, about* 40 *million lobbying for their bankruptcy agenda - an amount matched only by the enormous tobacco lobby. One can only dream about how many millions were spent when lobbying intensified during 1998.*'. Miller [2007] reinforces this argument, arguing that these efforts have been channelled not only in the consumer bankruptcies but also on provisions

3.2. Shift in Creditor Rights protection and the Bargaining Power of Workers

Did the shift in creditor rights affect the same way firms facing different bargaining power of workers? To answer this question I exploit two sources of variation: historical differences in the degree of unionization across states (*geographical dimension*), and the shift in the creditor rights protection regime (*time dimension*).

3.2.1. The U.S. Unionization Regions

I proxy the bargaining power of workers with the unionization coverage - the fraction of all employed civilian wage and salary workers covered by a collective bargaining agreement (Current Population Survey (CPS)) - of the U.S. state where the firm's headquarter is located. Then I organize U.S. states in two regions based on their historical levels of unionization.

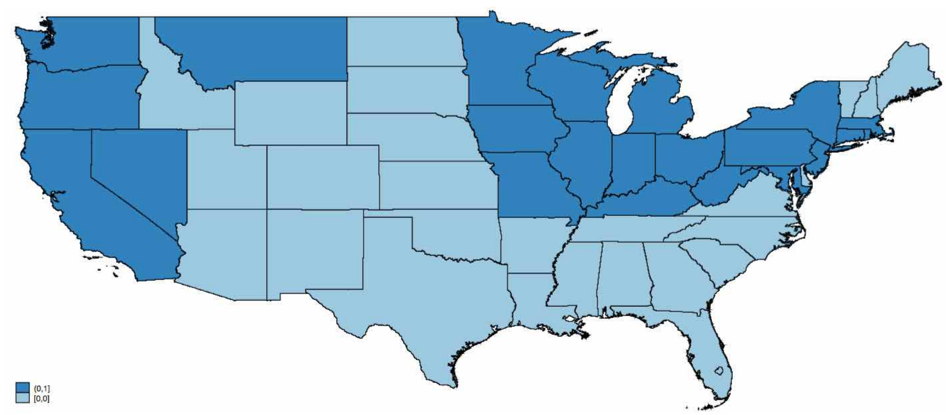

Figure 2: **Time series average coverage rate by state over the period 1983-2014.** *Source:* Union Membership and Coverage database (CPS), 1983-2014.

I assign states to the highly [lowly] unionized region if their 1983-2014 average coverage is above [below] the median of the U.S. states 1983-2014 average coverages. Figure 3.2.1 displays the results: highly unionized region in dark-blue and lowly unionized region in light-blue.

---

related to Ch 11 reorganization. These provisions became statutory with the enactment of the Bankruptcy Abuse Prevention and Consumer Protection Act in 2004.

Appendix B.2 addresses concerns about the stability of the U.S. states unionization coverage ranking over time. Among others, the time series of the cross-sectional standard deviation of the U.S. states unionization coverage looks pretty stable over the period of interest (Figure B.7).

3.2.2. Firm bankruptcy choices, by unionization region.

Did the shift in creditor rights affect the same way the bankruptcy phenomenon in highly and lowly unionized states? First of all, I restrict the attention to the population of publicly listed firms in bankruptcy reorganization (UCLA LoPucki Bankruptcy Research Database).

% of Successful Reorganizations Ch 11	**1979-1998**	**1999-2012**	**1979-2012**
Aggregate	0.9511	0.9201***	0.9296
Highly Unionized region	0.9661	0.9191 **	0.9310
Lowly Unionized region	0.9440	0.9208 **	0.9288

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, one-sided mean-comparison t test (Welch)

Table 1: The two-way table reports the ratio of the Ch 11 filings that are not converted to Ch 7 over the total number of Ch 11 filings for different regions (rows) and time periods (columns). Regions: the aggregate economy (row 1), highly unionized region (row 2), lowly unionized region (row 3); Time periods: Ch 11 cases that have been disposed in the pre-shift period (Column 1), post-shift period (Column 2) and the whole analysis period (Column 3). *Source*: UCLA LoPucki Bankruptcy Research Database, 1980-2012. The data-set is purged by involuntary filings, prepackaged cases, dismissals, and missing data.

The restructuring channel has clear predictions about the effect of an increase in creditor rights on the likelihood of success of the reorganization procedure. Shareholders have less incentives to restructure labour contracts making the reorganization more likely to fail (*intensive margin channel*). This effect should be particularly stronger when workers extract more rents, and a successful restructuring of labour contracts is required for the reorganization to succeed. To test these implications, Table 1 reports the fraction of Ch 11 cases that are not converted to Ch 7 before and after the break, in aggregate and by unionization region. Consistently with the legal literature findings, I document an economy-wide decrease in the likelihood of success of the Ch 11 procedure. On the top of that, I complement the existing evidence by documenting a larger drop in the likelihood of success in the highly unionized region. The empirical evidence is in line with the theoretical predictions.

Second, I restrict the attention to the population of publicly listed firms in bankruptcy: reorganization and liquidations (Compustat).

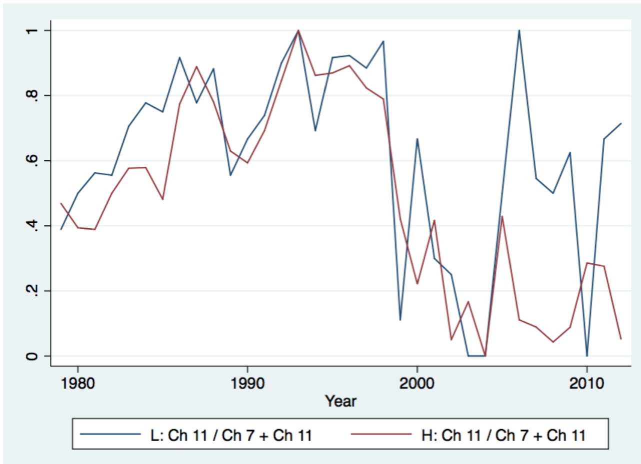

Figure 3: **Fraction of Ch 11 cases over total default, by unionization region.** Ratio of Ch 11 cases over total default (Ch 7 + Ch 11), in the lowly unionized region (blue), and highly unionized region (red). *Source:* Compustat North-America Fundamentals Annual, 1979-2012. The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR).

The theory suggests that after an increase in creditor rights Ch 11 is less attractive than Ch 7 (*extensive margin channel*), especially for firms where workers extract a lot of rents, and restructuring labour contracts is key to regain economic soundness. Figure 3.2.2 plots the relative use of Ch 11 by unionization region. In line with the theory, after the break the relative use of Ch 11 drops significantly more for firms in the highly unionized region (red line).

3.2.3. Firm balance-sheets, by unionization region.

Table 2 gives a snapshot of the firms' distribution by unionization region, in aggregate, and for the time-windows of interest: pre-shift, post-shift and over-all.

	1979-1998			1999-2012			1979-2012		
	Mean	Median	Std	Mean	Median	Std	Mean	Median	Std
Leverage	0.1853	0.1360	0.1859	0.1865	0.0985	0.2321	0.1873	0.1247	0.2030
Lowly Unionized	0.2054	0.1635	0.1939	0.2263	0.1657	0.2410	0.2152	0.1678	0.2118
Highly Unionized	0.1745	0.1232	0.1799	0.1665	0.0702	0.2224	0.1733	0.1065	0.1955
Dividend Price Ratio	0.0082	0.0013	0.0140	0.0044	0.0000	0.0120	0.0061	0.0006	0.0129
Lowly Unionized	0.0078	0.0010	0.0143	0.0054	0.0000	0.0143	0.0066	0.0005	0.0146
Highly Unionized	0.0086	0.0016	0.0141	0.0042	0.0000	0.0111	0.0061	0.0007	0.0124
Tobin-Q	1.6140	0.9033	2.1469	2.8728	1.0786	8.5315	2.7442	1.0667	7.7504
Lowly Unionized	1.3677	0.7849	1.8287	2.6398	0.9351	8.3024	2.5188	0.9191	7.6358
Highly Unionized	1.7408	0.9789	2.2659	2.5643	1.1563	5.8050	2.4871	1.1453	5.3403
Labour Productivity	1.9884	1.4255	2.1400	3.2138	2.0986	4.2002	2.4245	1.6811	2.8542
Lowly Unionized	2.1660	1.3977	2.5805	3.8110	2.1136	5.3781	2.7132	1.6625	3.5065
Highly Unionized	1.9016	1.4427	1.8717	2.9852	2.1433	3.5005	2.2898	1.7043	2.4450

Table 2: The table reports values of the panel average, median and standard-deviation of the statistic reported in the row at different geographical level (Aggregate, Lowly Unionized, and Highly Unionized Region) for the pre-shift period (1979-1998), post-shift period (1999-2012), and the whole period (1979-2012). *Source*: Compustat North-America Fundamentals Annual, 1979-2012. Union Membership and Coverage database (CPS). The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR). It also excludes observations with missing State field.

Few facts emerge. The median leverage decreased by 27% in the U.S., led by firms in highly unionized states (-43%). If any, leverage slightly increases in the lowly unionized area (1.3%). Similar behaviour for the dividend price ratio, that experienced a 46% drop at the country level, with firms in the highly unionized region on the driving seat (51% drop). While the median Tobin-q (market value of the firm over asset value) increases by almost 19% at any geographical level, the volatility more than quadruple at the country level, driven by firms in the lowly unionized region. In conclusion labour productivity increased by almost 50% (median), and doubled its dispersion, without significant regional differences.

3.3. Regression Analysis

This section attempts to isolate the effect of the shift in creditor rights, controlling for endogeneity issues that impairs the previous descriptive statistics analysis. Because of the absence of a control group, these findings do not have a causal interpretation and should be interpreted as suggestive.

The analysis is arranged in two layers. To motivate the question, I use *state*-level data and contrast the effect of the shift in creditor rights protection regime on labour productivity in highly and lowly unionized states. To substantiate the mechanism against competing hypothesis, I turn to *firm*-level data and investigate the impact of the shift on firms' bankruptcy choices, leverage, and labour productivity. Table 3 organizes the results accordingly. The analysis uses annual data over the period 1983-2012 from Compustat North-America Fundamentals Annual and the Union Membership and Coverage database (CPS)[24].

3.3.1. State-level Analysis

Table 3 Column 1 reports estimates of the following diff-in-diff regression

$$\ln \frac{Y_{t,s}}{L_{t,s}} = \alpha \; + \; \beta_U \cdot d_U \; + \; \beta_{>1998} \cdot d_{>1998} \; + \; \beta_{>1998,U} \cdot d_{>1998} \cdot d_U \\ + \; \ln \frac{Y_{t-1,s}}{L_{t-1,s}} \; + \; \sigma' X_{t,s} \; + \; \alpha_t d_t \; + \; \alpha_s d_s$$

of log measured labour productivity $\ln \frac{Y_{t,s}}{L_{t,s}}$ over its lagged value, dummy variables $d_{(\cdot)}$ and a set of controls X, where the t and s subscripts stand for time and state. The identification assumption is that $\ln \frac{Y_{t,s}}{L_{t,s}}$ follows a stationary[25] AR(1) process. The regressors of interest are: the treatment, d_{1998}, which takes value 1 after the break in 1998; d_U, which takes value 1 when a state is highly unionized; the interaction term $d_{>1998} \cdot d_U$, which informs about the differential impact of the shift in creditor rights in highly unionized states. In addition to time, α_t, and state, α_s, fixed effects, the regression includes time-varying state-specific controls

[24] The interested reader can refer to Appendix A for a detailed description of the data.
[25] In Appendix B.3 I perform a battery of panel data unit root tests followed by a state-by-state unit-root tests to support the assumption.

	State Level	Firms Level			
	Labour Productivity	Bankruptcy Choice		Leverage	Labour Productivity
		Continuation	Ch 11		
$d_{>1998}$	0.138***	8.145***	8.306**	0.092***	0.022**
	(0.038)	(2.472)	(3.926)	(0.009)	(0.010)
$d_{>1998} \cdot d_U$	-0.113**	2.340*	-3.005**	-0.026**	-0.035**
	(0.048)	(1.414)	(1.532)	(0.011)	(0.013)
d_U	-0.161**	-1.339*	-1.839***		
	(0.067)	(0.747)	(0.489)		
Trend	No	No	No	Yes	Yes
Time dummies	Yes	Yes	Yes	No	No
State dummies	Yes	Yes	Yes	Yes	Yes
Sector dummies	No	Yes	Yes	Yes	Yes
Firms Controls	No	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	1,477	177,988		148,949	140,847
$\hat{\beta}_{>1998} + \hat{\beta}_{>1998,U}$	0.026	0.000		0.066	-0.013
s.e.	0.02	0.00		0.01	0.01

Regression coefficients, Standard error clustered at state level in parenthesis
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Main Results. Regressions are organized in two panels: State Level and Firms Level. **State Level** [Column (1)]: Blundell-Bond two-steps estimates of the log of state level labour productivity, $\ln Y_{t,s}/N_{t,s}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit), number of firms, $N_{t,s}$. Time and states fixed effects are reported. *Instruments:* 1) GMM type: up to 3 lags of the dependent variable and continuous covariates; 2) iv-type: d_U, $d_{>1998}$, and $d_{>1998} \cdot d_U$. **Firms Level**: a) **Bankruptcy Choice** [Column (2)-(3)]: Multinomial logit regressions of firms continuation choice $\phi = \{\text{Continuation}, \text{Ch 7}, \text{Ch 11}\}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *Country level controls*: level of union coverage, Cov_t; 3) *State level controls*: aggregate real sales, $Y_{t,s}$, Herfindhal index of sectoral concentration (sector real sales shares unit), employment shares by sector (naics), level of union coverage, $Cov_{t,s}$, interaction terms: $d_U \cdot Cov_{t,s}$, $d_{>1998} \cdot Cov_{t,s}$, $d_{>1998} \cdot d_U \cdot Cov_{t,s}$; 4) *Firms level controls*: real sales, $y_{t,i}/P_t$, leverage, $b_{t-1,i}/a_{t-1,i}$, real total assets, $a_{t,i}/P_t$; 5) *Fixed effect controls*: time, states, and sector fixed effects are reported. Ch 7 and Ch 11 denote the relative bankruptcy choices (the baseline case Ch 7 is omitted). b) **Leverage** [Column (4)]: Fixed effect regression of $\ln b_{t,i}/a_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: lagged value, $\ln b_{t-1,i}/a_{t-1,i}$, log labour productivity, $\ln y_{t,i}/n_{t,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. Leverage is measured as total liabilities over total assets (compustat identifiers: lt, at). c) **Labour Productivity** [Column (5)]: Fixed effect regression of $\ln y_{t,i}/n_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: log labour productivity, $\ln y_{t-1,i}/n_{t-1,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. *Source:* Compustat North-America Fundamentals Annual, 1979-2012. Union Membership and Coverage database (CPS), 1983-2014.

$X_{t,s}$: Herfindhal index of sectoral concentration (sector real sales shares unit), number of firms $N_{t,s}$.

After the break, log productivity increases by 14% in lowly unionized states, while it increases by a not significant $\beta_{>1998} + \beta_{>1998,U} = 2.6\%$ in highly unionized states. The estimates of $\beta_{>1998}$ and $\beta_{>1998,U}$ are stable across different methodologies (LSDV, Fixed Effect, Random Effect, Blundell-Bond) - which controls for a variety of sources of endogeneity and non-stationarity issues - suggesting a very precise estimation. The interested reader can refer to Appendix B.3 for a detailed description of the empirical methodology adopted and robustness checks.

3.3.2. Firm-level Analysis

Table 3 walks the reader through the mechanism. The order of the columns mirrors the unfolding of the mechanism. An increase in creditor rights protection makes bankruptcy reorganization less attractive than the liquidation alternative, especially in highly unionized states - *extensive margin channel*. On the top of that, conditional on filing for bankruptcy reorganization, it reduces the incentive of shareholders to bargain with workers over the employment benefits, lowering the likelihood of success of Ch 11 - *intensive margin channel* (Table 1). Together, these channels imply lower recovery values upon default, and therefore more expensive debt, causing a shift towards a less leveraged capital structure, especially in highly unionized states - *general equilibrium channel*. The increase in the cost of debt per unit of collateral, makes more difficult for firms to exploit all their investment opportunities, with a relative drop in measured labour productivity, especially in highly unionized region. Appendix B.4 performs a battery of robustness checks.

4. The Static Model

The economy lasts for one period, and is populated by a representative firm, a representative worker and a mass one of identical lenders. The firm is run by a risk neutral shareholder and has access to a leontief technology that transforms capital, k, and a labour unit in output, $A \cdot \max\{k, \bar{k}\}$. The project scale, $\bar{k}$, denotes the threshold beyond which returns on capital sharply decrease. After production, the capital fully depreciates. The representative worker owns the firm, supplies a unit of labour inellastically, and consumes his income, $C = w + \Pi$, which consists of a wage, w, and firm's profits, Π. In conclusion, there is a competitive market of risk neutral lenders, which own $\bar{k}$[26] unit of capital that can lend to the representative firm or use to produce with a linear technology, k. To make the problem interesting, I assume that the firm's technology is more productive than the lenders' technology, $A > 1$.

The timing of the model is the following. At the beginning of the period the firm is paired with the worker, and lending takes place. At the end of the period the output is shared among the agents as follows. The shareholder chooses how much to borrow, k, to maximize profits

$$A \cdot \max\{k, \bar{k}\} - R_k \cdot k - w$$

The interest rate on the loan, R_k, and the wage, w, determines the shares of output that go to lenders and to the worker, respectively. On one side, price competition in the credit market bids the loan interest rate down to the return on the lenders' linear technology, $R_k = 1$. On the other side, the surplus of the firm - net of the capital repayment, k - is split between the shareholder and the worker in a nash bargaining fashion,

$$w = \arg\max_{v} \left[\, (A-1) \cdot k - v \,\right]^{1-\theta_U} \cdot \left[v - \underline{w}\right]^{\theta_U}$$

where θ_U denotes the bargaining power of the worker and $\underline{w}$ his outside opportunity. Since the worker does not value leisure, $\underline{w} = 0$.

An equilibrium in this economy is the set of prices $\{w, R_k\}$ and allocations such that the

[26] The fact that the aggregate amount of capital coincides with the project potential is for technical reasons (simplifies the algebra). Footnote 27 explains how.

firm maximizes profits and the bond market clears.

This environment is peculiar. Resources are in the wrong hands: lenders own capital but do not have access to the productive technology, and viceversa the firm. In this economy, the misallocation arises if frictions impede that capital moves from the lenders to the firm. To study it, I compare outcomes under two polar assumptions on the enforceablity of debt contracts: perfect and limited.

4.1. Perfect enforceability of debt contracts

If debt contracts are perfectly enforceable, in equilibrium all capital is invested in the firm technology, $k^* = \bar{k}$[27]. Henceforth, I refer to the output under perfect enforceability of debt contracts

$$Y^{FB} = A \cdot \bar{k} \tag{1}$$

as the first best aggregate output, and use it to contrast outcomes under limited enforceability of debt contracts.

4.2. Limited enforceability of debt contracts

This section introduces a twist: after producing, the shareholder can default on his debt obligations by filing either for reorganization (Ch 11) or liquidation (Ch 7). Bankruptcy is costly: upon bankruptcy all output is swiped out. In this environment, the firm value depends on the project scale. The two procedures differ on how they dispose of the project and share the surplus among the stakeholders: the shareholder, the lenders and the worker. Under Ch 7, lenders liquidate the project, net of a clearance loss $\psi \in (0, 1)$[28], and recover

[27] By assuming that the aggregate capital coincides with the project scale, we have that in first best all capital is invested in the productive technology. Assuming it differently - as long as the aggregate capital is greater than the project scale - would complicate the algebra but would keep unchanged the economic intuition.

[28] The liquidation clearance loss captures the presence of frictions in the cash-auction procedure. As instance, the *financing problem* and *the lack of competition problem* (See Aghion et al. [1994]). The first problem relates to the difficulties in raising big amount of fundings in a brief amount time. The second

$(1-\psi)\cdot\bar{k}$; the shareholder and the worker get nothing. Under Ch 11, the project is not liquidated and it is used to produce. In this case, $\zeta\cdot\bar{k}$[29] is the going-concern value of the firm, with $0\leq(1-\psi)<\zeta\leq 1<A$. In Ch 11 all contracts $\{w, R_k\}$ are annulled[30]. As a result, the shareholder, lenders and the worker enter in a two stage nash bargaining process, which is structured as follows. The shareholder bargains first with the worker and afterwards with lenders. This assumption formalizes the higher priority that the U.S. Corporate bankruptcy law recognizes to the workers over lenders on the firm's surplus[31]. To conclude, the likelihood of success of the reorganization procedure, $\alpha^R(e,\theta_U)$, depends on the effort, $e\in[0,1]$, that the shareholder decides to exert to restructure the labour contract, and the bargaining power of the worker, θ_U. In case of failure, the case is converted to Ch 7.

The shareholder solves the reorganization problem by backward induction. Accordingly, in the second stage he bargains with the lenders over a debt haircut, for a given wage compensation and level of effort (henceforth, the debt restructuring problem). Hence, in the first stage he bargains with the worker over the wage, for a given level of effort (henceforth, the labour restructuring problem). In conclusion, at the onset of the reorganization he chooses the level of effort that maximizes his expected share of the surplus, net of restructuring costs. The interested reader can refer to Appendix C for all the derivations.

4.3. The Debt Restructuring

In the second stage, for a given effort choice, e, and wage, v,

$$NB^C_{v,e}(\underline{k})=\max_{r\in\mathbb{R}^+}[\underbrace{\alpha^R(e;\theta_U)\cdot(\zeta\cdot\bar{k}-v-r)}_{\text{Firm's Expected Surplus}}]^{1-\theta_C}\cdot[\underbrace{\alpha^R(e;\theta_U)\cdot r+(1-\alpha^R(e;\theta_U))\cdot(1-\psi)\cdot\bar{k}-(1-\psi)\cdot\bar{k}}_{\text{Lenders' Expected Surplus}}]^{\theta_C}$$

$$\text{s.t}\quad \zeta\cdot\bar{k}-v-r\geq 0\qquad \alpha^R(e;\theta_U)\cdot r+(1-\alpha^R(e;\theta_U))\cdot(1-\psi)\cdot\bar{k}\geq(1-\psi)\cdot\bar{k} \tag{2}$$

problem depends on the lack of competition on the bidding sides. See Shleifer and Vishny [2011] for an amplification of the *financing problem* in recessions due to the congestion of the secondary markets (fire-sales).

[29] ζ captures the output distruption occurring during the reorganization: lost of supply-client relationship, best managers, etc..

[30] §365 (a) of the Bankruptcy Code.

[31] §507 (a) of the Bankruptcy Code.

the shareholder and lenders bargain over the debt repayment, r, to maximize the nash bargaining product between their expected surpluses (the debt restructuring problem). In this context, the bargaining power of lenders, θ_C, proxies for the level of creditor rights protection. If the reorganization is unsuccessful the firm gets liquidated, the shareholder receives nothing, $V^L = 0$, and lenders get the recovery value under Ch 7, $(1-\psi)\cdot\bar{k}$. The specification of the surplus of the lenders formalizes a legal requirement referred to as the *best interest of creditors* test: by law it is responsibility of the judge to guarantee that creditors recover under Ch 11 at least as much as under Ch 7[32].

As a result of the bargaining process, the expected recovery value under Ch 11 and the expected surplus of the shareholder are, respectively,

$$R^{11}_{v,e}(\bar{k}) = (1-\psi)\cdot\bar{k} + \alpha^R(e;\theta_U)\cdot\theta_C\cdot\max\left[\zeta\cdot\bar{k}-(1-\psi)\cdot\bar{k}-v\ ,\ 0\right] \tag{3}$$

$$S^F_{v,e}(\bar{k}) = \alpha^R(e;\theta_U)\cdot(1-\theta_C)\cdot\max\left[\zeta\cdot\bar{k}-(1-\psi)\cdot\bar{k}-v\ ,\ 0\right]. \tag{4}$$

4.4. The Labour Restructuring

In the first stage, for a given effort choice, e, the labour restructuring problem

$$NB^U_e(\underline{k}) = \max_{v\in\mathbb{R}^+}\ [\ \underbrace{S^F_{v,e}(\bar{k})}_{\text{Firm's Expected Surplus}}\ ]^{1-\theta_U}\ \cdot\ [\alpha^R(e;\theta_U)\cdot v]^{\theta_U} \tag{5}$$

entails the choice of the wage compensation that maximizes the nash bargaining product between the expected surpluses of the shareholder and of the worker. Again, if Ch 11 fails the case is transferred to Ch 7, where both get nothing. Substituting (4) in (5) we get the

[32] Pursuant to §1129 of Ch 11 impaired class of claims or interests ‘will receive or retain under the plan on account of such claim or interest property of a value, as of the effective date of the plan, that is not less than the amount that such holder would so receive or retain if the debtor were liquidated under chapter 7 of this title on such date.

wage compensation

$$w(\bar{k}) = \theta_U \cdot \max\left[\zeta - (1-\psi)\ ,\ 0\right] \cdot \bar{k} \tag{6}$$

Proposition 1. *The wage compensation upon labour restructuring decreases with the liquidation value* $(1-\psi)\bar{k}$. *(The threat of liquidation)*

The shareholder uses the threat of liquidation in the second stage to reduce the bargaining position of the worker in the first stage. This conclusion results from the timing of the debt and labour restructuring problems, which arises from the order of priority in the payment assigned by the law to employees and creditors.

For the ease of notation, let

$$S(\bar{k}) \equiv \max\left[\zeta - (1-\psi)\ ,\ 0\right] \cdot \bar{k}$$

denote the nash bargaining surplus. Substituting (6) in the objective function, it is easy to show that - for a given effort level e - the expected recovery value under Ch 11 and the expected surpluses of the shareholder and worker are, respectively,

$$R_e^{11}(\bar{k}) = (1-\psi) \cdot \bar{k} + \alpha^R(e;\theta_U) \cdot \theta_C \cdot (1-\theta_U) \cdot S(\bar{k}) \tag{7}$$

$$S_e^F(\bar{k}) = \alpha^R(e;\theta_U) \cdot (1-\theta_C) \cdot (1-\theta_U) \cdot S(\bar{k}) \tag{8}$$

$$S_e^W(\bar{k}) = \alpha^R(e;\theta_U) \cdot \theta_U \cdot S(\bar{k}). \tag{9}$$

4.5. The Restructuring Effort Problem

Upon entering reorganization, the shareholder chooses the restructuring effort, $e \in [0,1]$, that maximizes his claims on the expected surplus of the firm,

$$V^R(\bar{k}) = \max_{e\in[0,1]} S_e^F(\bar{k}) - c(e,\bar{k})$$

I assume $\alpha^R(e;\theta_U) = (1-(1-e)\cdot\theta_U)$. This specification formalizes the intuition that without a formal attempt to restructure labour contracts, $e = 0$, the probability of success of the reorganization procedure decreases with the bargaining power of the worker, $1-\theta_U$. By exerting restructuring effort, the shareholder can temper this negative effect and increase the likelihood of success $(1-\theta_U + e\cdot\theta_U)$. In conclusion, by assuming that the effort cost function is linear on the firm surplus, $c(e) \equiv c_{11}\cdot\frac{e^2}{2}\cdot S(\bar{k})$, the problem reads

$$V^R(\bar{k}) = \max_{e\in[0,1]}\left[(1-(1-e)\cdot\theta_U)\cdot(1-\theta_C)\cdot(1-\theta_U) - c_{11}\cdot\frac{e^2}{2}\right]\cdot S(\bar{k})$$

Proposition 2. *The optimal level of effort*

$$e^* = (1-\theta_C)\cdot(1-\theta_U)\cdot\frac{\theta_U}{c_{11}} \tag{10}$$

decreases with the bargaining power of lenders, θ_C.

An increase in creditor rights, θ_C, reduces the fraction of the nash-bargaining surplus that goes to the shareholder, tempering his incentives to exert effort. As a consequence, at optimum the likelihood of success of Ch 11

$$\alpha^R(e^*;\theta_U) = (1-\theta_U)\cdot\left[\left(1+\frac{\theta_U^2}{c_{11}}\right) - \frac{\theta_U^2}{c_{11}}\cdot\theta_C\right] \tag{11}$$

decreases with the creditor rights protection. In turn, this result implies that at optimum an increase in creditor rights has a countervailing effect on Ch 11 recovery values,

$$R^{11}(\bar{k}) = (1-\psi)\cdot\bar{k} + \underbrace{\alpha^R(e^*;\theta_U)\cdot\theta_C}_{\text{Trade off}}\cdot(1-\theta_U)\cdot S(\bar{k}) \tag{12}$$

If on one side, upon a successful reorganization it increases the recovery value (by increasing the share θ_C of the total surplus of the firms that goes to the lenders), on the other side it reduces the likelihood of success of Ch 11. As a result, an increase in creditor rights ought not to increase expected recovery values, and pro-creditor bankruptcy reforms can backfire. The next section, closes the model and studies how these reforms affect the allocation of resources in the economy.

4.6. Characterization of the equilbrium

The participation constraint, requires the debt repayment $R_k \cdot k$ to be no larger than the expected recovery value $L(\bar{k}) \;=\; \max\,[\; R^{11}(\bar{k})\;,\; R^{7}(\bar{k})\;]$[33],

$$R_k \;\cdot\; k \leq \; L(\bar{k})$$

By price competition in the credit market, $R_k = 1$, and the monotonicity of the firm's preferences over k we get the equilibrium level of borrowing

$$k^* = \;\min\left\{\;(1-\psi)\;+\;(1-\theta_U)^2\cdot\left[\left(1+\frac{\theta_U^2}{c_{11}}\right)\cdot\theta_C-\frac{\theta_U^2}{c_{11}}\cdot\theta_C^2\right]\cdot\max\,[\;\zeta-(1-\psi)\;,\;0\;]\;,\;1\right\}\cdot\bar{k} \tag{13}$$

Let $k^*/\bar{k}$ denote the fraction of resources that is invested in the firm's technology. Then, let $m = (\bar{k}-k^*)/\bar{k}$ denote the fraction of resources that is misallocated and invested in the un-productive linear technology. Then, the equilibrium output

$$Y = [1\cdot \underbrace{(1-m)}_{\text{Fraction of } \bar{k} \text{ invested in productive technology}} + \frac{1}{A}\cdot \underbrace{m}_{\text{Fraction of } \bar{k} \text{ invested in unproductive technology}}]\underbrace{\cdot A\cdot\bar{k}}_{Y^{FB}} \tag{14}$$

[33] The recovery value under bankruptcy has to be greater equal than the recovery value under Ch 7, independently on the procedure.

is smaller than the first best output, Y^{FB}. In turn, the misallocation of resources

$$m = 1 - \left[(1-\psi) + (1-\theta_U)^2 \cdot \underbrace{\left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \right]}_{\alpha^R(e^*;\theta_U)\,\cdot\,\theta_C} \cdot \max\left[\, \zeta - (1-\psi)\ ,\ 0\,\right] \right]$$

depends on the relative efficiency of the bankruptcy law (ζ, ψ) and - through the labour and debt restructuring activity - depends on the level of creditor rights protection and bargaining power of workers, (θ_U, θ_C).

4.7. Normative Analysis

What is the (optimal) output maximizing level of creditor rights? To answer this question I study the problem of a social planner which takes as given the bargaining power of the worker, and maximizes output by choosing the level of creditor rights protection, θ_C. This problem is equivalent to the one of minimizing the misallocation of resources

$$\max_{\theta_C \in [0,1]} Y(\theta_C;\theta_U) = (1-\theta_U)^2 \cdot \max\left[\, \zeta - (1-\psi)\ ,\ 0\,\right] \max_{\theta_C \in [0,1]} \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \right] \quad (15)$$

Proposition 3. *In an interior solution*[34]*, the optimal level of creditor rights*

$$\theta_C^*(\theta_U) = \frac{1}{2} \cdot \left[\frac{c_{11}}{\theta_U^2} + 1 \right] \quad (16)$$

decreases with the bargaining power of the worker.

The existence of a blissing point in the social planner problem is the result of the countervailing effect that an increase in creditor rights has on the equilibrium likelihood of success of Ch 11, $\alpha^R(e^*;\theta_U)$, and on the share of nash bargaining surplus that goes

[34] When $\zeta > (1-\psi)$, or equivalently when, $R^{11}(\bar{k}) > R^7(\bar{k})$.

to the lenders, $(1-\psi)\cdot\bar{k}+\alpha^R(e^*;\theta_U)\cdot\theta_C\cdot(1-\theta_U)\cdot S(\bar{k})$. Keeping fix $\alpha^R(e^*;\theta_U)$, an increase in θ_C mechanically increases the share of the nash bargaining surplus, $S(\bar{k})$, that goes to the lenders. Upon a successful reorganization, it increases recovery values, fosters ex-ante the lending, and reduces the misallocation of resources in the economy, boosting output. Yet, it reduces the share of the nash bargaining surplus that goes to the shareholder, $(1-\theta_C)\cdot(1-\theta_U)\cdot\alpha^R(e^*;\theta_U)\cdot S(\bar{k})$, tempers his incentives to exert restructuring effort, and, by doing so, reduces the likelihood of success of Ch 11, (11).

Proposition 3 says that whether one force prevails the other depends on the bargaining power of the worker. When $\theta_U\to 0$, exerting effort to restructure labour contracts, e, does not help the firm to regain economic soundness, and therefore does not alter the likelihood of success of Ch 11, $\alpha^R(e^*;\theta_U)$. It is then optimal to give all the bargaining power to the lenders, $\theta_C\to 1$. Conversely when $\theta_U\to 1$, failing in restructuring labour contracts can prevent the firm to regain its economic soundness, and therefore exerting effort in restructuring labour contracts is crucial. Accordingly, the optimal level of creditor rights attains its minimum, $0.5(c_{11}+1)$.

Out of the algebra, Proposition 3 contains an important message. In economies where worker extract a lot of rents, an increase in creditor rights can increase the misallocation of resources, by suffocating the incentives to restructure labour contracts in reorganization. This result might shed light on why more unionized countries - as Italy, France - have lower creditor rights protection than less unionized ones - say, U.S.

5. The Dynamic Model

The economy is populated by firms, credit intermediaries and a household. In the economy there are two regions. Regions differ by the bargaining power of workers - highly and lowly unionized - and by the measure of firms[35].

Firms are run by risk neutral shareholders[36], who maximize the expected discounted stream of dividends. They articulate in two types: incumbents and entrants.

There is a continuum of incumbents, which differ by the region where they are located, their (fixed) capital scale of production, their (fixed) productivity and their histories. The incumbents are the producing firms in the economy. They combine capital and labour into a decreasing returns-to-scale technology and experience uninsurable persistent idiosyncratic productivity shocks. The labour cost varies across regions and across firms: the (region-specific) bargaining power of workers determine the fraction of the (firm-specific) surplus that is extracted by workers. Incumbents finance investment and dividends using internal and external funds: retained profits, one-period non-contingent loans and equity issuance. Incumbents can renege on their debt obligations and default. In compliance with the bankruptcy law, they have access to two bankruptcy procedures: liquidation (Ch 7) and reorganization (Ch 11). In Ch 7 an incumbent relinquishes all its assets to the creditors (net of a liquidation loss) and exits from the market; workers are laid off. Conversely, in Ch 11 an incumbent enters in a reorganization procedure with the other stakeholders: workers and creditors. The process articulates in a two stage [nash] bargaining with workers (first) and creditors (later) over labour and debt contracts. The success of the Ch 11 procedure is stochastic. If the reorganization fails, the case is transferred to Ch 7. By exerting costly effort in restructuring labour contracts, the firm can increase the likelihood of success of the procedure.

In each period, a positive mass of potential entrants starts production with a time-to-build

[35] The household and the credit intermediaries abstract from the spatial dimension.

[36] The model abstracts from agency frictions arising from the separation of governance and control. Recent empirical studies suggests that managers vs shareholders does not characterize the key tension in large corporate reorganizations, where 70% of CEO are replaced within 2 years of the bankruptcy filing (Ayotte and Morrison [2009]).

lag. At entry, each firm draws a region, a capital-scale, and a permanent productivity level, that remain fixed over life. Then it draws a persistent idiosyncratic productivity shock and decide whether to *actually* enter or not. Actual entrants finance their capital scale by issuing equity or debt.

Firms have access to a competitive financial sector with free entry. Each financial intermediary offers a menu of loan sizes and interest rates to firms, wherein each loan makes zero expected profits.

In conclusion, the representative household owns the firms, saves in the credit market, supplies inellastically labour to firms, and consumes out of the wage income, returns on savings and the aggregate amount of dividends distributed by firms.

5.1. The State of the Incumbents

An incumbent is defined as a tuple (r, k, z, b, x) where: $r \in \mathrm{R} \equiv \{L, H\}$ is the index of the location, where L [H] denotes the lowly [highly] unionized region; $k \in \mathrm{K} \equiv [k_{min}, k_{max}] \subset \mathbb{R}_+$ is the physical capital stock scale, as drawn at entry; $z \in \mathrm{Z} \equiv [z_{\min}, z_{\max}]$ denotes the permanent productivity, as drawn at entry; $x \in \mathrm{X} \equiv [x_{\min}, x_{\max}] \subset \mathbb{R}_+$ is an uninsurable idiosyncratic productivity shock; $b \in \mathrm{B} \equiv \{b_{\min}, \ldots, b_{\max}\} \subset \mathbb{R}$ is the amount of outstanding debt/savings, where B is a finite set with cardinality $|\mathrm{B}|$, and $b_{\min} < 0$, $b_{\max} > 0$.

To simplify notation, I summarize with $\underline{p} \equiv (r, k, z) \in \underline{P} \equiv \mathrm{R} \times \mathrm{K} \times \mathrm{Z}$ the permanent characteristics, and with $\underline{s} \equiv (b, x) \in \underline{S} \equiv \mathrm{B} \times \mathrm{X}$ the endogenous state variables.

5.2. The Production Technology

Firms use capital, k, and labour, $n \in \mathrm{N} \equiv [n_{min}, n_{max}] \subset \mathbb{R}_+$, to produce an homogeneous consumption good, $y \in \mathrm{Y} \subset \mathbb{R}_+$, using a decreasing returns-to-scale production technology,

$$y(\underline{p}, x, n) \equiv (z \cdot x)^{(1-\alpha\eta)}(k^{1-\alpha}n^{\alpha})^{\eta} \tag{17}$$

where[37] η is the decreasing return to scale parameter[38] and α is the value-added share of labour. The idiosyncratic productivity, x, follows a stochastic process defined on the measurable space $(X, \mathcal{B}(\mathrm{X}))$ with transition function $Q(x, \mathrm{d}x')$[39], where hereafter $\mathcal{B}(\cdot)$ denotes the Borel algebra on X. The operating profits are

$$\pi(\underline{p}, \underline{s}, n) \equiv y(\underline{p}, x, n) - w(\underline{p}, \underline{s}, n) \cdot n - \chi_o \tag{18}$$

where the wage contracts $(\, \underline{p}\, ,\, \underline{s}\, ,\, n\, ,\, w(\underline{p}, \underline{s}, n)\,) \in W(\underline{p}, \underline{s}, n)$ are firm specific and determined through nash bargaining, as described in Section 5.7. To produce the firm has to incur a fixed maintenance cost of operation, χ_o. Capital depreciates at rate δ. Thereby, to maintain a constant capital scale, investment equals $i = \delta k$[40].

5.3. The Financing Technology

Incumbents finance investment using retained profits, one-period non-contingent loans and equity issuance[41]. Let

$$g(d) \equiv \left[\mathbb{I}_{\{d \geq 0\}} + \iota \cdot \mathbb{I}_{\{d < 0\}}\right] \cdot d$$

denote the flow of dividends [equity issuance] $d \in \mathrm{D} \equiv [\underline{d}, \bar{d}] \subset \mathbb{R}$ between the household and the firm. Henceforth, as a convention, let $\mathbb{I}_{\{y\}}$ denote an indicator function, which takes value 1 when y is true. The previous formula says that firms can issue equity by setting $d < 0$ and incurring an additional proportional cost, $\iota > 1$[42].

---

[37] The normalization parameter $(\cdot)^{1-\alpha\eta}$ on the actual productivity level, $z \cdot x$, ensures that the firm's profit function after wage compensation $\pi(\underline{p}, \underline{s})$ is linear on $z \cdot x$

[38] The parameter $(1 - \eta)$ is sometimes referred to as the *span of control* (Lucas [1978]).

[39] I assume that $Q(x, \mathrm{d}x')$ is continuous on (x, x'), is decreasing in a first order stochastic dominance sense on x. This property is satisfied by many processes - e.g. the first order autoregressive process on which I focus in the calibration - and capture the idea that the higher is the idiosyncratic productivity today, the more likely it will be higher tomorrow. On the top of that, I assume that $Q(x, \mathrm{d}x')$ satisfies the Feller property.

[40] The result follows from the law of motion of capital $k' = (1 - \delta)k + i$ and the fact that $k' = k$.

[41] To maintain tractable the state space, I do not consider the outright hierarchical layers of ownership (bonds, debentures, preferred equity, common equity) but just a neat pattern of layered debt and equity.

[42] Following the literature, equity issuance is expensive (Hennessy and Whited [2007]).

The presence of a default option yields a substantial departure of the loan-market arrangement from the Arrow-Debreu world. This departure formalizes in the device of *firm specific* one-period non-contingent loan contracts, $\big(\underline{p}, x, b', q(\underline{p}, x, b')\big)$, where $q : \underline{P} \times \underline{S} \to \mathrm{Q}$ is the pricing function in the space of continuous and bounded functions $\mathscr{C}^{\mathrm{Q}}$, with $\mathrm{Q} \equiv [0, q_{\max}] \subseteq \mathbb{R}$, $0 \leq q_{\max} \leq 1$. In particular, a firm with characteristics $(\underline{p}, x)$ is allowed to save $(b' < 0)$ or borrow $(b' > 0)$ at the price $q(\underline{p}, x, b')$. This specification highlights the dependence of the loan price on five key firms characteristics: the permanent (z) and persistent productivity (x), the assets (k), the region (r), and the size of the loan (b'). If shocks are persistent[43], an high productivity today, x, predicts an higher productivity next period. Thereby, the firm is less likely to default and can issue debt at a higher price. Similar argument holds for z. An higher capital scale, k, yields a larger collateral, which tempers creditors' losses upon default, and mitigates downward pressures on the debt price. The region, r, affects the labour cost and therefore the firm's profitability; by doing so, it alters the likelihood of financial distress and the associated interest rate on debt. In conclusion, larger loans increase the probability of default and commands higher interest rates.

As a result, firms preferences over the financing sources are in line with the pecking order theory: first retained profits, then debt and only then equity issuance. In *equilibrium* , the equity issuance cost, $\iota - 1$, establishes a lower bound to the debt price.

5.4. The Firm Choices

Firms take ordinary decisions (n, d, b'), and extra-ordinary decisions. In particular, they decide whether to continue $(\phi_X = 0)$ or exit $(\phi_X = 1)$. Upon exit, they decide whether to default $(\phi_D = 1)$ or repay the debt $(\phi_D = 0)$. If they default, they have to choose the bankruptcy procedure: reorganization $(\phi_R = 1)$ or liquidation $(\phi_R = 0)$.

[43] If productivity shocks were i.i.d., the price q would not depend anymore on the current x.

5.5. *The Bankruptcy Law Technology*

The bankruptcy procedures formalize the legal ways by which firms can repudiate their debt obligations. In the model, a *bankruptcy procedure*, ϕ_R, is: 1) a set of stipulations, $S^R_{\phi_R} \in \mathbb{R}^2$, on firms' ordinary decisions, (n, d, b'); 2) a legal environment whereby stakeholders[44] agree on how to split the surplus; 3) a resolution about the existence of the firm as a going concern.

5.5.1. *Bankruptcy Liquidation*

In bankruptcy liquidation ($\phi_R = 0$), a firm does not produce, and cannot take any ordinary decision (n, d, b')[45], $S^R_{1,0} \equiv \varnothing$. Creditors seize the collateral of the firm - which consists of undepreciated capital -

$$R^7(\underline{p}, \underline{s}) \equiv \min\{\ b\ ,\ (1-\psi)(1-\delta)k\ \} \tag{19}$$

suffering a liquidation clearance loss, $\psi \in (0, 1)$, which captures frictions in the cash-auction procedure[46]. Workers and shareholders get nothing. Once the firm is liquidated, it exits the market.

---

44 The definition of stakeholders include: shareholders, workers and credit intermediaries.

45 Indeed, in Ch 7 the firm ceases the ordinary activity. The judge appoints a trustee with the precise purpose of marshalling the assets of the firm and reimburse the creditors.

46 As instance, the *financing problem* and *the lack of competition problem* (See Aghion et al. [1994]). The first problem refer to the difficulties of raising large fundings in short time. The second problem arise from the lack of competition on the bidding sides. See Shleifer and Vishny [2011] for a study of the amplification of the *financing problem* in recessions due to the congestion of the secondary markets (fire-sales).

5.5.2. Bankruptcy Reorganization

During bankruptcy reorganization, a firm cannot distribute dividends, and cannot save[47][48]

$$
\begin{aligned}
&S_1^R(b,\underline{s}) \equiv \Big\{(n,d,b') \in \mathrm{N} \times \mathrm{D}_{-} \times B_{+} : \\
&d - q(\underline{p},x,b')b' + k \leq y(\underline{p},x,n) - w^R(\underline{p},\underline{s},n)\cdot n - \chi_o + (1-\delta)k - \alpha^C(\underline{p},\underline{s})b\Big\}
\end{aligned}
\tag{20}
$$

The reorganization procedure involves a two stage nash bargaining, first with workers over labour contracts, $w^R(\underline{p},\underline{s})$, and then with creditors over debt contracts, $\alpha^C(\underline{p},\underline{s})b$. Reorganizations can fail. By exerting costly effort (in restructuring labor contracts) the firm can increase the likelihood of success. Section 5.8 elaborates the details.

5.6. The Timing

The timing is the following: i) productivity shocks realize and incumbents decide ii) whether to continue, to exit or to default; iii.a) if they continue, they produce and take dividend, investment and financing decisions; iii.b) if they exit, they sell the assets, and use the proceedings to repay the debt and distribute dividends (if any); iii.c) if they file for liquidation, they do not produce and exit the market; iii.d) if they file for reorganization, they produce, restructure labour expenses, bargain over a debt haircut and take financing decisions (*jointly* with the creditors); if the reorganization succeeds they continue, otherwise they are liquidated.

5.6.1. The Incumbents

Let the value $V : \underline{P} \times \underline{S} \to \mathbb{R}$ of an incumbent $(\underline{p},\underline{s})$ be

$$
V(\underline{p},\underline{s}) = \max_{\phi_X}\left\{ \underbrace{V^C(\underline{p},\underline{s})}_{\text{Continuation}}, \max_{\phi_R}\left\{ \underbrace{V^X(\underline{p},\underline{s})}_{\text{Exit}}, \max_{\phi_D}\left\{ \underbrace{V^R(\underline{p},\underline{s})}_{\text{Reorganization}}, \underbrace{V^L(\underline{p},\underline{s})}_{\text{Liquidation}} \right\}\right\}\right\}
\tag{21}
$$

[47] These restrictions arise from an application of the Absolute Priority Rule: to secure the higher priority of creditors' claims over the shareholders' ones, most bankruptcy laws do not allow firms to divert funds (by distributing dividends or save).

[48] $Y_{-} = Y \setminus \mathbb{R}_{++}$, and $Y_{++} = Y \setminus \mathbb{R}_{-}$.

where

$$V^X(\underline{p}, \underline{s}) = (1-\delta)k - b$$

denotes the value at exit,

$$V^L(\underline{p}, \underline{s}) = 0$$

denotes the value of liquidation, and $V^C(\underline{p}, \underline{s})$, $V^R(\underline{p}, \underline{s})$ denote the value of a firm that decides, respectively, to continue and reorganize, as characterized in the following sections.

5.7. The Continuation Problem

Let

$$\begin{aligned} V^C(\underline{p}, \underline{s}) = & \max_{(n,d,b') \in \mathrm{N} \times \mathrm{D} \times \mathrm{B}} g(d) + \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}') \right] \\ & \text{s.t.} \quad d \leq y(\underline{p}, x, n) - w(\underline{p}, \underline{s}, n) \cdot n - \chi_o - \delta k + q(\underline{p}, x, b')b' - b \\ & \quad (\underline{p}, \underline{s}, n, w(\underline{p}, \underline{s}, n)) \in W(\underline{p}, \underline{s}, n) \end{aligned} \tag{22}$$

describe the problem of a firms that decides to continue. The menu of wage contracts $(\underline{p}, \underline{s}, n, w(\underline{p}, \underline{s}, n)) \in W(\underline{p}, \underline{s}, n)$ defines the wage compensation $w(\underline{p}, \underline{s}, n)$ to be paid by a firm $(\underline{p}, \underline{s})$ that hires n workers. Let $\theta_U(r) \in [0,1]$ denote the bargaining power of workers, which varies across regions, with $\theta_U(L) < \theta_U(H)$. Let $w : \underline{P} \times \underline{S} \times \mathrm{N} \to \mathrm{W} \equiv [0, w_{\max}]$ be the wage function in the space $\mathscr{C}^{\mathrm{W}}(\underline{P} \times \underline{S} \times \mathrm{N})$ of continuous functions bounded between $[0, w_{\max}]$.

Then, I can define the wage correspondence $(Ww) : \mathrm{W} \subseteq \mathbb{R}^+ \to \mathbb{R}^+$ as

$$\begin{aligned} (Ww)(\underline{p}, \underline{s}, n) \equiv & \arg\max_{v \in \mathrm{W}} \; V^C_{v,n}(\underline{p}, \underline{s})^{(1-\theta_U(r))} \cdot [v \cdot n - \underline{w} \cdot n]^{\theta_U(r)} \\ & \text{s.t.} \; V^C_{v,n}(\underline{p}, \underline{s}) \geq 0, \quad v \geq \underline{w} \end{aligned} \tag{23}$$

where $\underline{w}$ is the wage that satisfies the free entry condition, as specified in Section 5.9.1 and

$$V^{C}_{v,n}(\underline{p},\underline{s}) \equiv \max_{b' \in \mathrm{B}} g\left[y(\underline{p},x,n) - \delta k - \chi_o + q(\underline{p},x,b') \cdot b' - b - v \cdot n\right] + \beta \mathbb{E}_{x'|x}\left[V(\underline{p},\underline{s}')\right],$$

is the continuation value when the wage is v and the number of workers hired is n.

Theorem 1. *There exists a unique $w^* \in \mathscr{C}^{\mathrm{W}}(\underline{P} \times \underline{S} \times \mathrm{N})$ such that $w^* = (Ww^*)$.*

Proof. See Appendix D.1. □

Proposition 4. *Given a number of workers, n, and a continuing firm $(\underline{p},\underline{s})$, in an interior solution:*

- *the nash bargaining surplus is*

$$S(\underline{p},\underline{s},n) \equiv \max_{b' \in \mathrm{B}} y(\underline{p},x,n) - \delta k - \chi_o + q(\underline{p},x,b') \cdot b' - b - \underline{w}n + \beta \cdot \frac{1}{\mathbb{I}_{\{d \geq 0\}} + \iota \cdot \mathbb{I}_{\{d<0\}}} \cdot \mathbb{E}_{x'|x}\left[V(\underline{p},\underline{s}')\right] \tag{24}$$

- *the wage compensation is*

$$w(\underline{p},\underline{s},n) \cdot n = \underline{w} \cdot n + \theta_U(r) \cdot S(\underline{p},\underline{s},n) \tag{25}$$

Accordingly, the continuation problem (22) can be rewritten as

$$V^C(\underline{p},\underline{s}) = (1 - \theta_U(r)) \max_{n \in \mathrm{N}} S(\underline{p},\underline{s},n) \tag{26}$$

Proof. See Appendix D.2. □

Proposition (4) says that the continuation problem (22) boils down to (26): the firm chooses (n, b') to maximize the share of expected discounted value of future dividends that is not extracted by workers, (26). Appendix D.2 discusses the separability of the max operator over the firm's choices, b' and n. Proposition 5 characterizes the problem.

Proposition 5. *The labour demand, n^*, and output, y^*, of firm $(\underline{p}, \underline{s})$ are*

$$n^*(\underline{p}, \underline{s}) = z \cdot x \cdot \left(\frac{\alpha\eta}{\underline{w}}\right)^{\frac{1}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \quad (27) \qquad y^*(\underline{p}, \underline{s}) = z \cdot x \cdot \left(\frac{\alpha\eta}{\underline{w}}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \quad (28)$$

Proof. See Appendix D.2. □

Proposition 5 says that the firm's labour demand does not depend on $w(\underline{p}, \underline{s}, n)$, but on the outside opportunity cost, $\underline{w}$. In words, this result means that firm and workers' interests are aligned in making the pie as big as possible, $S(\underline{p}, \underline{s}, n^*)$, and contrast only on how to split it, $w(\underline{p}, \underline{s}, n^*)$. It also means, that the class of wage contracts studied is the *weakest*, in the sense that it does not *directly* distort ordinary decisions - say, to generate inefficient size choices - but it distorts *directly* only extensive margin ones: entry, exit and default.

Substituting the optimal choices, the wage compensation becomes

$$w(\underline{p}, \underline{s}) = \underline{w} + \theta_U \cdot \frac{S(\underline{p}, \underline{s}, n^*)}{n^*} \tag{29}$$

5.8. The Reorganization Problem

Let

$$\begin{aligned} V^R(\underline{p}, \underline{s}) = \max_{e \in \mathrm{E}} \; & \alpha^R(e; \theta_U(r)) \cdot \left[\max_{(n,d,b') \in \mathrm{N} \times \mathrm{D}_- \times \mathrm{B}_+} g(d) + \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}') \right] \right] - c(e) \\ \text{s.t.} \quad & d \le y(\underline{p}, x, n) - \underbrace{w^R(\underline{p}, \underline{s}, e, n)}_{\text{Labour Restructuring}} \cdot n - \chi_o - \delta k + q(\underline{p}, x, b') \cdot b' - \underbrace{\alpha^C(\underline{p}, \underline{s}, e, n, w^R(\underline{p}, \underline{s}, e, n))}_{\text{Debt Restructuring}} \cdot b \end{aligned} \tag{30}$$

$$\begin{aligned} & (\, \underline{p} \,, \, \underline{s} \,, \, e \,, \, n \,, \, v \,, \, \alpha^C(\underline{p}, \underline{s}, e, n, v) \,) \in A^C(\underline{p}, \underline{s}, e, n, v) \\ & (\, \underline{p} \,, \, \underline{s} \,, \, e \,, \, n \,, \, w^R(\underline{p}, \underline{s}, e, n) \,) \in W^R(\underline{p}, \underline{s}, e, n) \end{aligned} \tag{31}$$

describe the problem of a firm that decides to file for Ch 11. In reorganization, shareholders enter in a two stage nash bargaining, first with workers over the wage compenation w^R (labour restructuring problem) and then with creditors over the debt haircut α^C (debt restructuring problem). The timing reflects the super-priority that the U.S. Corporate bankruptcy law recognizes to workers claims over creditors' ones on the firm's surplus. The reorganization succeds with probability $\alpha^R(e, \theta_U(r))$, that depends on the restructuring effort, e, and the regional bargaining power of workers, $\theta_U(r)$. By backward induction, shareholders solve, first, the debt restructuring problem (for a given effort choice, number of workers, and wage), and then the labour restructuring problem (for a given effort choice). In conclusion, upon entering reorganization, they choose the effort that maximizes their share of the expected discounted value of future dividends net of a restructuring cost. The next sessions develop the details.

5.8.1. The Debt Restructuring

In the second stage, for a given effort choice, e, amount of workers, n, and wage, v, shareholders bargain with the credit intermediaries over the due recovery rate $a \in [0, 1]$ on the defaulted loan, b. Let the expected surplus of a firm $(\underline{p}, \underline{s})$ that files for reorganization be

$$S^F_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \equiv \alpha^R(e; \theta_U(r)) \cdot \max\left\{ \max_{b' \in \mathrm{B}_+} \iota \cdot \left[y(\underline{p}, x, n) - v \cdot n - \chi_o - \delta k + \underbrace{q(\underline{p}, x, b') \cdot b'}_{\text{D.I.P. Financing}} - ab \right] + \beta \cdot \mathbb{E}_{x'|x}\left[V(\underline{p}, \underline{s}')\right] \;, 0 \right\}$$

$$\text{s.t. } y(\underline{p}, x, n) - v \cdot n - \chi_o - \delta k + \underbrace{q(\underline{p}, x, b') \cdot b'}_{\text{D.I.P. Financing}} - ab \leq 0 \qquad (\textit{Equity Issuance}) \tag{32}$$

Let the credit intermediaries surplus be

$$S^C_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \equiv \min\left\{ b \,,\, \underbrace{\max[\, \alpha^R(e; \theta_U(r)) \cdot a \cdot b + (1 - \alpha^R(e; \theta_U(r))) \cdot R^7(\underline{p}, \underline{s}) \,,\, R^7(\underline{p}, \underline{s}) \,]}_{\text{Best Interest of creditors test}} \right\} \tag{33}$$

The minimum operator controls for the fact that creditors cannot recover more than the outstanding debt. Conversely, the maximum operator formalizes the following legal requirements

- sometimes referred to as the *best interest of creditors* test[49]: it is responsibility of the judge to guarantee that creditors recover under Ch 11 at least as much as under Ch 7.

Let $\theta_C \in (0,1)$ denote the bargaining power of creditors and $\alpha^C : \underline{P} \times \underline{S} \times \mathrm{E} \times \mathrm{N} \times \mathrm{W} \to \mathrm{A} \equiv [0,1]$ denote the Ch 11 recovery rate function. Then, I can define the reorganization recovery rates correspondence $(A^C \alpha^C) : \mathrm{A} \to \mathbb{R}^+$ as

$$(A^C\alpha^C)(\underline{p}, \underline{s}, e, n, v) \equiv \arg\max_{a \in [0,1]} \left\{ [\underbrace{S^F_{e,n,v}\left(\underline{p}, \underline{s}; a\right)}_{\text{Surplus Firm}}]^{(1-\theta_C)} \cdot [\underbrace{S^C_{e,n,v}\left(\underline{p}, \underline{s}; a\right)}_{\text{Surplus Creditors}}]^{\theta_C} \right\} \tag{34}$$
$$\text{s.t. } S^F_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \geq 0, \;\; S^C_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \geq 0$$

Theorem 2. *There exists a unique* $\alpha^{C,*} \in \mathscr{C}^{\mathrm{A}}(\underline{P} \times \underline{S} \times \mathrm{E} \times \mathrm{N} \times \mathrm{W})$ *such that* $\alpha^{C,*} = (N\alpha^{C,*})$.

Proof. See Appendix D.1. □

Proposition 6. *Given* (e, n, v)*, and a reorganizing firm* $(\underline{p}, \underline{s})$*, in an interior solution:*

- *the nash bargaining surplus is*

$$S^R_{n,v}(\underline{p}, \underline{s}) \equiv \max\left\{ \max_{b' \in \mathrm{B}_+} y(\underline{p}, x, n) - \chi_o + q(\underline{p}, x, b')b' - \delta k - vn + \beta \cdot \frac{1}{\iota} \cdot \mathbb{E}_{x'|x}\left[V(\underline{p}, \underline{s}')) \right] - R^7(\underline{p}, \underline{s}), 0 \right\} \tag{35}$$

- *the expected Ch 11 recovery value is*

$$R^{11}_{e,n,v}(\underline{p}, \underline{s}) \equiv \alpha^C(\underline{p}, \underline{s}, e, n, v)b = R^7(\underline{p}, \underline{s}) + \alpha^R(e; \theta_U(r)) \cdot \theta_C \cdot S^R_{n,v}(\underline{p}, \underline{s}) \tag{36}$$

- *the share of expected surplus that goes to shareholders is*

$$S^F_{e,n,v}(\underline{p}, \underline{s}) \equiv \alpha^R(e; \theta_U(r)) \cdot (1 - \theta_C) \cdot \iota \cdot S^R_{n,v}(\underline{p}, \underline{s}) \tag{37}$$

[49] Pursuant to §1129 of Ch 11 impaired class of claims or interests 'will receive or retain under the plan on account of such claim or interest property of a value, as of the effective date of the plan, that is not less than the amount that such holder would so receive or retain if the debtor were liquidated under chapter 7 of this title on such date.

Proof. See Appendix D.3.1. □

5.8.2. The Labour Restructuring

In the first stage, for a given effort choice, e, and amount of worker, n, shareholders bargain with workers over the wage compensation. Let $w^R : \underline{P} \times \underline{S} \times \mathrm{E} \times \mathrm{N} \to \mathrm{W} \equiv [0, w_{\max}]$ be the wage function in the space $\mathscr{C}^{\mathrm{W}}(\underline{P} \times \underline{S} \times \mathrm{E} \times \mathrm{N})$ of continuous functions bounded between $[0, w_{\max}]$. Then, I can define the wage correspondence $(W^R w^R) : \mathrm{W} \subseteq \mathbb{R}^+ \to \mathbb{R}^+$ as

$$(W^R w^R)(\underline{p}, \underline{s}, e, n) \equiv \arg\max_{v \in \mathrm{W}} \, [S^F_{e,n,v}(\underline{p}, \underline{s})]^{(1-\theta_U(r))} \; \cdot \; [\alpha^R(e; \theta_U(r)) \cdot (v \cdot n - \underline{w} \cdot n)]^{\theta_U(r)} \tag{38}$$
$$\text{s.t. } S^F_{e,n,v}(\underline{p}, \underline{s}) \geq 0, \quad v \geq \underline{w}$$

where I assume that workers get nothing if the reorganization procedure fails (and the case is transferred to Ch 7).

Theorem 3. *There exists a unique* $w^{R,*} \in \mathscr{C}^{\mathrm{W}}(\underline{P} \times \underline{S} \times \mathrm{E} \times \mathrm{N})$ *such that* $w^{R,*} = (W^R w^{R,*})$.

Proof. See Appendix D.1. □

The menu of wage contracts $(\, \underline{p}\, , \, \underline{s}\, , \, n\, , \, e\, , \, w^R(\underline{p}, \underline{s}, e, n)\,) \in W(\underline{p}, \underline{s}, e, n)$, establishes the wage compensation $w^R(\underline{p}, \underline{s}, e, n)$ that a firm $(\underline{p}, \underline{s})$ has to pay when decides to hire n workers, and exert e effort in restructuring labour contract.

Proposition 7. *Given* (n, e)*, and a reorganizing firm* $(\underline{p}, \underline{s})$*, in an interior solution:*

- *the nash bargaining surplus is*

$$S^R_n(\underline{p}, \underline{s}) \equiv \max\left\{ \max_{b' \in \mathrm{B}_+} y(\underline{p}, x, n) - \chi_o + q(\underline{p}, x, b')b' - \delta k - \underline{w}n + \beta \cdot \frac{1}{\iota} \cdot \mathbb{E}_{x'|x}\left[V(\underline{p}, \underline{s}')) \right] - R^7(\underline{p}, \underline{s}), 0 \right\} \tag{39}$$

- *the wage compensation is*

$$w^R(\underline{p}, \underline{s}, e, n) \cdot n = \underline{w} \cdot n + \theta_U(r) \cdot S^R_n(\underline{p}, \underline{s}) \tag{40}$$

- the expected recovery value under Ch 11 is

$$R^{11}_{e,n}(\underline{p},\underline{s}) \equiv R^{7}(\underline{p},\underline{s}) + \alpha^{R}(e;\theta_U(r)) \cdot \theta_C \cdot (1-\theta_U(r)) \cdot S^{R}_{n}(\underline{p},\underline{s}) \tag{41}$$

- the share of expected surplus that goes to shareholders

$$S^{F}_{e,n}(\underline{p},\underline{s}) \equiv \alpha^{R}(e;\theta_U(r)) \cdot (1-\theta_C) \cdot (1-\theta_U(r)) \cdot \iota \cdot S^{R}_{n}(\underline{p},\underline{s}) \tag{42}$$

Accordingly, the reorganization problem (30) can be rewritten as

$$V^{R}(\underline{p},\underline{s}) = \max_{e\in \mathrm{E}} \alpha^{R}(e;\theta_U(r)) \cdot (1-\theta_C) \cdot (1-\theta_U(r)) \cdot \iota \cdot \max_{n\in \mathrm{N}} S^{R}_{n}(\underline{p},\underline{s}) - c(e) \tag{43}$$

Proof. See Appendix D.3.2. □

By substituting (39) in (40), the main result of Proposition 1 carries through the dynamic framework: the firm uses the threat of liquidation to reduce the bargaining position of the workers. (Again, this result stems from the timing of the restructuring problems.) The reorganization problem (30) boils down to (43): the firm chooses (n, b') to maximize the share of expected discounted value of future dividends that is not extracted by the workers, or creditors (43). Appendix D.3 discusses the separability of the max operator over the firm's choices, b' and n.

Proposition 8. *The labour demand, n^*, and output, y^**

$$n^*(\underline{p},\underline{s}) = z \cdot x \cdot \left(\frac{\alpha\eta}{\underline{w}}\right)^{\frac{1}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \tag{44}$$

$$y^*(\underline{p},\underline{s}) = z \cdot x \cdot \left(\frac{\alpha\eta}{\underline{w}}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \tag{45}$$

coincides with the ones under continuation (Proposition (5)).

Proof. See Appendix D.3.3. □

The model does not capture the lay-offs of workers that firms experience during bankruptcy. Since firms and workers bargain over the wage (and not over wage and number of workers) there are no distorsions in size choices. That said, the wage compensation $\underline{w}^R(\underline{p}, \underline{s}, e^*, n^*) \cdot n^*$ shrinks during bankruptcy (as in the data), because of the reduction in the surplus due to the threat of liquidation. Beside tractability, this particular class of labour contracts allows me to get sharper predictions: in the model, all the inefficiencies arise from extra-ordinary decisions (extensive margin) and not from inefficient size choices (intensive margin). This has important consequences on the interpretation of the quantitative results, which should be taken as a conservative measure of the impact of pro-creditor bankruptcy reforms.

Substituting the optimal choices, we get an expression for the nash bargaining surplus in reorganization, the expected recovery value under Ch 11, and the expected share of the surplus that goes to shareholders and workers

$$S^R(\underline{p}, \underline{s}) \equiv \max\left\{\max_{b' \in \mathrm{B}} y(\underline{p}, x, n^*) - \chi_o + q(\underline{p}, x, b')b' - \delta k - \underline{w}n^* + \beta \cdot \frac{1}{\iota} \cdot \mathbb{E}_{x'|x}\left[V(\underline{p}, \underline{s}')\right] - R^7(\underline{p}, \underline{s}), 0\right\} \tag{46}$$

$$R_e^{11}(\underline{p}, \underline{s}) \equiv R^7(\underline{p}, \underline{s}) + \alpha^R(e; \theta_U(r)) \cdot \theta_C \cdot (1 - \theta_U(r)) \cdot S^R(\underline{p}, \underline{s}) \tag{47}$$

$$S_e^F(\underline{p}, \underline{s}) \equiv \alpha^R(e; \theta_U(r)) \cdot (1 - \theta_C) \cdot (1 - \theta_U(r)) \cdot \iota \cdot S^R(\underline{p}, \underline{s}) \tag{48}$$

$$S_e^W(\underline{p}, \underline{s}) \equiv \alpha^R(e; \theta_U(r)) \cdot \theta_U(r) \cdot S^R(\underline{p}, \underline{s}) \tag{49}$$

Expressions (47), (48), (49) are the dynamic version of the solution to the debt restructuring and labour restructuring problem in the static model (7), (8), (9).

5.8.3. The Restructuring Effort Problem

The effort cost function $c : \underline{P} \times \underline{S} \times \mathrm{E} \to \mathbb{R}_+$, with $c'(\underline{p}, \underline{s}, \cdot) > 0$, gives the shareholders' cost in firm $(\underline{p}, \underline{s})$ to exert e units of effort to restructure labour contracts (in output units). Let $\alpha^R : \mathrm{E} \times \mathrm{R} \to [0, 1]$, with $\alpha^{R\prime}(\cdot; r) > 0$, denote the likelihood of success of Ch 11 for a given effort, e, and bargaining power of workers, $\theta_U(r)$, with $r \in \mathrm{R} \equiv \{L, H\}$. Shareholders choose the amount of effort $e \in \mathrm{E} \subseteq \mathbb{R}_+$ that solves

$$V^R(\underline{p}, \underline{s}) = \max_{e \in \mathrm{E}} S_e^F(\underline{p}, \underline{s}) - c(\underline{p}, \underline{s}, e) \tag{50}$$

where $V^R(\underline{p}, \underline{s})$ is the value of reorganization that results from the restructuring activity. Because of the symmetry between the dynamic and static model, it is easy to show that at optimum, e^*, the expected recovery value under Ch 11

$$R^{11}(\underline{p}, \underline{s}) \equiv R^7(\underline{p}, \underline{s}) + \underbrace{\alpha^R(e^*; \theta_U(r)) \cdot \theta_C}_{\text{Trade off}} \cdot (1 - \theta_U(r)) \cdot S^R(\underline{p}, \underline{s}) \tag{51}$$

carries on the main trade-off illustrated in (12): an increase in creditor rights (θ_C) ought not to increase expected recovery values.

5.9. *Credit Intermediaries*

In the economy there is a competitive financial sector. Each risk neutral credit intermediary offers a set of firm-specific contracts $\left(\underline{p}, x, b', q(\underline{p}, x, b')\right) \in \Omega\left(\underline{p}, x, b'\right)$. Let the pricing function $q : \underline{P} \times \underline{S} \to \mathrm{Q} \equiv [0, q_{\max}] \subset \mathbb{R}_+$ be

$$q(\underline{p}, x, b') = \begin{cases} \dfrac{1}{1 + r_F} & b' \leq 0 \\ \dfrac{1}{b'(1 + r_F)} \mathbb{E}\left[\underbrace{(1 - \phi_X \cdot \phi_D)}_{\text{No Default}} \cdot b' + \underbrace{\phi_X \cdot \phi_D}_{\text{Default}} \cdot \Big(\underbrace{\phi_R}_{\text{Ch 11}} \cdot R^{11}(\underline{p}, \underline{s}) + \underbrace{(1 - \phi_R)}_{\text{Ch 7}} R^7(\underline{p}, \underline{s}) \Big)\right] & b' > 0 \end{cases} \tag{52}$$

with $\phi_i \equiv \phi_i(\underline{p}; \underline{s}')$, $i = \{X, D, R\}$. Under price competition, we have that (52) holds with equality whenever contracts are traded in strictly positive quantities[50]. So, firms earn the

[50] As a result of the optimization problem of a profit maximiser risk neutral credit intermediary with deep pockets.

risk-free interest rate, r_F, on their savings, $b' \leq 0$. Conversely, loans' prices depend on the endogenous probability that the firm will meet its debt obligation and the recovery rates upon default; both these factors are function of firms' bankruptcy choices. In conclusion, let $a(\underline{p}, x, b')$ denote the aggregate amount of contracts $\big(\underline{p}, x, b', q(\underline{p}, x, b')\big)$ issued

$$a(\underline{p}, x, b') \equiv \underbrace{q(\underline{p}, x, b') \cdot b'}_{\text{Amount of Loan granted}} \left[\underbrace{\int_{\underline{P} \times \mathrm{X}} [\underbrace{(1-\phi_X)}_{\text{Continuation}} + \underbrace{\phi_X \phi_D \phi_R}_{\text{Reorganization}}] \cdot \mathbb{I}_{b'(\underline{p}, \underline{s})=b'} \, \mu(b, \mathrm{d}s)}_{\text{Measure Incumbents asking for debt}} + \underbrace{M \int_{\underline{P} \times \mathrm{X}} \phi_E \cdot \mathbb{I}_{b'(\underline{p}, x)=b'} G(\mathrm{d}s)}_{\text{Measure Entrants asking for debt}} \right] \tag{53}$$

5.9.1. Entrants

A large number of ex-ante identical potential entrants, M, decides whether to pay a fixed cost to enter, χ_E.

If they pay, they draw from the probability measure space $(\underline{P} \times \mathrm{X}, \mathcal{B}(\underline{P} \times \mathrm{X}), G_{r,k,z,x})$ a region, r, a permanent idiosyncratic productivity, z, a permanent capital scale, k, and an idiosyncratic persistent productivity shock, x.

Upon the realization (r, k, z, x), entrants decide whether to actually enter ($\phi_E = 1$) or not ($\phi_E = 0$). If they decide to enter, they finance their capital scale, k, by accessing a menu of firm specific not contingent debt contracts $\big(\underline{p}, x, b', q(\underline{p}, x, b')\big) \in \Omega\left(\underline{p}, x, b'\right)$[51] and, ultimately, by issuing equity. The problem of a potential entrant, can be described as

$$\begin{aligned} V^E(\underline{w}) = \int_{\underline{P} \times \mathrm{X}} \max_{\phi_E} \phi_E \cdot \left[\max_{(d,b') \in \mathrm{D} \times \mathrm{B}} g(d) + \beta \cdot \int_{\mathrm{X}} V(\underline{p}, \underline{s}') Q(x, \mathrm{d}x') \right] G_{r,k,z,x}(r, \mathrm{d}k, \mathrm{d}z, \mathrm{d}x) \\ \text{s.t. } d + k \leq q(\underline{p}, x, b') \cdot b' \\ g(d) = \left(\mathbb{I}_{\{d \geq 0\}} + \iota_E \cdot \mathbb{I}_{\{d<0\}} \right) \cdot d \end{aligned} \tag{54}$$

[51] Notice how the bankruptcy law affects firms entry decision by changing the feasible set of external financing opportunities.

By assuming free entry in the credit industry, the wage $\underline{w} \in \mathbb{R}^+$ is such that

$$V^E(\underline{w}) \geq \chi_E \tag{55}$$

with equality if in steady state, $M > 0$. Henceforth I will refer to (55) as the free entry condition (FEC) and to $\underline{w}$ as the FEC-wage. Differently from Hopenhayn [1992], firms finance the capital scale, k, by issuing equity or firm specific debt contracts $q(\underline{p}, x, b') \cdot b'$ that depends on the bankruptcy law. In conclusion, because of the decreasing returns-to-scale production technology and the proportional investment cost, δk, firms can finance a high capital scale, k, only if they draw an high permanent productivity, z. As a result, in equilibrium large firms have to be productive.

5.9.2. Invariant Distribution

Let $\Pi^I_{\underline{p}} : (\mathrm{B} \times \mathrm{X}) \times \left(2^{\mathrm{B}} \times \mathcal{B}(\mathrm{X})\right) \to [0,1]$ be the transition function of a (r,k,z)-type incumbent from the state (b,x) to the state $Z \equiv Z^{b'} \times Z^{x'}$,

$$\Pi^I_{\underline{p}}((b,x),Z) = \left[1 - \phi_X(\underline{p},\underline{s}) \cdot \left(1 - \phi_D(\underline{p},\underline{s}) \cdot \phi_R(\underline{p},\underline{s})\right)\right] \cdot \mathbb{I}_{b'(\underline{p},\underline{s}) \in Z^{b'}} \cdot \int_{Z^{x'}} Q(x, \mathrm{d}x')$$

where $Z^{b'}, Z^{x'}$, are the projections of $Z \in \left(2^{\mathrm{B}} \times \mathcal{B}(\mathrm{X})\right)$.

Similarly, let $\Pi^E_{\underline{p}} : \mathrm{X} \times \left(2^{\mathrm{B}} \times \mathcal{B}(\mathrm{X})\right) \to [0,1]$ be the transition function of a (r,k,z)-type entrant, defined as

$$\Pi^E_{\underline{p}}(x,Z) = \phi_E(\underline{p},x) \cdot \mathbb{I}_{b'(\underline{p},x) \in Z^{b'}} \cdot \int_{Z^{x'}} Q(x, \mathrm{dx}')$$

Let μ a probability measure in the space $\Gamma\left(\mathrm{B} \times \mathrm{X}, 2^{\mathrm{B}} \times \mathcal{B}(\mathrm{X})\right)$ of probability measures. Then, I can define the operator $(\Psi\mu)$:

$$(\Psi\mu)(Z) = \sum_{B} \int_{\underline{P}\times \mathrm{X}} \Pi^{I}_{\underline{p}}((b,x),Z)\mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) + M \int_{\underline{P}\times \mathrm{X}} \Pi^{E}_{\underline{p}}(x,Z) G_{r,k,z,x}(r,\mathrm{d}k,\mathrm{d}z,\mathrm{d}x) \quad (56)$$

5.10. The Household

The economy is populated by a unit measure of infinitely-lived, identical households, with preferences over streams of consumption - represented by an istantaneous Bernoulli utility function $u(C)$ - that discount the future as the firms, β.

In each period each household is endowed with N_s unit of time that supplies inelastically. It further decides how much to consume, C, and how much to lend to the financial intermediaries, B'. Accordingly, the problem of the representative household can be described as

$$V_H(B;\mu) = \max_{\{C,B'\}} u(C) + \beta \cdot V_H(B') \quad (57)$$

$$\text{s.t.} \quad C + q_{\max} B' = W + D + B$$

where D is the aggregate dividend, and $q_{\max} \equiv \dfrac{1}{1+r_F}$, where r_F is the risk free interest rate. Then in steady state

$$\beta = q_{\max} \equiv \frac{1}{1+r_F} \quad (58)$$

5.11. The Aggregates of the Economy

The producing firms in the economy are the incumbents that either do not exit or reorganize. As a result, the net aggregate output

$$
\begin{aligned}
Y \equiv & \sum_B \int_{\underline{P}\times \mathrm{X}} \left[1-\phi_X\left(1-\phi_D\phi_R\right)\right] y^*(\underline{p},\underline{s})\mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) \\
& + \sum_B \int_{\underline{P}\times \mathrm{X}} \phi_X(1-\phi_D)\cdot(1-\delta)\cdot k\ \mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) \\
& - \sum_B \int_{\underline{P}\times \mathrm{X}} \left[\underbrace{\left[1-\phi_X\left(1-\phi_D\phi_R\right)\right]\cdot\chi_o}_{\text{Maintainance cost of operation}} + \underbrace{\phi_X\phi_D\phi_R\cdot c(\underline{p},\underline{s},e^*)}_{\text{Reorganizing costs}}\right] \mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) \\
& - \sum_B \int_{\underline{P}\times \mathrm{X}} [\iota-1]\cdot\mathbb{I}_{\{d<0\}}\ \mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) \\
& - \underbrace{M\cdot\chi_E}_{\text{Entry cost}}
\end{aligned} \tag{59}
$$

The aggregate investment is

$$
I \equiv \sum_B \int_{\underline{P}\times \mathrm{X}} \left[1-\phi_X(1-\phi_D\phi_R)\right]\cdot\delta k\,\mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) + M\int_{\underline{P}\times \mathrm{X}} \phi_E\cdot k\ G_{r,k,z,x}(r,\mathrm{d}k,\mathrm{d}z,\mathrm{d}x) \tag{60}
$$

and, by national income accounting (resource constraint) aggregate, consumption is

$$
C = Y - I \tag{61}
$$

The aggregate dividends amount to

$$
\begin{aligned}
D \equiv & \sum_B \int_{\underline{P}\times \mathrm{X}} \left[1-\phi_X\cdot(1-\phi_D\phi_R)\right] g(d^*(b,\underline{s}))\mu(\mathrm{d}\underline{p},\mathrm{d}\underline{s}) \\
& + M\int_{\underline{P}\times \mathrm{X}} \phi_E g\left(d^*(\underline{s})\right) G_{\underline{s}}(\mathrm{d}s)
\end{aligned} \tag{62}
$$

The aggregate demand of labour equals

$$N^d \equiv \sum_B \int_{\underline{P}\times \mathrm{X}} n^*(\underline{p}, \underline{s})\mu(\mathrm{d}\underline{p}, \mathrm{d}\underline{s}) \tag{63}$$

where $n^*(\cdot)$ is defined in (27).

Then, the aggregate demand of loans is

$$B^d \equiv \sum_B \int_{\underline{P}\times \mathrm{X}} a(\underline{p}, x, b') \; \mu(b, \mathrm{d}s) \tag{64}$$

where $a(\underline{p}, x, b')$ is defined in (53).

In conclusion, the aggregate wage equals

$$W \equiv \sum_B \int_{\underline{P}\times \mathrm{X}} w(\underline{p}, \underline{s}) \cdot n^*(\underline{p}, \underline{s})\mu(\mathrm{d}\underline{p}, \mathrm{d}\underline{s}) \tag{65}$$

5.12. Equilibrium

Definition. A steady-state competitive equilibrium is a wage $\underline{w}$, a set of price schedules $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, a measure μ^*, a mass of potential entrants M^*, the incumbents policies $\{\phi^*_X, \phi^*_D, \phi^*_R, b^{\prime,*}, n^*, d^*\}$, the entrants policy functions $\{\phi^{E,*}, b^{\prime,*}_e, d^*_e\}$, and the household decisions $(C^*, b^{\prime,*})$ such that:

1. given $\underline{w}$ and $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, then $\{\phi^*_X, \phi^*_D, \phi^*_R, b^{\prime,*}, n^*, d^*\}$ solve the incumbents problem (21);

2. given $\underline{w}$, $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$ and $\{\phi^*_X, \phi^*_D, \phi^*_R, b^{\prime,*}, n^*, d^*\}$, then $\{\phi^*_E, b^{\prime,*}_e, d^*_e\}$ solve the entrants problem (54);

3. given $\underline{w}$, $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, $\{\phi^*_X, \phi^*_D, \phi^*_R, b^{\prime,*}, n^*, d^*\}$, and $\{\phi^*_E, b^{\prime,*}_e, d^*_e\}$, and $B^{\prime,*}$, then C^* solves the household problem (57);

4. given $\underline{w}$, $\{w^*, q^*, w^{R,*}\}$, and $\{\phi_X^*, \phi_D^*, \phi_R^*, b'^{,*}, n^*, d^*\}$, then $\alpha^{C,*}$ is the nash bargain solution (34);

5. given $\underline{w}$, $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, $\{\phi_X^*, \phi_D^*, \phi_R^*, b'^{,*}, n^*, d^*\}$, then q^* satisfies the zero-profit condition (52)

6. given $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, $\{\phi_X^*, \phi_D^*, \phi_R^*, b'^{,*}, n^*, d^*\}$, and $\{\phi_E^*, b_e'^{,*}, d_e^*\}$, then $\underline{w}$ satisfies FEC (55);

7. given $\underline{w}$, $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, $\{\phi_X^*, \phi_D^*, \phi_R^*, b'^{,*}, n^*, d^*\}$, and $\{\phi_E^*, b_e'^{,*}, d_e^*\}$, then $\mu^* = \Psi\mu^*$, $\forall M$;

8. given $\underline{w}$, $\{w^*, q^*, w^{R,*}, \alpha^{C,*}\}$, $\{\phi_X^*, \phi_D^*, \phi_R^*, b'^{,*}, n^*, d^*\}$, and $\{\phi_E^*, b_e'^{,*}, d_e^*\}$, μ^* and C^*:

   8.1. M^* is such that labour market clears, $N^s = N^d(M^*)$, where N^d defined in (63);

   8.2. $B'^{,*}$ is such that the loan market clears, $B^d = B'^{,*}$, where B^d defined in (64).

6. Quantitative Analysis

How did the shift in creditor rights protection regime affect firms' bankruptcy choices, and the firms distribution? What would have happened if Ch 11 had never been introduced in 1979? To answer these questions I calibrate the dynamic model to the U.S. economy from 1979-1998. The firm level accounting data are from Compustat North-America Fundamentals Annual, 1950-2012; further information on bankruptcy are from UCLA LoPucki Bankruptcy Research Database, 1980-2012.

6.1. Functional Forms

The calibration requires more structure on both the uncertainty governing the model economy, and the restructuring process.

6.1.1. *Uncertainty*

The log-idiosyncratic productivity shock, $\ln x_t$, follows an AR(1) process

$$\ln x_{t+1} = (1 - \rho_{\ln x}) \cdot \bar{\mu}_{\ln x} + \rho_{\ln x} \ln x_t + \epsilon_{t+1}, \qquad \epsilon_{t+1} \sim N\left(0, \sigma_\epsilon^2\right) \tag{66}$$

I approximate the process with a discrete-state Markov chain, by using Gauss-Hermite nodes and weights and by applying the Tauchen and Hussey [1991] weights correction in order to account for the persistency. I discretize the support[52] of the idiosyncratic productivity shock using 9 points.

For what concerns the uncertainty at entry, $G_{r,k,z,x}$, I make the following assumptions: the permanent and persistent idiosyncratic productivity shocks are drawn from log-normal distributions, $G_z(\mu_{G(z)}, \sigma_{G(z)})$ and $G_x(\mu_{G(x)}, \sigma_{G(x)})$; the fixed capital scale is drawn from a pareto distribution $G_k((\kappa_k, k_{\min})$. In conclusion entrants are born with probability $p_{\theta_U(H)}$ in the highly unionized region (formally $G_r = \{1, 0; p_{\theta_U(H)}, 1 - p_{\theta_U(H)}\}$). By assuming independence across these dimensions, I have $G_{r,k,z,x} = G_r \cdot G_k \cdot G_z \cdot G_x$.

6.2. *The Restructuring problem*

I need to specify functional forms for the effort cost function, $c(\underline{p}, \underline{s}, e)$, and the likelihood of a success of Ch 11, $\alpha^R(e; \theta_U(r))$ (Section 5.8.3).

I assume $c(\underline{p}, \underline{s}, e)$ is linear in the surplus, $c(\underline{p}, \underline{s}, e) = c(e) \cdot \iota \cdot S^R(\underline{p}, \underline{s})$, as in the static model; differently, I set $c(e) = c_{11} \cdot e$.

Then, I set $\alpha^R(e; \theta_U(r)) = s^r_{11,p} \cdot (1 - \exp(-e) \cdot \theta_U(r))$, with $r = L, H$. An interpretation is in order. As explained in the static model, this specification formalizes the intuition that without a formal attempt to restructure labour contracts, $e = 0$, the probability of success of the reorganization procedure decreases with the bargaining power of workers, $1 - \theta_U(r)$. By

[52] Following standard practice, I determine the bounds of the support using a trimming parameter $m = 20$.

exerting restructuring effort, shareholders can temper this negative effect and increase the likelihood of success, $1 - \exp(-e) \cdot \theta_U(r)$. In this context, $\theta_U(r)$ proxies for the reluctance of workers to accept changes in labour conditions, namely the reduction in the wage w^R. In conclusion, I scale the likelihood of success of Ch 11 in the two regions by a different factor $s^r_{11,p}$ with $r = L, H$, to let the U.S. data say where the scope of restructuring labour contracts is stronger.

6.3. Calibration

The economy is calibrated over the period 1979-1998[53]. One period in the model corresponds to one year. The model has 28 parameters: physical technology (α, η, δ, χ_o), labour market ($\theta_U(L)$, $\theta_U(H)$, $p_{\theta_U(H)}$), financing technology (ι_I, ψ, θ_C), restructuring technology ($c_{11}, s^L_{11,p}, s^H_{11,p}$), entrants ($\chi_E, \iota_E$), discounting ($\beta$, r), labour supply, N, and uncertainty $\{(\bar{\mu}_{\ln x}, \rho_{\ln x}, \sigma_\epsilon), (\mu_{G(x)}, \sigma_{G(x)}), (\mu_{G(z)}, \sigma_{G(z)}), (\kappa_k, k_{\min}), \lambda_X\}$, whose parameters are discussed, in details, in the next section.

I use estimates or impose restrictions on 12 of them and structurally estimate the rest.

6.4. Parameters Restrictions

I start by imposing restrictions on the **uncertainty** governing the model economy.

First of all, I set the unconditional mean of the log-idiosyncratic productivity shock to 0, $\bar{\mu}_{\ln x} = 0$. Following, I impose restrictions on $(\mu_{G(x)}, \sigma_{G(x)})$, $(\mu_{G(z)}, \sigma_{G(z)})$. In particular, I assume the initial idiosyncratic productivity shocks x' are drawn from the long-run log normal distribution, $G_x(0, \sigma_\epsilon/\sqrt{1 - \rho^2_{\ln x}})$. Hence, I assume $G_z = G_x$, and I discretize the permanent idiosyncratic productivity into 3 levels associated to the conditional expectation of z falling in one of the following intervals: $[0, x_{20th}]$, $[x_{20th}, x_{80th}]$, $[x_{80th}, \infty]$, where x_{qth}, denotes the qth percentiles. By so doing I tie the cross-sectional distribution properties of

[53] In 1978 the U.S. Congress enacted the Bankruptcy Reform Act, which became effective on October 1, 1979.

the permanent efficiency with the long-run property of the efficiency process estimated in the data.

Physical Technology			
α	0.70	Value-added share of labour	Gilchrist et al. [2013]
η	0.85	Production Function Returns to Scale	Gilchrist et al. [2013]
Financing Technology			
ι_E	ι_I	Equity issuance cost entrants	Restriction
Bankruptcy Technology			
$s^H_{11,p}$	1.00	Scope of restructuring in highly unionized region	Normalization
Economy			
β	0.96	Subjective Discount Factor	FOC
r^F	0.04	Real Risk-Free Interest Rate	FRED
N^s	1.00	Labour Supply	Normalization
Uncertainty			
$\bar{\mu}_{\ln x}$	0	Unconditional mean of $\ln x_t$	Standard
$\mu_{G(x)}$	0	Expected persistent productivity $\ln x_t$	Restriction
$\sigma_{G(x)}$	$\sigma_\epsilon / \sqrt{1-\rho^2_{\ln x}}$	Standard deviation of persistent productivity $\ln x_t$	Restriction
$\mu_{G(z)}$	0	Expected permanent productivity $\ln z_t$	Restriction
$\sigma_{G(z)}$	$\sigma_\epsilon / \sqrt{1-\rho^2_{\ln x}}$	Standard deviation of permanent productivity $\ln z_t$	Restriction

Table 4: Parameters Restrictions

Next I move to the **physical technology**. Following Gilchrist et al. [2013], I set the value-added share of labour in the production function $\alpha = 0.7$, and the estimated decreasing return to scale parameter $\eta = 0.85$[54]. The real risk-free rate and the annual firm discount factor are set to $r = 0.04$. By (58), the steady-state household annual discount rate is

[54] These parameters are consistent with the literature (e.g. Barseghyan and DiCecio [2011]). In turn, this parameters specification imply a decreasing returns to scale parameter over physical capital $\gamma = 0.63$ consistent with the lower bound of reasonable parameters for the class of Cobb-Douglas production function (e.g. Arellano et al. [2012]).

$\beta = \dfrac{1}{1 + r_F} = 0.9615$. Hence, I normalize the labour supply $N^s = 1$.

For what concerns the **financing technology**, I assume that entrants and incumbents face the same equity issuance cost, $\iota_I = \iota_E$.

I conclude by normalizing the scope of restructuring parameter in the highly unionized region to $s_{11,p}^{H} = 1$. Table 4 summarizes parameters and restrictions.

6.5. Estimation Strategy

I estimate 16 parameters by minimizing the weighted sum of squared residual between a set of moments computed in the model, $m(\underline{\theta})$, and in the data, $\hat{m}$. I choose 34 moments that are a priori informative[55] about the firms distribution and the phenomenon of corporate bankruptcy default.

Since some moment is more sensitive to changes in some parameter, to illustrate the tightest links, I partition the set of estimated parameters in two: the one responsible for the default/exit phenomenon, and the one responsible of the firm distribution. For what concern the parameters responsible to match the default/exit phenomenon: p_X targets the aggregate exit rate (by default and not); χ_o is used to match the aggregate default rate; ψ matches the Ch 7 default rate; $\theta_U(L)$, $\theta_U(H)$ match Ch11 default rates in the lowly and highly unionized regions; c_{11} and $s_{11,p}^{L}$ match the fraction of Ch 11 that are converted to Ch 7 in the highly and lowly unionized region, respectively; $p_{\theta_U(H)}$ targets the fraction of firms in highly unionized states; θ_C targets the aggregate median recovery value under Ch 11. For what concerns the firm distribution, I devote a set of parameter to capture information about the size of the firms and another set of parameters to capture moments related to the leverage: the equity issuance cost ι_I is used to match the expected leverage of the incumbents; the entry cost χ_E targets the Tobin-q statistics of incumbents; $k_{\min}$ targets the median leverage at entry; κ_k

[55] Heuristically speaking the moments are informative about the unknown parameter if they are sensitive to its changes.

Target	Data	Model	Parameter		Description
			Default		
$E_i[\text{Exit Rate}]$	0.0639	0.0192	p_X	0.0148	Exogenous Prob Exit
$E_i[\text{Default Rate}]$	0.0077	0.0075	χ_o	6.4215	Maintenance Cost
$E_i[\text{Ch 7 Default Rate}]$	0.0023	0.0019	ψ	0.7672	Clearance Loss under Ch 7
$E_i[\text{Ch 11 Default Rate}\|r = L]$	0.0020	0.0015	$\theta_U(L)$	0.1192	Unions Barg.pow in region L
$E_i[\text{Ch 11 Default Rate}\|r = H]$	0.0034	0.0041	$\theta_U(H)$	0.3741	Unions Barg pow in region H
$E_i[\alpha^R(e^*)\|r = H]$	0.9440	0.9440	c_{11}	0.0110	Cost of Restructuring Effort
$E_i[\alpha^R(e^*)\|r = L]$	0.9661	0.9661	$s^L_{11,p}$	0.9681	Scope of restructuring in region L
$E_i[\mathbb{I}_{r=H}]$	0.6536	0.6224	$p_{\theta_U(H)}$	0.7113	Pr. entering in region H
$q_{i,50}[\alpha^R \cdot \alpha^C + (1-\alpha^R) \cdot C_7(k)/b]$	0.5309	0.2730	θ_C	0.4824	Creditors bargaining power
			Firms Distribution		
$q_{50,i}[B/A \mid \text{Incumbents}]$	0.1360	1.2551	ι_I	1.0985	Inc. Equity Issuance Cost
$E_i[V/A \mid \text{Incumbents}]$	1.6140	0.2561	χ_E	0.2531	Entry Cost
$q_{50,i}[B/A \mid \text{Entry}]$	0.1190	1.2551	$k_{\min}$	0.7054	Lower Bound k
$\sigma_i[B/A\| \text{Incumbents}]$	0.1859	0.4253	κ_k	0.3633	Pareto Exponent G_k
$\sigma_i[V/A \mid \text{Incumbents}]$	2.1469	0.3765	δ	0.2208	Depreciation Rate
$\sigma_i[B/A \mid \text{Entry}]$	0.2137	0.2049	σ_ϵ	0.0943	Volatility of innovation of $\ln(x)$
$q_{50,i}[Y/\text{Employee}]$	1.4255	0.5121	$\rho_{\ln x}$	0.9657	Persistency of $\ln(x)$ AR(1)

Table 5: **Simulated Method of Moments Estimation.** The first and second column report the structural parameters of the model and their description. The third column reports the targeted statistics: $E[\cdot]$ denotes time series averages, while $E_i[\cdot]$, $\sigma_i[\cdot]$ and $q_{x,i}[\cdot]$ denote the time series averages of, respectively, cross-sectional averages, standard deviations and cross-sectional x-percentiles. The Data column reports the moment computed in the data (firms ratios are trimmed at 1 and 99 percentiles). *Source:* Compustat North-America Fundamentals Annual, 1979-1998. The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR).

and δ matches the cross-section standard deviation of leverage and Tobin-q of incumbents. In conclusion $\rho_{\ln x}$ σ_ϵ have major effects on all the statistics in the model. In particular, I use them to match 10th, 20th, 50th, 70th, 90th percentiles of the distribution of leverage (incumbents and entrants) and Tobin-Q. Table 5 reports the results of the estimation.

7. The Shift in Creditor Rights Protection Regime

How did the shift in creditor rights protection regime affect the U.S. economy and the firms financial structure? In this section I use the calibrated model economy to answer this question. To discipline the exercise, I increase the bargaining power of creditors, θ_C, to mach the 1999-2012 fraction of Ch 11 filings that are converted to Ch 7, keeping all the other parameters fixed at their 1979-1998 levels. Table 6 reports the fit.

Panel A. *Disciplining the Shift in Creditor Rights Protection Regime*

	1979-1998		1999-2012	
	Data	Calibrated Model	Data	Post-shift Model
θ_C	-	0.4824	-	0.7500
Likelihood of Success of Ch 11	0.9511	0.9601	0.9201	0.9267

Table 6: Discipline of the increase in creditors rights protection. The table reports the likelihood of success (row 2) in the Data and in the Model for the pre (1979-1998) and post (1999-2012) shift period for different values of θ_C (row 1).

Table 7 compares the steady-states outcomes at region and aggregate level. As main result, it validates the mechanism. Let me start with the trigger. An increase in creditor rights depresses the restructuring effort, reducing the likelihood of success of the Ch 11 procedure (-3.5%). The effect is stronger in highly unionized states (-3.8% against -2.7%), where the scope of restructuring is stronger (see Figure 4).

Thereby, reorganization becomes less attractive than its liquidation alternative (-0.5%), especially for firms where workers extract many rents (-0.7%). Accordingly, the recovery rate upon default drops (-3.3%), driven by the drop in the recovery rates in Ch 11 (-4.88%).

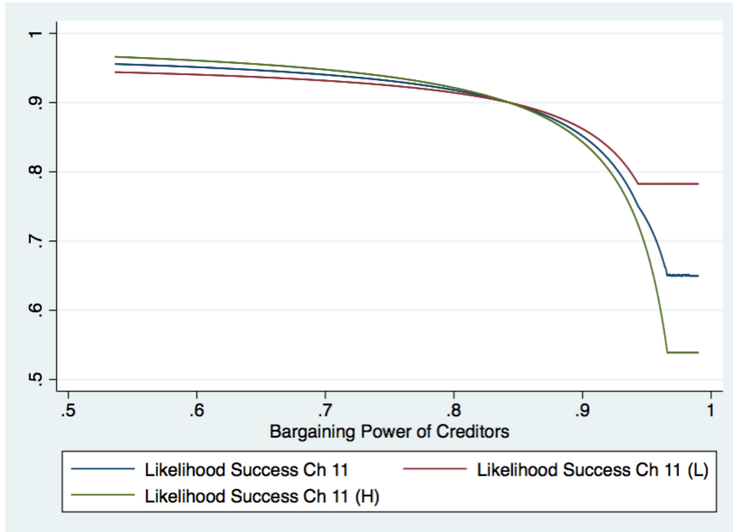

Figure 4: **Likelihood of Success of Ch 11 procedure and creditor rights.** Implied Likelihood of success of the Ch 11 procedure for different bargaining power of the creditors θ_C by unionization region: highly (green), lowly (red) and aggregate (blue). The statistic is computed using the parameterization in Tables 4 and 5, but for the bargaining power of the creditors.

The cost of debt service raises and hinders firms' ability to use debt to smooth out shocks, reducing their profitability especially in highly unionized states. Firms are less likely to enter in the highly unionized region (-0.01%), and when they enter they ought to be smaller (-0.22%) and more productive. TFP increases by (0.02%) and the productivity distribution becomes more positively skewed (2.01%). Firms substitute retained earning for debt, which explains the drop in the dividend price ratio (-2.1%).

Since debt is more expensive for unit of collateral, the model captures a country level deleverage -0.22% (as in the data), but does not match the across regions dynamic. The reason is that smaller amount of debt together with more productive firms, reduces the likelihood of default (-0.33%) on a given loan, especially in lowly unionized regions. As in the data, the model predicts an increase in the Tobin-Q volatility 0.24%, but fail to produce the across-region. The model replicates qualitatively the country-wise and regional drop in the dividend-price ratio observed in the data.

In aggregate, output does not fall, but the economy records sensible regional effects.

Effect of the Shift in Creditor Rights Protection Regime			
	Lowly Unionized %	Highly Unionized %	Aggregate %
Bankruptcy Composition			
Fraction of Ch 11 which are successful	-2.7309	-3.7553	-3.4860
Fraction of defaulters which file for Ch 11	-0.1563	-0.7023	-0.5400
Firms Distribution			
Assets per firm	-0.1094	-0.2235	-0.1825
Employee per firm	-0.0692	-0.1260	-0.1081
Total Factor Productivity	0.0077	0.0237	0.0169
Total Factor Productivity *Skewness*	0.8964	2.0158	1.5960
Leverage	-0.3245	-0.0791	-0.2237
Labour Productivity	-0.0000	-0.0000	-0.0000
Tobin Q	0.6829	0.7072	1.0265
Tobin Q Standard Deviation	-0.2874	0.4301	0.2496
Dividend Price Ratio	-2.5546	-2.5843	-2.1252
National Income Accounting			
Output (Y)	0.6045	-0.3627	0.0000
Consumption (C=NY-I)	0.5950	-0.3927	-0.0214

Table 7

8. The Economic Value of the Bankruptcy Reorganization Procedure

What is the economic value of Ch 11? This question traces its roots back to 1979 - year of the enactment of the Bankruptcy Code - when Ch 11 was for the first time introduced. I address this question by investigating what would have happened if Ch 11 had never been introduced. Table 8 compares the 1979-1998 U.S. model economy with what it would have been without Ch 11.

Effect of Shutting Down Ch 11			
	Lowly Unionized %	Highly Unionized %	Aggregate %
Bankruptcy Composition			
Fraction of Ch 11 which are successful	-0.0000	0.0000	-100.0000
Fraction of defaulters which file for Ch 11	-100.0000	-100.0000	-100.0000
Firms Distribution			
Assets per firm	-0.5169	-5.2130	-3.1409
Employee per firm	-0.0732	-2.6724	-1.6160
Total Factor Productivity	-0.0370	0.5257	0.2383
Total Factor Productivity *Skewness*	-4.3795	48.5853	23.0546
Leverage	-47.7650	-1.0651	-19.7417
Labour Productivity	-0.1185	-0.1185	-0.1185
Tobin Q	78.4584	0.1766	84.8176
Tobin Q Standard Deviation	-39.4996	15.8793	25.3063
Dividend Price Ratio	-100.1352	65.3641	-82.1180
National Income Accounting			
Output (Y)	23.3297	-14.1846	-0.1184
Consumption (C=NY-I)	24.3028	-14.8402	-0.1263

Table 8

The results are striking, and this is the logic. The closure of Ch 11 pushes expected recovery values down and makes debt more expensive. An increase in the debt cost has two countervailing effects: 1) it makes more difficult for firms to smooth out shocks; 2) it reduces the value of being an incumbent (in both regions) pushing the FEC-wage down (-0.12%).

Firms in different regions are more sensitive to one or the other effect. An increase in the debt cost washes out, unproductive firms, increasing aggregate TFP (0.24%). TFP increases in highly unionized states by half a percentage point while it drops in lowly unionized states (−0.03%). The reason is that highly unionized firms suffer disproportionally more the loss of Ch 11. They experience a significant reduction in size (−5.2%) and need to be more productive to stay. The lowly unionized firms benefit more from the drop in the FEC-wage, allowing more unproductive firms to stay. This drives up the debt cost (−2.11% drop in the price), decreases their leverage, and yields a significant change in the dividend distribution policy (drop in dividend price ratio). The equity issuance becomes more attractive than the debt alternative (44%), especially for entry firms (153%). Through entry, firms relocate in the lowly unionized region. Fixing the mass of firms at entry, because of the churning effect there will be less firms, more productive, producing a greater amount of output. Then, to maintain labour demand equal to labour supply the mass of firms has to increase. Consumption and output sensibly falls by 0.1% in aggregate but with a strong asymmetric impact on the economy: it drops by 14% in the highly unionized region and increase by 24% in the lowly unionized one.

On the top of that, there are significant changes in the corporate structure of firms. The increase in the debt price comports a signficant deleveraging, extremely pronounced in lowly unionized regions (−48% vs −1%). Per unit of assets, firms are more valuable (84% increase in Tobin-Q), especially in lowly unionized regions (78%). Besides, the dividend yield drops by 80%, led by lowly unionized firms (−100%). Conversely, firms in highly unionized states experience a 65% increase.

9. Conclusions

In this paper I study from a positive and normative point of view the macroeconomic implications of bankruptcy reforms when workers extract rents. By doing so, I make four contributions.

First, I foreground a *channel* through which pro-creditor bankruptcy reforms can backfire, which does not appeal to agency frictions. Firms file for bankruptcy reorganization not only to restructure debt but also to restructure labour contracts. An increase in creditor rights suffocate the incentives of the shareholders to bargain with the workers, making the procedure more likely to fail. When workers extract many rents - and restructuring labour contracts is required to re-establish the economic soundness - the drop in the likelihood of success can offset the increase in recovery values upon success, and make the reform backfire.

Second, I embed the *restructuring channel* into a static model - where I use the bankruptcy law to microfound the enforcement constraint - and show how the optimal (output maximizing) level of creditor rights decreases with the bargaining power of workers. The exercise sheds some light on why more unionized countries - as Italy, France - have lower creditor rights protection than less unionized ones - say, U.S.

Third, I establish the mechanism in the U.S. data. To do that, I exploit two sources of variation: historical differences in the degree of unionization across states, and a shift in the creditor rights protection regime. As a result, I document a break in the relative use of Ch 11 in 1998, associated with a drop in the likelihood of success of Ch 11, a significant deleveraging (-27%), drop in the dividend yields (46%), a three-fold increase in Tobin-Q dispersion. The theory rationalizes the different response of highly and lowly unionized firms.

Fourth, I perform a *positive* analysis. First of all, I build a general equilibrium firm dynamic model, where the default option captures salient features of the U.S. corporate bankruptcy law. The novel ingredient is the restructuring problem among the stakeholders: shareholders, bondholders and workers. Second, I calibrate the model to the U.S. economy from 1979-1998, using firm level accounting data from Compustat North-America Fundamentals Annual, bankruptcy information from UCLA LoPucki Bankruptcy Research Database, and a proxy for the bargaining power of workers from Union Membership and Coverage database (CPS).

Then, I perform two policy experiments. In the first experiment, I use the model economy to assess the effect of the observed increase in creditor rights protection. An increase in creditor rights tempers the shareholder incentives to restructure labour contract, reducing the likelihood of success of Ch 11. In turn, it makes Ch 11 less attractive than Ch 7, causing the inefficient liquidation of viable firms. The reduction in the expected recovery rates upon default, yields an increase in the cost of debt service and a decrease in the leverage. These effects are stronger in highly unionized regions, where restructuring labour contract is more crucial for the success of the reorganization process. In a second policy experiment, I try to attach an economic value to Ch 11 gauging the losses of shutting it down. Indeed, the reorganization procedure was a novelty of the 1979 bankruptcy code. What would have happened if Ch 11 had never been introduced? Despite output and consumption do not show significant changes in aggregate (-0.11% and -0.12%) the regional effects are economically important. Highly unionized firms suffer disproportionally from the loss of the Ch 11 procedure, as summarized by a 15% drop in output and consumption. Since there are more highly unionized firms in the economy the wage that clears the free entry conditions drops. Firms in lowly unionized states benefit significantly from the drop in the wage, bringing about a significant restructuring of their financial structure (43% drop in leverage, associated with a huge decrease in dividend yield). All together the lowly unionized region records a significant increase in consumption and output (around 24%).

The quantitative results are a conservative measure of the macroeconomic implications of changes in the corporate bankruptcy law. Bankruptcy reforms affect directly extensive margin decisions (entry and form of exit), and only *indirectly* - through prices - firms' intensive margin choices (leverage, hirings,...).

In my future work, I plan to fill this gap by exploring the following extensions. On one side, by assuming that in reorganization share-holders can reduce the bargaining power of workers for a stochastic number of periods, we will observe a strategic use of leverage to enter

Ch 11 default and restructure labour contracts. This mechanism would provide an alternative explanation of the strategic use of capital structure to lower hiring cost (complementing the *bargaining* channel of Quadrini and Sun [2015]). On the other side, by assuming hiring and firing costs, I can explore the interaction between my *restructuring* channel and the *bargaining* channel of Quadrini and Sun [2015]. I expect both these extensions to amplify the real effects of bankruptcy reforms.

References

Adlera, B. E., C. Vedran, and L. A. Weiss (2010). Destruction of Value in the New Era of Chapter 11. *NYU Journal of Law & Business*, 1–47.

Aghion, P., O. Hart, and J. Moore (1994). The economics of bankruptcy reform. In *Transition in Eastern Europe*, Volume 2, pp. 215–244.

Arellano, C., Y. Bai, and J. Zhang (2012). Firm Dynamics and Financial Development. *Journal of Monetary Economics 59*(6), 533–549.

Ayotte, K. M. and E. R. Morrison (2009). Creditor Control and Conflict in Chapter 11. *Journal of Legal Analysis 1*(2), 511–551.

Baird, D. G. and R. K. Rasmussen (2003). Chapter 11 at Twilight. *191*(July), 1–49.

Barseghyan, L. and R. DiCecio (2011, sep). Entry costs, industry structure, and cross-country income and TFP differences. *Journal of Economic Theory 146*(5), 1828–1851.

Biais, B. and T. Mariotti (2009). Credit, Wages, and Bankruptcy Laws. *Journal of the European Economic Association 7*(5), 939–973.

Chatterjee, S., D. Corbae, M. Nakajima, and J.-V. Rios-Rull (2007). A quantitative theory of unsecured consumer credit with risk of default. *Econometrica 75*(6), 1525–1589.

Cooley, T. F. and V. Quadrini (2001). Financial Markets and Firm Dynamics. *American Economic Review 91*(5), 1286–1310.

Corbae, D. and P. D. D'Erasmo (2015). Reorganization or Liquidation: Bankruptcy Choice and Firm Dynamics.

Erosa, A. and A. H. Cabrillana (2008). On Finance as a Theory of TFP, Cross-Industry Productivity Differences, and Economic Rents. *International Economic Review 49*(2), 437–473.

Gennaioli, N. and S. Rossi (2010). Judicial discretion in corporate bankruptcy. *Review of Financial Studies 23*(11), 4078–4114.

Geva, E. Z. (2012). The Trajectory of Labor Relations Under Chapter 11. *DePaul Business & Commercial Law Journal*.

Gilchrist, S., J. W. Sim, and E. Zakraj (2013). Uncertainty, Financial Frictions, and Irreversible Investment.

Hennessy, C. A. and T. M. Whited (2007). How Costly Is External Financing? Evidence from a Structural Estimation. *Journal of Finance 62*(4), 1705–1745.

Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica 60*(5), 1127–1150.

Jermann, U. and V. Quadrini (2009). Financial Innovations and Macroeconomic Volatility. *National Bureau of Economic Research w12308*.

Jermann, U. and V. Quadrini (2012). Macroeconomic Effects of Financial Shocks. *American Economic Review 102*, 238–71.

King, R. and R. Levine (1993). Finance, entrepreneurship, and growth. *Journal of Monetary economics 32*, 513–542.

Klasa, S., W. F. Maxwell, and H. Ortiz-Molina (2009, jun). The strategic use of corporate cash holdings in collective bargaining with labor unions. *Journal of Financial Economics 92*(3), 421–442.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. W. Vishny (1997). Legal determinants of external finance. *Journal of Finance 52*(3), 1131–1150.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. W. Vishny (1998). Law and Finance. *Journal of Political Economy 106*(6), 1113–1155.

Lucas, R. E. (1978). On the size distribution of business firms. *The Bell Journal of Economics 9*(2), 508–523.

Matsa, D. A. (2010, jun). Capital Structure as a Strategic Variable: Evidence from Collective Bargaining. *The Journal of Finance 65*(3), 1197–1232.

Michelacci, C. and V. Quadrini (2009). Financial Markets and Wages. *Review of Economic Studies 76*, 795–827.

Miller, H. R. (2007). Chapter 11 in Transition - From boom to bust and into the future. *American Bankruptcy Law Journal 81*, 375–404.

Moll, B. (2014). Productivity Losses from Financial Frictions: Can Self-Financing Undo Capital Misallocation? *American Economic Review 104*(10), 3186–3221.

Monacelli, T., V. Quadrini, and A. Trigari (2011). Financial Markets and Unemployment. *NBER Working Paper 17389*(September), 44.

Peri, A. (2015). A Quantitative Theory of Corporate Bankruptcy.

Quadrini, V. and Q. Sun (2015). Credit and Hiring.

Rajan, R. and L. Zingales (1998). Financial Dependence and Growth. *American Economic Review 88*(3), 559–586.

Shleifer, A. and R. Vishny (2011). Fire sales in finance and macroeconomics. *NBER Working Paper*.

Tauchen, G. and R. Hussey (1991). Quadrature-Based Methods for Obtaining Approximate Solutions to Nonlinear Asset Pricing Models. *Econometrica 59*(2), 371–396.

Warren, E. (1999). The Changing Politics of American Bankruptcy Reform. *Osgoode Hall Law Journal 37*(1/2), 189–204.

Warren, E. and J. Westbrook (2003). Secured Party in Possession. *American Bankruptcy Institute Journal* (September).

Appendix A. Compustat Data

The firm level accounting information is from COMPUSTAT North America fundamentals annual data. The cleansing of the database is conducted at several layers. Firstly, I purge the sample from utilities (NAICS 22), financial (NAICS 52) and public administration corporations (NAICS 92). Secondly, I drop CUSIPs for American Depository Receipts (ADRs)[56].

Appendix A.1. Description

The description of the variable is organized in three layers: firm (t, i), state (t, s) and aggregate level t. In case of user-defined variables (as instance, real debt $b_{t,i} = l_{t,i}/P_t$) the reader can find the definition of the variables in the relative subsections.

Appendix A.1.1. Firm Level

Sales $sale_{t,i}$. This item represents gross sales (the amount of actual billings to customers for regular sales completed during the period) reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers, for each operating segment. Variable name in Compustat: sale.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Firms real output $y_{t,i} = sale_{t,i}/P_t$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Long-term debt $l_{t,i}$. (U.S. and Canadian GAAP Definition) The item represents debt obligations due more than one year from the company's balance sheet date. This item is a component of Total Liabilities (LT). This item includes: Purchase obligations and payments to officers, when listed as long-term liabilities; Notes payable, due within one year and to be refunded by long-term debt when carried as a non-current liability; Long-term lease obligations (capitalized lease obligations); Industrial revenue bonds; Advances to finance construction; Loans on insurance policies; Indebtedness to affiliates; Bonds, mortgages, and similar debt; All obligations that require interest payments; Publishing companies' royalty contracts payable Timber contracts for forestry and paper; Extractive industries' advances for exploration and development; Production payments and advances for exploration and development. This item excludes: Subsidiary preferred stock, included in Minority Interest; The current portion of long-term debt, included in Current Liabilities; Accounts payable due after one year, included in Liabilities Other; Accrued interest on long-term debt, included in Liabilities Other; Customers' deposits on bottles, kegs, and cases, included in Liabilities Other; Deferred compensation; Long-term debt should be reported net of premium or discount. Standard & Poor's will collect the net figure. Variable name in Compustat: dltt.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Real debt $b_{t,i} = l_{t,i}/P_t$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Total Asset $at_{t,i}$. This item represents the total assets/liabilities of a company at a point in time. If the company does not report a useable amount, this data item will be left blank. Variable name in Compustat: at.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Real asset $a_{t,i} = at_{t,i}/P_t$.

[56] ADRs are securities created to permit the trading in U.S of stock listed on foreign stock exchanges.

Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Employee $n_{t,i}$. This item represents the actual number of people employed by the company and its consolidated subsidiaries. Variable name in Compustat: emp.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Output per Worker $y_{t,i}/n_{t,i} = y_{t,i}/n_{t,i}$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Probability that a Ch 11 case is converted to Ch 7, $1 - \hat{\alpha}^R = \frac{\#(\text{Ch 11 to Ch7})}{\#\text{Ch 11}}$. It is ratio of the Ch 11 filings which are converted to Ch 7 over the total number of Ch 11 filings which are not dismissed. The numerator includes Ch 11 cases which are confirmed and eventually converted. The sample includes all the Ch 11 cases which have been *disposed*[57] before the end of 1998. The data-set is purged by involuntary filings, prepackaged cases, dismissals, and missing data. The Lopucki variables involved in the computation are: Disposition, Chapter, Voluntary, Prepackaged, YearDisposed.
Source: UCLA LoPucki Bankruptcy Research Database, 1980-1998.
Website: http://lopucki.law.ucla.edu.
Average Recovery Rate under Ch 11., $\mathbb{E}[\alpha^R \cdot \alpha^C + (1-\alpha^R) \cdot C_7(k)]$. I compute the recovery rate under Ch 11 for each case as the ratio between: a) numerator: the sum between the distribution to all classes of secured and unsecured credtors, and b) denominator: secured and unsecured creditors claims, as reported in the disclosure statement. Hence I average this statistic across cases in the same year, and compute the final statistic as time-series average of the cross-sectional first moments. The sample includes all the Ch 11 cases which have been *disposed* before the end of 1998. The data-set is purged by involuntary filings, prepackaged cases, dismissals, and missing data. On the top of that I trim all the observations for which any of the secured/unsecured claims and dispositions were missing. The Lopucki variables involved in the computation are: Chapter, Voluntary, prepackpreneg, YearDisposed, DistribUnsec, DistribSecDiscloState, ClaimsSecDiscloState, ClaimsUnsec.
Source: UCLA LoPucki Bankruptcy Research Database, 1980-1998.
Website: http://lopucki.law.ucla.edu.
Fraction of firms in highly unionized states, $\mathbb{E}[\hat{m}(p_{\theta_U(H)})]$. The statistic is computed as the 1979-1998 time series average of the percentage firms in highly unionized states.
Source: Compustat North-America Fundamentals Annual, 1979-1998.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Fraction of Ch 11 cases over total default, by region, $\mathbb{E}[\hat{m}(\theta_U(L))]$, $\mathbb{E}[\hat{m}(\theta_U(H))]$. The statistic is the 1979-1998 time series average of the ratio between the number of Ch 11 cases and the total default (Ch 7 + Ch 11), by region.
Source: Compustat North-America Fundamentals Annual, 1979-1998.
Website: http://wrds-web.wharton.upenn.edu/wrds/.

Appendix A.1.2. Sector Level

Sector j. NAICS classification sectors. Excluded: utilities (22), financial (52) and public administration corporations (92). Variable name in Compustat: naics.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Employment Share $Empshare_{t,s,j} = \int \phi_{J(i)=j,S(i)=s} \frac{n_{t,i}}{N_{t,s}} \mathrm{d}i$, where $J(i)$ and $S(i)$ are the sector and state

[57] Using the filing year produces insignificant changes.

of firm i.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.

Appendix A.1.3. State Level

Union Coverage $Cov_{t,s} = N_{t,s}^{Cov}/N_{t,s}^{Tot}$. **a)** $N_{t,s}^{Tot}$ represents the all employed civilian wage and salary workers, ages 16 and over in the Current Population Survey. Not included are employed 14-15-year-olds, self-employed workers, or a small number of unpaid family workers. **b)** $N_{t,s}^{Cov}$ is the number of employed civilian wage and salary workers who has answered yes to one of these successive questions related to their principal job: A) 'On this job, is ... a member of a labor union or of an association similar to a union?'. If the answer is 'no' than the worker is asked: B) 'On this job, is ... covered by a union or employee association contract?'. Hence, workers are counted as covered by a collective bargaining agreement if they are union members or if they are not members but say they are covered by a union contract.
Source: Union Membership and Coverage database (CPS), 1983-2014.
Website: http://www.unionstats.com.
Number of Firms $I_{t,s}$. Total number of firms active at time t in state s.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Herfindhal Index $H_{t,s} = \int Empshare_{t,s,j}^{2} \mathrm{d}j$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.

Appendix A.1.4. Country Level

Aggregate Output $Y_{t,i} = \int_i y_{t,i} \mathrm{d}i$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Employment $N_{t,i} = \int_i n_{t,i} \mathrm{d}i$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.
Labour Productivity $Y_{t,i}/N_{t,i}$.
Source: Compustat North-America Fundamentals Annual, 1950-2012.
Website: http://wrds-web.wharton.upenn.edu/wrds/.

Appendix B. Empirical Analysis

Appendix B.1. Identification of the break

Figure B.5 reports the relative use of Ch 11 procedure, computed as the ration between the annual filings for Ch 11 over the annual filings for bankruptcy by publicly listerd firms. The figure suggests a break in the relative use of the reorganization procedure in 1998. The Quandt-likelihood-ratio test - for the presence of a structural break at an unknown date in the number of annual Ch 11 filings - corroborates the finding (Fig. B.6).

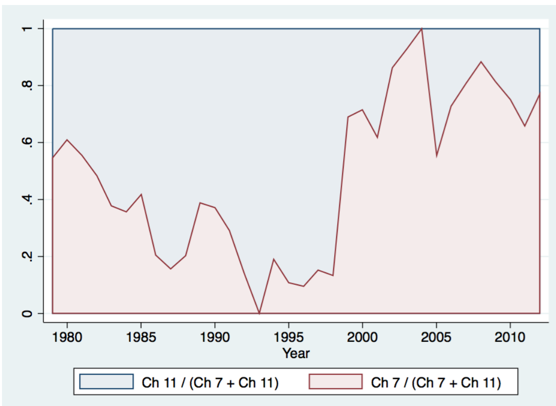

Figure B.5: **Time series of default composition by bankruptcy procedure.** The shaded areas denote the share of annual bankruptcy filings by bankruptcy procedure: Ch 7 (red), Ch 11 (blue). *Source:* Compustat North-America Fundamentals Annual, 1950-2012. The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR).

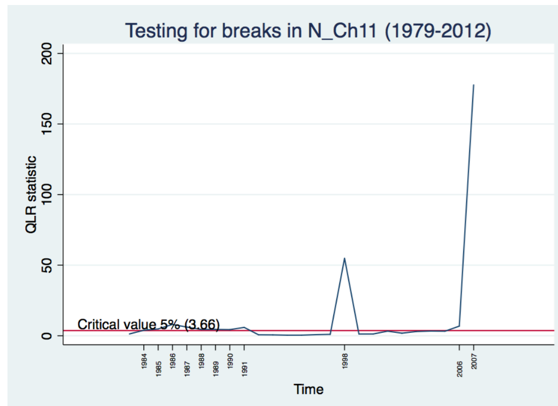

Figure B.6: **Quandt likelihood ratio over 1979-2012.** (QLR test - Quandt,1960) *Source:* Compustat North-America Fundamentals Annual, 1950-2012. The sample excludes: utilities (NAICS 22) financial (NAICS 52) and public administration (NAICS 92) corporations, American Depository Receipts (ADR).

Appendix B.2. Stability of the unionization coverage ranking over time.

Figure B.7 reports the time series of the cross-sectional mean and standard deviation of the U.S. States unionization coverage, over the period 1983-2012. While the average unionization coverage has significantly decreased over time (red line), the standard deviation of coverage has remained stable (blue line). This empirical evidence suggests that the cross-sectional long-run unionization coverage rankings was preserved over time.

Appendix B.3. State-Level Analysis

See Online Appendix.

Appendix B.4. Firm-Level Analysis

See Online Appendix.

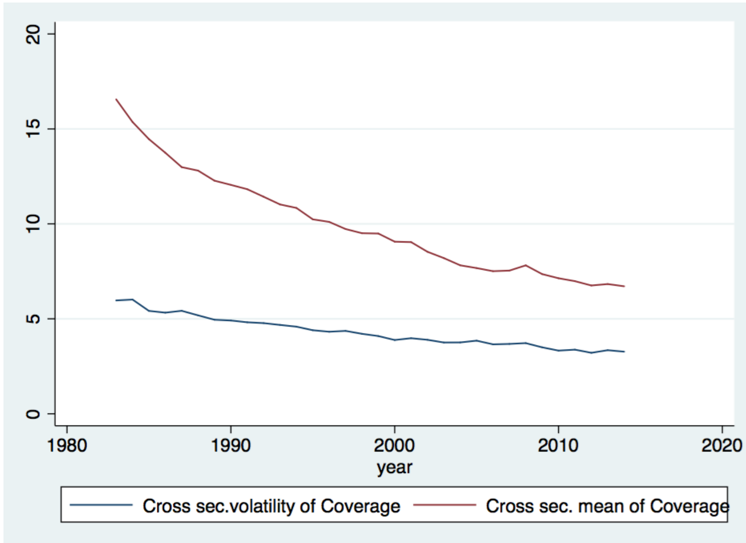

Figure B.7: **Time series of cross-sectional mean and standard deviation of Coverage.** *Source:* Union Membership and Coverage database (CPS), 1983-2014.

Appendix B.5. How are results sensitive to the structural break date?

The bankruptcy literature agrees that Ch 11 looks nowadays more creditor-friendly than it did 30 years ago. Nonetheless, the shift in creditor rights protection did not arise from an amendment to the Bankruptcy Code, but from a series of causes. Warren [1999] and Miller [2007] point at financial institutions lobbying for their bankruptcy agenda. Adlera et al. [2010] identify a break in 2001, with a change in the Uniform Commercial Code ("UCC") and the adoption of UCC §9-104, that sanctioned the practice of writing control provisions into debt instruments, allowing in case of distress to shift control over a debtor's financial decisions from equity-appointed management to the creditor. Adlera et al. [2010] and Gennaioli and Rossi [2010] also suggests a shift in the judicial attitude. The enactement in 2004 of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) contains several pro-creditor provisions relating to Ch 11 reorganizations[58]. For this reason Figure B.8 reports the main coefficients of interest (break $\beta_{>1998}$ and interaction term $\beta_{>1998,U}$ in Table (3)) when the break date ranges between 1998 and 2004. Broadly speaking, results hold through.

Appendix B.6. How are results sensitive to the partition of firms in highly and lowly unionized?

In order to answer this question, Figure B.9 reports the main coefficients of interest (break $\beta_{>1998}$ and interaction term $\beta_{>1998,U}$ in Table (3)) under different percentiles of the unionization coverage distribution separating lowly from highly unionized states: 20%, 25%, 33.33%, 50%, 66.66%, 75%, 80%. Broadly speaking, results hold through.

[58] Among others, the mandatory cap on a debtor's exclusive period to file a plan of reorganization; enhanced protections for reclamation and trade creditors; a mandatory cap on the period to assume or reject unexpired leases of non-residential real property; expanded protection of utilities; mandatory appointment of a chapter 11 trustee in certain circumstances and relaxation of the ability to recover preferences.

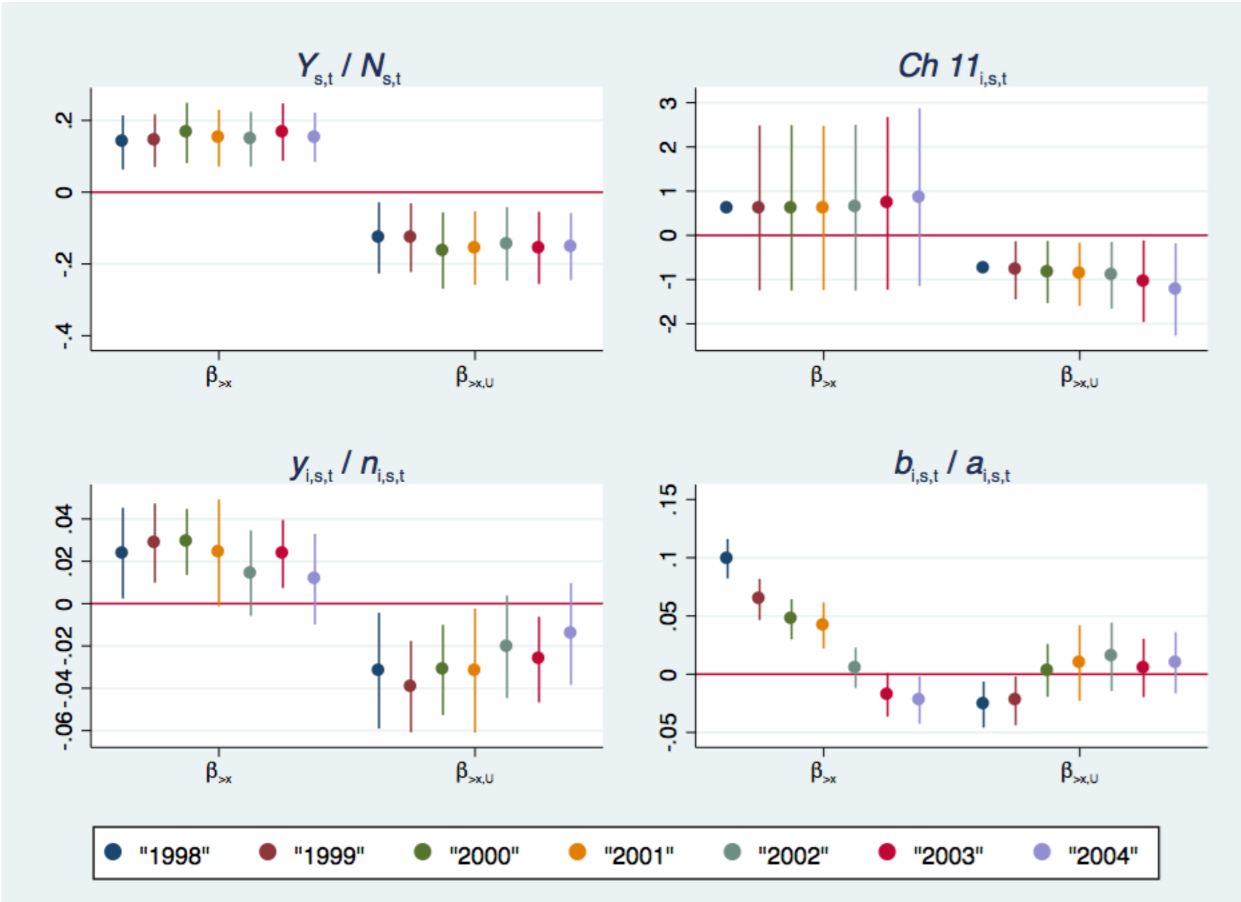

Figure B.8: **Coefficient estimates and 95% c.i. on $\beta_{>1998,U}$, $\beta_{>1998}$ for different percentiles of the unionization coverage distribution separating lowly from highly unionized states: 20%, 25%, 33.33%, 50%, 66.66%, 75%, 80%.** The results are displayed in 4 panels. Each panel reports - in order / by colour - the pair of coefficient estimates of $\beta_{>1998}$ (on the left) and $\beta_{>1998,U}$ (on the right) coming from the same regression. In a panel, regressions differ by the assumption on the break date. In order (by colour): 1998 (blue), 1999 (purple), 2000 (green), 2001 (orange), 2002 (light-green), 2003 (red), 2004 (violet). The 4 panels report clockwise and starting from the north-west corner coefficients estimates from: **I. State-Level Labour Productivity** Blundell-Bond two-steps regression of state level labour productivity, $\ln Y_{t,s}/N_{t,s}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit). Time and states fixed effects are reported. *Instruments:* a) GMM type: up to 3 lags of the dependent variable and continuous covariates; b) iv-type: d_U, $d_{>1998}$, and $d_{>1998} \cdot d_U$. **II. Bankruptcy Choice** Multinomial logit regressions of firms continuation choice $\phi = \{\text{Continuation}, \text{Ch 7}, \text{Ch 11}\}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *Country level controls*: level of union coverage, Cov_t; 3) *State level controls*: aggregate real sales, $Y_{t,s}$, Herfindhal index of sectoral concentration (sector real sales shares unit), employment shares by sector (naics), level of union coverage, $Cov_{t,s}$, interaction terms: $d_U \cdot Cov_{t,s}$, $d_{>1998} \cdot Cov_{t,s}$, $d_{>1998} \cdot d_U \cdot Cov_{t,s}$; 4) *Firms level controls*: real sales, $y_{t,i}/P_t$, leverage, $b_{t-1,i}/a_{t-1,i}$, real total assets, $a_{t,i}/P_t$; 5) *Fixed effect controls*: time, states, and sector fixed effects are reported.. Ch 7 and Ch 11 denote the relative bankruptcy choices (the baseline case Continuation is omitted). **III. Leverage** Fixed effect regression of $\ln b_{t,i}/a_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: lagged value, $\ln b_{t-1,i}/a_{t-1,i}$, log labour productivity, $\ln y_{t,i}/n_{t,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. Leverage is measured as total liabilities over total assets (compustat identifiers: lt, at). **IV. Labour Productivity** Fixed effect regression of $\ln y_{t,i}/n_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: log labour productivity, $\ln y_{t-1,i}/n_{t-1,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. *Source:* Compustat North-America Fundamentals Annual, 1979-2012. Union Membership and Coverage database (CPS), 1983-2014.

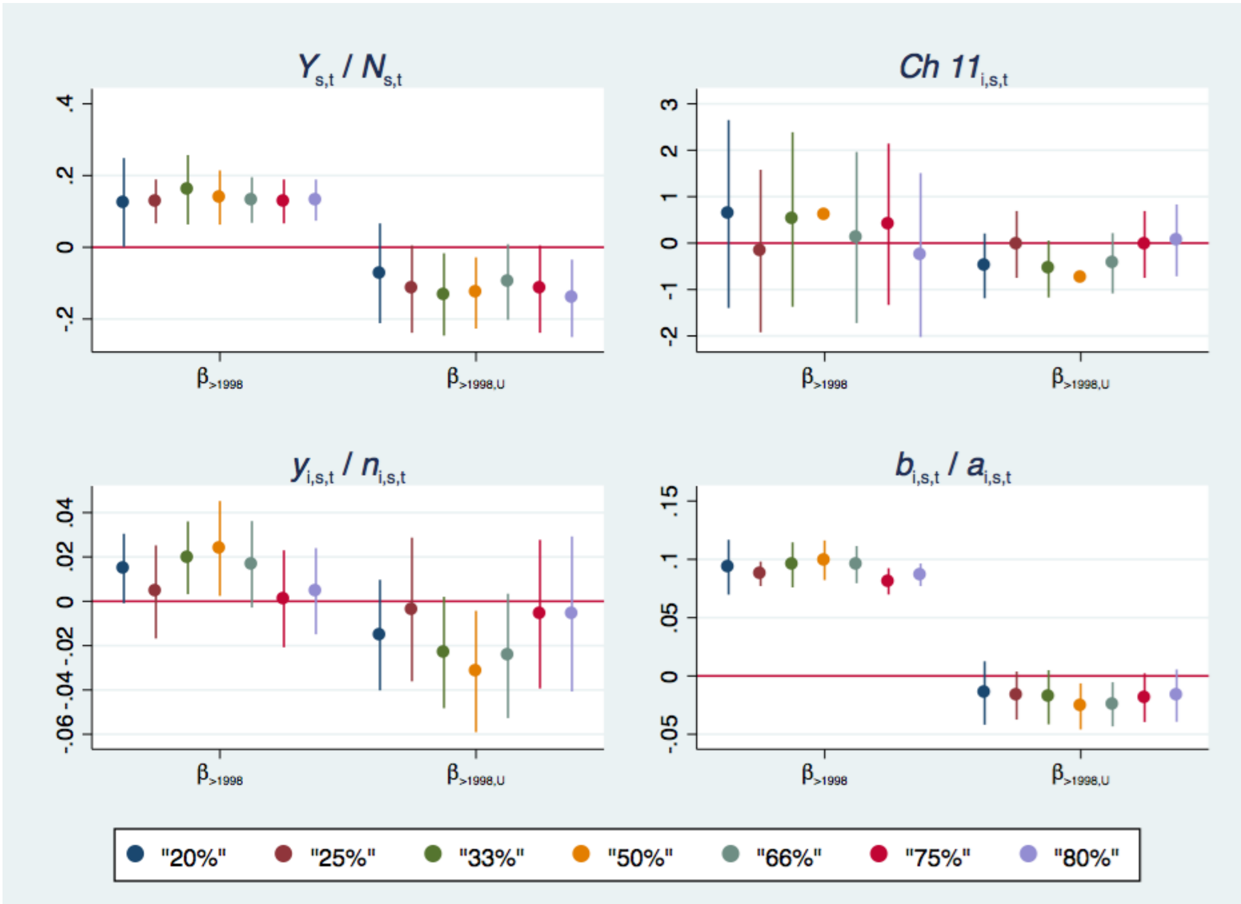

Figure B.9: **Coefficient estimates and 95% c.i. on $\beta_{>1998,U}$, $\beta_{>1998}$ for different percentiles of the unionization coverage distribution separating lowly from highly unionized states: 20%, 25%, 33.33%, 50%, 66.66%, 75%, 80%.** The results are displayed in 4 panels. Each panel reports - in order / by colour - the pair of coefficient estimates of $\beta_{>1998}$ (on the left) and $\beta_{>1998,U}$ (on the right) coming from the same regression. In a panel, regressions differ by the assumption on the percentile of the unionization coverage distribution separating lowly from highly unionized states. In order (by colour): 20% (blue), 25% (purple), 30% (green), 50% (orange), 70% (light-green), 75% (red), 80% (violet). The 4 panels report clockwise and starting from the north-west corner coefficients estimates from: **I. State-Level Labour Productivity** Blundell-Bond two-steps regression of state level labour productivity, $\ln Y_{t,s}/N_{t,s}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit). Time and states fixed effects are reported. *Instruments:* a) GMM type: up to 3 lags of the dependent variable and continuous covariates; b) iv-type: d_U, $d_{>1998}$, and $d_{>1998} \cdot d_U$. **II. Bankruptcy Choice** Multinomial logit regressions of firms continuation choice $\phi = \{\text{Continuation}, \text{Ch } 7, \text{Ch } 11\}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *Country level controls*: level of union coverage, Cov_t; 3) *State level controls*: aggregate real sales, $Y_{t,s}$, Herfindhal index of sectoral concentration (sector real sales shares unit), employment shares by sector (naics), level of union coverage, $Cov_{t,s}$, interaction terms: $d_U \cdot Cov_{t,s}$, $d_{>1998} \cdot Cov_{t,s}$, $d_{>1998} \cdot d_U \cdot Cov_{t,s}$; 4) *Firms level controls*: real sales, $y_{t,i}/P_t$, leverage, $b_{t-1,i}/a_{t-1,i}$, real total assets, $a_{t,i}/P_t$; 5) *Fixed effect controls*: time, states, and sector fixed effects are reported.. Ch 7 and Ch 11 denote the relative bankruptcy choices (the baseline case Continuation is omitted). **III. Leverage** Fixed effect regression of $\ln b_{t,i}/a_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: lagged value, $\ln b_{t-1,i}/a_{t-1,i}$, log labour productivity, $\ln y_{t,i}/n_{t,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. Leverage is measured as total liabilities over total assets (compustat identifiers: lt, at). **IV. Labour Productivity** Fixed effect regression of $\ln y_{t,i}/n_{t,i}$ over: 1) *Treatment variables*: structural break, $d_{>1998}$, unionization dummy, d_U, interaction term, $d_{>1998} \cdot d_U$; 2) *State level controls*: Herfindhal index of sectoral concentration (sector real sales shares unit); 3) *Sector level controls*: aggregate amount of debt over aggregate amount of assets by sector in the state of consideration, $\ln B_{s,j,t}/A_{s,j,t}$, employment share of labour by sector in the state of consideration; 4) *Firms level controls*: log labour productivity, $\ln y_{t-1,i}/n_{t-1,i}$, log real total assets, $\ln a_{t-1,i}/P_t$. 5) *Other*: linear trend, t, and interaction term $t \cdot d_U$. *Source:* Compustat North-America Fundamentals Annual, 1979-2012. Union Membership and Coverage database (CPS), 1983-2014.

Appendix C. Static Model

Appendix C.0.1. The Debt Restructuring

The debt restructuring problem (2) can be rewritten as

$$NB^C_{v,e}(\underline{k}) = \alpha^R(e;\theta_U) \cdot \max_{r\in\mathbb{R}^+}[\zeta \cdot \bar{k} - v - r]^{1-\theta_C} \cdot [r - (1-\psi)\cdot \bar{k}]^{\theta_C} \tag{C.1}$$

$$\text{s.t} \quad \zeta \cdot \bar{k} - v - r \geq 0 \quad r \geq (1-\psi)\cdot \bar{k} \tag{C.2}$$

Upon success, the recovery value under Ch 11 which solves the problem is

$$r^* = \max\{\ \theta_C \cdot (\zeta \cdot \bar{k} - v) + (1-\theta_C)\cdot(1-\psi)\cdot\bar{k}\ ,\ (1-\psi)\cdot\bar{k}\ \}$$

Substituting in the objective function, it is easy to show that for a given v and e the expected surplus of the firm is

$$\begin{aligned} S^F_{v,e}(\bar{k}) &= \alpha^R(e;\theta_U)\cdot(\zeta\cdot\bar{k} - v - r^*) \\ &= \alpha^R(e;\theta_U)\cdot\left[\zeta\cdot\bar{k} - v - \theta_C\cdot(\zeta\cdot\bar{k}-v) - (1-\theta_C)\cdot(1-\psi)\cdot\bar{k}\right] \\ &= \alpha^R(e;\theta_U)\cdot\left[(1-\theta_C)\cdot(\zeta\cdot\bar{k}-v) - (1-\theta_C)\cdot(1-\psi)\cdot\bar{k}\right] \\ &= \alpha^R(e;\theta_U)\cdot(1-\theta_C)\cdot\left[\zeta\cdot\bar{k} - v - (1-\psi)\cdot\bar{k}\right] \end{aligned}$$

$$S^F_{v,e}(\bar{k}) = \alpha^R(e;\theta_U)\cdot(1-\theta_C)\cdot\max\left[\zeta\cdot\bar{k} - v - (1-\psi)\cdot\bar{k}\ ,\ 0\right] \tag{C.3}$$

Similarly, the expected surplus of the lenders is

$$S^C_{v,e}(\bar{k}) = \alpha^R(e;\theta_U)\cdot\theta_C\cdot\max\left[\zeta\cdot\bar{k} - v - (1-\psi)\cdot\bar{k}\ ,\ 0\right]$$

and the expected recovery value under Ch 11 is

$$R^{11}_{v,e}(\bar{k}) = (1-\psi)\cdot\bar{k} + \alpha^R(e;\theta_U)\cdot\theta_C\cdot\max\left[\zeta\cdot\bar{k} - v - (1-\psi)\cdot\bar{k}\ ,\ 0\right] \tag{C.4}$$

Equations (4), (3) follows.

Appendix C.0.2. The Labour Restructuring

Substituting the surplus of the firm (4) in (5) the problem reads

$$NB^U_e(\bar{k}) = \alpha^R(e;\theta_U)\cdot(1-\theta_C)^{1-\theta_U}\max_{v\in\mathbb{R}^+}[\zeta\cdot\bar{k} - (1-\psi)\cdot\bar{k} - v]^{1-\theta_U}\cdot[v]^{\theta_U}$$

from which we get that the wage compensation (6),

$$w(\bar{k}) = \theta_U\cdot\max\left[\zeta - (1-\psi)\ ,\ 0\right]\cdot\bar{k}$$

For the ease of notation, let

$$S(\bar{k}) = \max\left[\zeta - (1-\psi)\ ,\ 0\right]\cdot\bar{k}$$

denote the surplus of the firm.
Let $[\zeta - (1-\psi)]\cdot\bar{k} = 0$, then $w(\bar{k}) = 0$ and therefore $S^F_e(\bar{k}) = S^W_e(\bar{k}) = 0$ and $R^{11}_{v,e}(\bar{k}) = (1-\psi)\cdot\bar{k}$.

On the other hand, let $[\zeta - (1-\psi)] \cdot \bar{k} > 0$. Then by substituting (6) in the objective function, we have that

$$\begin{aligned} S_e^F(\bar{k}) &= \alpha^R(e;\theta_U) \cdot (1-\theta_C) \cdot \max\left[\zeta \cdot \bar{k} - w(\bar{k}) - (1-\psi) \cdot \bar{k}\ ,\ 0\right] \\ &= \alpha^R(e;\theta_U) \cdot (1-\theta_C) \cdot \max\left[[\zeta - (1-\psi)] \cdot \bar{k} - \theta_U \cdot [\zeta - (1-\psi)] \cdot \bar{k}\ ,\ 0\right] \\ &= \alpha^R(e;\theta_U) \cdot (1-\theta_C) \cdot (1-\theta_C) \cdot [\zeta - (1-\psi)] \cdot \bar{k} \end{aligned}$$

and similarly

$$S_e^W(\bar{k}) = \alpha^R(e;\theta_U) \cdot (1-\theta_C) \cdot \theta_U \cdot [\zeta - (1-\psi)] \cdot \bar{k}$$

$$R_e^{11}(\bar{k}) = (1-\psi) \cdot \bar{k} + \alpha^R(e;\theta_U) \cdot \theta_C \cdot (1-\theta_U) \cdot [\zeta - (1-\psi)] \cdot \bar{k} \tag{C.5}$$

The results (8), (9), and (7) follow.

Appendix C.1. The Restructuring Effort Problem

Appendix C.1.1. Proof Proposition 2

Proof. Given

$$e^* = (1-\theta_C) \cdot (1-\theta_U) \cdot \frac{\theta_U}{c_{11}}$$

Result a. The optimal level of effort decreases in θ_C

$$\frac{\partial e^*}{\partial \theta_C} = -(1-\theta_U) \cdot \frac{\theta_U}{c_{11}} < 0$$

Result b.

$$\frac{\partial e^*}{\partial \theta_U} = \frac{1-\theta_C}{c_{11}} \cdot \frac{\partial(\theta_U - \theta_U^2)}{\partial \theta_U} = \frac{1-\theta_C}{c_{11}} \cdot [1 - 2 \cdot \theta_U]$$

The results follows. □

Substituting (10), the probability of success of the Ch 11 procedure

$$\alpha^R(e^*;\theta_U) = (1-\theta_U) \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) - \frac{\theta_U^2}{c_{11}} \cdot \theta_C\right]$$

Substituting $\alpha^R(e^*;\theta_U)$ and simplifying we get

$$\begin{aligned} R^{11}(\bar{k}) &= (1-\psi) \cdot \bar{k} + (1-\theta_U) \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) - \frac{\theta_U^2}{c_{11}} \cdot \theta_C\right] \cdot \theta_C \cdot (1-\theta_U) \cdot S(\bar{k}) \\ &= (1-\psi) \cdot \bar{k} + (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2\right] \cdot S(\bar{k}) \end{aligned}$$

Appendix C.2. Characterization of the equlibrium

Appendix C.2.1. The enforcement constraint

By using (12), the recovery value in bankruptcy $L(\bar{k}) = \max\left[\ R^{11}(\bar{k})\ ,\ R^7(\bar{k})\ \right]$ becomes

$$L(\bar{k}) \ = \ \left\{(1-\psi) \ + \ (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2\right] \cdot \max\left[\ \zeta - (1-\psi)\ ,\ 0\ \right]\right\} \cdot \bar{k} \tag{C.6}$$

The participation constraint, requires the debt repayment $R_k \cdot k$ to be not larger than the expected recovery value,

$$R_k \ \cdot \ k \leq \ L(\bar{k})$$

By price competition in the credit market, $R_k = 1$. Then, since the firm preferences are increasing in k, ex-*ante*, the optimal amount borrowed by the firm is

$$k^* = \ \min\{ \ L(\bar{k}) \ , \ \bar{k} \ \}$$

where the minimum operator captures the resource feasibility constraint (the lenders cannot lend more than the total amount of capital they have).
Substituting (C.6) we get the optimal level of borrowing

$$k^* = \ \min\left\{ \ (1-\psi) \ + \ (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \right] \cdot \max \left[\ \zeta - (1-\psi) \ , \ 0 \ \right] \ , \ 1 \right\} \cdot \bar{k}$$

Appendix C.2.2. The misallocation of resources

The output in the economy is given by

$$\begin{aligned}
Y &= A \cdot k^* + [\bar{k} - k^*] \\
&= AL(\bar{k}) + [\bar{k} - L(\bar{k})] \\
&= A \ \underbrace{\left[(1-\psi) \ + \ (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) - \frac{\theta_U^2}{c_{11}} \cdot \theta_C \right] \cdot \theta_C \cdot \max \left[\ \zeta - (1-\psi) \ , \ 0 \ \right] \right]}_{<1} \cdot \bar{k} \\
&\quad + \left[1 - \underbrace{\left[(1-\psi) \ + \ (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) - \frac{\theta_U^2}{c_{11}} \cdot \theta_C \right] \cdot \theta_C \cdot \max \left[\ \zeta - (1-\psi) \ , \ 0 \ \right] \right]}_{<1} \right] \cdot \bar{k} \\
&= [A \cdot (1-m) + 1 \cdot m] \cdot \bar{k} \\
&= [1 \cdot \underbrace{(1-m)}_{\text{Fraction of } \bar{k} \text{ invested in productive technology}} + \frac{1}{A} \cdot \underbrace{m}_{\text{Fraction of } \bar{k} \text{ invested in unproductive technology}}] \cdot A \cdot \bar{k}
\end{aligned}$$

and (14) follows.

Appendix C.3. Normative Analysis

The problem of a social planner which chooses the optimal level of creditor rights by taking as given the bargaining power of workers

$$\begin{aligned}
\max_{\theta_C \in [0,1]} (1 - m(\theta_U, \theta_C, \zeta, \psi)) &= \ (1-\psi) \ + \ (1-\theta_U)^2 \cdot \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \right] \cdot \max \left[\ \zeta - (1-\psi) \ , \ 0 \ \right] \\
&= \ (1-\psi) \ + \ (1-\theta_U)^2 \cdot \max \left[\ \zeta - (1-\psi) \ , \ 0 \ \right] \cdot \max_{\theta_C \in [0,1]} \left[\left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \right] \\
&= \max_{\theta_C \in [0,1]} \left(1 + \frac{\theta_U^2}{c_{11}}\right) \cdot \theta_C - \frac{\theta_U^2}{c_{11}} \cdot \theta_C^2 \qquad \text{(C.7)}
\end{aligned}$$

is equivalent to (15). Hence taking FOC

$$\left(1+\frac{\theta_U^2}{c_{11}}\right)-2\cdot\frac{\theta_U^2}{c_{11}}\cdot\theta_C=0$$

$$\theta_C=\frac{1}{2}\cdot\left[\frac{c_{11}}{\theta_U^2}+1\right]$$

we get (16).

Appendix D. Dynamic Model

Appendix D.1. Proof of Theorem 1, 2, 3

Appendix D.1.1. Existence of unique continuous function

Without loss of generality, let us express the nash bargaining problems (23), (34), and (38) as

$$\begin{aligned}(Tf)(\underline{p},\underline{s}) &= \arg\max_{c\in \mathrm{C}}\left\{A\left(\underline{p},\underline{s},c\right)^{(1-\theta)}\cdot B\left(\underline{p},\underline{s},c\right)^{\theta}\right\}\\ \text{s.t. } & A\left(\underline{p},\underline{s},c\right)\geq 0,\quad B\left(\underline{p},\underline{s},c\right)\geq 0\end{aligned} \tag{D.1}$$

where $c\in \mathrm{C}$ reads $v\in \mathrm{W}$ in (23), and (38), and reads $a\in[0,1]$ in (34). $A(\cdot), B(\cdot)$ are continuous; I will be more precise about their functional forms when needed.

Proof. The proof proceeds in 3 steps.

1. For any $f\in\mathscr{C}^{\mathrm{C}}(\underline{P}\times\underline{S})$ and $(\underline{p},\underline{s})\in\underline{P}\times\underline{S}$, $(Tf)(\underline{p},\underline{s})\subset\mathbb{R}$ is i) not-empty, ii) compact valued, iii) upperhemicontinuous and $(Tf)(\underline{p},\underline{s}):\mathrm{C}\to\mathrm{C}$.

   Proof. Since C is a not-empty, compact valued, continuous feasible correspondence, and the objective function is continuous (product of continuous functions), then by direct application of the Berge's Maximum Theorem the optimal correspondence is not-empty compact-valued, uhc and is contained in the feasible correspondence C. Noticing that $\underline{s}$ was arbitrary the result follows. □

2. For any $f\in\mathscr{C}^{\mathrm{C}}(\underline{P}\times\underline{S})$, the product correspondence

   $$(Tf)(\underline{p},\underline{s})=\Pi_{(\underline{p},\underline{s})\in\underline{P}\times\underline{S}}(Tf)(\underline{p},\underline{s})\subset\mathrm{C}$$

   is not empty, compact valued, uhc and $(Tf)(\underline{p},\underline{s}):\mathrm{C}\to\mathrm{C}$.

   Proof. The result follows from the fact that: 1) by point 1, $(Tf)(\underline{p},\underline{s})$ is not empty, compact valued, uhc, included in C; 2) the product correspondence preserves these properties (Aliprantis and Border, 1999: Thm 16.28). □

3. Since $\theta\in\Theta\subset[0,1]$, then $(Tf)(\underline{p},\underline{s})$ is a not-empty, compact and convex-valued uhc correspondence with $(Tf)(\underline{p},\underline{s}):\mathrm{C}\to\mathrm{C}$.

   Proof. Lemma (1) shows that the solution is unique. In particular if $\theta\in\Theta\subset[0,1]$, by strict concavity of the objective function over $\underline{S}$, the Nash Bargaining Problem is well defined with a unique continuous solution.
   This implies that the product correspondence $(Tf)(\underline{p})$ is a single-valued, continuous function. □

Hence by Kakutani-Fan-Glicksberg FPT there exists a continuous $f^*(\underline{p},\underline{s})\in\mathrm{C}$ such that $f(\underline{p},\underline{s})^*\in(Tf)(\underline{p},\underline{s})$. Because of Lemma 1 we know also that the solution is unique (which completes the proof). □

Appendix D.1.2. Uniqueness

Lemma 1. *If $\theta \in \Theta \subset [0,1]$, for a given $\underline{p}$ there exists a* ***unique*** $f(\underline{p}, \underline{s}) \in \mathscr{C}^{\mathrm{C}}(\underline{P} \times \underline{S})$ *which solves the Nash Bargaining Problem.*

Proof. Since the proof require to specify the functional forms of $A(\cdot), B(\cdot)$ I will proceed theorem-wise. I start first with the restructuring problems (34) and (38), which are differentiable on the whole support, and move eventually to the continuation problem (23), which is differentiable almost everywhere, except in $d = 0$. For simplicity, let $h(\cdot) = A(\cdot)^{\theta} B(\cdot)^{1-\theta}$ denote the objective function.

- *Theorem 2*: uniqueness of solution to the debt restructuring problem
  Taking derivative with respect to a

$$\frac{\partial h(a)}{\partial a} = \alpha^R \left[-(1-\theta_C) \cdot \iota b (S^F)^{-\theta_C} (S^C)^{\theta_C} + \theta_C (S^F)^{1-\theta_C} (S^C)^{\theta_C - 1} b \right]$$

  Taking second derivative:

$$\frac{\partial^2 h(a)}{\partial a^2} = -\alpha^R \Bigg\{ \Bigg[\underbrace{\theta_C(1-\theta_C) \cdot (\iota b)^2 \cdot (S^F)^{-\theta_C - 1} (S^C)^{\theta_C} + \theta_C (1-\theta_C) \cdot \iota b^2 (S^F)^{-\theta_C} (S^C)^{\theta_C - 1}}_{+} \Bigg] \Bigg[\underbrace{(1-\theta_C)\theta_C (S^F)^{-\theta_C} (S^C)^{\theta_C - 1} \iota b^2 + (1-\theta_C)\theta_C (S^F)^{1-\theta_C} (S^C)^{\theta_C - 2} b^2}_{+} \Bigg] \Bigg\} < 0$$

  which completes the proof.

- *Theorem 3*: uniqueness of solution to the labour restructuring problem
  Taking derivative with respect to w

$$\frac{\partial h(v)}{\partial v} = \alpha^R \left[-(1-\theta_U) \cdot \iota n (S^F)^{-\theta_U} (S^W)^{\theta_U} + \theta_U (S^F)^{1-\theta_U} (S^W)^{\theta_U - 1} n \right]$$

  Taking second derivative:

$$\frac{\partial^2 h(v)}{\partial v^2} = -\alpha^R \Bigg\{ \Bigg[\underbrace{\theta_U(1-\theta_U) \cdot (\iota n)^2 \cdot (S^F)^{-\theta_U - 1} (S^W)^{\theta_U} + \theta_U (1-\theta_U) \cdot \iota n^2 (S^F)^{-\theta_U} (S^W)^{\theta_U - 1}}_{+} \Bigg] \Bigg[\underbrace{(1-\theta_U)\theta_U \cdot (S^F)^{-\theta_U} (S^W)^{\theta_U - 1} \iota n^2 + (1-\theta_U)\theta_U (S^F)^{1-\theta_U} (S^W)^{\theta_U - 2} n^2}_{+} \Bigg] \Bigg\} < 0$$

  which completes the proof.

- *Theorem 1*: uniqueness of solution to the wage bargaining problem when the firm continues.
  Taking derivative with respect to w

$$\frac{\partial h(v)}{\partial v} = -(1-\theta_U) \cdot g'(\cdot) \cdot n (S^F)^{-\theta_U} (S^W)^{\theta_U} + \theta_U (S^F)^{1-\theta_U} (S^W)^{\theta_U - 1} n$$

Taking second derivative:

$$\frac{\partial^2 h(v)}{\partial v^2} = -\Bigg\{ \Bigg[\underbrace{\theta_U(1-\theta_U)\cdot(g'(\cdot)\cdot n)^2\cdot(S^F)^{-\theta_U-1}(S^W)^{\theta_U} + \theta_U(1-\theta_U)\cdot g'(\cdot)\cdot n^2(S^F)^{-\theta_U}(S^W)^{\theta_U-1}}_{+}\Bigg]$$
$$\Bigg[\underbrace{(1-\theta_U)\theta_U\cdot(S^F)^{-\theta_U}(S^W)^{\theta_U-1}g'(\cdot)\cdot n^2 + (1-\theta_U)\theta_U(S^F)^{1-\theta_U}(S^W)^{\theta_U-2}n^2}_{+}\Bigg]\Bigg\} < 0$$

Since in an interior solution with $d \neq 0$ $g(\cdot) = 1$ if $d > 0$ and $g(\cdot) = \iota$ if $d < 0$, the result follows.

□

Appendix D.2. The Continuation Problem

Since firm's preferences are monotonic in d, the budget constraint in (22) is binding, the firm's ordinary choices reduce to (n, b'), and the continuation problem simplifies to

$$V^C(\underline{p},\underline{s}) = \max_{(n,b')\in \mathrm{N}\times\mathrm{B}} g\left(y(\underline{p},x,n) - w(\underline{p},\underline{s},n)\cdot n - \chi_o - \delta k + q(\underline{p},x,b')b' - b\right) + \beta\cdot\mathbb{E}_{x'|x}\left[V(\underline{p},\underline{s}')\right]$$
$$\text{s.t.}\quad (\underline{p},\underline{s},n,w(\underline{p},\underline{s},n)) \in W(\underline{p},\underline{s},n)$$

Since labour is not a state variable, the *static* size choice, n - taken in order to maximize profits - does not alter the *inter-temporal* debt choice, b' - taken to smooth dividends over time. Mathematically, since the two controls enter additively in the objective function and the derivative is a linear operator, the problems are separable.

Hence, (22) becomes

$$V^C(\underline{p},\underline{s}) = \max_{n\in\mathrm{N}}\max_{b'\in\mathrm{B}} g\left(y(\underline{p},x,n) - w(\underline{p},\underline{s},n)\cdot n - \chi_o - \delta k + q(\underline{p},x,b')b' - b\right) + \beta\cdot\mathbb{E}_{x'|x}\left[V(\underline{p},\underline{s}')\right]$$
$$\text{s.t.}\quad (\underline{p},\underline{s},n,w(\underline{p},\underline{s},n)) \in W(\underline{p},\underline{s},n)$$

To simplify notation, let the operating profits net of investment and gross of the debt issuance be

$$A(\underline{p},\underline{s},n,b') \equiv y(\underline{p},x,n) - \chi_o + q(\underline{p},x,b')b' - \delta k$$

let the discounted markov operator be

$$E(\underline{p},x,b') \equiv \beta\cdot\mathbb{E}_{x'|x}\left[V(\underline{p},\underline{s}')\right]$$

and let omit the dependence of the bargaining power on the region, $\theta_U \equiv \theta_U(r)$.

Appendix D.2.1. Proposition 4 and 5

By and large, for a given n, we can rewrite (23)

$$w(\underline{p},\underline{s},n) \equiv \arg\max_{v\in\mathrm{W}} \Bigg[\underbrace{\max_{b'\in\mathrm{B}} g\left[A(\underline{p},\underline{s},n,b') - b - v\cdot n\right] + E(\underline{p},x,b')}_{V^C_{v,n}(\underline{p},\underline{s})}\Bigg]^{(1-\theta_U)} \cdot \left[v\cdot n - \underline{w}\cdot n\right]^{\theta_U}$$
$$\text{s.t. } V^C_{v,n}(\underline{p},\underline{s}) \geq 0, \qquad v \geq \underline{w}$$

Fix b'. By taking first order condition with respect to v

$$(1-\theta_U)\frac{g'(\cdot)}{g\left(A(\underline{p},\underline{s},n,b')-b-vn\right)+E(\underline{p},x,b')}n=\theta_U\frac{1}{v-\underline{w}}$$

$$(1-\theta_U)g'(\cdot)[v-\underline{w}]n=\theta_U\left[g\left(A(\underline{p},\underline{s},n,b')-b-vn\right)+E(\underline{p},x,b')\right] \tag{D.2}$$

By definition of $g(d)=\left[\mathbb{I}_{\{d\geq 0\}}+\iota\cdot\mathbb{I}_{\{d<0\}}\right]\cdot d$, we have $g'[\cdot]=1$ if $d>0$, $g'[\cdot]=\iota$ if $d<0$, and $g'[0]$ is not defined. Accordingly, Problem (23) might have an interior or corner solution.
An interior solution is the wage $w^{interior}(\underline{p},\underline{s},n)$ which satisfies (D.2), for either $d>0$ or $d<0$.
The existence of an interior solution proceeds by guess and verify: first, I guess that $d>0$, substitute it in (D.2) and check if for $w_{d>0}(\underline{p},\underline{s})$ satisfies it. If not I proceed with $d<0$.
Let us guess $d>0$. Than solving (D.2) when $g'[\cdot]=1$, we get

$$\begin{aligned}(1-\theta_U)g'(\cdot)[v-\underline{w}]n&=\theta_U\left[g\left(A(\underline{p},\underline{s},n,b')-b-vn\right)+E(\underline{p},x,b')\right]\\ vn&=+\underline{w}n+\theta_U\left[A(\underline{p},\underline{s},n,b')-b-\underline{w}n+E(\underline{p},x,b')\right]\end{aligned}$$

and therefore

$$w^{interior}_{d>0}(\underline{p},\underline{s},n)n=\underline{w}n+\theta_U\left[A(\underline{p},\underline{s},n,b')-b-\underline{w}n+E(\underline{p},x,b')\right]$$

Then I verify that:

$$d=A(\underline{p},\underline{s},n,b')-b-w(\underline{p},\underline{s},n)n\geq 0$$

If not, I guess $d<0$. Than $g'[\cdot]=\iota$ and

$$\begin{aligned}(1-\theta_U)g'(\cdot)[v-\underline{w}]n&=\theta_U\left[g(A(\underline{p},\underline{s},n,b')-b-vn)+E(\underline{p},x,b')\right]\\ vn&=+\underline{w}n+\theta_U\left[A(\underline{p},\underline{s},n,b')-b-\underline{w}n+\frac{1}{\iota}\cdot E(\underline{p},x,b')\right]\end{aligned}$$

and therefore

$$w^{interior}_{d<0}(\underline{p},\underline{s},n)n=\underline{w}n+\theta_U\left[A(\underline{p},\underline{s},n,b')-b-\underline{w}n+\frac{1}{\iota}\cdot E(\underline{p},x,b')\right]$$

Then I verify that

$$d=A(\underline{p},\underline{s},n,b')-b-w(\underline{p},\underline{s},n)n<0$$

Let us denote the nash bargaining surplus of the firm

$$S(\underline{p},\underline{s},n)=\begin{cases}\max_{b'\in \mathrm{B}}A(\underline{p},\underline{s},n,b')-b-\underline{w}n+E(\underline{p},x,b') & d>0\\ \max_{b'\in \mathrm{B}}A(\underline{p},\underline{s},n,b')-b-\underline{w}n+\frac{1}{\iota}\cdot E(\underline{p},x,b') & d<0\end{cases}$$

or more compactly

$$S(\underline{p},\underline{s},n)\ \equiv\ \max_{b'\in \mathrm{B}}A(\underline{p},\underline{s},n,b')-b-\underline{w}n+\beta\ \cdot\ \frac{1}{\mathbb{I}_{\{d\geq 0\}}+\iota\cdot\mathbb{I}_{\{d<0\}}}+E(\underline{p},x,b')$$

Then we can rewrite the interior solutions

$$w^{interior}(\underline{p},\underline{s},n)n=\underline{w}n+\theta_U S(\underline{p},\underline{s},n)$$

and the value of continuation for a given number of workers

$$V^C_n(\underline{p},\underline{s})=(1-\theta_U)S(\underline{p},\underline{s},n)$$

Since the b' which maximizes $V_n^C(\underline{p},\underline{s})$ coincides with the b' which maximizes the nash bargaining surplus $S(\underline{p},\underline{s},n)$, then it maximizes both $w_{d<0}^{interior}, w_{d>0}^{interior}$. Equations (24), (25) follows. The firm chooses n to maximize

$$\max_{n \in \mathrm{N}} (1-\theta_U) \cdot S(\underline{p},\underline{s},n)$$

and (26) follow.
Let $b^{',*}$ be the optimal choice of debt, manipulating and substituting

$$(1-\theta_U) \max_{n \in \mathrm{N}} A(\underline{p},\underline{s},n,b^{',*}) - b - \underline{w}n + \frac{1}{\mathbb{I}_{\{d \geq 0\}} + \iota \cdot \mathbb{I}_{\{d<0\}}} \cdot E(\underline{p},x,b^{',*})$$

Since hiring is a static choice, by taking FOC and using (17):

$$\alpha\eta(z \cdot x)^{(1-\alpha\eta)} k^{(1-\alpha)\eta} n^{\alpha\eta - 1} = \underline{w}$$

$$n = z \cdot x \left(\frac{\alpha\eta k^{(1-\alpha)\eta}}{\underline{w}} \right)^{\frac{1}{1-\alpha\eta}}$$

Equations (27) follows.
Hence substituting in (17)

$$\begin{aligned} y(\underline{p},x,n^*) &= (z \cdot x)^{(1-\alpha\eta)} (k^{1-\alpha} n^{*,\alpha})^{\eta} \\ &= (z \cdot x) \left(\frac{\alpha\eta}{\underline{w}} \right)^{\frac{\alpha\eta}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \end{aligned}$$

and equation (28) follows.

Let me now turn to the corner solutions, i.e. the wage for which $d = 0$

$$w^{corner}(\underline{p},\underline{s},n) = \frac{A(\underline{p},\underline{s},n,b') - b}{n}$$

Given n, a solution to (23) is the wage which maximizes the nash-bargaining product.

$$\max\{V^C_{w^{interior},n}(\underline{p},\underline{s})^{(1-\theta_U(r))} \cdot [w^{interior} \cdot n - \underline{w} \cdot n]^{\theta_U(r)}, \max\{V^C_{w^{corner},n}(\underline{p},\underline{s})^{(1-\theta_U(r))} \cdot [w^{corner} \cdot n - \underline{w} \cdot n]^{\theta_U(r)}\}$$

When $w^{corner}(\underline{p},\underline{s},n)$ solves (23), there is indeterminacy of n. To see this

$$\begin{aligned} V^C_{w^{corner},n}(\underline{p},\underline{s}) &= \max_{b' \in \mathrm{B}} g\left[A(\underline{p},\underline{s},n,b^{',*}) - b - \underline{w}^{corner} n\right] + E(\underline{p},x,b') \\ &= \max_{b' \in \mathrm{B}} g\left[A(\underline{p},\underline{s},n,b^{',*}) - b - (A(\underline{p},\underline{s},n,b^{',*}) - b)\right] + E(\underline{p},x,b') \end{aligned}$$

Hence only $w^{corner} \cdot n$ is determined. This is a computationally interesting case. How do I deal with it? Since $\lim_{d \to 0^+} n^*(\underline{p},\underline{s}) = \lim_{d \to 0^-} n^*(\underline{p},\underline{s}) = n^*(\underline{p},\underline{s}) = z \cdot x \cdot \left(\frac{\alpha\eta}{\underline{w}} \right)^{\frac{1}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}$ to preserve continuity, I assume that $n^*_{d=0} = n^*$ as well. In words, since a firm $(\underline{p},\underline{s})$ which distribute a small amount of dividends chooses the same amount of worker $n^*(\underline{p},\underline{s})$, as if it were issuing a small amount of equity, than I assume it makes the same hiring choice when it does not distribute dividends. I do not have a counter-argument why the continuity should not hold, i.e. what is the rationale why a firm that distribute [issue] a small amount of dividends [equity] differ dramatically in its hiring choices than the same firm that does not distribute dividends.

Appendix D.3. The Reorganization problem

Since firm's preferences are monotonic in d, the budget constraint in (30) is binding, the firm's ordinary choices reduce to (n, b'), and the reorganization problem simplifies to

$$\begin{aligned} V^R(\underline{p}, \underline{s}) = &\max_{e \in \mathrm{E}} \ \alpha^R(e; \theta_U(r)) \cdot \\ &\left[\max_{(n,b') \in \mathrm{N} \times \mathrm{B}_+} \iota \left[y(\underline{p}, x, n) - w^R(\underline{p}, \underline{s}, e, n) \cdot n - \chi_o - \delta k + q(\underline{p}, x, b') \cdot b' - \alpha^C(\underline{p}, \underline{s}, e, n, w^R(\underline{p}, \underline{s}, e, n)) \cdot b \right] + \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}') \right] \right] - c(e) \\ \text{s.t.} \quad & y(\underline{p}, x, n) - w^R(\underline{p}, \underline{s}, e, n) \cdot n - \chi_o - \delta k + q(\underline{p}, x, b') \cdot b' - \alpha^C(\underline{p}, \underline{s}, e, n, w^R(\underline{p}, \underline{s}, e, n)) \cdot b < 0 \qquad (\textit{Equity Issuance}) \\ & (\underline{p}, \underline{s}, n, v, e, \alpha^C(\underline{p}, \underline{s}, e, n, v)) \in A^C(\underline{p}, \underline{s}, e, n, v) \\ & (\underline{p}, \underline{s}, n, e, w^R(\underline{p}, \underline{s}, e, n)) \in W^R(\underline{p}, \underline{s}, e, n) \end{aligned}$$

Since labour is not a state variable, the *static* size choice, n - taken in order to maximize profits - does not alter the *inter-temporal* debt choice, b' - taken to smooth dividends over time. Mathematically, since the two controls enter additively in the objective function and the derivative is a linear operator, the problems are separable.
Hence, (22) becomes

$$\begin{aligned} V^R(\underline{p}, \underline{s}) = &\max_{e \in \mathrm{E}} \ \alpha^R(e; \theta_U(r)) \cdot \\ &\left[\max_{n \in \mathrm{N}} \max_{b' \in \mathrm{B}_+} \iota \left[y(\underline{p}, x, n) - w^R(\underline{p}, \underline{s}, e, n) \cdot n - \chi_o - \delta k + q(\underline{p}, x, b') \cdot b' - \alpha^C(\underline{p}, \underline{s}, e, n, w^R(\underline{p}, \underline{s}, e, n)) \cdot b \right] + \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}') \right] \right] - c(e) \\ \text{s.t.} \quad & y(\underline{p}, x, n) - w^R(\underline{p}, \underline{s}, e, n) \cdot n - \chi_o - \delta k + q(\underline{p}, x, b') \cdot b' - \alpha^C(\underline{p}, \underline{s}, e, n, w^R(\underline{p}, \underline{s}, e, n)) \cdot b < 0 \qquad (\textit{Equity Issuance}) \\ & (\underline{p}, \underline{s}, n, v, e, \alpha^C(\underline{p}, \underline{s}, e, n, v)) \in A^C(\underline{p}, \underline{s}, e, n, v) \\ & (\underline{p}, \underline{s}, n, e, w^R(\underline{p}, \underline{s}, e, n)) \in W^R(\underline{p}, \underline{s}, e, n) \end{aligned}$$

To simplify notation, let the operating profits net of investment and gross of the debt issuance be

$$A(\underline{p}, \underline{s}, n, b') \equiv y(\underline{p}, x, n) - \chi_o + q(\underline{p}, x, b')b' - \delta k$$

let the discounted markov operator be

$$E(\underline{p}, x, b') \equiv \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}') \right]$$

and let omit the dependence of the bargaining power on the region, $\theta_U \equiv \theta_U(r)$.
To simplify notation, let

$$A(\underline{p}, \underline{s}, n, b') = y(\underline{p}, x, n) - \chi_o + q(\underline{p}, x, b'^{,*}_{e,n,v}(\underline{p}, \underline{s}))b'^{,*}_{e,n,v}(\underline{p}, \underline{s}) - \delta k$$

and let

$$E(\underline{p}, \underline{s}) = \beta \cdot \mathbb{E}_{x'|x} \left[V(\underline{p}, \underline{s}')) \right]$$

Appendix D.3.1. Proposition 6

By and large, for a given (e, n, v) we can rewrite (34)

$$\begin{aligned} \alpha^C(\underline{p}, \underline{s}, e, n, v) \equiv &\arg\max_{a \in [0,1]} \left\{ \underbrace{[S^F_{e,n,v}\left(\underline{p}, \underline{s}; a\right)]}_{\text{Surplus Firm}}{}^{(1-\theta_C)} \cdot \underbrace{[S^C_{e,n,v}\left(\underline{p}, \underline{s}; a\right)]}_{\text{Surplus Creditors}}{}^{\theta_C} \right\} \\ \text{s.t. } & S^F_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \geq 0, \ \ S^C_{e,n,v}\left(\underline{p}, \underline{s}; a\right) \geq 0 \end{aligned}$$

Hence using the definition of firm surplus (32) and credit intermediary surplus (33), we rewrite (34)

$$\alpha^C(\underline{p},\underline{s},e,n,v) = \arg\max_{a\in A}\left[\alpha^R\cdot[\max_{b'\in B_+}\iota\cdot[A(\underline{p},\underline{s},n,b')-vn]+E(\underline{p},\underline{s})-\iota ab]\right]^{(1-\theta_C)}\cdot\left[\alpha^R ab+(1-\alpha^R)R^7(\underline{p},\underline{s})-R^7(\underline{p},\underline{s})\right]^{\theta_C}$$
$$\text{s.t. } S^F_{e,n,v}\left(\underline{p},\underline{s};a\right)\geq 0,\quad S^C_{e,n,v}\left(\underline{p},\underline{s};a\right)\geq 0,\quad d\leq 0,$$

where $\alpha^R(e;\theta_U(r))=\alpha^R$. By simplifying it further,

$$\alpha^C(\underline{p},\underline{s},e,n,v)=\alpha^R(e;\theta_U(r))\cdot\arg\max_{a\in A}\left[\max_{b'\in B_+}\iota\cdot[A(\underline{p},\underline{s},n,b')-vn]+E(\underline{p},\underline{s})-\iota ab\right]^{(1-\theta_C)}\cdot\left[ab-R^7(\underline{p},\underline{s})\right]^{\theta_C}$$
$$\text{s.t. } S^F_{e,n,v}\left(\underline{p},\underline{s};a\right)\geq 0,\quad S^C_{e,n,v}\left(\underline{p},\underline{s};a\right)\geq 0,\quad d\leq 0,$$

Since $a\in A\equiv[0,1]$ and $b\in B$, I make the following change of variable $r=ab\in[0,b_{\max}]\subseteq R_+$ and I get the equivalent representation

$$\alpha^C(\underline{p},\underline{s},e,n,v)=\alpha^R(e;\theta_U(r))\cdot\arg\max_{r\in[0,b_{\max}]}\left[\max\left\{\max_{b'\in B_+}\iota\cdot[A(\underline{p},\underline{s},n,b')-vn]+E(\underline{p},\underline{s})-\iota r,0\right\}\right]^{(1-\theta_C)}\cdot\left[\max\{r-R^7(\underline{p},\underline{s}),0\}\right]^{\theta_C}$$

Since the debt is chosen over a discrete finite set, $b'\in B\equiv\{b_{\min},\dots,b_{\max}\}\subset\mathbb{R}$, then we can solve the problem for any b'

$$\alpha^C(\underline{p},\underline{s},e,n,v;b')=\alpha^R(e;\theta_U(r))\cdot\arg\max_{r\in[0,b_{\max}]}\left[\max[\iota\cdot[A(\underline{p},\underline{s},n,b')-vn]+E(\underline{p},\underline{s})-\iota r,0]\right]^{(1-\theta_C)}\cdot\left[\max[r-R^7(\underline{p},\underline{s}),0]\right]^{\theta_C}$$

and then choose the optimal level of debt such that

$$b^{',*}=\arg\max_{b'\in B_+}\alpha^C(\underline{p},\underline{s},e,n,v;b')$$

Then for a given b', by taking first order conditions

$$(1-\theta_C)\cdot\frac{\iota}{\iota\cdot[A(\underline{p},\underline{s},n,b')-vn]+E(\underline{p},\underline{s})-\iota r}=\theta_C\cdot\frac{1}{r-R^7(\underline{p},\underline{s})}$$
$$r=R^7(\underline{p},\underline{s})+\theta_C\cdot\left[A(\underline{p},\underline{s},n,b')-vn+\frac{1}{\iota}E(\underline{p},\underline{s})-R^7(\underline{p},\underline{s})\right]$$

Let the nash bargaining surplus in debt restructuring for a given (e,n,v) be

$$S^R_{n,v,e}(\underline{p},\underline{s})=\max\{A(\underline{p},\underline{s},n,b')-vn+\frac{1}{\iota}E(\underline{p},\underline{s})-R^7(\underline{p},\underline{s}),0\}$$

Clearly, for an interior solution to exist the nash bargaining surplus has to be (strictly) greater than zero $S^R_{n,v,e}(\underline{p},\underline{s})>0$. Then upon success, the recovery value under Ch 11 is

$$r^*=R^7(\underline{p},\underline{s})+\theta_C\cdot\max\left\{A(\underline{p},\underline{s},n,b')-vn-R^7(\underline{p},\underline{s})+\frac{1}{\iota}E(\underline{p},\underline{s}),0\right\}$$

Lemma 2. *The optimal level of debt in possession financing $b^{',*}$ and the Ch 11 recovery value upon success r^* do not depend on the level of effort exerted e.*

Proof. The result comes by noticing that maximizing

$$\alpha^C(\underline{p}, \underline{s}, e, n, v) = \alpha^R(e; \theta_U(r)) \cdot \underset{r\in[0,b_{\max}]}{\arg\max} \Big[\max[\iota \cdot [A(\underline{p}, \underline{s}, n, b') - vn] + E(\underline{p}, \underline{s}) - \iota r, 0] \Big]^{(1-\theta_C)} \cdot \big[\max[r - R^7(\underline{p}, \underline{s}), 0]\big]^{\theta_C}$$

tantamounts to maximize

$$\alpha^C(\underline{p}, \underline{s}, e, n, v) = \underset{r\in[0,b_{\max}]}{\arg\max} \Big[\max[\iota \cdot [A(\underline{p}, \underline{s}, n, b') - vn] + E(\underline{p}, \underline{s}) - \iota r, 0] \Big]^{(1-\theta_C)} \cdot \big[\max[r - R^7(\underline{p}, \underline{s}), 0]\big]^{\theta_C}$$

□

Hence we can drop the dependence of the nash bargaining surplus on e, $S^R_{n,v}(\underline{p}, \underline{s})$, and considering the optimal debt $b^{',*}$ equation (35) follows.

Substituting r^* in (32) we get the expected reorganization value of a firm after debt restructuring for a given (e, n, v)

$$\begin{aligned}
&S^F_{e,n,v}(\underline{p}, \underline{s}) \\
&= \alpha^R(e; \theta_U(r)) \cdot \big[\iota \cdot [A(\underline{p}, \underline{s}, n, b') - vn] + E(\underline{p}, \underline{s}) - \iota r^*\big] \\
&= \alpha^R(e; \theta_U(r)) \cdot \iota \cdot \left[A(\underline{p}, \underline{s}, n, b') - vn + \frac{1}{\iota}E(\underline{p}, \underline{s}) - r^*\right] \\
&= \alpha^R(e; \theta_U(r)) \cdot \iota \cdot \left[A(\underline{p}, \underline{s}, n, b') - vn + \frac{1}{\iota}E(\underline{p}, \underline{s}) - R^7(\underline{p}, \underline{s}) - \theta_C \cdot \max\left\{A(\underline{p}, \underline{s}, n, b') - vn - R^7(\underline{p}, \underline{s}) + \frac{1}{\iota}E(\underline{p}, \underline{s}), 0\right\}\right] \\
&= \alpha^R(e; \theta_U(r)) \cdot (1-\theta_C) \cdot \iota \cdot \max\left\{A(\underline{p}, \underline{s}, n, b') + \frac{1}{\iota}E(\underline{p}, \underline{s}) - vn - R^7(\underline{p}, \underline{s}), 0\right\}
\end{aligned}$$

and equation (37) follows

$$S^F_{e,n,v}(\underline{p}, \underline{s}) = \alpha^R(e; \theta_U(r)) \cdot (1-\theta_C) \cdot \iota \cdot S^R_{n,v}(\underline{p}, \underline{s})$$

Similarly, substituting r^* we get the expected recovery value under Ch 11

$$\begin{aligned}
R^{11}_{e,n,v}(\underline{p}, \underline{s}) &\equiv \alpha^R(e; \theta_U(r))r^* + (1-\alpha^R(e; \theta_U(r)))R^7(\underline{p}, \underline{s}) \\
&= \alpha^R(e; \theta_U(r)) \left[R^7(\underline{p}, \underline{s}) + \theta_C \cdot \max\left\{A(\underline{p}, \underline{s}, n, b') - vn + \frac{1}{\iota}E(\underline{p}, \underline{s}) - R^7(\underline{p}, \underline{s}), 0\right\}\right] + (1-\alpha^R(e; \theta_U(r)))R^7(\underline{p}, \underline{s}) \\
&= R^7(\underline{p}, \underline{s}) + \alpha^R(e; \theta_U(r)) \cdot \theta_C \cdot \max\left\{A(\underline{p}, \underline{s}, n, b') - vn + \frac{1}{\iota}E(\underline{p}, \underline{s}) - R^7(\underline{p}, \underline{s}), 0\right\}
\end{aligned}$$

and (36) follows.

Appendix D.3.2. Proposition 7

Let us report the labour restructuring problem (38)

$$\begin{aligned}
&(W^R w)(\underline{p}, \underline{s}, e, n) = \underset{v\in \mathrm{W}}{\arg\max}\ [S^F_{e,n,v}(\underline{p}, \underline{s})]^{(1-\theta_U)} \ \cdot \ [\alpha^R(e; \theta_U(r)) \cdot [v \cdot n - \underline{w} \cdot n]]^{\theta_U} \\
&\text{s.t. } S^F_{e,n,v}(\underline{p}, \underline{s}) \geq 0, \qquad v \geq \underline{w}
\end{aligned}$$

Substituting (37)

$$(W^R w)(\underline{p},\underline{s},e,n) = \arg\max_{v\in \mathrm{W}} \, [\alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot S^R_{n,v}(\underline{p},\underline{s})]^{(1-\theta_U)} \;\cdot\; [\alpha^R(e;\theta_U(r))\cdot[v\cdot n - \underline{w}\cdot n]]^{\theta_U}$$
$$\text{s.t. } S^F_{e,n,v}(\underline{p},\underline{s}) \geq 0, \qquad v \geq \underline{w}$$

and simplifying

$$(W^R w)(\underline{p},\underline{s},e,n)$$
$$= \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)^{(1-\theta_U)}\cdot \arg\max_{v\in \mathrm{W}} \, [\max\left\{\iota\cdot[A(\underline{p},\underline{s},n,b') - vn - R^7(\underline{p},\underline{s})] + E(\underline{p},\underline{s}),0\right\}]^{(1-\theta_U)} \;\cdot\; [v\cdot n-\underline{w}\cdot n]^{\theta_U}$$
$$\text{s.t. } S^F_{e,n,v}(\underline{p},\underline{s}) \geq 0, \qquad v \geq \underline{w}$$

By taking first order conditions,

$$(1-\theta_U)\cdot\frac{n\cdot\iota}{\iota\cdot[A(\underline{p},\underline{s},n,b') - vn - R^7(\underline{p},\underline{s})] + E(\underline{p},\underline{s})} = \theta_U\cdot\frac{n}{v\cdot n-\underline{w}\cdot n}$$
$$v\cdot n = \underline{w}\cdot n + \theta_U\cdot\left[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n + \frac{1}{\iota}E(\underline{p},\underline{s})\right]$$

Let the labour restructuring nash bargaining surplus

$$S^R_n(\underline{p},\underline{s}) = \max\{A(\underline{p},\underline{s},n,b') + \frac{1}{\iota}E(\underline{p},\underline{s}) - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n, 0\}$$

Clearly, for an interior solution to exist the nash bargaining surplus has to be (strictly) greater than zero $S^R_n(\underline{p},\underline{s}) > 0$. Equation (39) follows.
Then we get the wage compensation which maximizes the labour restructuring problem

$$w(\underline{p},\underline{s},e,n) = \underline{w} + \theta_U\cdot\frac{\left[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n + \frac{1}{\iota}E(\underline{p},\underline{s})\right]}{n}$$

as in equation (40), and the expected surplus of the workers is

$$S^W_n = \alpha^R(e;\theta_U(r))\cdot\theta_U\cdot S^R_n(\underline{p},\underline{s})$$

Similarly, substituting in (37) we get the expected reorganization value of a firm after restructuring the labour

$$S^F_{e,n}\left(\underline{p},\underline{s}\right)$$
$$= \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot\max\left\{\iota\cdot[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - w(\underline{p},\underline{s},e,n)n] + E(\underline{p},\underline{s}),0\right\}$$
$$= \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot\max\left\{\iota\cdot[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}n - \theta_U\cdot\left[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n + \frac{1}{\iota}E(\underline{p},\underline{s})\right]] + E(\underline{p},\underline{s}),0\right\}$$
$$= \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot\max\left\{\iota\cdot\left[(1-\theta_U)\cdot[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}n] - \theta_U\frac{1}{\iota}E(\underline{p},\underline{s})\right] + E(\underline{p},\underline{s}),0\right\}$$
$$= \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot(1-\theta_U)\cdot\iota\cdot\max\left\{[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}n + \frac{1}{\iota}\cdot E(\underline{p},\underline{s})],0\right\}$$

from which equation (42) follows

$$S^F_{e,n}\left(\underline{p},\underline{s}\right) = \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot(1-\theta_U)\cdot\iota\cdot S^R_n(\underline{p},\underline{s})$$

Similarly, substituting in (36) we get the expected recovery value under Ch 11

$$\begin{aligned}
&R^{11}_{e,n,v}(\underline{p},\underline{s})\\
&= R^7(\underline{p},\underline{s}) + \alpha^R(e;\theta_U(r))\cdot\theta_C\cdot\max\left\{A(\underline{p},\underline{s},n,b') - w(\underline{p},\underline{s},e,n)n + \frac{1}{\iota}E(\underline{p},\underline{s}) - R^7(\underline{p},\underline{s}), 0\right\}\\
&= R^7(\underline{p},\underline{s}) + \alpha^R(e;\theta_U(r))\cdot\theta_C\cdot\max\left\{A(\underline{p},\underline{s},n,b') + \frac{1}{\iota}E(\underline{p},\underline{s}) - R^7(\underline{p},\underline{s}) - \left[\underline{w}n + \theta_U\cdot\left[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n + \frac{1}{\iota}E(\underline{p},\underline{s})\right]\right], 0\right\}\\
&= R^7(\underline{p},\underline{s}) + \alpha^R(e;\theta_U(r))\cdot\theta_C\cdot(1-\theta_U(r))\cdot\max\left\{A(\underline{p},\underline{s},n,b') + \frac{1}{\iota}E(\underline{p},\underline{s}) - R^7(\underline{p},\underline{s}) - \underline{w}n, 0\right\}
\end{aligned}$$

and equation (41) follows

$$R^{11}_{e,n}(\underline{p},\underline{s}) = R^7(\underline{p},\underline{s}) + \alpha^R(e;\theta_U(r))\cdot\theta_C\cdot(1-\theta_U(r))\cdot S^R_n(\underline{p},\underline{s})$$

In conclusion the expected surplus of the workers

$$\begin{aligned}
S^W_{e,n}\left(\underline{p},\underline{s}\right) &= \alpha^R(e;\theta_U(r))\left[w(\underline{p},\underline{s},e,n)n - \underline{w}n\right]\\
&= \alpha^R(e;\theta_U(r))\cdot\theta_U\cdot\left[A(\underline{p},\underline{s},n,b') - R^7(\underline{p},\underline{s}) - \underline{w}\cdot n + \frac{1}{\iota}E(\underline{p},\underline{s})\right]\\
&= \alpha^R(e;\theta_U(r))\cdot\theta_U\cdot S^R_n(\underline{p},\underline{s}) \qquad \text{(D.3)}
\end{aligned}$$

Appendix D.3.3. Proposition 8

The firm chooses n to maximize (42).

$$\max_{n\in\mathrm{N}} \alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot(1-\theta_U(r))\cdot\iota\cdot S^R_n(\underline{p},\underline{s})$$

or equivalently to maximize the nash bargaining surplus

$$\alpha^R(e;\theta_U(r))\cdot(1-\theta_C)\cdot(1-\theta_U(r))\cdot\iota\max_{n\in\mathrm{N}}\cdot S^R_n(\underline{p},\underline{s})$$

which since the hiring choice is a static decision, is equivalent in maximizing

$$\max_{n\in\mathrm{N}} A(\underline{p},\underline{s},n,b') - \underline{w}\cdot n = \max_{n\in\mathrm{N}} y(\underline{p},x,n) - \chi_o + q(\underline{p},x,b')b' - \delta k$$

and simplifying

$$\max_{n\in\mathrm{N}} y(\underline{p},x,n) - \underline{w}\cdot n$$

The firm chooses the number of workers which equates the marginal product of labour to the outside opportunity cost of workers.
Taking FOC and using (17) equation (44) follows.

$$n = z\cdot x\left(\frac{\alpha\eta k^{(1-\alpha)\eta}}{\underline{w}}\right)^{\frac{1}{1-\alpha\eta}}$$

Hence substituting in (17)

$$\begin{aligned}
y(\underline{p},x,n^*) &= (z\cdot x)^{(1-\alpha\eta)}(k^{1-\alpha}n^{*,\alpha})^\eta\\
&= (z\cdot x)\left(\frac{\alpha\eta}{\underline{w}}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} k^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}
\end{aligned}$$

and equation (45) follows. Substituting the solution in (41), (42) and (D.3), then (47), (48) and (49) follows.